Programme scientifique

Lundi 14 Juin	Mardi 15 Juin	Mercredi 16 Juin	Jeudi 17 Juin	Vendredi 18 Juin
Astro fondamentale (Géodésie spatiale, mécanique céleste, et systèmes de réference) **Amphi A3 (mat)**	Journée Commune SF2A **Amphi A1**	Journée Commune SF2A **Amphi A1**	ASHRA+PNPS **Amphi B3**	PCMI (Physique et Chimie du Milieu Interstellaire) **Amphi B3**
PNP (Planètes) **Amph A1**			PCHE (Phénomènes Cosmiques de Haute Energie) **Amphi A1**	PCHE (Phénomènes Cosmiques de Haute Energie) **Amphi A1**
PNST (Soleil-Terre) **Amphi A2 (mat), A3 (a-m)**			PNG (Galaxies) **Amphi A2**	PNG (Galaxies) **Amphi A2**
ASHRA (Haute Résolution Angulaire) **Amphi B3**			PNC (Cosmologie) **Amphi A3**	PNC (Cosmologie) **Amphi A3**
PNPS (Physique Stellaire) **Amphi A2**				

Table des matières

Programme « Astronomie Fondamentale »

L'astronomie fondamentale occupe une place singulière mais très importante dans la communauté A&A. Elle est en effet située, pour les uns, à la frontière de l'astronomie et de la géophysique, à la frontière de l'astronomie et de la planétologie pour les autres. Les méthodes qu'elle fait utiliser, cependant, sont spécifiques, continuent et continueront d'apporter des résultats très importants pour la discipline, ainsi que pour les thématiques qui lui sont sous-jacentes : mécanique céleste, mécanique spatiale, planétologie, systèmes de référence spatio-temporels, géodynamique, cinématique terrestre, temps-fréquence, notamment.
Le «fil rouge» de cette année est le projet GALILEO. Même si les présentations retenues ne sont pas toutes nécessairement reliées de très près à ce projet, il est l'occasion, à quelques années seulement de sa mise en service opérationnelle, d'afficher le rôle central et fédérateur qu'il occupe en astronomie fondamentale.
Organisateurs : Florent Deleflie, Pierre Exertier

Lundi 14 Juin 2004 (matin 9h-13h)

Exposé introductif

9 :00-9 :25	Nicole Capitaine (SYRTE)	Développements récents des concepts et modèles en astronomie fondamentale

Session 1. Rotation de la Terre

9 :30-9 :45	Patrick Charlot (Obs. Bordeaux)	Densification of the International Celestial Reference Frame in the Northern Hemisphere.
9 :50-10 :05	Géraldine Bourda (SYRTE)	Earth orientation and temporal variations of the gravity field.
10 :10-10 :25	Jean Souchay (SYRTE)	Rotation of the Earth, Mars and asteroïds : comparative study of models and data quality.

Session 2. Systèmes de Référence et Physique Fondamentale

10 :30-10 :45	David Coulot (GEMINI/LAREG)	Combination of space geodesy techniques for monitoring the kinematics of the Earth.
10 :50-11 :10		PAUSE avec démonstration interactive : Interactive Earth rotation through the Web par Christian Bizouard (SYRTE)
11 :10-11 :25	Christophe LePoncin-Laffite (SYRTE)	General post-Minkowskian expansions of Synge's world function, time transfer and gravitational deflection of light ray. Applications to GAIA and GALILEO.
11 :30-11 :45	Philippe Merck (BNM-SYRTE)	TWSTFT technique at BNM-SYRTE : a potential alternative to GPS for time and frequency transfer.
11 :50-12 :05	Bartolomé Coll (SYRTE)	Construction of a primary and autonomous relativistic positioning system with GALILEO : SYPOR project.

Session 3. Mécanique céleste et spatiale

12 :10-12 :25	Florent Deleflie (GEMINI/FUNDP)	Resonance effects in the GPS and GALILEO constellations : comparisons over 2 centuries.
12 :30-12 :45	Alain Vienne (IMCCE/LAL)	Mutual events in the jovian and saturnian systems.
12 :50-13 :05	Nicolas Rambaux (Obs. Bordeaux/ORB)	Mercury's spin-orbit model and its physical libration.

Session POSTER

Christophe LePoncin-Laffite (SYRTE)	Influence of the multipole moments of a giant planet on the propagation of light
Julio Ignacio Bueno de Camargo (Obs. Bordeaux)	Near-Infrared astrometry and photometry of Southern ICRF quasars.
Valéry Lainey (IMCCE/ORB)	Io’s secular acceleration vs. observations accuracy

Programme PNP

Cette année, "Mars" a été choisi comme thème de la journée PNP.
Organisateurs : François Forget , Nicolas Mangold, Daniele Pinti

Lundi 14 Juin 2004

SESSION 1 : "Les glaces de Mars"

09 :00-09 :20	J.P. Bibring et l'équipe Omega	Les calottes Martiennes vues par OMEGA (Mars Express)
09 :20-09 :35	B. Schmitt et S. Doute	Glaces polaires et condensations saisonnières sur Mars
09 :35-09 :55	S. Maurice	Les glaces observées par le Gamma Ray Spectrometer de Mars Odyssey
09 :55-10 :15	B. Levrard	Modèles climatiques et variations d'obliquité : des glaciers sur Mars
10 :15-10 :30	W. Kofman	Observation des calottes et du sous-sol de Mars par le radar MARSIS (Mars Express)

SESSION 2 : "L'air de Mars"

11 :00-11 :10	J.L. Bertaux	Présentation générale de SPICAM sur Mars Express
11 :10-11 :20	E. Quemerais	L'atmosphère de Mars observée par occultation d'étoiles avec SPICAM
11 :20-11 :30	S. Perrier	Mesures de l'ozone dans l'ultra-violet avec SPICAM
11 :30-11 :42	P. Drossart	Observation de l'atmosphère martienne par Omega sur Mars Express
11 :42-11 :53	E. Lellouch	Vapeur d'eau et CO observées par PFS sur Mars Express
11 :53-12 :04	T. Encrenaz	Détections d'espèces mineures dans l'atmosphère martienne par spectroscopie depuis la Terre et avec Mars Express
12 :04-12 :15	J.P. Maillard	Détection du Methane dans l'atymosphère martienne par le spectromètre FTS du télescope CFHT
12 :15-12 :30	F. Lefevre et S. Lebonnois	Modèles chimie-transport de l'atmosphère martienne
	DÉJEUNER	

SESSION 3 : "Des lacs sur Mars ?"

14 :00-14 :25	Equipe Omega	La minéralogie des sédiments martiens vue par OMEGA
14 :25-14 :55	L. D'Uston	Le site de Terra Meridiani vu par "Opportunity"
14 :55-15 :10	V. Ansan	Morphologies des vallées anciennes sur Mars
15 :10-15 :25	C. Quantin	Rivières et lacs dans Valles Marineris
15 :25-15 :35	F. Forget	Modélisation du climat ancien

SESSION 4 : "Les roches de Mars"

16 :00-16 :15	P. Pinet	Propriété des surfaces vues par la caméra HRSC sur Mars Express
16 :15-16 :30	D. Baratoux	Application de l'imagerie sur Mars Express à l'étude des glissement de terrain.
16 :30-16 :50	O. Gasnault	La composition du sol vue par le Gamma Ray Spectrometer (Mars Odyssey)
16 :50-17 :10	P. Rochette et V. Chevrier	Altération et magnétisme de la surface de Mars
17 :10-17 :40	A. Jambon	Géochimie des météorites martiennes

Programme PNST

La journée PNST comporte 2 sessions d'une demi-journée chacune : une session commune avec le PNPS et une session dédiée aux plasmas solaires et magnétosphériques.
Organisateurs : Dominique Fontaine , pour la physique magnétosphérique, Ludwig Klein, pour la physique solaire, avec Marie-Jo Goupil et Claude Catala pour la sessions commune avec le PNPS
Le temps indiqué pour les contributions orales comprend les questions. Les exposés invités sont suivis de la lettre "I" . Voir (*) pour la liste des posters.

Lundi 14 Juin 2004

Session Commune PNPS+PNST : le magnétisme solaire et stellaire

09 :00-09 :25	P. Petit	Dynamo processes and differential rotation in solar-type stars
09 :25-09 :40	A.S. Brun	Stellar magnetic activity and dynamo effect
09 :40-09 :55	J. Ballot	Convection/rotation interaction in young solar-like stars : 3-D hydrodynamic simulations
09 :55-10 :20	C. Briand	What's new about intergranular magnetic field
10 :20-10 :45	F. Lignieres	Origine des champs magnetiques des etoiles chaudes : modeles et questions en suspens
	PAUSE	
11 :00-11 :25	R. Grappin, G. Aulanier	Structure and dynamics of the solar corona : the peculiar role of the photosphere
11 :25-11 :40	J. Bouvier	Star-disc magnetospheric interaction in T Tauri stars
11 :40-11 :55	I. Zouganelis	Solar wind acceleration : relevance of kinetic collisionless models
11 :55-12 :10	M. Chadid	Interactions between shock waves, turbulence and magnetic field in the atmospheres of post-main sequence stars.
12 :10-12 :25	H. Ozawa	The X-ray emission from Young Stellar Objects in the rho Ophiuchi dark cloud as seen by XMM-Newton
12 :25-12 :40	J.F. Donati	ESPADONs : the new generation stellar spectropolarimeter"
	DEJEUNER	

Session PNST : environnements ionisés solaire et terrestre

Session 1. Observations récentes

14 :00-14 :25	G. Trottet (I)	First observations of solar flares at sub-millimeter wavelengths
14 :25-14 :40	E. Pariat	Flux tube emergence, from photosphere to chromosphere
14 :40-14 :55	A. Roux	Stability of the geomagnetic tail : Cluster observations
14 :55-15 :10	V. Bommier	Themis observations : longitudinal and transverse magnetic field map under a filament
15 :10-15 :25	A. Lopez	Magnetic maps of solar prominences
15 :25-15 :50	P. Canu (I)	Multi-point observations of plasma waves with the instrument Whisper of Cluster
15 :50 - 16 :40	Session POSTERS (voir *)	présence des auteurs + Pause café

Session 2. Méthodes numériques

16 :40-16 :55	E. Buchlin	Statistical simulations of simplified MHD
16 :55-17 :20	F. Mottez (I)	Numerical simulation of turbulence and acceleration in the magnetospheric auroral zone
17 :20-17 :35	O. Alexandrova	Alfven wave instabilities : magnetosheath Cluster observations and hybrid simulations
17 :35-18 :00	PL. Blelly (I)	Ionosphere models : numerical methods and coupling problems in the system atmosphere-ionosphere-magnetosphere

*** POSTERS**

V. Bommier	Second solar spectrum observed at the Pic-du-Midi : depth probing of the turbulent magnetic field intensity in a quiet region
C. Dauphin	Particle acceleration in a solar active region modelled by a cellular automat
M. Derouich	Second solar spectrum observed at the Pic-du-Midi : depth probing of the turbulent magnetic field intensity in a quiet region.
K-L. Klein	A search for solar energetic particles events with flareless coronal mass ejections
K-L. Klein	Tracing Sun-Earth magnetic connections using radio bursts and magnetic field extrapolations
S. Koutchmy	Analysis of non-thermal velocities in the Solar Corona
S. Koutchmy	First analysis of the Compton effect on energetic beams of the solar corona
A. Lopez-Ariste	Last scientific results and present status of THEMIS
F. Mottez	Fundamental process in plasma physics with a very low noise particle in cell simulation code.
N. Vilmer	X-ray and radio observations of energetic electrons produced during the 3 November 2003 GOES X4 flare

Programme ASHRA

Cet atelier comportera une partie commune avec le PNPS le Jeudi 17 Juin.
Organisateurs : Michel Tallon , Denis Mourard
Pour la session commune, Bruno Lopez, Fabien Malbet, Guy Perrin

Lundi 14 Atelier ASHRA

09 :30-09 :45	C. Perrier/D. Mourard	Nouveau fonctionnement de l'ASHRA
09 :45-10 :05	A. Chelli	Le JMMC
10 :05-10 :25	F. Lacombe	Le GdR R&D en OA
10 :25-10 :50	J.-L. Beuzit	JRA Optique Adaptative & JRA Détecteurs
10 :50-11 :05	A. Chelli	European Initiative for Interferometry
	PAUSE	
11 :25-11 :35	V. Foresto/D. Mourard	GENIE Science Advisory Team
11 :35-11 :55		Synthèse, discussion
11 :55-12 :15	F. Vakili	Projets HRA Dôme C
12 :15-12 :30	N. Epchtein	Emissivité proche infrarouge du fond de ciel au Dôme C
	DEJEUNER	
14 :00-14 :15	T. Fusco	Simulations d'optique adaptative extrême
14 :15-14 :35	E. Gendron	SESAME : banc d'optique adaptative
14 :35-14 :50	A. Blanc	Couverture du ciel en optique adaptative multi conjuguée
14 :50-15 :05	M. Nicolle	Analyse de surface d'onde pour l'optique adaptative multi conjuguée
15 :05-15 :20	R. Foy	Etoile laser polychromatique
15 :20-15 :35	Y. Clenet	3 ans d'observation du centre galactique sur le VLT/NACO
15 :35-15 :50	M. Glanc	Imagerie et tomographie de la rétine
	PAUSE	
16 :10-16 :30	G. Perrin	OHANA
16 :30-16 :45	P.Baudoz	Le projet PEGASE
16 :45-16 :55	F. Martinache	La nouvelle encyclopédie des planètes extrasolaires
16 :55-17 :10	D. Gratadour	Coronographie de NGC1068 sur NACO
17 :10-17 :30	J.L. Beuzit	VLT Planet Finder
17 :30-17 :45	A. Boccaletti	MIRI/JWST

Jeudi 17 Juin 2004

Journée commune ASHRA/PNPS "Physique stellaire et Interférométrie optique"

09 :00-09 :30	Introduction à la mesure interférométrique
09 :30-10 :00	Revue des interféromètres existants
10 :00-10 :30	AMBER (état, premiers résultats, ouverture)
11 :00-11 :30	MIDI (état, premiers résultats, ouverture)
11 :30-12 :00	Préparation des observations : outils JMMC et demandes ESO DE-JEUNER
14 :00-14 :30	Réduction des données AMBER et MIDI : comment se former et accéder aux logiciels de réduction
14 :30-15 :00	Logiciel de modélisation JMMC
15 :00-17 :30	Résultats en physique stellaire (appel à contributions orienté pour couvrir l'ensemble des sujets)
17 :30-18 :00	Les programmes stellaires de MIDI et AMBER (exposé et discussion, présenter les possibilités et le contenu des programmes sur temps garanti.)

Programme PNPS

Cet atelier comporte une partie commune avec le PNST Lundi 14 Juin et avec le PNPS Jeudi 17 Juin.
Organisateurs : Bertrand Plez
Pour la session commune avec PNST, Ludwig Klein, Marie-Jo Goupil, Claude Catala
Pour la session commune avec ASHRA, Bruno Lopez, Fabien Malbet, Guy Perrin

Lundi 14 juin 2004

Session Commune PNPS+PNST : le magnétisme solaire et stellaire

09 :00-09 :25	P. Petit	Dynamo processes and differential rotation in solar-type stars
09 :25-09 :40	A.S. Brun	Stellar magnetic activity and dynamo effect
09 :40-09 :55	J. Ballot	Convection/rotation interaction in young solar-like stars : 3-D hydrodynamic simulations
09 :55-10 :20	C. Briand	What's new about intergranular magnetic field
10 :20-10 :45	F. Lignieres	Origine des champs magnetiques des etoiles chaudes : modeles et questions en suspens
	PAUSE	
11 :00-11 :25	R. Grappin, G. Aulanier	Structure and dynamics of the solar corona : the peculiar role of the photosphere
11 :25-11 :40	J. Bouvier	Star-disc magnetospheric interaction in T Tauri stars
11 :40-11 :55	I. Zouganelis	Solar wind acceleration : relevance of kinetic collisionless models
11 :55-12 :10	M. Chadid	Interactions between shock waves, turbulence and magnetic field in the atmospheres of post-main sequence stars.
12 :10-12 :25	H. Ozawa	The X-ray emission from Young Stellar Objects in the rho Ophiuchi dark cloud as seen by XMM-Newton
12 :25-12 :40	J.F. Donati	ESPADONs : the new generation stellar spectropolarimeter"
	DEJEUNER	

Atelier PNPS

Stellar Formation - Young objects

14 :00-14 :15	COMBET Celine	Flows around low and high mass young stellar objects : Effects of opacity and magnetic field
14 :15-14 :30	HENNEBELLE Patrick	Collapse and fragmentation of self-gravitating filaments
14 :30-14 :45	FROMANG Sebastien	Planet migration in protoplanetary magnetized disks
14 :45-15 :00	MEYNADIER Frédéric	Massive star forming regions in the Magellanic Clouds : results from recent observations
15 :00-15 :15	MINIER Vincent	Massive protostellar cores : Galactic distribution and dynamics

Low mass stars

15 :15-15 :30	ALLARD France	Spectral Properties of Brown Dwarfs and Extrasolar Planets
15 :30-15 :45	BOUY Herve	Statistical and Physical properties of binaries of low-mass stars and brown dwarfs
15 :45-16 :00	MORAUX Estelle	Brown dwarfs and the substellar mass function of young open clusters
	PAUSE	

Transport processes in stellar interiors

16 :15-16 :30	MATHIS Stephane	Mixing in stellar radiation zones : new theoretical results

Sismology-Pulsations

16 :30-16 :45	BARBAN Caroline	New observations of solar-like oscillations in red giant stars
16 :45-17 :00	GARCIA Rafael A.	The solar radiative interior : gravity modes and future instrumentation
17 :00-17 :15	MOSSER Benoît	Asteroseismology with HARPS : first observations and new insights on a Corot target
17 :15-17 :30	BARRIÈRE-FOUCHET Laure	pulsating stars : description of the problem and difficulties

Grands releves

17 :30-17 :45	BEAULIEU Jean-Philippe	Probing the atmosphere of the bulge G5III star OGLE-2002-BUL-069 by analysis of microlense H alpha line

Shocks

17 :45-18 :00	LEYGNAC Sébastien	Radiative shocks experiments with high energy density lasers : 3D geometric effects on the radiative transfer

Magnetism

18 :00-18 :15	REESE Daniel	Shear Alfvén modes in magnetized spherical shells

Jeudi 17 Juin 2004

Journée commune ASHRA/PNPS "Physique stellaire et Interférométrie optique"

09 :00-09 :30		Introduction à la mesure interférométrique
09 :30-10 :00		Revue des interféromètres existants
10 :00-10 :30		AMBER (état, premiers résultats, ouverture)
	PAUSE	
11 :00-11 :30		MIDI (état, premiers résultats, ouverture)
11 :30-12 :00		Préparation des observations : outils JMMC et demandes ESO
	DEJEUNER	
14 :00-14 :30		Réduction des données AMBER et MIDI : comment se former et accéder aux logiciels de réduction
14 :30-15 :00		Logiciel de modélisation JMMC
15 :00-17 :30		Résultats en physique stellaire (appel à contributions orienté pour couvrir l'ensemble des sujets)
17 :30-18 :00		Les programmes stellaires de MIDI et AMBER (exposé et discussion, présenter les possibilités et le contenu des programmes sur temps garanti.)

Session Plénière du 15 Juin

Revues PNP

09 :00-09 :25	Marc Chaussidon (Nancy)	Les radioactivités éteintes du 7Be et du 10Be : des traces de l'irradiation de la nébuleuse protosolaire par le soleil jeune
09 :25-09 :50	Matthieu Gounelle (Orsay)	Origine des radioactivités éteintes et irradiation dans le Système solaire primitif

Revues PNST

09 :50-10 :15	P. Louarn (Toulouse)	Création et annihilation de structures magnétiques, accélérations et chauffage associés : l'apport de Cluster
10 :15-10 :40	S. Galtier (Orsay)	Chauffage de la couronne solaire
	PAUSE	

Revues PNPS

11 :10-11 :35	A. Baglin et E. Michel	Sismologie du sol et de l'espace
11 :35-12 :00	F. Ménard	Disques d'accrétion

Assemblée Générale

12 :00-12 :30		Rapport d'activité, financier, résultat des élections, etc..
	DÉJEUNER	

Etats Généraux de la Recherche

14 :00-15 :30	Débat Section 14, CNAP, CSA	Thèmes des 6 groupes de travail : organismes de recherche, évaluation, le métier de chercheur, le projet BLGM, recherche et société, avenir de l'astronomie et interdisciplinarité.
	PAUSE	

Revue Astro-Fondamentale

16 :00-16 :15		Intérêts et enjeux du programme GALILEO en astronomie fondamentale (géodésie spatiale, systèmes de référence, temps-fréquence, physique fondamentale)

Revues ASHRA

16 :15-16 :35	P. Kervella (ESO, Chili)	Physique stellaire et extragalactique avec l'interféromètre VLTI
16 :35-16 :45	R. Petrov (Nice)	Amber : la première lumière
16 :45-17 :05	D. Mouillet (Tarbes) /G. Chauvin (Grenoble)	NAOS

Projets de l'ESO

17 :05-17 :45	Catherine Cesarsky

Remise des prix HP Jeunes Chercheurs de la SF2A
19h Grande Galerie de l'Observatoire de Paris
par Catherine Cesarsky (Directeur général de l'ESO) et Philippe Devins (HP)

Cocktail 20h Salle du Conseil/jardins de l'Observatoire de Paris

Session Plénière du 16 Juin

Nouvelles du CFHTLS

08 :30-09 :00	J-C. Cuillandre (Hawaii) et Y. Mellier (Paris)	Le CFHTLS : Etat d'avancement du survey

Revues PNG

09 :00-09 :25	D. Schaerer (Genève)	Galaxies à très grand redshift
09 :25-09 :50	A. Robin (Besançon)	Structure et Evolution de la Voie Lactée

Revues PNC

09 :50-10 :15	M. Arnaud (Saclay)	Physics of cluster formation and evolution : the XMM view
10 :15-10 :40	O. Le Fèvre (Marseille)	VIMOS VLT Deep Survey : sondage systématique de l'univers jusqu'à z=5
	PAUSE	

Revues PCMI

11 :10-11 :35	Alain Abergel (Orsay)	Evolution des poussières interstellaires.
11 :35-12 :00	M. Pérault (Paris)	Apport des activités de simulation numérique pour la physique des nuages interstellaires

PN Astro-Particules

12 :00-12 :25	P. Binétruy (Orsay)	Les conclusions de la Prospective Astroparticules
	DEJEUNER	

Revues PCHE

14 :00-14 :25	M. de Naurois (Paris)	Un premier bilan des observations de HESS (rayons gamma E>180 GeV)
14 :25-14 :50	R. Mochkovitch (Paris)	Le point sur les sursauts gamma

Nouvelles du VLT

14 :50-15 :02	H. Florès (Meudon)	GIRAFFE/IFU : Velocity fields of distant galaxies
15 :02-15 :10	P-O. Lagage (Saclay)	VISIR : première lumière Spitzer Space Telescope
15 :10-15 :35	Hervé Dole (Orsay)	Les premiers résultats
	PAUSE	

Actions Spécifiques- Prospective

16 :00-16 :25	M. Tagger (Saclay)	ASSNA (AS-Simulations Numériques en Astrophysique)
16 :25-16 :50	F. Genova (Strasbourg)	OV-France (AS- Observatoires Virtuels)
16 :50-17 :15	C. Veillet (Hawaii)	Le Télescope Canada-France-Hawaii fête ses 25 ans... pour quel futur ?
17 :15-17 :40	F. Casoli (Paris)	ASA (Action Spécifique ALMA)
17 :40-18 :05	D. Kunth (Paris)	Prospective UV

Programme PCHE

Cet atelier sera constitué de 8 sessions sur 2 jours.
Organisateurs : Bernard Degrange, Didier Barret
Les exposés invités (indiqués en caractères gras) durent 25 minutes plus 5 minutes de questions. Les exposés courts durent 15 minutes plus 5 minutes de questions. L'exposé de Michel Blanc le matin du 18 juin n'est pas spécifique du GdR PCHE mais ouvert à toute la communauté d'astrophysique : en effet Michel Blanc rendra compte des recommandations du Comité d'évaluation pour la Recherche et l'Exploration Spatiale (CERES) concernant la programmation par le CNES des futures expériences spatiales.

Jeudi 17 Juin 2004

SESSION 1 : Jeudi Matin

9h00 - 9h30	Guy PERRIN (Meudon)	Noyaux actifs de galaxies à très haute résolution angulaire dans l'infrarouge : premiers résultats des grands interféromètres et perspectives
9h30 - 9h50	Suzy COLLIN-ZAHN (Meudon)	Accretion rate in Narrow Line Seyfert 1 Galaxies, and the growth of massive black holes
9h50 - 10h10	Olivier GODET (Toulouse)	X-ray He-like diagnostics for photoionized plasmas
10h10 - 10h40	Giovanni BIGNAMI (Toulouse)	XMM-Newton and neutron stars
	PAUSE	
11h00 - 11h30	Felix MIRABEL (Saclay)	Microquasars and ULXs : Fossils of GRB Sources
11h30 - 11h50	Jérôme RODRIGUEZ (Saclay)	Simultaneous INTEGRAL/RXTE Observations of GRS 1915+105
11h50 - 12h10	Marion CADOLLE-BEL (Saclay)	INTEGRAL, XMM-Newton and Rossi-XTE Observations of the State Transition of the X-ray Transient and Black Hole Candidate XTE J1720-31
12h10 - 12h30	Georg WEIDENSPOINTNER (Toulouse)	The first year of INTEGRAL/SPI : status of 511 keV positron annihilation line observations
	DÉJEUNER	

SESSION 2 : Jeudi après-midi

14h00 - 14h30	Régis TERRIER (Paris)	On the soft gamma-ray interstellar emission
14h30 - 14h50	Jürgen KNÖDLSEDER (Toulouse)	SPI/INTEGRAL observation of 1809 keV gamma-ray line emission from the Cygnus X region
14h50 - 15h10	Matthieu RENAUD (Saclay)	Search of young remnants of galactic supernovae by line emission of 44Ti with INTEGRAL
15h10 - 15h30	Marc ALLAIN (Toulouse)	Bayesian Imaging Reconstruction Methods for INTEGRAL/SPI
15h30 - 15h50	Alexandre MARCOWITH (Toulouse)	Astroparticle yield in radio galaxies jets and hot spots
	PAUSE	
16h10 - 16h40	Anne DECOURCHELLE (Saclay)	Particle Acceleration in Supernova Remnants
16h40 - 17h00	Jean-François OLIVE (Toulouse)	Investigating X-ray Quasi-Periodic Oscillations in the time domain
17h00 - 17h20	Jérôme PETRI (Utrecht)	Forced oscillations in accretion disks and QPOs
17h20 - 17h40	Laurent NOTTALE (Meudon)	Energy structure at 3.2 10^{20} eV in special scale-relativity
17h40 - 18h00	Olivier RAVEL (Nantes)	Radiodetection of cosmic ray extensive air showers : present status of the CODALEMA experiment

Vendredi 18 Juin 2004

SESSION 3 : Vendredi Matin

9h00 - 9h20	Isabelle LHENRY-YVON (Orsay)	Pierre Auger Observatory in the starting blocks for the highest energy cosmic rays
9h20 - 9h40	Eric ARMENGAUD (Paris)	Search for large-scale anisotropies and point sources in the Pierre Auger experiment
9h40 - 10h00	Pierre DA SILVA (Paris)	Primary identification in AUGER
10h00 - 10h20	Hakima MANSERI (Paris)	Results from the CELESTE experiment
10h20 - 10h40	Martin TLUCZYKONT (Paris)	Highlight Results of the HEGRA Experiment
	PAUSE	
11h00 - 11h35	Michel BLANC (Marseille)	Proposition de programmation spatiale préparée par le CERES
11h35 - 11h50		Discussion ouverte
11h50 - 12h10	Julien RAUX (Paris)	First Results From the HESS Experiment with an Analysis Method based on a Semi-analytical Shower Model
12h10 - 12h30	Marianne LEMOINE (Paris)	An advanced analysis method for stereoscopic systems of Cherenkov Telescopes in gamma-ray astronomy
	DÉJEUNER	

SESSION 4 : Vendredi après-midi

14h00 - 14h30	Gilles HENRI (Grenoble)	Very high energy emission and the physics of relativistic jets
14h30 - 14h50	Anne LEMIÈRE (Paris)	HESS observations of Mkn 421
14h50 - 15h10	Nicolas LEROY (Paris)	VHE gamma-ray observation from the blazar PKS2155-304 with H.E.S.S.
15h10 - 15h30	Claude THÉORET (Paris)	VHE gamma-ray Observations from the binary pulsar PSR B1259-63 with the HESS telescope array
15h30 - 15h50	Pierre-Yves LONGARETTI (Grenoble)	Pressure-driven instabilities in MHD jets
	PAUSE	
16h10 - 16h40	Pascal VINCENT (Paris)	HESS phase II experiment
16h40 -17h00	Nathalie WEBB (Toulouse)	Using X-rays to probe the binary content of globular clusters
17h00 - 17h20	Dorota GONDEK-ROSINSKA (Meudon)	Gravitational waves from binary neutron stars
17h20 - 17h40	Jérôme NOVAK (Meudon)	A new 3D general relativistic hydro code for simulation of gravitational waves from core-collapses
17h40 - 18h00	François LIMOUSIN (Meudon)	Quasi-equilibrium sequences of binary strange quark stars in general relativity

Programme PNG

Cet atelier est organisé par le PNG dans le cadre de la semaine SF2A This workshop is organized by the Programme National Galaxies in the context of the annual meeting of the Societe Francaise d'Astronomie et d'Astrophysique.
The availability of new large surveys and the upcoming Virtual Observatory dramatically transform our working methods when we are studying galaxies. The goal of this workshop is to review the various tools, databases or processing/analysis systems, to study the physics of the Galaxy and of galaxies. This tools may be yet available or still under development. We hope to identify new fields were particular development efforts are urgently needed and will be scientifically much profitable.
Organisateurs : Philippe Prugniel , Françoise Genova, Laurence Tresse , Caroline Soubiran

Jeudi 17 Juin

09 :00-09 :10	Philippe Prugniel	Welcome

Session 1 : Stellar and Galactic physics, ISM

09 :15-09 :40	C. Soubiran (Bordeaux)	Spectres et paramètres stellaires pour les galaxies
09 :40-10 :05	J. Moultaka (Cologne)	ELODIE-SOPHIE : Spectroscopic archive
10 :05-10 :30	A. Siebert	RAVE
10 :30-11 :00		Coupure café & démonstrations
11 :00-11 :25	D. Katz (Paris)	GAIA RVS
11 :25-11 :50	C. Babusiaux (Bruxelles)	The Gaia Instrument and Basic Image Simulator
11 :50-12 :15	C. Reyle (Besancon)	Online modeling of the Galaxy and its applications
12 :15-14 :15		Coupure déjeuner & démonstrations
14 :15-14 :40	M-L. Dubernet (Meudon)	Base spectroscopique pour l'ISM des galaxies
14 :40-15 :05	A. Walters (Toulouse)	Spectroscopic databases and their use in the analysis of astrophysical spectra.

Session 2 : Nearby Galaxies

15 :05-15 :30	Ph. Prugniel (Lyon-Paris)	MIGALE : Multiparametric Virtual Instrument for galaxy evolution
15 :30-15 :55	B. Vollmer (Strasbourg)	Bases extragalactiques
15 :55-16 :25	Coupure café & démonstrations	
16 :25-16 :50	A. Boselli	Goldmine
16 :50-17 :15	D. Le Borgne (Toronto)	Population synthesis tools
17 :15-17 :40	P. Ocvirk (Munich)	Caractérisation des populations stellaires : méthodes et écueils

Vendredi 18

09 :00-09 :25	G. Theureau (Orleans)	HI galaxies and the Nancay Archive
09 :25-09 :50	H. Mathis (Oxford)	Extracting star formation histories from large, medium resolution spectroscopic surveys
09 :50-10 :15	D. Vergani / V. Cayatte (Paris)	Euro-3D : An european consortium for 3D spectro
10 :15-10 :40	H. Wozniak (Lyon)	Theoretical VO for nearby galaxies
10 :40-11 :10	Coupure café & démonstrations	

Session 3 : Distant Objects and Large surveys

11 :10-11 :35	M. Allen (Strasbourg)	Discovery of type 2 QSO with the AVO prototype
11 :35-12 :00	L. Tresse (Marseille)	Bases de donnees VVDS & CENCOS
12 :00-12 :25	B. Guiderdoni (Paris)	Bases de galaxies virtuelles (GalICS)
12 :25-14 :25	Coupure déjeuner & démonstrations	
14 :25-14 :50	Y. Mellier (Paris)	Bases extragalactiques du CFHTLS-Terapix
14 :50-15 :15	H. Flores (Paris)	Virtual Instruments for distant galaxies : Disgal
15 :15-15 :40	E. Bertin (Paris)	Online morphological classification service
15 :40-16 :05	D Rizzo (Toulouse)	Photometric redshifts with neural networks
16 :05-16 :35	Coupure café & démonstrations	
16 :35-17 :00	D. Burgarella (Marseille)	Galex
17 :00-17 :30	Francoise Genova	Summary

Programme PNC

les sessions ont lieu de 9h à 10h30 et de 11h à 12h30 le matin puis de 14h à 15h30 et de 16h à 17h30 l'après midi.

jeudi 17 juin

session 1 : grandes structures et évolution des galaxies

9h - 9h30	GOLDONI Paolo	The X-Shooter Spectrograph
9h30 - 9h45	PEROUX Celine	Formation and evolution of quasar absorbers
9h45 - 10h	ROLLINDE Emmanuel	Density structure in host galaxy of quasars from the longitudinal proximity effect
10h - 10h15	FOUCAUD Sébastien	The remote universe, with Integral Field spectroscopy.
10h15 - 10h30	COURTOIS Helene	Maps of the Local Universe : the bright galaxy distribution
	PAUSE	

session 2 : la matière noire

11h - 11h30	SALATI Pierre	La matière noire
11h30 - 11h45	NOLLEZ Gerard	Status of the EDELWEISS dark matter search
11h45 - 12h	DE MARCILLAC Pierre	Comment tirer des photons de la matière noire ?
12h - 12h15	HÉBRARD Guillaume	D/O, D/N, and D/H with FUSE : a new vision of the interstellar abundance of deuterium
12h15 - 12h30	PIAT Michel	Precise measurement of CMB polarisation from Dome-C : the BRAIN and CLOVER experiments
12h30 - 12h45	PONTHIEU Nicolas	Polarization with Archeops and implications for future CMB polarization measurements
	DÉJEUNER	

session 3 : CMB

14h - 14h45	BERNARDEAU Francis	Bilan et actions du Programme National de Cosmologie
14h45 - 15h	RENAULT Cecile	Archeops power spectrum and comparison with WMAP
15h - 15h15	DOUSPIS Marian	The initial spectrum of fluctuations
15h15 - 15h30	RIAZUELO Alain	Fond diffus cosmologique et topologie de l'univers
	PAUSE	

session 4 : grandes structures et évolution des galaxes (suite)

16h-16h15	BOURNAUD Frederic	Evolution of galaxies along the Hubble Sequence : secular evolution, galaxy interactions, and gas accretion
16h15-16h30	BURGARELLA Denis	GALEX, hyper-luminous UV sources, star formation and dust
16h30-16h45	DOLE Herve	Overview of the First Results from Spitzer
16h45 - 17h	MAMON Gary	LCDM dark matter in elliptical galaxies ?
17h-17h15	MOHAYAEE Roya	Neutralino annihilation in caustics of dark matter halos

vendredi 18 juin

session 5 : physique de l'univers primordial

9h - 9h15	NOTTALE Laurent	Scale relativity and "dark potential"
9h15 - 9h30	LEHNER Thierry	Formation de structures par l'équation de Hartree
9h30 - 9h45	CELERIER Marie-Noëlle	Generalized macroscopic Schrodinger equation in scale relativity
9h45 - 10h	POLARSKI David	La production de perturbations adiabatiques dans l'univers primordial
10h - 10h15	BRUNIER Tristan	Non gaussianités dans les modeles inflationnaires
10h15 - 10h30	CHATILLON Nicolas	Low-energy effective action and cosmological evolution of a Gauss-Bonnet brane world
	PAUSE	

session 6 : l'énergie noire

11h - 11h30	REFREGIER Alexandre	Le projet JDEM/DEP
11h30 - 11h45	PAIN Reynald (à confirmer)	SNIFS : status report
11h45 - 12h	PAIN Reynald (à confirmer)	SNLS : status report
12h - 12h15	BRAX Philippe	Chameleons and quintessence
12h15 - 12h30	FAY Stéphane	Characterisation of dark energy with supernovae in General Relativity with a massive scalar field
	DÉJEUNER	

session 7 : simulations numériques

14h - 14h30	Teyssier Romain	Le projet Horizon
14h30 - 14h45	COLOMBI Stephane	Vlasov Poisson in phase-space : 1D-1D prototypes
14h45 - 15h	COURTY Stéphanie	Host galaxies of gamma-ray bursts and galaxy formation
15h - 15h15	DA SILVA Antonio	The CLEF-SSH simulation project
15h15 - 15h30	FüZFA André	Discriminate between quintessence models with structure formation
	PAUSE	

session 8 : amas de galaxies

16h-16h15	PIERRE Marguerite	La population des amas de galaxies dans le survey XMM-LSS
16h15 - 16h30	VAUCLAIR Sebastien	XMM-Omega project : High redshift X-ray galaxy clusters, cosmological implications
16h30 - 16h45	SADAT Rachida	The baryon fraction in remote galaxy clusters observed with XMM
16h45 - 17h	DURRET Florence	An XMM-Newton view of the greedy cluster Abell 85
17h - 17h15	FAURE Cecile	Galaxy groups in the direction of lensed quasars
17h15 - 17h30	SAUVAGEOT Jean-Luc	XMM View of Merging Clusters

Session des posters

CELERIER Marie-noelle	Singularities in spherically symmetric cosmological models and the horizon problem
DOLE Herve	First Results from IR Extragalactic Surveys with Spitzer
DURRET Florence	Stellar populations in the z=0.64 cluster CL 0048-2942
FILIOL Melanie	The Supernova program of the cfht Legacy Survey - Supernovae spectroscopy
MARTY Philippe	Last results from the XMM-Newton observations of Hi-Lx clusters
SOREL Maud	CIB AND CIRRUS IN LOW SKY BRIGHTNESS

Programme PCMI

Le thème de la journée PCMI sera consacré à la physique et chimie du milieu interstellaire dans le contexte extragalactique.
Organisateurs : François Boulanger, Stéphane Guilloteau, Christine Joblin, Claude Le Forestier, Brian Mitchell, Evelyne Roueff, Michel Vervloet

Vendredi 18 Juin 2004

Session 1 :

9 :00-9 :10	F. Boulanger (Orsay)	Message de Bienvenue
9 :10-9 :30	N. Rodriguez-Fernandez (Paris)	Survey de molécules dans le centre Galactique
9 :30-9 :50	L. Cambresy (Strasbourg)	Large scale variations of the dust optical properties in the Galaxy
9 :50-10 :10	C. Bot (Strasbourg)	Poussières dans le petit Nuage de Magellan : milieu diffus et nuages denses
10 :10-10 :30	J. Braine (Bordeaux)	Gas moléculaire et naines de marée
	PAUSE	
11 :00-11 :30	M. Sauvage (Saclay)	Molécules et poussières dans les galaxies proches
11 :30-12 :00	M. Gerin (Paris)	Distribution de CI et CO dans les galaxies
12 :00-12 :30	D. Rouan (Meudon)	Nano-particules de poussière dans NGC 1068
	DÉJEUNER	

Session 2 :

14 :00-14 :30	M. Guélin (Grenoble)	Astrophysique moléculaire extra-galactique
14 :30-14 :50	G. Callejo (Paris)	Dynamics of the molecular gas in the OMC-1 molecular cloud in Orion
14 :50-15 :10	D. Marshall (Besancon)	Modelling Interstellar Extinction in Three Dimensions
15 :10-15 :30	P. Hennebelle (Paris)	Thermal condensation in atomic hydrogen driven by turbulence
	PAUSE	
16 :30-16 :50	P. Salomé (Grenoble)	Gaz moléculaire dans les flots de refroidissement
16 :50-17 :10	A. Beelen (Orsay)	Gaz et Poussières dans les galaxies à grand z
17 :10-17 :40	A. Omont (Paris)	Perspectives pour l'observation des galaxies à très grand z dans l'IR lointain
17 :40-18 :00	P. Encrenaz (Paris, TBC)	Recherche de molécules primordiales avec ODIN
18 :00-18 :15	V. Charmandaris (Cornell)	Spectroscopic observations of interstellar matter in galaxies with the Spitzer IR Space Telescope

Quelques suggestions de restaurants dans les environs de Jussieu

par Michel Dennefeld (IAP)

Précision : ces pages sont une remise en forme de celles écrites par M. Dennefeld à l'occasion des journées 2002. Il est donc possible qu'il y ait eu des changements depuis.

Notes liminaires

- Il est difficile, à Paris, de manger bien pour pas cher (l'inverse, par contre, est très fréquent !)
- Donc, si vous voulez dépenser peu (moins de 15 euros), vous trouverez peu de choses dans cette liste. Il y a des gargottes tout autour de Jussieu, où vous trouverez de petits plats plus ou moins exotiques, et des sandwiches variés.
- Il y a évidemment trop de restaurants pour les citer tous ici (475 rien que dans le cinquième arrondissement !) : nous nous limitons donc aux environs de Jussieu (10mn à pied).
- Tous ceux qui sont mentionnés ont été testés (plusieurs fois pour beaucoup d'entre eux), sans parler de tous ceux qui ont été testés et ne seront pas mentionnés !
- Notez qu'il n'y a quasiment rien à l'est de l'université (Jardin des Plantes, et au-delà)
- Ces remarques n'engagent que leur auteur (comme souvent, c'est d'abord une question de goût !)

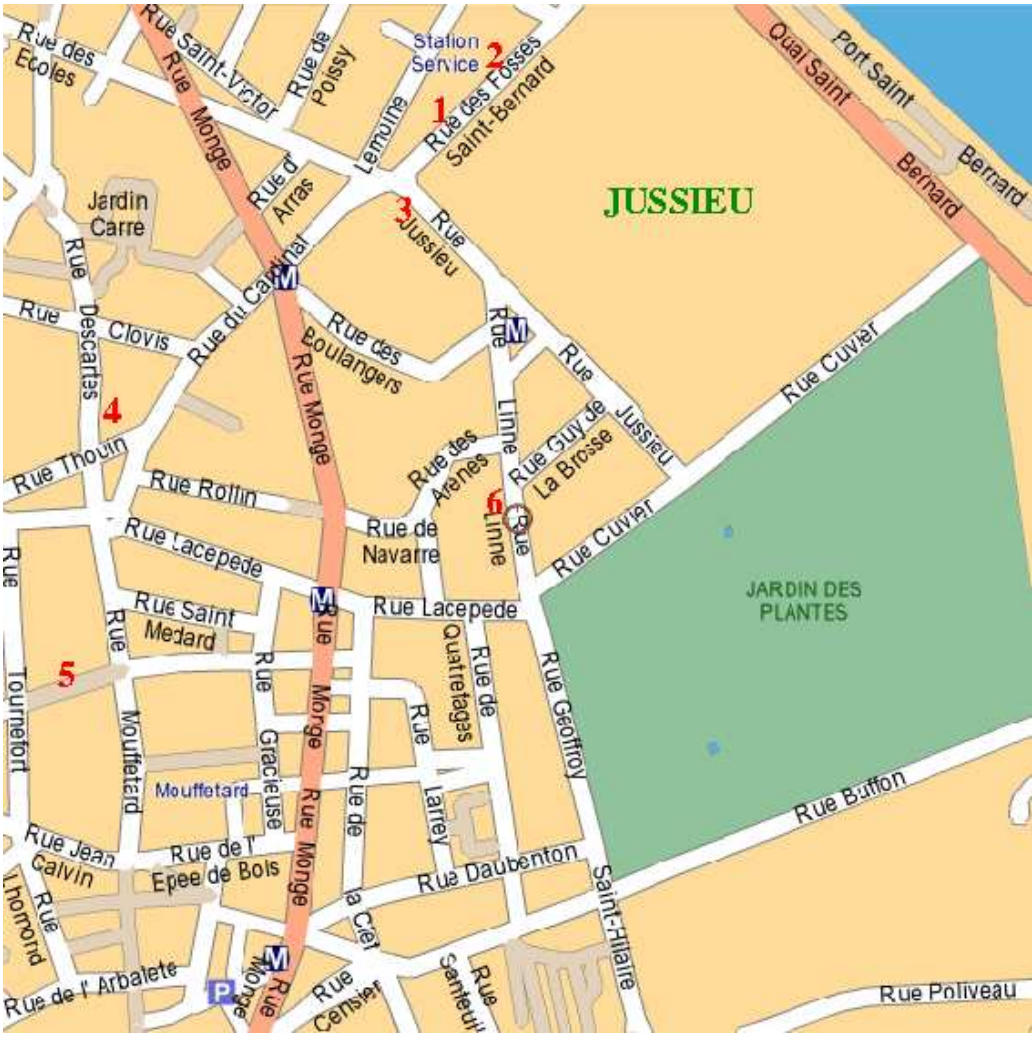

Fig. 1 – Carte B

Disons cependant qu'il y a beaucoup de petits restaurants à peu près corrects (sans plus) dans la rue Descartes, et la rue Mouffetard, où vous pouvez trouver de quoi satisfaire votre curiosité (carte B). Idem pour la rue du Pot de Fer (l'annexe de l'ENS...numéro 5 sur la carte B). Une mention spéciale pour :

- Descartes Mandarin (33, rue Descartes), excellents Dim-Sum, prix raisonnables(15-20E) (A-4)
- Mavrommatis (tout en bas de la rue Mouffetard, coin rue Daubenton), grec excellent, mais plus cher (compter 20-30 E)

Même remarque sur la rue Linné, catégorie quelconque, avec par exemple la pizzéria Amore Mio et le Roi du couscous, côte à côte au numéro 13 (B-6)
Nous terminerons cette première carte en indiquant les annexes de la cantine de Jussieu (prix et qualité sans aucune comparaison..., bonne cuisine traditionnelle, 20 à 30 E) :
– Le Buisson Ardent , 25 rue Jussieu (A-3 et B-3)
– Moissonnier, 28 rue des Fosses St Bernard (A-1 et B-1)
– Le Moulin à Vent, 20 rue des Fosses St Bernard (A-2 et B-2) (Chez Henri, et son "boeuf à la ficelle")
Pour passer aux choses sérieuses, passez au prochain chapitre !

Les bonnes adresses...

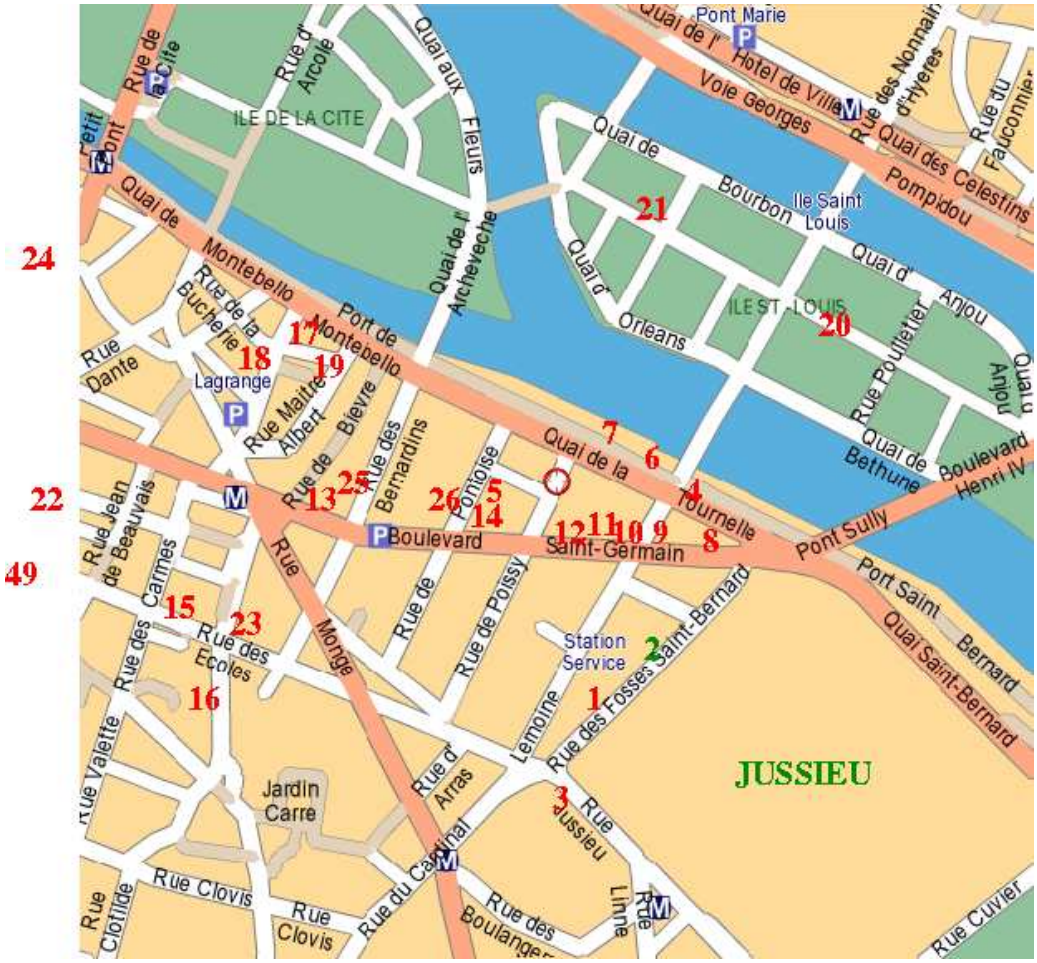

Fig. 2 – Carte A

Pour ceux qui aiment l'exotisme (en-dehors de la rue Mouffetard) :

– L'Atlas, 12 Bd St Germain (A-9) Une des meilleures pastillas de Paris...
– Pemathang-Lhassa, 13 rue de la Montagne St Genevieve A-23 (excellent thibétain)
– Chou-Chen, 3 rue de Cluny (A-22), un des plus vieux chinois de Paris, et pas cher...
– Fogon St Julien, 10 rue St Julien le Pauvre (A-24) tapas et paellas (le soir seulement)
– Anahuacalli, 30 rue des Bernardins (A-25) cuisine sud-américaine
– Inagiku, 14 rue de Pontoise (A-26), le japonais de service
– Il Pescatore, 28 rue des Ecoles (A-15), bons petits plats (et pizze) à bon prix...
– Il y a aussi un grec, un égyptien, un indien... mais quelconques, entre les numéros 10 et 50 Bd St Germain (coté droit en remontant)

La cuisine traditionnelle

A-1, A-2, A-3 annexes de Jussieu déjà mentionnées...
Sur le quai de la Tournelle :
– La Tour d'Argent, 15 quai de la Tournelle (A-4) (01 43 54 23 31) Nous commencons fort, nous direz-vous....mais depuis qu'elle a perdu des étoiles, il y a des efforts, et un menu à déjeuner encore abordable (60 E), pour ceux qui veulent absolument avoir une vue sur Notre-Dame....
– Rôtisserie du Beaujolais (au 19, A-6), bonne cuisine du même nom (20-30 E) Quai V, au 25 du quai (A-7), excellente cuisine provençale (menu déjeuner à 17E avec un verre de vin) un des meilleurs rapports qualité/prix du quartier, mais ne vous y précipitez pas tous, la salle est toute petite....
Boulevard St Germain :
– La vieille trousse au n.6 (A-8), un vieux de 68...
– Chez René, au 14 (A-10), lyonnais, mais cher
– Bistrot Côté Mer, au 16 (A-11), cuisine de poissons tres fine (M. Rostang) mais les portions le sont aussi...(20-30E)
– Ma cuisine, au 26 (A-12), bon, mais pas comme chez vous !
– Le Pactole a malheureusement disparu (de même que le Dodin Bouffant), il reste Vartan à côté, au 52 (A-13), mais c'est nettement moins bien...
Toujours dans le quartier :
– La marée verte, 9 rue de Pontoise (A-14), bonne cuisine de poissons (15-20E)
– Le petit Pontoise, juste à côté (A-14), pour ceux qui ne veulent pas de poisson, cuisine familiale (15E)
– Chez Toutoune, au 5 rue de Pontoise, un excellent menu carte à large choix (30E) Réserver pour le soir (01 43 21 56 81)
Plus près de Notre-Dame...
– La Bouteille d'Or, 9 quai de Montebello (A-17) Bonne cuisine corse traditionnelle (menu-carte à 20E), et vue imprenable sur Notre-Dame (quand il n'y a pas trop de feuilles aux arbres...)
– Le Reminet, 3 rue des Grands-Degrés (A-19), cuisine de qualité, mais la réputation venant, le service s'en ressent...
– La Maison, 1 rue de la Bucherie (A-18), excellent ! prenez le temps de savourer à l'extérieur sur la petite place tranquille, surtout le soir...
Et si vous préferez Ste Geneviève, allez à la Ferme Ste Geneviève, au 40 de la rue du même nom(A-16), fromages et cuisine normande traditionnelle...Il y a aussi "Chez Henri" et "L'Escapade"...
Suite au prochain chapitre...

Bonnes adresses (suite...)

ou "Si vous osez franchir le Rubicon"

Allez, sortons du quartier latin, il n'y a pas de déshonneur !
Dans l'Ile Saint -Louis, prenez la rue Saint-Louis en l'Ile.... plein d'attrape-touristes (et même un attrape-français, "Nos Ancêtres les Gaulois"), mais des perles s'y cachent encore !
Le Gourmet en l'Isle, au n. 42 (A-20 ou C-20), bonne cuisine traditionnelle (environ 20E)
Le Monde des Chimères, au n. 69 (A-21 ou C-21), à vous de vérifier...
Dans l'ile Notre-Dame, c'est beaucoup plus dur....à moins que vous ne poussiez jusqu'à la Place Dauphine (derrière le Palais de Justice), cela en vaut la peine. Et vous pourrez déjeuner à l'extérieur : Chez Paul, au Caveau du Palais ou à la Rose de France, bonne cuisine traditionnelle, mais à prix en rapport avec les honoraires d'avocat !
Ou bien franchissez directement, en sortant de Jussieu par le nord, le pont Sully....Petit bistrot au 12 quai des Célestins (le petit Célestin, C-2), ou bar à vins (corses !) au coin des rues Saint-Paul et des Lions (C-10).
Café-restaurant plus traditionnel au coin du Boulevard Morland (Le Sully, C-1)... la bibliothèque de l'Arsenal n'est pas loin, de même que le hall d'exposition de la ville de Paris.
L'Ecume, 25bis Bd Henri IV (C-3) Quoique son nom ne l'indique pas, excellentes viandes de boeuf...
La Bastoche, 7 rue Saint Antoine (C-4) Bonne cuisine, Bon rapport qualité/prix, sympa, et même une salle pour les groupes...
L'Impasse, Impasse Guéménée (C-5), petit bistrot sans prétentions, style années 30
Et puisqu'on y est, pourquoi ne pas pousser jusqu'à la place des Vosges ? Sympa de manger à l'extérieur, sous les arcades... Ma Bourgogne (C-7) quelques plats du terroir à prix raisonnable... Annibal de Coconnas (C-6), plus stylé et plus cher, mais de la claaasse !
Si vous préferrez une cuisine solide pour lutter contre les grands froids, allez à l'auberge de Jarente (7, rue de Jarente , C-8), cuisine basque de qualité à petits prix.
Vous pouvez aussi explorer la rue Francois Miron et ses vieilles maisons du Moyen-Age, en essayant le Bouchon du Marais (au 15, C-9), les autres étant plus risqués...

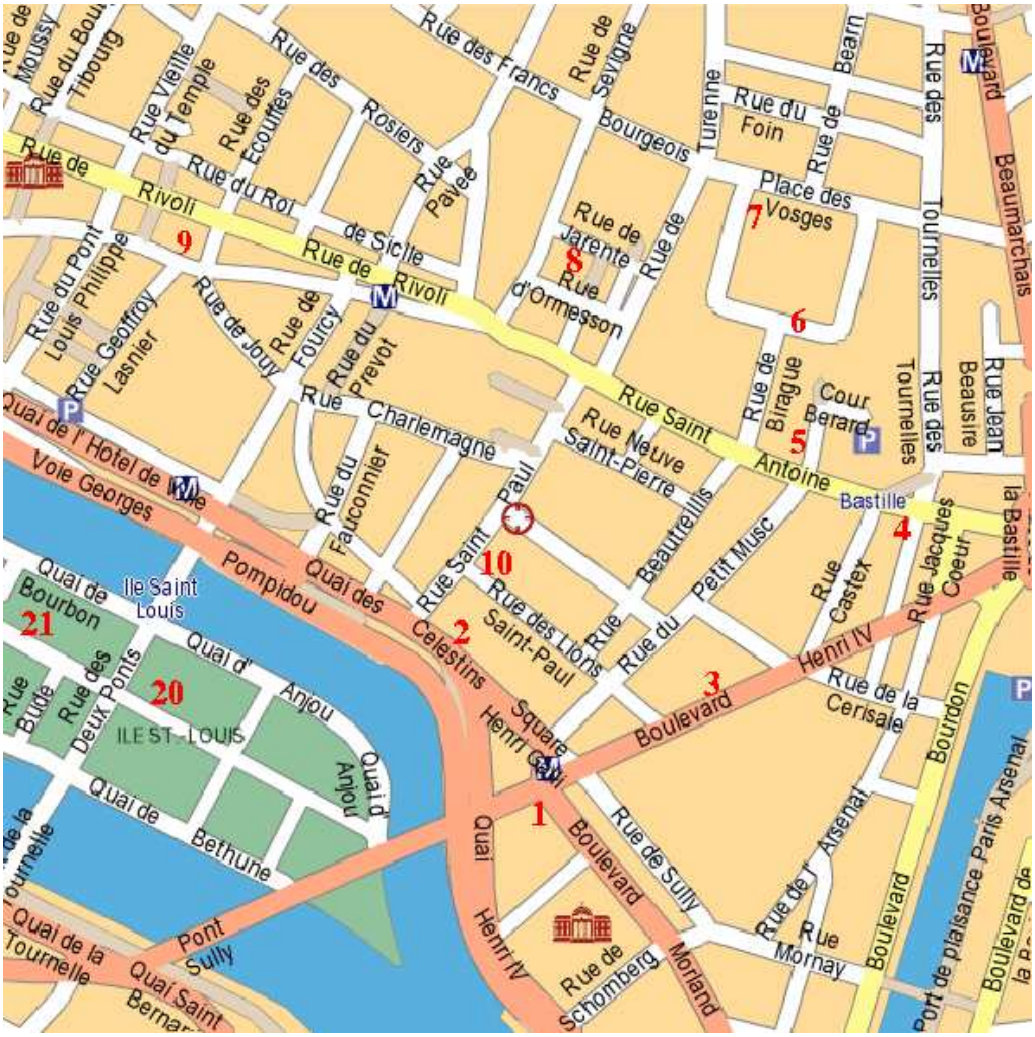

Fig. 3 – Carte C

Mais il est temps de retourner aux sessions de la SF2A....admirez au passage les beaux hôtels du quartier Saint-Paul... et ne digérez pas pendant les sessions !
Commentaires et suggestions seront bien entendu les bienvenus pour enrichir le palmarès.
Michel Dennefeld

Sessions plénières

Oral contributions

Evolution of interstellar dust
A. Abergel
(IAS)

Interstellar dust takes an active part in the matter evolution cycle in galaxies. Throughout this cycle, dust grains are subject to many processes in which their physical characteristics evolve, and in particular their optical properties. I will present a summary of results obtained from the two last decades of space observations and confront them to the many laboratory experiments undertaken in particular within the framework of the national program PCMI. The stakes of this work largely exceed the interstellar medium study. Interstellar dust emission of our Galaxy indeed dominates the sky emission in many bands at large wavelength in the cosmological experiments (Archeops, WMAP, Planck...). The interpretation of the observations requires in all cases to subtract with the best possible precision the contribution of interstellar dust.

Conclusions of Astroparticle Prospective
P. Binetruy
(APC)
The Interdisciplinary Commision 47 carried out recently a prospective on Astroparticles, in relation to CNRS departements SDU, IN2P3 and SPM. This exercice of prospective was concluded by a 3 days meeting in La Londe les Maures, gathering a hundred participants. I will present the conclusions reached.

The extinct radioactivities of 7Be and 10Be : traces of the irradiation of the protosolar nebula by the young Sun
Marc Chaussidon, Francois Robert & Kevin D. McKeegan
(CRPG-CNRS)
Ca-Al-rich refractory inclusions (CAIs) of primitive meteorites contain traces of the incorporation during their formation of short-lived radioactive isotopes (extinct radioactivities) such as 26Al which has a half-life of 0.7 Ma. The origin of these extinct radioactive nuclides is controversial. Our recent work shows the incorporation of two "new" extinct radioactivities in CAIs : 10Be (half-life of 1.5 Ma) and 7Be (half-life of 53 days). The incorporation by CAIs of these two radioactive Be isotopes implies that CAIs formed in a region of the protosolar nebula which was irradiated by the forming Sun in its T-Tauri phase.

The CFHT Legacy Survey : data and services for the community
Jean-Charles Cuillandre
(Canada-France-Hawaii Telescope)
The CFHT Legacy Survey, a 500 nights commitment over 5 years of the MegaPrime 1 square degree optical imager, will be described from the view point of the services offered to the entire French and Canadian scientific communities. The talk will cover the description of data acquisition, data pre-processing and calibration at CFHT, the distribution of the data at the Canadian Astronomy Data Centre in Victoria and its relation to the Terapix data processing center. CFHT data quality assessment will be described, as well as all the means developed at CFHT to pass on the most pertinent information to the CFHTLS users to help them quickly asserting the goals they can set on their specific scientific programs based on the CFHTLS data.

GIRAFFE/IFU : Velocity fields of distant galaxies
H. Flores, F. Hammer, M. Puech ; O. Garrido et C. Balkowski
(GEPI, Obs. de Paris-Meudon)
The GIRAFFE spectrograph is unique in providing the integral field spectroscopy of fifteen distant galaxies at the same time. We present GIRAFFE observations acquired during the Guaranteed Time Observation of the Paris Observatory, using total exposure times ranging from 6 to 12 hours. Our team has developed a technique that allows us to combine HST data with GIRAFFE/IFU observations to recover velocity fields of galaxies. Thanks to this new technique , this instrument opens a large avenue to study dynamical properties and dark matter distribution of distant galaxies until z=1.

Heating of the solar corona
Sebastien Galtier
(Institut d'Astrophysique Spatiale / Universite Paris-Sud)
It is now clearly established that the solar coronal heating is due to the presence of the magnetic field which is revealed for example through intermittent structures like X-ray bright points, at scales smaller than 10 arcsec, or solar flares at larger scales. The widely accepted scenario for the formation of such structures is the flaring of magnetic loops which would be the main heating source for the corona. In this talk a brief review will be given on observations and heating models of magnetic loops.

Origin of extinct radioactivities and irradiation in the primitive solar system
Matthieu Gounelle
(CSNSM-Université Paris XI)
Meteorites contained short-lived radionuclides (<5 Ma) when they formed 4.5 Ga ago. The origin of these radioactivities is debated. They could have been synthesised by a supernova close to the dense molecular cloud progenitor of our Sun, and injected in the Solar System. Alternatively, they could have been made in situ by spallation reactions between protosolar cosmic rays and gas and/or dust belonging to the protosun accretion disk. We will discuss these two possibilities, focusing on recent meteoritic data (discovery of 60Fe and 7Be).

The Canada-France-Hawaii Legacy Survey : scientific goals, status of the survey, quality assessment and first data release.
Y. Mellier
(IAP et Obs. de Paris/LERMA)
The CFHTLS is spread in three main surveys : the deep, the wide and the very wide. Each has primary scientific goals. I will present the scientific objectives and the observing strategy of each survey. Then I will focus on the high level quality assessment derived from the Terapix processing and I will describe the data we will release to CFHTLS users. I will show that the instrument as it stands now meet most of the specifications and what are the last issues : time sequences and image quality.

Recent resultts in stellar and planet formation
F. Menard et l'équipe FOST du LAOG
(Laboratoire d'Astrophysique de Grenoble (LAOG))
In this contribution we will present a few new results obtained by our team regarding the structure and evolution of proto-planetary disks around young stars. These examples will span a range of topics, from the "sculpted" or structured disk of HD141569, to the multi-wavelength models of the scattered light from edge-on disks, to "tomography" of the inner disk structure of AA Tauri. These examples will serve to show how fundamental the study of disks is for a better understand of the planet formation scenarios.
All these results were obtained with the financial help of the "Programme National de Physique Stellaire" (PNPS) of CNRS/INSU, France.

VLT-NAOS results review
D. Mouillet, G. Chauvin
(Observatoire Midi-Pyrenees)
The Adaptive Optics system NAOS is installed on the 8-m ESO-VLT telescope, and coupled with the infrared camera Conica. NAOS was commissionned in 2002 and has been operated for two years. We will review the main results obtained in various fields of astrophysics. We will briefly discuss the performance obtained compared to other instruments, the experience learnt with this instrument, and open perspectives for future high angular resolution instruments on large ground-based telescopes.

Structure and evolution of Milky Way
A.C. Robin
(Observatoire de Besançon)

Starbursts at redshift z 6 to 10
Daniel Schaerer Roser Pello
(Observatoire de Geneve, Observatoire Midi Pyrenees)
A systematic application of strong gravitational lensing and detailed spectral modeling has allowed an important break-through in the detection of very high redshift galaxies from a survey for metal-poor or Population III starbursts at z > 7. Indeed, our pilot program based on ultra-deep near-IR imaging and spectroscopic follow-up with ISAAC at the VLT have led to the first identification of a galaxy at redshift 10 (Pello et al. 2004).
The main objectives, the strategy, and the first results from this survey are discussed here. Photometric and spectroscopic data of several high-z galaxies and galaxy candidates allow us to study their star formation properties and to derive interesting constraints on the intergalactic medium during the end of re-ionization. Ongoing and future observations of z 6-10 galaxies approaching the Dark Ages are discussed.

Le Telescope Canada-France-Hawaii fete ses 25 ans... pour quel futur ?
Christian Veillet
(CFHT)

Poster contributions

A l'ecoute de l'astronomie, ou l'enseignement de l'astronomie aupres des sourds.

Dominique Proust, Daniel Abbou et Eric Lawrin.
(Observatoire de Meudon - GEPI)

La communaute sourde a pendant plus d'un siecle ete marginalisee par l'interdiction de l'usage de la Langue des Signes (Congres de Milan, 1895). Depuis maintenant 20 ans, elle a retrouve en France son statut de langue a part entiere. Cependant cet ostracisme a eu pour consequence de rendre l'acces aux disciplines scientifiques en general et a l'astronomie en particulier extremement difficile pour les etudiants, et le public sourd en general. Dans le cadre d'un partenariat entre l'Observatoire de Paris et l'Academie Francaise de Langue des Signes, et en relation avec la Cite des Sciences, nous presenterons le travail effectue depuis trois ans ouvrant l'astronomie a la communaute sourde.

Session Astronomie Fondamentale

Oral contributions

Interactive Earth rotation through the Web

Ch. Bizouard
(Observatroire de Paris / SYRTE)

Within the framework of the international Service of the Earth rotation, we propose to the Net surfers (on http ://hpiers.obspm.fr/eop-PC/) interactive tools to select, visualize and analyze the parameters of Earth rotation (movement of the pole, precession-nutation, excess length of the day) in relation to the geophysical excitations which cause their variations. Our presentation will consist of a demonstration of these tools, which allow to catch quickly the terrestrial rotation irregularities, even those of the week in progress.

Earth orientation and temporal variations of the gravity field

G. Bourda, Observatoire de Paris (France), SYRTE/UMR8630 R. Biancale, J.-M. Lemoine, CNES/GRGS (Observatoire Midi-Pyrénées)
(Observatoire de Paris/SYRTE)

The high accuracy now reached in the VLBI Earth Orientation Parameters (EOP) determination requires looking further at the various geophysical contributions to variations in EOP.
The determination of the Earth gravity field from space geodetic techniques now allows us to obtain the temporal variations of the low degree coefficients of the geopotential, combining the treatment of different satellites (e.g. Lageos1, Lageos2, Starlette ?). We present a new computation of the degree 2 coefficients of the variable Earth gravity field. This study is based upon the using of (i) new orbit standards, (ii) the GRACE mean gravity field and (iii) Lageos1 data from 1985 until 2004 (merged with Lageos2 data from 1993).
These temporal variations of the Earth gravity field can be related to the Earth Orientation Parameters through the inertia tensor. This paper shows these relations and discusses how such geodetic data can contribute to the understanding of the variations in EOP.
This paper also studies if these refined 20-yr of Lageos data can give us refined value of the 18.6-yr tidal term, as well as of the secular drift of the C20 geopotential coefficient.

Développements récents des concepts et modèles en astronomie fondamentale/Recent developments in the concepts and models for fundamental astronomy

Nicole Capitaine
(Observatoire de Paris/Syrte)

English version : The application of the very long baseline interferometry (VLBI) technique to astrometry, by giving access to a “quasi-ideal” celestial system, has challenged the traditional definitions of fundamental astronomy. The use of VLBI together with space geodetic techniques (GPS, laser ranging) for a high precision determination of the Earth’s rotation and reference systems requires a worldwide coordination relying on common conventions and models. Moreover the significant improvement in the precision of measurements has required astronomers, geodesists and geophysicists to combine their efforts to improve the models for effects for which a few years ago approximate theories were still sufficient. .Such an evolution of fundamental astronomy due to the technique has been accompanied by an evolution of ideas and models. Thus, the international astronomical Union, after having adopted, in 1997, the International Reference System (ICRS) realized by a set of coordinates of extragalactic radio sources, has adopted in 2000 a new set of resolutions in order to use this celestial reference system in the most accurate way. These resolutions, also adopted by the IUGG in 2003, are recommending new concepts (abandonment of the equinox as a reference, revision of the definition of the celestial pole, Universal Time, Sidereal Time, etc.) and new models (relativistic transformation of the space and time coordinates between the barycentric and geocentric reference systems, precession and nutation of a non-rigid Earth model, etc.) to be considered for a scientific use of high accuracy observations. This talk will present the most recent developments of concepts and models in the field of celestial reference systems and Earth’s rotation.

(**Version Française :**)
L'application de la technique d'interférométrie à très longue base à l'astrométrie, en donnant accès à un système de référence céleste « quasi-idéal », a entraîné une remise en question des définitions traditionnelles de l'astronomie fondamentale. L'utilisation du VLBI et des techniques de géodésie spatiale (GPS, télémétrie laser) pour une détermination de haute précision de la rotation de la Terre et de systèmes de référence exige une coordination mondiale reposant sur des conventions et des modèles communs. De plus, l'important gain en précision des mesures oblige astronomes, géodésiens et géophysiciens à conjuguer leurs efforts pour perfectionner les modèles pour lesquels il y encore quelques années on pouvait se contenter de théories approchées. Cette évolution de l'astronomie fondamentale fondée sur la technique, s'accompagne d'une évolution des idées et des modèles. Ainsi, l'UAI, après avoir adopté en 1997 le système de référence céleste international (ICRS) réalisé par les coordonnées d'un ensemble de radio-sources extra-galactiques, a adopté en 2000 un ensemble de résolutions permettant l'utilisation la plus exacte possible de ce système de référence. Ces résolutions, également adoptées par l'UGGI en 2003, recommandent de nouveaux concepts (abandon de la référence à l'équinoxe, révision de la définition du pôle céleste, du Temps universel, Temps sidéral, etc.) et de nouveaux modèles (transformation relativiste des coordonnées espace-temps entre repère géocentrique et barycentrique, précession- nutation d'un modèle de Terre non rigide, etc.) à utiliser pour une exploitation scientifique des observations de très grande exactitude. Cet exposé présentera les développements les plus récents des concepts et des modèles dans le domaine des systèmes de référence célestes et de la rotation de la Terre.

Densification of the International Celestial Reference Frame in the Northern Hemisphere
P. Charlot (1), A. L. Fey (2), C. S. Jacobs (3), C. Ma (4), O. J. Sovers (5), A. Baudry (1) – (1) Observatoire Aquitain des Sciences de l'Univers - CNRS/UMR 5804, (2) US Naval Observatory, (3) Jet Propulsion Laboratory, (4) NASA/GSFC, (5) Remote Sensing Analysis Systems
(Observatoire Aquitain des Sciences de l'Univers)
The current realization of the International Celestial Reference Frame (ICRF) comprises a total of 717 extragalactic radio sources distributed over the entire sky. We present an observing program underway to densify the ICRF in the northern hemisphere using the European VLBI network (EVN) and other geodetic antennas in Spitsbergen, Canada and USA. The approach used in this project is designed to improve the overall source distribution in the ICRF by filling the "empty regions" of the frame. A total of 150 new sources at specific sky locations have been observed for this purpose during three EVN experiments. Only sources with no or limited extended VLBI structures have been selected for this densification in order to ensure high astrometric accuracy.

CONSTRUCTION OF A PRIMARY AND AUTONOMOUS RELATIVISTIC POSITIONING SYSTEM WITH GALILEO : SYPOR PROJECT
Bartolomé COLL
(SYRTE)
Relativistic positioning systems are the best realizations of coordinate systems conceived up to now. We present here their basic properties and the way to make possible the use of Galileo constellation of satellites as a primary and autonomous relativistic positioning system for the Earth and its vicinity (SYPOR project).

Combination of space geodesy techniques for monitoring the kinematics of the Earth
Coulot D., Biancale R., Berio P., Gontier A.-M., Loyer S., Soudarin L., Altamimi Z., Lemoine J.-M., Capitaine N., Exertier P. & Gambis D.
(IGN/LAREG & OCA/GEMINI)
The main goal of this work is to prove the efficiency of space technique combinations for computation of Earth's Orientation Parameters (EOPs) and Terrestrial Reference Frames (TRFs). We use four techniques (SLR, DORIS, GPS and VLBI) and the parameters of interest are polar motion, universal time and nutation corrections with a 6-hour sampling and station positions with a weekly sampling. In order to calibrate our method we carry out two combinations. The first one is made directly on measurements and the second one is based on individual solutions.

Resonance effects in the GPS and GALILEO constellations : comparisons over 2 centuries.
F. Deleflie
(Observatoire de la Côte d'Azur)
Orbits of the satellites of the GPS and GALILEO constellations are resonant. This is due to a commensurability between the period of revolution of the satellites and of the Earth : for the GPS satellites, terms of order 2 of the gravity field are resonant, whereas terms of order 5 are resonant for the GALILEO ones.
It is worth studying these resonant effects for, at least, two reasons. On a short time scale, they breed various kinds of maneuvers to be applied to each satellite to maintain the initial configuration. On long time scales, they breed large variations of the orbital parameters, which question the evolution of a given orbit after the end of life of the corresponding satellite.
In this talk, we will present the effects of resonant parameters of the gravity field, and we will quantify them for the GPS and GALILEO constellations computed over 2 centuries. In particular, we will show the strong influence of the Moon and Sun on the stability of these orbits.

General post-Minkowskian expansions of Synge's world function, time transfer and gravitational deflection of light ray. Applications to GAIA and GALILEO.
Christophe Le Poncin-Lafitte, Bernard Linet and Pierre Teyssandier
(Observatoire de Paris, SYRTE)
The knowledge of Synge's world function giving half the square of the geodesic distance between two points in a curved space-time enables one to determine the time transfer functions and the gravitational deflection of light rays. We present a recursive method for expanding the world function into a perturbative series of powers of the Newtonian gravitational constant G. We carry out the calculations up to the order G^2 for a static, spherically symmetric metric involving three arbitrary parameters and we show how to apply these results to GAIA mission and other highly accurate astrometric projects. We also emphasize the interest of the method for the systems of navigation like GALILEO.

TWSTFT technique at BNM-SYRTE : a potential alternative to GPS for time and frequency transfer
Philippe MERCK Joseph ACHKAR
(BNM-SYRTE)
The national metrology institute BNM-SYRTE has developed an earth station for satellite communications in order to compare, by using radiofrequency link with other earth stations installed in Europe and USA, atomic clocks disseminated in the time laboratories. The goal of BNM-SYRTE is to contribute in the realization of International Atomic Time (TAI) calculated by the BIPM, by using an alternative technique to GPS, denoted TWSTFT (Two Way Satellite Time and Frequency Transfer). This presentation will report the TWSTFT technique used and describe the setup of the station at BNM-SYRTE. The talk will be concluded on the description of the developments in progress (calibration of the station, study of the stability of the different TWSTFT links, etc...).

Mercury's spin-orbit model and its physical libration
Rambaux, N.,
(Observatoire Royal de Belgique)
The upcoming space missions, MESSENGER and BepiColombo with onboard instrumentation capable of measuring the rotational parameters stimulate the objective to reach an accurate theory of the rotational motion of Mercury. Our work deals with the physical and dynamical causes that induce librations of Mercury in order to evaluate accurately the rotational motion of this planet. In this aim, we have extended our BJV relativistic model of solar system integration including the spin-orbit coupled motion of the Moon to the spin-orbit coupling of terrestrial planets and particularly to Mercury (the BJV model was previously built by Bois, Journet and Vokrouhlicky in accordance with the requirements of the Lunar Laser Ranging observational accuracy). The model is at present called SONYR, acronym of Spin-Orbit N-BodY Relativistic model.
Using the model, we can analyze the different families of rotational librations and identify their causes such as the planetary interactions or the impact of the parameters describing the dynamical figure of Mercury. In addition, the spin-orbit motion of Mercury is characterized by two proper frequencies (15.847 and 1066 years). Mercury presents also, between its angle of precession and the ascending node of the orbit, a second synchronism of 278898 years, which can be understood as a spin-orbit secular resonance. Besides, within the SONYR model, which integrates simultaneously the orbital and rotational motion of Mercury, we have been able to improve the Hermean's mean obliquity (1.665 arcminutes) and we identify the non-linear relationship between the dynamical figure and both the obliquity and the angle of libration in longitude. These determinations provide constraints on the internal structure of Mercury.

Rotation of the Earth, Mars and asteroïds : comparative study of models and data quality
Jean Souchay & Sébastien Bouquillon (obs. de Paris) (obs. de Tokyo)
(Observatoire de Paris)
We explain in some detail the analytical formulations which enable to modelize both the free and the forced motion of any celestial body taken as rigid or deformable, and we show how they have been applied (with the corresponding level of precision) for the Earth, Mars and the asteroids in general

Mutual events in the jovian and saturnian systems Les phénomènes mutuels dans les systèmes jovien et saturnien
Vienne A., Noyelles B. et Lainey V.
(LAL-IMCCE)
Campaign of observations of mutual events are organized regularly by the IMCCE : since 1979 for the PHEMU campaign of the Galilean satellites and since 1995 for the PHESAT campaign of the Saturnian satellites. These observations are usefull in order to detect tidal effects in the planet and in the satellites because they lead to very accurate positions. We describe mutual events and the advantages of this kind of observations besides the classical astrometrical ones.

Poster contributions

Near-Infrared astrometry and photometry of Southern ICRF quasars
Camargo, J.I.B., Daigne, G., Ducourant, C., Charlot, P.
(L3AB/Observatoire de Bordeaux)
We present high quality astrometry, along with J, H and Ks photometry, for 30 southern ICRF quasars with 11.5 < Ks < 17.5, observed with the ESO NTT/SOFI at la Silla. Internal precisions of the magnitudes in the three photometric filters are better than 0.04 mags, and spectral indices of the observed quasars have been derived. To attenuate statistical errors from the reference catalogue (UCAC2) within
the astrometric tasks, mosaics of overlapping images around the positions
of fourteen quasars were observed. The rms of the positional differences Radio (VLBI) minus Observations of the quasars, as obtained from the treatment of these mosaics, is better than 30 mas. Corrections for the field distortion pattern were previously applied. Internal positional precisions, to measurements near the centre of the image, are better than 10 mas. One of the objectives of this ongoing project is to provide a selection of candidates to the optical/near-IR extension of the ICRF.

Near-Infrared astrometry and photometry of Southern ICRF quasars
Camargo, J.I.B., Daigne, G., Ducourant, C., Charlot, P.
(Observatoire Aquitain des Sciences de l'Univers)

Io's secular acceleration vs. observations accuracy
V.Lainey, G.Tobie
(ORB/IMCCE)
The high dissipation observed on Io's surface (the closest Galilean satellite to Jupiter) since the Voyager spacecraft arrival, has suggested that acceleration on its mean motion must be observed. Although that the detection of tidal accelerations among the Galilean satellites has begun since the beginning
of the last century (de Sitter 1928), no real agreement has been found yet.
Using a numerical approach, we present how these tidal effects can vanish in the fit to the observations, and so provide reasonable (O-C)s. Three different values for the dissipation have been tested. It appears that the highest one must be rejected as no convergence in the fit can be performed.

Influence of the multipole moments of a giant planet on the propagation of light.
Christophe Le Poncin-Lafi tte and Pierre Teyssandier
(Observatoire de Paris, SYRTE)
In highly accurate astrometric missions like GAIA and SIM, it will be indispensable to take into account the influence of the multipole structure of giant planets, like Jupiter and Saturn, on the propagation of light. We present an algorithmic procedure to determine this influence within the Nordtvedt-Will parametrized post-Newtonian formalism.

Session ASHRA

Invited talks

The Planet Finder project for the VLT
J.-L. Beuzit, D. Mouillet, C. Moutou, T. Fusco, A. Longmore, M. Saisse, M. Ferrari, S. Udry, G. Rousset, R. Conan, F. Menard, A.-M. Lagrange, D. Segransan, P. Rabou, K. Dohlen et al.
(LAOG)
We will present the current status of the Planet Finder project, a second generation instrument for the VLT.

The Opticon Joint Research Activity #1 Adaptive Optics
J.-L. Beuzit
(LAOG)
I will give an overview of the Opticon JRA1-AO whose main objectives are to support the R&D activities needed for the second generation of VLT instruments.

The Jean-Marie Mariotti Center
Alain Chelli
(LAOG)
The Jean-Marie Mariotti Center has been created by INSU in 2000 in order to optimize the use of optical interferometers. It aims at developing software, training the users and participating to the prospective around new instruments and interferometric facilities. The concept of service is central at the JMMC. After 4 years of activities, we make the summary of its actions.

The Euro-Interferometry Initiative (EII) and the Joint Research Activity # 4 (JRA4) of OPTICON
Alain Chelli
(LAOG)
The European interferometry community has created a structure called Euro-Interferometry Initiative in order to promote interferometry. The EII is formed by 3 projects : the Joint Research Activity # 4 (JRA4), the Network # 5 and a Marie Curie Program. The JRA4 and the N5 have been approved and funded for 5 years by Europe in the framework of OPTICON. We describe these projects, especially the JRA4 whose main objectives are to prepare the second generation of VLTI instruments and to produce a software to model interferometric observables.

GENIE : le précurseur de DARWIN au VLTI
Vincent Coudé du Foresto (LESIA) Denis Mourard (OCA)
(LESIA – Observatoire de Paris)
GENIE, a joint project of ESA and ESO, is a ground based interferometric nuller instrument that is being studied for implementation at the VLTI around 2008. It will demonstrate from the ground nulling interferometry operations similar to DARWIN, and in this context carry out precursor science linked to exozodys and large planet measurements.

SESAME : banc de R&D en optique adaptative
E. Gendron
(observatoire de meudon)
On développe un banc ouvert et polyvalent d'études en optique adaptative, appelé SESAME, ayant pour vocation de servir de base pour la R&D dans de multiples domaines de l'optique adaptative et la HRA. On propose de faire évoluer ce banc vers un rôle de facilité nationale pour la communauté HRA, offrant la possibilité de recevoir des expériences " locataires " nécessitant un faisceau turbulent corrigé.

New ASHRA operational mode
D. Mourard, C. Perrier
(Observatoire de la Côte d'Azur)

Haute Résolution Angulaire au Dôme C de l'Antarctique
Farrokh VAKILI
(UMR 6525 LUAN-Université de Nice)
Dome C of Antarctica presents extroardinary conditions for high spatial resolution observations in the optical wavelengths both in the visible and IR wavelengths. These conditins will be described on the ground of the most recent site seeing monitoring results from our team at Dome C during the last 2 years. From this I shall derive a few conclusions for a step-by-step development of an optical interferometric called KEOPS which targets to direct detection and spectral characterization of exo-Earths and a few other scientific objectives benefitting from the special conditions at Dome C.

Oral contributions

The PEGASE project : characterisation of Pegasids and Brown Dwarfs

P. Baudoz, D. Rouan, J. Schneider, A. Leger, M. Ollivier, D. Mourard, X Leyre, G. Rousset, O. Absil, F. Allard, C. Nary Man, F. Malbet, S. Udry, E. Martin
(Observatoire de Meudon/ LESIA)

I will present the PEGASE project proposed within the framework of the CNES call for idea on flights in formation. This ambitious project, gathering a dozen laboratories, proposes an interferometry mission in infrared I(1.5 to 6 μm) with spectroscopic capabilities. The bases of the interferometer will reach up to 500m, giving to PEGASE a resolution higher than the milli-arcsecond. The interferometric recombination includes a very simple mode, measurement of the visibility by excursion of the optical path difference and a mode in black fringe or nulling. The very high angular resolution of the instrument and high dynamical range with the nulling mode will allow to consider exciting scientific objectives : the characterization of Pegasids or hot Jupiters, the study of the internal structure and the atmospheres of brown dwarfs and the analysis of the internal areas of proto-planetary disks. I will first of all describe the basic configuration of the mission and will show that its simplicity ensures the feasibility of the project. I will explain then the relevance of such an instrument for the characterization of Pegasids. I will detail finally the various possible technical options to be attached to the initial version, in order to increase the effectiveness of the mission and to extend its scientific objectives.

Study of sky coverage for MCAO, multi-conjugate adaptative optics

A. Blanc, T. Fusco, J.-L. Beuzit, V. Michau, G. Rousset, M. Nicolle et N. Hubin
(LAOG)

This presentation is concerned with sky coverage studies for MCAO systems. We propose a modification of the "classical" computing for the sky coverage (only based on star counts) by taking into account the sky area actually observable from a fixed number of stars. The results obtained by this new approach are compared with those of the "classical" method. Two types of systems are studied : the "Layer Oriented" and the "Star Oriented" approaches. The sky coverage is computed from stellar densities provided by the Besancon model of the Milky Way [Robin et al-2003]. The results are presented for different conditions (star number, limiting magnitude, position in the sky, etc.).

The MIRI/JWST project : extra-solar planets imagery

Boccaletti A., Baudoz P., Riaud P., Baudrand J., Rouan D., Reess J.M.
(LESIA Observatoire de Meudon)

I will first present in a general way the JWST and the mid-IR instrument, MIRI. I will discuss then the project of Phase Coronograph which should allow extrasolar planets imagery at mid-IR wavelengths and to characterise them thanks to a specific choice of filters. Then, I will present results of numerical simulations to estimate the detection level as well as the first experiments in laboratory to characterize the phase masks.

Status of the MIDI instrument and first scientific results

O. Chesneau, C. Leinert, B. Lopez, G. Perrin, A. Dutrey
(Max-Planck Institut für Astronomie)

The Mid-IR interferometric instrument MIDI has performed its first scientific observations on the Very Large Telescope Interferometer (VLTI) in June 2003. MIDI allows interferometric observations over the 8-13 micron wavelength range, with a spatial resolution ranging from 5 to 20 milliarcsec, a spectral resolution of 30 and 250, and a expected point source sensitivity of N = 4 mag (1 Jy). The instrument is particularly well suited to the study of dust shells and disks. It is able to resolve the location and geometry of the dusty circumstellar environment of young and evolved stars, and to study spatially and spectrally the innermost regions where dust survives. In a few scientific nights, MIDI has already provided beautiful results concerning disks around hot stars, ranging from Herbig AeBe stars to the famous LBV Eta Car. In particular, for the first time studies of the chemical composition of the dust embedded near and far from the central source is possible.

3 years of Galactic Center observations in the thermal infrared with NACO at VLT

Clénet, Y., Rouan, D., Lacombe, F., Gratadour, D., Gendron, E., Léna, P.
(ESO Garching)

The Galactic Center region has been observed with NACO at VLT for 3 years. Near-infrared observations have confirmed the existence of a black hole at the center of the Galaxy and lead to the detection of a highly variable emission from its environment. I will present results obtained from observations in the thermal infrared and compare them to the conclusions drawn from the near-infrared ones as well as to the present Sgr A* emission models.

First observations of Vega-like stars with the VLTI (PNPS-ASHRA)
E. Di Folco, F. Thévenin, P. Kervella, A. Domiciano, V. Coudé du Foresto, P. Morel
(ESO (Garching))
VINCI, the commissioning instrument of the VLTI (Kervella et al. 2000, 2002), has made possible the measurement of numerous main sequence dwarfs diameters. With a typical precision of 1-2%, these interferometric observations allow us to constrain the evolution models. We have thus used VINCI (operating in the K band) together with the stellar evolution code CESAM (Morel 1997) to constrain and model the atmosphere and internal structure of five Vega-like stars : Fomalhaut, Beta Pictoris, Beta Leonis, Epsilon Eridani and Tau Ceti. These measurements augur well of the performance of the upcoming AMBER instrument, which is to be delivered soon to the community. On the basis of the newly derived fundamental parameter, the precise modeling with CESAM allows us to determine stellar ages, taking into account the additional spectrophotometric quantities. We will demonstrate the potential and interest of these investigation methods in the framework of debris-disk stars studies.

ASPRO and its user's support : the JMMC tools for preparing VLTI Observations
Gaspard Duchene, Jean-Philippe Berger, Gerard Zins, Gilles Duvert
(LAOG)
We will present an overview of the main features of the current and next (to be released at the end of the summer) versions of the ASPRO software that are being developed by the JMMC to prepare VLTI observing programs. To help ASPRO users prepare their AMBER and MIDI proposals, an active helpdesk will also be available.

A near-infrared monitoring of the sky background emission above Dome C
N. Epchtein, LUAN/UNSA, Nice M. Busso, G. Tosti, Université de Perugia, Italie
(LUAN/CNRS/UNSA)
The near-IR sky emission properties above Dome C are still poorly known. They are currently estimated using numerical models or extrapolations of the South Pole data. We present simple monitoring devices aimed at the evaluation of the site in the 2-5 μm range that could start operations in 2005. These data will be essential for the definition of the specifications of future wide field telescopes and interferometers at CONCORDIA.

Polychromatic laser star : recent results
Foy, R., Girard, J., Pique, J.-P. et al.
(CRAL / Observatoire de Lyon)
We present new results obtained within the framework of the ELP-OA programme (Étoile laser polychromatique pour optique adaptative). For the first time the chromatic derivative of the slope of a wavefront is evidenced from the observations of stars, at Observatoire de Haute-Provence. We used a Cascade CCD camera, from Roper. We show a detailed characterization of this new device based on the Texas TCD253 chip with charge multiplication.

End-to- end simulation of XAO systems : application to the planet finder project
T. Fusco, R. Conan, D. Mouillet, J.-L. Beuzit, M. Nicolle, G. Rousset
(ONERA)
A complete End-to-End simulation of an Extreme AO system has been made in the frame of the Planet-Finder project. A detail presentation of the simulation tool, including its potentialities and limitaions will be made. Examples of results will be presenetd as an illustration of the simulation specifities as well as a first End-to-End Planet Finder simulations (including all the known error sources).

Imagery and tomography of human retina in vivo at high résolution.
Marie GLANC, David LAFAILLE, Caren BELLMANN, Francois LACOMBE, Eric GENDRON, Douchane STEFANOVITCH, Claude COLLIN, Pierre LENA
(LESIA Observatoire de Paris)
For almost 15 years, the Laboratory of Spatial Research and Instrumentation for Astrophysics (LESIA) at Paris Observatory has contributed to the development of world major Adaptive Optics systems dedicated to astronomy (recently, NAOS at Paranal Observatory). In parallel, the LESIA and its partners (ESPCI, Hôpital des XV-XX, and the firm Mauna Kea Technologies) have started since 1998, a joined program for developing novel solutions for retinal imaging and tomography at high resolution. These new applications of Adaptive Optics have already brought spectacular results on human living retinas. Recent results (large field reconstruction...) will be shown together with a description of the experimental setup. A detailed overview of the current work at LESIA for coupling AO with an improved en face Optical Coherence Tomography system will be given.

4-quadrant Phase Mask Coronagraphy of the nucleus of NGC 1068 with NAOS-CONICA

Damien Gratadour, Daniel Rouan, Anthonny Boccaletti, Pierre Riaud, Yann Clénet
(Observatoire de Paris-Meudon)

We present recent observations of NGC 1068 with NAOS-CONICA on VLT, using the new four quadrant phase mask that we recently developed. Thanks to the use of this new type of coronagraph, the complex dusty neighborhood of the central source is observable at a resolution of 0.07". Previous K band adaptive optics observations of this AGN suffered from limited exposure time either than scattered light in the immediate vicinity of the core. Our images reveal structures comparable to those previously observed at 3.8 and 4.8 microns. North of the nucleus, an elongated bending structure is followed by a series of four elongated and aligned knots. Given the direction they align on, this knots may trace shocks induced in the ISM by the passage of the jet, very close to its origin. Precise relative photometry agrees well with our previous interpretation. Near Infrared flux from these knots may be dominated by the emission of VSG, transiently heated by the central source. Coronagraphy coupled with adaptive optics is a new way to study the direct environment of the core of closest AGN, and these images show the benefit of using such a device with ground based telescope.

The New Extrasolar Planet Encyclopedia

Frantz Martinache & Jean Schneider
(LISE, College de France)

The Extrasolar Planets Encyclopedia (Schneider J., 1995), established since February 1995 is a portal devoted to comprehensive and up-to-date professional informations on exoplanets (catalogs, bibliography, etc).
We present a renewed and extented '2nd generation' version of the Encyclopaedia, with an on-line demonstration, which includes user-friendly softwares treating on line some informations about planets.
The new portal will be open to the community at the time of the presentation.

A new reconstruction method for optical interferometry

serge MEIMON Laurent MUGNIER Guy LE BESNERAIS
(ONERA)

Current optical interferometers are affected by unkown turbulent phases on each telescope. The complex Fourier samples measured by the instrument are thus multiplied by unknown phasers corresponding to the turbulent differential pistons between each couple of telescopes. So, the only unaffected phase information is the closure phase of each coherent subarray. Instead of considering the closures as the only phase data, we consider that we have more data and more unknowns. More specifically, we construct complex data affected by turbulent pistons, and explicitely incorporate the pistons in the inverse problem. Then, we reconstruct the object by minimizing an original metric in the object and these pistons.
To do so, we minimize the metric alternatively in object and phases,i.e. we do several "calibration cycles", each one made of a step in object with a know set of phases and a step in phases with a known object.
We have recently designed a metric such that the minimization problem is convex for given pistons while modelling accurately the noise statistics. Here we develop a technique to compute the global minimum of the data likelihood criterion for the phase step, in spite of the fact that the latter is dramatically non unimodal. This is achieved by exploiting the separable structure of the phase metric. We are currently testing our technique on experimental data.

A first result of the analysis of T Sgr MIDI data and modelisation

Jean-Luc Menut, Olivier Chesnau,Nicole Berruyer, Bruno Lopez, Gilles Niccolini
(Observatoire de la Cote d'Azur - Gemini)

We present the first results of the observation of the S star T Sgr at 10 μm with the MIDI intrument on VLTI. We compare this observation to a model done with the MCTRANSF tranfert code in order to determine some astrophysical caracteristics of the source.

Wavefront analysis for Multi-Conjugated Adaptive Optics.

Magalie NICOLLE, Thierry FUSCO, Vincent MICHAU, Gérard ROUSSET, Jean-Luc BEUZIT, Amandine BLANC
(ONERA)

Adaptive Optics isoplanatical field is limited to a few tens of arcseconds by the angular decorrelation of turbulent wavefronts. The concept of Multi-Conjugated Adaptive Optics (MCAO) have been proposed in order to enlarge this corrected field. This is made possible by using several guide stars for the phase perturbation measurement. Various concepts of MCAO have been developped, each one leading to specific requirements for the system dedicaced to the phase perturbation analysis. One charactirizes here the wavefront measurement requirements of one of these systems, allowing correction of the turbulence located close to the telescope ("Ground Layer AO"). Influence of the number of guides stars used for the wavefront analysis and effects of some differences of magnitudes between them are studied for various wavefront analysis strategies.

From stellar radius to limb-darkening constraints with VINCI/VLTI for asteroseismic targets.

Frédéric Thévenin et al.
(O.C.A.)

Very precise angular diameters from recent VINCI/VLTI observations of a number of MS stars covering a wide range of effective temperatures and radii are used when combined with precise Hipparcos parallaxes, photometry, spectroscopy as well as the asteroseismic information available for some of these stars the angular diameters put strong constraints on the detailed models of these stars. Procyon is one of the best example of how an uncertain Teff or luminosity can be replace by an accurate radius. That radius can be improved with better parallaxe and better estimate of the limb-darkening. An example is given with the star Alpha Cen B.

Poster contributions

The infrared 4-quadrants coronograph in laboratory : tests to prepare MIRI/JWST and VLT-PF

P. Baudoz, A. Boccaletti, P. Riaud, D. Rouan, J. Baudrand, J.-M. Reess, J. Parisot
(Observatoire de Meudon/ LESIA)

The contrast between an extrasolar planet and its star is too severe to allow a direct detection without using imagery techniques at high dynamical range. One of these techniques is the use of a coronograph of the type "nulling" on a telescope presenting a not too disturbed wave front. The LESIA developed one of these coronographs, the 4-quadrant coronograph. I will present the IR cryogenic bench recently developed with the LESIA to validate the use of this coronograph in IR. On the one hand, I will have the results obtained around 4.8 microns which allow to compare various fabrication techniques and various materials for the coronographs considered for the instrument MIRI (on board JWST). In addition I will present the tests which were made in near-IR (2.2 microns) in preparation to VLT-PF. I will discuss the validity of these results compared to the specifications of VLT-PF on the sky.

The JMMC Evolutive Search Calibrator Tool

D. Bonneau (OCA), J-M. Clausse (OCA),X. Delfosse (LAOG),G. Duvert (LAOG), P. Borde (OPM), D. Mourard (OCA), P. Berio (OCA), P. Cruzalebes (OCA)
(OCA Département GEMINI)

In stellar interferometry, the raw fringe visibilities must calibrated to obtain the true visibilities and then observables which can be interpreted as astrophysical parameters. The selection of suitable calibration stars is crucial to obtain the ultimate precision of the interferometric instruments like VLTI. The calibrators must have spectro-photometric properties and sky location close to those of the scientific target. The smaller the calibrators the lesser the sensibility of the angular diameter determination to their intrinsic visibility or sources of instabilities. So, we have developed , we have adopted a method of “virtual the observatory” type to create an evolutive catalog of stars giving all the useful informations for the selection of calibrators with respect to the requirements of the astrophysical program. The list of possible calibrators is obtained from a set of catalogs available at the Centre de Données astronomiques de Strasbourg (CDS). The CDS request is based on some criteria like angular distance and magnitude around the scientific target. For each star, the squared visibility is computed as function of the wavelength, the maximum baseline and the value of the angular diameter (measured or computed from the colors or spectral type). The accuracy of this visibility of possible calibrators must satisfy constraints fixed by the expected accuracy of the scientific objet visibility and the instrumental configuration. It is possible to refine the choice of the calibrators using selection criteria (sky position, magnitude difference, spectral type, variability and multiplicity). This calibrator selection tool is integrated to ASPRO the interferometric observing preparation software developed by the JMMC.

NAOS performances : impact of the telescope vibrations and possible origins

Clénet Y.
(ESO Garching)

Since its installation in 2002, NAOS performances have been degraded by different vibrations. I will present (i) the conclusions of tests performed to measure the impact of the vibrations on the correction (ii) as well as the possible origins of these vibrations.

APISD - The Antarctic Plateau Interferometer Science Demonstrator

Vincent Coudé du Foresto (LESIA) Mark Swain (OCA) Farrokh Vakili (U. Nice)
(LESIA – Observatoire de Paris)

The high antarctic plateau (Dome C - Concordia station) has recently been identified as potentially the best ground-based location for high angular infrared observations : extremely dry atmosphere, low sky emission, low and slow turbulence, large isoplanetic angle. These properties make it possible to consider, in the field of explanetary science, observations that could otherwise only carried out from space.

As a stepping stone into a long term exoplanet program from Concordia, the objective of the APISD project is to demonstrate within 5 years the scientific potential of the site by performing the spectrophotometric analysis of a few close-in giant exoplanets.

The determination of stellar diameter from photometry in the JMMC Evolutive Search Calibrator tool.
X. Delfosse, D. Bonneau
(LAOG, Observatoire de Grenoble)
Calibrators for optical interferometric observation must have properties (in position, magnitude and color) close to those of the scientific target. As a general rule such object doesn't have direct determination of theirs angular radius. A surface brightness relation should be used to compute, from photometry, theirs angular radius.
We have compiled stellar diameter (from interferometric measurement, lunar occultation or eclipsing binaries) and BVRI-JHK photometry for a large sample of stars of spectral type O to M and for all the luminosity class. Angular radius versus photometry relation have been established, they are used in JMMC Evolutive Search Calibrator tool to compute angular diameter of calibrators. Same for calibrators for which the luminosity class is unknown, the angular diameter is determined with an accuracy between 5 to 10%.

Phase Induced Zonal Zernike Apodization (PIZZA)
Frantz Martinache
(LISE, College de France)
Pupil apodization is one of the tools that will lead us to the obtention of the first exoplanet image and phase-contrast may prove to be an efficient, field-selective, apodizing technique designed to be used both with a coronograph.
I present the theoritical aspects and the expected performances, including chromatism influence, of this now called PIZZA technique.

An interferometric test bench for imaging : The densified pupil concept applied to the VLTI.
Patru Fabien ; Mourard Denis ; Lardière Olivier ; Spang Alain ; Clausse Jean-Michel ; Bresson Yves ; Lagarde Stéphane
(OCA)
The purpose of this poster is to present a test bench that we are developing at Observatoire de la Cote d'Azut to study the performances of interferometric imaging systems. The goal is to study the densified pupil concept in different configurations of the VLTI. This work is linked to the next generation instrument VIDA (VLTI Imaging with a Densified Array). This bench is used to specify the technical requirements like tip-tilt correction and cophasing. We will compare the imaging performances of the aperture synthesis, Fizeau and densified pupils configuration.

Kalman filter based control loop for MCAO : frequential characterization and filtering improvements
Cyril Petit, Fernando Quiros-Pacheco, Jean-Marc Conan, Caroline Kulcsàr, Henri-François Raynaud, Thierry Fusco
(ONERA)
Classical Adaptive Optics suffer from a limitation of the corrected Field Of View. This drawback has lead to the development of MultiConjugated Adaptive Optics. While the first MCAO experimental set-ups are presently under construction, little attention has been paid to the control loop. This is however a key element in the optimization process especially for MCAO systems. Different approaches have been proposed in recent articles for astronomical applications : simple integrator, Optimized Modal Gain Integrator and Kalman filtering. We study here Kalman filtering which seems a very promising solution.
Following the work of Brice Leroux, we focus on a frequential characterization of kalman filters, computing a transfert matrix. The result brings much information about their behaviour and allows comparisons with classical controllers. It also appears that straightforward improvements of the system models can lead to static aberrations and vibrations filtering. Simulation results are proposed and analysed thanks to our frequential characterization.
Related problems such as model errors, aliasing effect reduction or experimental implementation and testing of Kalman filter control loop on a simplified MCAO experimental set-up could be then discussed.

Session PCHE

Oral contributions

Bayesian Imaging Reconstruction Methods for INTEGRAL/SPI

Marc ALLAIN
(CESR/LA2T/CNES Observatoire Midi-Pyrénées)

This communication addresses the problem of image reconstruction of both pointlike and extended sources from SPI data. As is the case for many other data inversion problems, this problem is non robust and a priori information is needed to obtain meaningful solutions.
We have used the Bayesian framework to formulate the reconstruction problem as a problem of statistical estimation. Bayesian inference introduces the user's knowledge via a prior probability distribution function (pdf). The posterior pdf, which gathers information coming from data and prior knowledge from the user, can then be used to compute an estimation for the sky-map.
For this application, we designed a prior model which is pertinent to the reconstruction of either point sources or diffuse emission. Maximizing the posterior pdf produces a sky map estimation through a computationally attractive convex optimisation problem. The performance of the method is tested on mock and on real data (Cygnus region and the "Galactic Center Deep Exposure") and compared with standard reconstruction techniques like SPIROS [Skinner03] and the Richardson-Lucy algorithm [Lucy74].

Search for large-scale anisotropies and point sources in the Pierre Auger experiment

Eric Armengaud, for the french groups of the Auger Collaboration
(PCC/IAP)

The study of arrival directions distribution in the most energetic cosmic rays is one of the major goals of Pierre Auger Observatory. It could leed to the detection of point sources, as well as to the observation of larger scale structures, such as the galactic or supergalactic plane.
Although the ultra-high energy cosmic rays present a globally isotropic distribution, there have been in the previous years two claims by the Agasa collaboration of anisotropy detection : an excess from a region near the galactic center slightly above 1 EeV on one hand, and on the other hand a small-scale clustering at the highest energies $E > 40$ EeV. Those are still being questioned because of the lack of statistics. The Pierre Auger Observatory will be ideal to study such departures from isotropy at the highest energies.
We present in this talk general methods we want to apply to look for departures from isotropy in a distribution of arrival directions on the sphere. On large scales, we present a method inspired from the CMB community to deduce the spherical harmonic expansion from a list of arrival directions even if only a fraction of the sky is covered by the experiment. At smaller scales, the available methods to detect excesses with low statistics are reviewed and commented.

Investigating X-ray Quasi-Periodic Oscillations in the time domain

Olive Jean-François, Barret Didier, Kluzniak Wlodek
(CESR)

The origin of millisecond variability of X-rays (quasi-periodic oscillations or QPOs) discovered in accreting neutron stars remains unknown, despite a wealth of theoretical models, most involving signatures of General Relativity in the strong field regime. It is agreed that the Q-value of the oscillator is very constraining for theories of QPO. We find that previous investigations have underestimated its actual value. Here we present the first results of an on-going investigation aiming at determining the intrinsic properties of QPO signal.

Newton and neutron stars

Giovanni Bignami
(Centre d'Etude Spatiale des Rayonnements)

The ESA X-ray astronomy cornerstone Newton/XMM and its EPIC focal plane instrument have the right combination of throughput, timing and energy resolution for opening a new era in the astronomy of Isolated Neutron Stars. Of particular interest are the so-called "Three Musketeers", i.e. Geminga, PSR 1055-52 and PSR 0656+14. A short phenomenological preview will be presented of their X-ray properties, including recent phase-resolved spectroscopy, now available for all of them. As in the case of 1E1207, it will be seen that phase-resolved spectroscopy is indeed a powerful tool for understanding INS physics, separating non-thermal from thermal component(s). Evidence for phase-variable hot spots on INS surfaces will be presented for the first time, and some implications will be discussed.

INTEGRAL, XMM-Newton and Rossi-XTE Observations of the State Transition of the X-ray Transient and Black Hole Candidate XTE J1720-318

Marion Cadolle Bel, A. Goldwurm, J. Rodriguez,P. Sizun, S. Corbel, P. Goldoni, A.N. Parmar, E. Kuulkers, M. Del Santo, P. Ubertini, J.P. Roques, F. Frontera, R. Farinelli, N.J. Westergaard
(Service d'Astrophysique/CEA-Saclay)

We report on INTEGRAL, XMM and RXTE observations of the transient source XTE J1720-318 discovered in January 2003 with RXTE. In the first observations, the source was in a very soft state, similar to those seen in black hole transients. Following INTEGRAL observations revealed that the source, active only few months after the outburst, transited towards a much harder state : the source was detected up to 200 keV with typical power law photon index of 1.9 and a peak luminosity of 7.35×10^{36}ergss^{-1}. We will present the spectral and timing properties of the source during the year 2003, using all the high energy instrument data available to us. We conclude that XTE J1720-318 is a new specimen of the black hole X-ray novae which populate our galactic bulge and we discuss its properties in the frame of the spectral models used for transient black hole binaries.

Accretion rate in Narrow Line Seyfert 1 Galaxies, and the growth of massive black holes

Suzy Collin and Toshihiro Kawagachi
(Observatoire de Paris-Meudon)

Using several samples of quasars and AGNs and assuming that their optical luminosity is emitted by the accretion disc, we show that Narrow Line Seyfert Galaxies 1 (NLS1) accrete at super-Eddington rates, while their luminosity stays of the order of the Eddington limit, in agreement with the "slim disc model". It means that the mass of the supermassive central black holes (BH) increases by one order of magnitude in less than 10**8 years. We suggest that the BHs of these galaxies are in the process of formation, in agreement with recent claims that the BHs of NLS1s are undermassive with respect to the host bulge masses. Since these galaxies represent at least 10% of active galaxies up to at least a redshift of 0.5, these active phases should play an important role in shaping the mass function of local BHs, and possibly also in the early stage of BH formation.

Primary identification in AUGER

Pierre Da Silva, for the AUGER collaboration (FRANCE)
(LPNHE)

The identification of the nature of the primaries in the Ultra High Energy Cosmic Rays topic is of major importance to constrain theoretical models and potential astrophysic sources. The main differences between light and heavy nuclei are the longitudinal evolution of the atmospheric showers and their muonic/electromagnetic ratio. The quantity Xmax is directly seen by the Fluorescence Detector (FD), while other composition sensitive characteristics at ground level are measured by the Surface Detector (SD) : rise times, lateral distribution, front curvatures, etc... Because of the big fluctuations at the beginning of the cascade, these quantities give an ambiguous information for a single shower, but they are statistically significative, especially if they can be combined. The discrimination becomes easier with increasing energy. On the other hand, more "exotic" particles (photons and neutrinos) are expected to be very rare, but they will give a clearer signature.
We will present the different parameters which are used for the identification of primaries, how they are affected by the fluctuations and what we can hope from the accumulation of statistics.

Radiodetection of cosmic ray extensive air showers : present status of the CODALEMA experiment

Ardouin D., Belletoile A., Dallier R., Denis L., Gousset T., Haddad F., Lautridou P., Lecacheux A., Rahmani A., Ravel O.
(Subatech)

Radiodetection can be considered as very complementary to usual techniques (ground detectors, fluorescence detectors) for detection and analysis of the extensive atmospheric air showers produced by very high energy cosmic rays ($> 10^{18}$ eV). We will present the last results of the CODALEMA experiment, set up at the Nançay Observatory since 2002. We will show that triangulation between several antennas allows the reconstruction of the arrival direction of the radio wave emitted by the shower, and that expected pulses can be distinguished from radio background both in time and frequency domains.

Current Status and First Results of the High Energy Stereoscopic System (H.E.S.S.)

Mathieu de Naurois for the H.E.S.S. collaboration
(LPNHE Universites Paris VI/VII)

H.E.S.S. (High Energy Stereoscopic System) is an array of four 107 $\{m\}^2$ large Imaging Cherenkov Telescopes devoted to gamma-ray astronomy above 100 GeV. The first telescope started operation on June 10th, 2002 and the three other telescopes have been brought into operation during the year 2003. The full system is operational since December 2003.
H.E.S.S. combines the advantages of stereoscopy, large dish, fine pixelization camera and fast electronics, which makes it currently the most sensitive instrument in the TeV domain. The sensitivity has been improved by an order of magnitude compared to the previous-generation intruments and the threshold
has been lowered down to 100 GeV at zenith, with a angular resolution of 0.1 degrees for point sources.
We will report on the current status of the system and its performances in terms of sensitivity and resolution. We will also present the first results of H.E.S.S. on the Crab Nebula, an upper limit on the TeV flux from the supernova remnant SN 1006 and possibly results on other sources. The recent detection of the binary millisecond pulsar PSR 1259-63 near its periastron will be shown, together with observations and monitoring of the blazars PKS 2155-304 and Markarian 421, but these will be presented in greater detail in parallel sessions.

Particle Acceleration in Supernova Remnants

Decourchelle, A.
(SAp, DAPNIA, CEA Saclay)

Shocks in supernova remnants (SNRs) are long thought to be responsible for the acceleration of Galactic Cosmic Rays up to the knee (> 1000 TeV). While synchrotron radio emission attests to the presence of GeV accelerated electrons, the advent of X-ray spectro-imagery has allowed to obtain observational evidence for the acceleration of electrons up to energies of about 100 TeV. I will first discuss the effects of efficient particle acceleration on the overall hydrodynamical structure and thermal X-ray emission in young supernova remnants. I will then review the recent observations of nonthermal X-ray emission in both young ejecta-dominated and synchrotron-dominated (SN 1006 and G347.3-0.5) SNRs. These observations provide unique constraints on poorly known aspects of particle acceleration like the magnetic turbulence, the acceleration efficiency and potentially the level of particle injection.

X-ray He-like diagnostics for photoionized plasmas

O. Godet, S. Collin, A.-M. Dumont
(CESR)

The new space X-ray observatories XMM-Newton and Chandra have modified our vision of the photoionized media in the Active Galactic Nuclei (AGN) or in the X-ray binaries, by revealing the complexity of the soft X-ray spectra i.e. many observed lines, in particular the He-like ion lines of the n = 2 complex. These lines are al-ready used in the collisional plasmas as diagnostics to derive the temperature and the density of the media. We present a work based on the study of the He-like lion lines in the case of the photoionized media. We consider a grid of models built with our Titan code, encompassing a large range of parameters (such as the column density, the ionization parameter, the varying abundance and the possible existence of microtur-bulence) met in the emission medium, such as in the Seyfert 2 nuclei. We give the R and G ratios of the He-like ions (resonance, intercombination and forbidden lines). We show that a large microturbulence results in a decrease of the G ratio for large column densities, for which the He-triplet resonant lines are optically thick.

Gravitational waves from binary neutron stars

D. Gondek-Rosinska, T. Bulik, E. Gourgoulhon, M. Bejger, L. Zdunik, P. Haensel, K. Taniguchi
(LUTH, Observatoire de Paris, Meudon)

Coalescing neutron star binaries are expected to be among the strongest sources of gravitational radiation to be seen by laser interferometers. Using the well tested StarTrack binary population synthesis code we show that regardless of the maximal mass of a neutron star a significant fraction of the observed systems in gravitational waves will have low mass ratios < 0.7. Taking into account both the above results and properties of the known double neutron star binaries we perform calculations of the final phase of binary neutron star inspiral in general relativity. We show that for neutron star binaries described by modern realistic equation of state
(Akmal et al. 1998) the merger will take place for high frequency of gravitational waves > 1.1 kHz regardless of taken mass ratio 0.675 ; 0.9 ; 1. We show the dependence of gravitational waveforms on nuclear equations of state.

Very high energy emission and the physics of relativistic jets.

Gilles HENRI, Ludovic SAUGE and Guy PELLETIER
(Laboratoire d'Astrophysique de Grenoble)

Since the discovery of VHE gamma-ray photons from the BL Lac Markarian 501 by the Whipple Atmospheric Cerenkov Telescope, the number of detected sources has raised to six confirmed objects. Despite the hope that these observations would give eventually definite answers to the origin of non thermal particles in blazars, and hence to the issue of relativistic jets formation, there are still many open questions left. After reminding the most popular model for gamma-ray emission, namely the Synchrotron Self Compton model, we will show that this model, at least in its homogeneous version, faces serious difficulties. The high level of gamma-ray emission, particularly when corrected from extragalactic absorption, seems to require very high bulk Lorentz (around 50) to avoid strong gamma-gamma attenuation. On the other hand, the fact that a fair fraction of close BL Lacs have been indeed detected, joined to statistical arguments about beamed vs unbeamed number of sources, points to much lower values of the Lorentz factor, around 3 or 4. These values are also more compatible with the absence of highly superluminal motion in TeV blazars. We will show that the paradox can be solve only if many conditions are simultaneaously fulfilled : the Lorentz factor must be low, the jet must be inhomogeneous, the particle distribution must be quasi monoenergetic, and the rather high optical depth favours a dense electron-positron plasma. All features are compatible with the "two-flow" model proposed to explain the structure of relativistic jets in AGNs.

SPI/INTEGRAL observation of 1809 keV gamma-ray line emission from the Cygnus X region

J. Knödlseder, M. Valsesia, M. Allain, S. Boggs, R. Diehl, P. Jean, K. Kretschmer, J.-P. Roques, V. Schönfelder, G. Vedrenne, P. von Ballmoos, G. Weidenspointner, C. Winkler
(CESR)

We present first results on the observation of 1809 keV gamma-ray line emission from the Cygnus X region with the SPI imaging spectrometer. Our analysis is based on data from the performance verification phase of the INTEGRAL instruments and comprises 1.3 Ms of exposure time. We observe a 1809 keV line flux of (7.3 +/- 0.9) 10-5 ph cm-2 s-1 from a region delimited by galactic longitudes 73-93 degrees and |b| < 7 degrees at a significance level of 8 sigma. The 1809 keV line appears moderately broadened, with an intrinsic FWHM of 3.3 +/- 1.3 keV. Although this broadening is only marginal (at the 2 sigma level our data are compatible with an unbroadened line), it could reflect the 26Al ejecta kinematics.

HESS observations of Mkn 421.

Anne Lemiere for the HESS collaboration .
(PCC college de france - Paris7)

HESS observations of Mkn 421.
HESS is an array of ground based imaging atmospheric Cherenkov telescopes used to detect gamma emissions of energy >100 Gev with a sensitivity on the order of 10^{-11} photons/cm2/sec at 100 GeV. The four telescope array is fully operational since December 2003. In early April 2004, flaring activity of Mkn 421 was detected in X-rays with ASM/RXTE satellite. Mkn 421 has subsequently monitored with the HESS array for roughly 2 weeks. We will report on the preliminary analyis of this data.

An advanced analysis method for stereoscopic systems of Cherenkov Telescopes in gamma-ray astronomy

Marianne Lemoine (LLR, Ecole Polytechnique) for the H.E.S.S. Collaboration
(IN2P3 - Laboratoire Leprince-Ringuet)

H.E.S.S. (High Energy Stereoscopic System) is an array of four large imaging Cherenkov telescopes devoted to gamma-ray astronomy above 100 GeV. It has been fully operational since December 2003. The stereoscopic reconstruction of air showers and the high-definition imaging bring significant improvements both in flux sensitivity and energy resolution with respect to previous Atmospheric Cherenkov Telescopes.
Here we report on a new analysis method based on a very simple 3D-modelling of an electromagnetic air shower. This method allows to separate gamma-rays from background events in the field of view without any assumption on the morphology of the source or on the background distribution. This is a crucial point in the study of extended sources (e.g Supernovae Remnants) or in the search for unexpected sources in a sky survey. The performance of the method as compared to the standard analysis, in particular regarding background rejection, angular and energy resolutions will be presented. Results of the method based on real data taken on galactic sources will also be shown.

VHE gamma-ray observation from blazar PKS2155-304 with H.E.S.S.
Nicolas Leroy for the H.E.S.S. collaboration
(IN2P3 - Laboratoire Leprince-Ringuet)
The High Energy Stereoscopic System (H.E.S.S.) experiment is an array of four imaging Cerenkov telescopes devoted to gamma-ray astronomy above 100 GeV. Observations started in July 2002, with the first telescope, and continued with different upgrades, the system being completed in December 2003.
The BL Lac PKS2155-304 is one of the main H.E.S.S. targets and has been observed for over 80 hours during 2002 and 2003. The source was found active in all periods of observation by H.E.S.S. . With a redshift of 0.116, this source could also provide informations on the extragalatic infra-red background.

Pierre Auger Observatory in the starting blocks for the highest energy cosmic rays
Isabelle Lhenry-Yvon
(Institut de Physique Nucléaire d'Orsay)
The Pierre Auger Observatory has now started data taking with more than 330 water tanks and 6 fluorescence telescopes currently running. The number of surface detectors is continuously growing and should reach about 800 at the end of this year. Many events above 1019 eV have been detected as well as several good quality hybrid events. The current status of the Observatory and preliminary data will be presented. The derivation of an energy spectrum from the data will be discussed. This involves the identification of a reliable event selection and the related calculation of the detector's acceptance taking into account the time-dependent evolution of the effective surface of the array. .

Quasi-equilibrium sequences of binary strange quark stars in general relativity
LIMOUSIN Francois, GONDEK-ROSINSKA Dorota and GOURGOULHON Eric
(LUTH - Observatoire de Paris-Meudon)
Inspiraling compact binaries are expected to be the strongest sources of gravitational waves for VIRGO, LIGO and other laser interferometers. We present the first computations of quasi-equilibrium sequences of compact binaries containing two strange quark stars (which are currently considered as a possible alternative to neutron stars). We study a precoalescing stage in the conformal flatness approximation of general relativity using a multidomain spectral method. A hydrodynamical treatment is performed under the assumption that the flow is either rigidly rotating or irrotational. In each of those cases, we show the differences in the gravitational waves signal from neutron stars described by polytropic equation of state.

Pressure-driven instabilities in MHD jets
Pierre-Yves Longaretti
(LAOG (Grenoble))
The object of this talk is twofold :
- discuss the fact that the text-book use of the MHD Energy Principle leaves out a whole class of (relevant) modes of instability.
- specify the conditions under which these modes are important for the stability of MHD jets.

Results from the CELESTE experiment
Hakima Manseri
(LLR)
CELESTE is a ground-based gamma ray experiment that samples the Cherenkov light emitted by atmospheric shower. Its detection threshold is under 100 GeV.
Since 2000, the detector has been upgraded by adding 13 channels and improving the quality of our Flash ADC. In addition, 12 heliostats are used to measure the extent of the atmospheric shower while the others aim at the electromagnetic shower maximum at 11 km above the ground. To increase the Cherenkov to night sky light ratio, Flash ADC data are summed over all the channels. The shape of this sum depends on the nature and on the impact parameter of the shower in the 11 km plane. Using the difference between hadronic and electromagnetic showers, a substantial part of the hadronic background is rejected leading to a sensitivity of $5\sigma/sqrt\{hour\}$ on the Crab Nebula, with a gamma-to-cosmic ray ratio of 25%. This allowed us to detect the blazar Markarian 421 in flaring states in 2003 and 2004.

Astroparticle yield in radio galaxies jets and hot spots
A. Marcowith & F. Casse
(CESR)
In this work we present a new numerical method to handle relativistic particle transport in complex flows. The code couples 3D fluid magneto-hydrodamics to stochastic differential equations. We apply it to the transport effects on cosmic-rays in extragalactic jets and particularly to the hot spots of FRII radio galaxies. From the observations, we selected the best candidates for the production of ultra high energy cosmic-rays and neutrinos. and evaluate the contribution of the strongest astroparticle sources to the different extragalactic diffuse backgrounds.

Microquasars and ULXs : Fossils of GRB Sources
I.F. Mirabel
(SAp-CEA)
Gamma-ray bursts (GRBs) of long duration probably result from the core-collapse of massive stars in binary systems. After the collapse of the primary star the binary system may remain bound leaving a microquasar or ULX source as remnant. In this context, microquasars and ULXs are fossils of GRB sources and should contain physical and astrophysical clues on their GRB-source progenitors. Here I show that the identification of the birth place of microquasars can provide constrains on the progenitor stars of compact objects, and that the runaway velocity can be used to constrain the energy in the explosion of massive stars that leave neutron stars and black holes. The observations show that the neutron star binaries LS 5039, LSI +61{∘}303 and the low-mass black hole GRO J1655-40 formed in energetic supernova explosions, whereas the black holes of larger masses (M ≥ 10 M_{⊙}) in Cygnus X-1 and GRS 1915+105 formed promptly, in the dark or in underluminous supernovae. The association with clusters of massive stars of the microquasar LSI +61{∘}303 and the magnetars SGR 1806-20 and SGR 1900+14, suggest that very massive stars (M≥ 50 M_{⊙}) may -in some cases- leave neutron stars rather than black holes. The models of
GRB sources of long duration have the same basic ingredients as microquasars and ULXs : compact objects with accretion disks and relativistic jets in binary systems. Therefore, the analogies between microquasars and AGN may be extended to the sources of GRBs.

Gamma-Ray Bursts : new results and perspectives
Robert Mochkovitch
(Institut d'Astrophysique de Paris)
The detection of the bright GRB 030329 by the HETE 2 satellite has confirmed that GRBs are related to the explosive death of massive stars since an underlying type Ic supernova was discovered in the afterglow spectrum and light curve. HETE 2 has also allowed to study in more details X-Ray Flahes, a new class of objects discovered by the Beppo-SAX satellite and which represent an extension of GRBs to lower energy. The SWIFT satellite to be launched this fall will be able to study GRB afterglows within a minute after the event. These very early observations will put strong constraints on the burst physics and the nature of its environment.

Energy structure at 3.2 10^{20} eV in special scale-relativity
Nottale L.
(CNRS, LUTH, Observatoire de Paris-Meudon)
In scale relativity, one considers a space-time geometry that is continuous but non-differentiable, which implies its fractality (i.e., a structuring of the scale-space). One can show that the standard laws of dilation correspond to a "Galilean" version of the theory. Their Lorentzian generalization involves the appearance of two length-scales, invariant under dilations and unreachable, one toward the small scales that can be identified with the Planck length-scale and the other toward the large scales that can be identified with the scale L of the cosmological constant (Lambda=$1/L^2$). One of the consequences of these new laws of dilation is the existence of a very high energy structure at E = (3.2 ± 0.2) 10^{20} eV, generated when the SU(2) running coupling reaches the critical value 1/4 pi^2. This predicted energy is precisely the maximal energy observed for ultra-high energy cosmic rays by the Fly's Eye detector, at E = (3.2 ± 0.9) 10^{20} eV.

Mariage des maillages : A new 3D general relativistic hydro code for simulation of gravitational waves from core-collapses.
Jerome Novak, Harrald Dimmelmeier et Jose A. Font
(LUTH - Observatoire de Paris-Meudon)
We present a new three-dimensional general relativistic hydrodynamics code which can be applied to study stellar core collapses and the resulting gravitationnal radiation. This code uses two different numerical techniques to solve partial differential equations arising in the model : high-resolution shock capturing (HRSC) schemes for the evolution of hydrodynamic quantities and spectral methods for the solution of Einstein equations. The equations are written and solved using spherical polar coodinates, best suited to stellar topology. Einstein equations are formulated within the 3+1 formalism and conformal flat condition (CFC) for the 3-metric and gravitational radiation is extracted using Newtonian quadrupole formulation.

High angular resolution observations of active galactic nuclei in the infrared : first results with large interferometers and prospects

G. Perrin
(Observatoire de Paris / LESIA)

Optical-near infrared interferometers have up to now been used for the sole purpose of stellar physics. This was mainly due to the small pupils available and to the lack of long exposure capability. With the advent of large interferometers such as Keck and VLTI, extragalactic sources now become a major target for interferometers. Two AGNs have been observed as of today and some other results are being expected in the near future. The current resolution of interferometers will allow to study dust tori and possibly the BLR of the closest objects. Future porjects with kilometric baselines such as 'OHANA will provide a better resolution to reach the inner parts of AGNs in the near and mid-infrared.

Forced oscillations in accretion disks and QPOs

PETRI Jerome
(Universite d'Utrecht (PAYS-BAS))

Accretion discs are very widespread in the Universe. One observes them in many astrophysical objects such as the active nuclei of galaxies, the binary systems including a compact object, or around stars in formation. However, the mechanism responsible for this accretion towards the central object is still badly known. Indeed, molecular viscosity alone is too weak to explain the accretion rates observed. Nevertheless, the discovery of the quasi-periodic oscillations (QPOs) in the mid 80' offers a new appropriate probe of the accretion discs in their internal regions. Certain models such as for example the relativistic precession or the beat frequency at the sonic point or at the magnetospheric radius were advanced to explain this phenomenon. However, those require either the presence of a magnetic field dragged by the rotation of the accreting source or effects of pure General Relativity. However recent observations showed a correlation between QPOs of white dwarfs, neutron stars and black holes. If one accepts the idea of a common origin for these QPOs, one is led to reject the existing models.
In this presentation, I will propose a new model using a nonaxisymmetric component, in rotation either in the gravitational field or in the magnetic field of the accreting star. In a first part, I will show that the linear stability analysis of a disc evolving in such a structure predicts the existence of 3 instability types : a resonance of corotation, a parametric resonance and a resonance of forcing. In a second part, these results will be generalised with 2D simulations using pseudo-spectral methods. Lastly, I will discuss the observational consequences of these instabilities on the light curves emitted by the disc, allowing later a confrontation with the observations.

First Results From the HESS Experiment with an Analysis Method Based on a Semi-analytical Shower Model

Loic Rolland and Mathieu de Naurois for the H.E.S.S. collaboration - LPNHE - IN2P3/CNRS
(LPNHE)

Applications of the analysis method developed for the CAT experiment (Cerenkov At Themis) which has been adapted for mono-telescope and stereoscopic observations with HESS are reported. This method is based on an analytical model giving the longitudinal and transverse light distribution resulting from the developement of a gamma-ray initiated shower in the atmosphere in the focal plane of each of the cameras. It simultaneously determines the energy of the initiating gamma-ray, the position of the shower axis with respect to the detector, and the source location (gamma-ray origin) on a shower-by-shower basis. Results of this method applied to HESS experimental data and a preliminary spectrum from Crab Nebula are shown.

Search of young remnants of galactic supernovae by line emission of 44Ti with INTEGRAL

M.Renaud, F.Lebrun, R.Terrier, N. Prantzos, A. Decourchelle, J. Ballet
(CEA-Saclay, Service d'Astrophysique)

No supernova has been observed in the Milky Way since the Kepler supernova in 1604, except the possible detection of Cas A by Flamsteed (1680). The supernova rate in spiral galaxies is thought to be 2-3 per century. Therefore, the probability that no supernova has occured during this time is very low and these young galactic supernovae are believed to have taken place in strongly optically obscured regions such as dense molecular clouds. However, the Galaxy is transparent to the gamma radiation emitted by radiactive nuclei like 44Ti, created in supernovae. Since this nucleus has a lifetime of about 80 years, it is a useful tool to search for young SNe. The results of a search for these events in the Galactic central regions with the INTEGRAL satellite will be presented and their implications on SNe rate and 44Ti yield will be discussed.

Simultaneous INTEGRAL/RXTE Observations of GRS 1915+105 over 2003

J. Rodriguez, D.C. Hannikainen, S.E. Shaw, C. Cabanac, Y. Fuchs
(CEA Service d'Astrophysique/ ISDC Geneve)

We report on simultaneous INTEGRAL and RXTE observations of the Galactic micro quasar GRS 1915+105 performed over 2003. While the first observation ever involving INTEGRAL reveal a new class of variability, our nice coverage during spring 2003 caught the source in a common (hard) steady state. Deep analysis of the high energy spectra, and timing properties of the source shows, however, that this steady state presents some peculiarities compared to previous observations.
We discuss our results in the framework of theoretical models, and propose an explanation where the high energy behaviour of the source is not simply related to an accretion disc, but also to a steady powerful compact jet.

On the soft gamma-ray interstellar emission (Invited talk)

R. Terrier, F. Lebrun, A. W. Strong
(APC/CNRS)

The nature of the soft gamma-ray (20-200 keV) Galactic emission has been a matter of debate for a long time. Previous experiments have tried to separate the point source contribution from the real interstellar emission, but with a rather poor spatial resolution, they concluded that the interstellar emission could be a large fraction of the total Galactic emission. INTEGRAL, having both high resolution and high sensitivity, is well suited to reassess more precisely this problem. We present a new study of this topic, using the both SPI and IBIS data, exploiting the complementarity of these instruments.

VHE gamma-ray Observations from the binary pulsar PSR B1259-63 with the HESS telescope array

Claude G.Théoret, Berrie Giebels, Guillaume Dubus, for the HESS Collaboration
(APC/PCC College de France)

The binary system PSR B1259-63 is composed of a 47.7ms radio pulsar in a highly eccentric 3.4 year orbit around a massive Be star. The combination of high energy particles from the relativistic pulsar wind and copious amounts of target photons for inverse compton from the Be star leads to the emission of very high energy (VHE) gamma-rays from the system. Simultaneous X-ray and gamma-ray observations offer unique insights into the time-dependent interaction of a Crab-like pulsar wind with its environment. We shall report an initial VHE gamma ray detection (6.0 sigma) on data taken around the periastron passage of the pulsar, between February 26th and March 29th, 2004, taken with the HESS array at an energy threshold of 200 GeV. A brief introduction to this unique source will be presented along with relevant X-ray and gamma-ray data.

Highlight Results of the HEGRA Experiment

M. Tluczykont for the HEGRA Collaboration
(LLR Ecole Polytechnique)

The HEGRA experiment (High Energy Gamma Ray Astronomy) was operating 6 Cherenkov Telescopes on the Canary Island of La Palma until fall 2002 in the TeV energy regime. Five of these telescopes were operated in coincidence mode (stereoscopy), thus pioneering the stereoscopic observation technique, subsequently adopted by most of the next generation of Cherenkov Telescope experiments. Throughout the operation of the HEGRA stereoscopic system unique results have been obtained for different object classes such as Active Galactic Nuclei, Plerions, shell-type Super Nova Remnants and an unidentified source. A review of the most important results on various detections will be given.

HESS phase II experiment

Pascal Vincent for the H.E.S.S. collaboration LPNHE - IN2P3/CNRS - Universites Paris VI & VII
(LPNHE - Univ Paris 6 & 7)

The HESS experiment began taking data in the middle of 2002 when the first telescope was comissioned. The stereoscopic system is operational since the installation of the second camera, at the start of 2003, and the system is now fully operational with the four telescopes installed by the end of December, 2003. Many galactic and extragalactic objects have been observed since operation began, and the detection of various sources such as the Crab Nebula, the AGN PKS2155-304, and the binary pulsar system PSR 1259-63 – amongst others – in the short intervening time interval has proven the performance of the detector and validated the technical options chosen.
The collaboration is currently studing the next phase of the HESS project. The detector system currently in operation has a threshold above 100 GeV. Many sources such as pulsars, micro-quasars, or neutralino annihilation are expected to emit gamma radiation at lower energy. Futhermore, the absortion of high energy gammas by the intergalactic infrared background limits the observation depth of these experiments. A lower threshold will allow the sensitivity to distant sources to be increased, and additionally will enable us to improve our knowledge of the infra-red background. It will also be useful to have a better overlap between the HESS experiment and the future space observatories for intercalibration of both detectors.
The second phase of the HESS experiment consists of an additional larger telescope positioned in the centre of the existing four-telescope array. With a 600 m^2 miror, a 2,000-pixel camera with a FoV of about 3.5° and a telescope of 35 meters focal length the new system may reach a threshold as low as 10-20 GeV in single telescope mode and about 50 GeV in coincidence with the four other telescopes. The construction should start in 2005 and the installation is expected to take place in 2008, less than one year after the launch of the GLAST observatory.
After a brief overview of the HESS phase I experiment, we will describe the motivation of a new large telescope for high energy gamma ray research. Then the set-up and expected performance are presented.

Using X-rays to probe the binary content of globular clusters

Natalie WEBB, Didier BARRET, Bruce GENDRE
(CESR)

Globular clusters should harbour a large number of close binaries which are thought to be responsible for delaying the inevitable core collapse of these dense clusters. However, close binaries are hard to identify optically due to the high stellar density. Observing these clusters in X-rays, where in such a domain the compact binaries are bright, diminishes the over-crowding problem. Using the new generation of X-ray observatories, it is possible to identify populations of neutron star low mass X-ray binaries, cataclysmic variables and millisecond pulsars as well as other types of binary systems. We present X-ray and optical evidence for a variety of compact binaries that we have identified in four globular clusters observed by XMM-Newton. We show that through population studies we can begin to understand the formation of individual classes of binaries in globular clusters and hence start to unfold the complex evolutionary paths of these systems.

The first year of INTEGRAL/SPI : status of 511 keV positron annihilation line observations

G. Weidenspointner, V. Lonjou, J. Knoedlseder, P. Jean, M. Allain, P. von Ballmoos, M.J. Harris, G. Vedrenne, B.J. Teegarden, N. Gehrels, N. Guessoum, V. Schoenfelder, C. Chapuis, Ph. Dorouchoux, E. Cisiana, M. Valesia
(CESR)

The INTEGRAL observatory, launched in October 2002, carries as one of its two main instruments the high resolution Ge spectrometer SPI . A coded mask allows SPI to image the sky with an angular resolution of about 3 degrees. We summarize the status of SPI observations of 511 keV positron annihilation line radiation from the Galactic center region after the first year of the INTEGRAL mission. The spatial distribution is dominated by emission from the bulge of the Galaxy ; this bulge emission is well described by a Gaussian with a FWHM of about 8 degrees. The 511 keV line flux from the bulge is about 10^{-3} ph/cm^2/s, the intrinsic width of the line is 2.7 keV (FWHM). We discuss the implications of these results for the origin of positrons in our Galaxy.

Poster contributions

Fundamental and Nuclear Physics with Black Holes and Neutron Stars
Didier Barret & Mariano Mendez
(CESR)
Stellar-mass compact objects (black holes, neutron stars and white dwarfs) play a key role in astrophysics as they are the end product of stellar evolution, and the collapse of their progenitors is responsible for the enrichment of the Universe in heavy elements. Recently, the first diagnostics of General Relativity in the strong-field regime were claimed in the X-ray emission of accreting black holes and neutron stars, strengthening the idea that X-rays can be used to map out the strongly curved spacetime around compact stars. X-ray timing and spectroscopy of neutron stars have revealed its potential to constrain their masses and radii, to estimate their, sometimes extreme, magnetic fields and to measure millisecond spin periods in accreting systems. This has opened the way to determine the equation of state of matter at supra-nuclear density, test strong-field quantum electrodynamics and study highly energetic particle acceleration processes. A leap in sensitivity by an order of magnitude, as would be provided by a 10 m^2 class X-ray observatory, would convert current diagnostics of General Relativity into true tests of gravitation in the strong-field regime, and set unprecedented constraints on the equation of state of dense matter. Understanding the Universe globally requires gauging the limits of physicals laws ; compacts objects are undoubtedly the best tools for this purpose.

Mrk 421 and 501 at 90 GeV – The influence of CELESTE's Energy Scale on the Study of Flares & Spectra
E. Brion for the CELESTE Collaboration
(CENBG)
The CELESTE atmospheric Cherenkov detector running at the Themis solar facility has detected several 90 GeV gamma ray flares of Mrk 421 since 1999, the most recent being on 2004 March 15 & 17. We have also searched for emission from Mrk 501. We significantly improved our understanding of the optical throughput of our detector using stellar photometry, and of the atmosphere using a LIDAR. Improved data analysis provides better background rejection. We compare our improved light curves with X-ray and optical data, and present a spectral measurement for Mrk 421.

Optical Monitoring of Blazars at Bordeaux Observatory
P. Charlot, J.-F. Le Campion – Observatoire Aquitain des Sciences de l'Univers - CNRS/UMR 5804
(Observatoire Aquitain des Sciences de l'Univers)
Several blazars, among which the TeV-emitting gamma-ray sources Mkn 421 and Mkn 501, have been monitored in the optical band since 1998 at Bordeaux Observatory. The observations are carried out in automatic mode using the CCD meridian instrument, hence providing measurements every night if weather permits. The precision of the data ranges from about 0.02 mag for objects with magnitude 12-13 to 0.1 mag for objects with magnitude 16. The absolute calibration is derived by observing 300-400 reference stars every night. We present the multi-year light curves obtained from this monitoring and discuss the variability of the sources.

The bright Sy 2/starburst galaxy NGC 4945 observed with INTEGRAL and RXTE : first results
S. Deluit et al.
(INTEGRAL Science Data Center)
In early January 2004, NGC 4945 has been observed simultaneously by INTEGRAL and RXTE.
The combination of the two satellites allows to perform detailed studies of the soft and hard X-ray emission of this source. We present the first results of our analysis.

The Cosmic Ray Energetics And Mass (CREAM) experiment
L. Derome, A Barrau, K. Protassov, M Buenerd
(LPSC-IN2P3)
The Cosmic Ray Energetics And Mass (CREAM) experiment is a US-Korea-Italian collaboration. It will measure the flux and the elemental composition of ultra high energy (10e12 to > 5 x 10e14 eV) cosmic rays. This will be performed by means of a series of Ultra Long Duration Balloon (ULDB) flights of which the first is currently scheduled for December 2004. The goal is to observe the spectral features and/or abundance changes expected for a supernova shock acceleration limit. The CREAM detector consists of a combination of a sampling tungsten/scintillating-fiber calorimeter backing a graphite hadronic converter (0.5 interaction length), with a transition radiation detector (TRD, Z>3 nuclei), and a set of scintillating fibers hodoscopes for trigger and track reconstruction. Two XY scintillator paddles hodoscopes are used for particle charge measurements. The physic goals of the CREAM project together with the main characteristics of the instrument will be presented, and the LPSC Grenoble proposal of adding a Cherenkov counter to improve the charge resolution will be discussed.

Rapid correlated X/TeV variability in Mkn421
Berrie Giebels, Guillaume Dubus, Bruno Khelifi
(LLR Ecole Polytechnique)
A very high emission state of Mkn421 and its correlated variability in the X-ray and TeV bands are reported. The lightcurve and spectral variability are analyzed and we specify how physical parameters derived in the context of the SSC model are obtained for this highly interesting episode.

Rapidly rotating compact stars as sources of gravitational waves
D. Gondek-Rosinska, E. Gourgoulhon, P. Haensel
(LUTH, Observatoire de Paris, Meudon)
Rapidly rotating relativistic stars can be subject to different kinds of instabilities leading to gravitational wave emission. A instability spins down a star by allowing it to radiate away its angular momentum in gravitational waves. We have investigated the effects of general relativity upon the nonaxisymmetric viscosity-driven bar mode instability of rotating strange quark stars.We find that general relativity weakens the viscosity driven bar mode instability, but the stabilizing effect is not very strong. We will overview the stellar instabilities relevant for an old accreting strange star in low mass X-ray binaries. Taking into account actual values of viscosities in strange quark matter and neglecting the magnetic field we will show that in contrast to neutron stars, strange quark stars described by the MIT bag model can be accelerated to very high frequency in LMXBs if the strange quark mass is consistent with values based on particle data tables.

Probing the black hole/torus in abscured AGN and QSOs. A measurement method based on a restricted 3-body problem.
J.M. Huré, Boudol F., Lira N., Pierens A.
(LUTh/Observatoire de Paris-Meudon & Univ. Paris 7)

Nuclear Astrophysics - Gamma-ray Spectroscopy in the MeV domain
Jürgen Knödlseder, in behalf of a large consortium of scientists involved in nuclear astrophysics
(CESR)
Since the advent of gamma-ray astronomy, nuclear astrophysics is intermediately related to the field of MeV gamma-ray spectroscopy. Nuclear transition lines in the MeV domain provide an exceptional probe for nuclear astrophysics, allowing the determination of isotope abundances, the identification of nucleosynthesis processes, the tracing of star formation activity, and in general, the study of nuclear physics. Observations of the Compton Gamma-Ray Observatory have clearly demonstrated the potential of this field, and first results from ESA's INTEGRAL observatory illustrate the power of such observations. A leap in sensitivity by 1-2 orders of magnitude, as would be provided by a focusing gamma-ray lens telescope and - complementary - by an advanced Compton telescope, would turn gamma-ray spectroscopy into an integral and powerful tool for nuclear astrophysics. Key questions that could be addressed by such next generation instruments comprise the understanding of supernovae physics, the origin of cosmic rays, the origin of antimatter, and nucleosynthesis and star formation activity.

Super-bubbles : laboratories for high energy astrophysics and cosmic-ray physics
A. Marcowith, E. Parizot, E. van der Swaluw, A. Bykov & V. Tatischeff
(CESR)
Observations indicate that most massive stars in the Galaxy appear in groups, called OB associations, where their strong wind activity generates large structures known as superbubbles, inside which the subsequent supernovae (SNe) explode, in tight space and time correlation. Acknowledging this fact, we investigate four main questions : 1) does the clustering of massive stars and SN explosions influence the particle acceleration process usually associated with SNe, and induce collective effects which would not manifest around isolated supernova remnants ? ; 2) does it make a difference for the general phenomenology of Galactic Cosmic Rays (GCRs) , notably for their energy spectrum and composition ? ; 3) can this help alleviate some of the problems encountered within the standard GCR source model ? ; and 4) Is the link between superbubbles and energetic particles supported by observational data, and can it be further tested and constrained ? We argue for a positive answer to all these questions.

Hybrid analysis for Pierre Auger Observatory

Playez Nathalie
(LAL (Orsay))

With now currently nearly 300 water Cerenkov tanks for the Surface Detector (SD), the Pierre Auger Observatory is the largest Ultra High Energy Comic Rays experiment in the world. The Fluorescence Detector with its 2 working 6-Telescopes Flyes'Eyes makes it possible to record "Golden" events, i.e. events which can be reconstructed independently by the Surface Detector and the Fluorescence Detector , and in addition by an Hybrid method, combining the information of both Detector. This last technic increases the precision of the geometric reconstruction and also give an intercalibration of both detector. In our analysis of these events we compare the different methods of reconstruction for shower geometry and energy.

IGR J19140+0951 as seen by INTEGRAL and RXTE.

J. Rodriguez, C. Cabanac, D.C. Hannikainen
(CEA Service d'Astrophysique/ ISDC Geneve)

IGR J19140+0951 was discovered during the first observation campaign of the famous micro quasar GRS1915+105 by the IBIS/ISGRI detector onboard INTEGRAL. The source which is 1 degree from from GRS1915+105, shows strong X-ray luminosity and spectral variations on timescales from seconds to hours.
We report here the results obtained from our AO1 INTEGRAL campaign and observations of the source during Galactic Plane Scans and Galactic Centre Deep Exposure as well as RXTE observations. We study the high energy spectral and timing properties of the source, and propose it to be a Galactic X-ray binary. We also discuss the type of the compact object based on the spectral parameters of the source.

A simple idea for the complex lag structure of microquasars

P. Varniere
(University of Rochester)

The phase lag structure between the hard and soft X-ray photons observed in GRS 1915+105 and XTE J1550+564 has been said to be "complex" because the phase of the Quasi-Periodic Oscillation fundamental Fourier mode changes with time and because the even and odd harmonics signs behave differentely. From simultaneous X-ray and radio observations this seems to be related to the presence of a jet (level of radio emission). We propose a simple model where a partial absorption of the signal can shift the phases of the Fourier modes and account for the phase lag reversal. We also briefly discuss a possible physical mechanism that could lead to such an absorption of the quasi-periodic oscillation modulation.

AstroBEAR : toward a disk/jet 3D AMR MHD code

P. Varniere, A. Frank, S. Mitran
(University of Rochester)

AstroBEAR is a new code being build to explore the disk/jet connection. In this poster we will present the main characteristic of this 3D AMR MHD code and some first results.

Session PCMI

Oral contributions

Gaz et poussière dans les quasars à grand décalage spectral

Alexandre Beelen
(IAS)

L'étude du gaz et de la poussière dans les galaxies hôtes des quasars à grand décalage spectral nous permet de sonder les conditions physiques de la formation stellaire au moment où les premières structures se forment. En effet, la majorité de l'énergie générée par les flambées de formations stellaires est absorbée par la poussière qui la re-émet dans l'infrarouge lointain, émission décalée dans les fenêtres atmosphériques millimétrique et submillimétrique. Ces fenêtres contiennent aussi les transitions rotationnelles élevées de CO permettant d'étudier le gaz moléculaire dense et chaud de la galaxie hôte.

Nous exposerons d'abord les résultats des relevés récents dans le continuum infrarouge lointain et radio de quasars optiquement lumineux et "radio-quiet" à grand décalage spectral (1.9<6.4). Ces relevés montrent que dans la plupart de ces quasars des masses importantes de poussière froide (T 50 K) sont présentes avec $M_{dust} \sim 10^8 M_\odot$ jusqu'à l'époque de la fin de la réionization. Les donnees radio montrent que la relation entre l'emission infrarouge et radio des galaxies locales est verifiee pour les quasars a grand z, indiquant que le chauffage dominant provient des etoiles massives nouvellement formees. Les taux de formation stellaire tres eleves (1000 $M_\odot$/yr) indiquent une intense activite de flambee d'etoiles dans ces systemes et la necessite d'un reservoir de gaz important pour soutenir celle-ci.

Nous présenterons ensuite des etudes du gaz moleculaire des ces systemes lointains detectes via les transitions rotationnelles de la molécule CO, notamment pour le quasar J1409+5628 a z=2.56 et pour J1148+5251, le quasars le plus lointain détecté à ce jour à z=6.41. Les masses de gaz moleculaires sont estimees a $M_{H_2} \sim 10^{9-10} M_\odot$. Dans quelques cas, la detection de plusieurs transitions de CO permet de contraindre les conditions physiques du gaz moleculaire qui est chaud (60-100 K) et dense (10^3-10^4 cm^{-3}) et comparable aux conditions de starbursts locaux tels M82 ou Arp220.

Dust in the Small Magellanic Cloud.

C. Bot, F. Boulanger, M. Rubio, G. Lagache, L. Cambrésy, and D. Egret
(observatoire astronomique de Strasbourg)

The Small Magellanic Cloud is a nearby galaxy of low metallicity, strong star formation rate in spite of an apparently small proportion of molecular gas (weak and rare CO detections). The observations of gas and dust of this galaxy allow to study the impact of metallicity and of star formation history on dust abondance. The multi-wavelength dust emission, outside of the star formation areas, allows to measure the temperature and the emissivity by hydrogen atom of the grains in the diffuse medium of the SMC. The emissivity of the grains in the diffuse medium is 30 times weaker than in the solar vicinity, whereas the difference in metallicity is only 10. The gas-to-dust ratio is thus 3 times higher in the diffuse medium of the SMC than in the solar vicinity. There is thus a smaller fraction of metals in solid form in the SMC. The study of a quiescent molecular cloud, SMC B1#1, shows the opposite result. The modeling of emission of dust in this cloud requires high abundance of dust. For a column density of hydrogen traced by CO integrated emission, one finds a gas-to-dust extinction ratio of galactic value, incompatible with measurements of metallicity in the SMC. There is thus a large quantity of hydrogen not traced by CO emission. Moreover, the gas-to-dust ratio in the dense medium of the SMC is definitely weaker than in the diffuse medium. This evolution of the gas-to-dust ratio from diffuse medium to dense medium can be reproduced by a frequent destruction of the grains by the explosions of supernovae in the diffuse medium and accretion on dust of the heavy élements in the molecular clouds where the grains are protected.

Gas moléculaire et naines de marée

Jonathan Braine (Observatoire de Bordeaux)
(Observatoire de Bordeaux)

We investigate the process of galaxy formation as can be observed in the only currently forming galaxies – the so-called Tidal Dwarf Galaxies, hereafter TDGs – through observations of the molecular gas detected via its CO (Carbon Monoxide) emission. These objects are formed of material torn off of the outer parts of a spiral disk due to tidal forces in a collision between two massive galaxies. Molecular gas is a key element in the galaxy formation process, providing the link between a cloud of gas and a *bona fide* galaxy. We have detected CO in 9 TDGs with an overall detection rate of 80%, showing that molecular gas is abundant in TDGs, up to a few $108 M_{\odot}$. The CO emission coincides both spatially and kinematically with the HI emission, indicating that the molecular gas forms from the atomic hydrogen where the HI column density is high. A possible trend of more evolved TDGs having greater molecular gas masses is observed, in accord with the transformation of HI into H_2.

Although TDGs share many of the properties of small irregulars, their CO luminosity is much greater (factor $\sim$ 100) than that of standard dwarf galaxies of comparable luminosity. This is most likely a consequence of the higher metallicity (> 1/3 solar) of TDGs which makes CO a good tracer of molecular gas. This allows us to study star formation in environments ordinarily inaccessible due to the extreme difficulty of measuring the molecular gas mass. The star formation efficiency, measured by the CO luminosity per Hα flux, is the same in TDGs and
full-sized spirals.

CO is likely the best tracer of the dynamics of these objects because some fraction of the HI near the TDGs may be part of the tidal tail and not bound to the TDG. Although uncertainties are large for individual objects, as the geometry is unknown, our sample is now of nine detected objects and we find that the “dynamical" masses of TDGs, estimated from the CO line widths, seem not to be greater than the “visible" masses (HI + H_2 + a stellar component). Although higher spatial resolution CO (and HI) observations would help reduce the uncertainties, we find that TDGs require no dark matter, which would make them the only galaxy-sized systems where this is the case. Dark matter in spirals should then be in a halo and not a rotating disk. Most dwarf galaxies are dark matter-rich, implying that they are *not* of tidal origin.

We provide strong evidence that TDGs are self-gravitating entities, implying that we are witnessing the ensemble of processes in galaxy formation : concentration of large amounts of gas in a bound object, condensation of the gas, which is atomic at this point, to form molecular gas and the subsequent star formation from the dense molecular component.

Dynamics of the molecular gas in star-forming regions : the OMC-1 molecular cloud in Orion.

Gonzague Callejo, Jean-Louis Lemaire, Guillaume Pineau des Forets, David Field
(observatoire de Paris-LERMA)

The Orion molecular cloud OMC-1 is the perfect object for the study of the dense interstellar medium accounting for active star formation ; the intrinsic complexity of this region serves as a stallion, both for observing techniques and for interstellar medium modelling.

A detailed dynamic and spectroscopic study has been performed using VLT and CFHT observations of the infrared Kleinmann-Low nebula ; yielding a complete
small-scale structure in velocity and most importantly powerful diagnosis tools in order to put a new light into the gas behaviour.

These results allow to build up a consistent model of the gas excitation, and a clear dynamical view of the region. The crucial action of the shock waves is confirmed, and the discrepancies between the observations and the standard models are discussed.

The consequencies of this modelling will be discussed in terms of extinction, magnetic field, and other quantities related to induced star formation. The goodness of the models used for the interpretations will be also discussed and some future directions of investigation enhanced.

Large scale variations of the dust optical properties in the Galaxy

L. Cambrésy (Obs Strasbourg), T.H. Jarrett (IPAC), C.A. Beichman (IPAC)
(Observatoire de Strasbourg)

We present an analysis of the dust optical properties at large scale, for the whole galactic anticenter hemisphere. We used the 2MASS Extended Source Catalog to obtain the total reddening on each galaxy line of sight and we compared this value to the IRAS 100 microns surface brightness converted to extinction by Schlegel et al. (1998). We performed a careful examination and correction of the possible systematic effects resulting from foreground star contamination, redshift contribution and galaxy selection bias. We also evaluated the contribution of dust temperature variations and interstellar clumpiness to our results. The correlation of the near–infrared extinction to the far–infrared optical depth shows a discrepancy for visual extinction greater than 1 mag with a ratio Av(FIR)/Av(gal)=1.31. We attribute this result to the presence of fluffy/composite grains characterized by an enhanced far–infrared emissivity. Our analysis, applied to half of the sky, provides new insights on the dust grains nature suggesting fluffy grains are found not only in some very specific regions but in all directions for which the visual extinction reaches about 1 mag.

Spectroscopic observations of interstellar matter in galaxies with the Spitzer IR Space Telescope
V.Charmandaris, J.R. Houck, D. Weedman, L. Armus, B.T. Soifer (for the IRS/GTO team)
(Cornell University)
The infrared spectrograph (IRS) on the Spitzer Space Telescope, launched in August 2003, provides the opportunity to perform low and medium resolution spectroscopy from 5 to 40microns to a mJy level, more than 100 times fainter than what has been available to date. We will present some first results on the properties of new infrared features detected on normal and active galaxies observed as part of the on the IRS extragalactic guaranteed time program.

The role of C and CO in the interstellar gas cooling in nearby galaxies
Maryvonne Gerin, Estelle Bayet, Tom Phillips
(LERMA / ENS)
While the ground state rotational line of carbon monoxyde is easily detected in galaxies, and can be used as a tracer of the gas mass, this line has a very small contribution to the gas thermal balance. The neutral gas cooling is dominated by the fine structure lines of oxygen [OI], ionized [CII], and neutral carbon [CI], together with the excited rotational transitions of carbon monoxide at submillimeter wavelengths. We discuss in this contribution the respective roles of these lines in the gas cooling, in external galaxies, as deduced from observations obtained with the Caltech Submillimeter Observatory, and the perspectives offered in the near future by APEX, ALMA and Herschel. We also present how these observations can be used for understanding the submilleter spectrum of distant galaxies.

Astrophysique Moleculaire Extragalactique : resultats recents
M. Guélin
(IRAM)
Extragalactic Molecular Astrophysics : recent results
The gains in sensibility and angular resolution provided by new instrumentation on the mm-wave telescopes and interferometers have open the way to detailed studies of the dense interstellar clouds in extragalactic objects. This is true for nearby galaxies, where one has started to investigate the distribution, dynamics, and physico-chemical properties of individual clouds, as well as for high redshift galaxies and quasars, where the first molecule other than CO and H2 has just been observed. The latest results obtained in this field with mm/submm-wave telescopes will be quickly reviewed and their impact on galactic evolution and star formation briefly discussed.

Thermal condensation in atomic hydrogen driven by turbulence
Hennebelle P., Audit E.
(0bservatoire de Paris-ENS (LERMA))
The interstellar neutral hydrogen is a thermally bistable medium. The dynamical processes with two coexisting phases involve a large range of spatial (and temporal) scales, that need to be adequately represented in numerical simulations.
We have performed 2-d simulations of a converging and turbulent flow. A statistical analysis of the fraction and the properties of the different phases has been carried out and is presented.

Modelling Interstellar Extinction in Three Dimensions
Douglas J. Marshall, Annie C. Robin, Céline Reylé
(Observatoire de Besançon)
Interstellar extinction remains a serious obstacle for the observation of stars in the Milky Way, and for interpreting these observations in terms of Galactic Structure. We have developed a technique that estimates the three dimensional extinction in the Galactic plane. The colour distribution (J-K) of stars from the 2MASS survey are compared to that of stars from the Besançon model of the Galaxy, to which we do not add the effects of extinction. If the luminosity function and the density laws of the different populations are well modeled, any differences in the colour distributions will be due to interstellar extinction. After having described the method, we will show the results for several different regions in the Galactic plane.

Perspectives for the observation of galaxies at very high z in the Far IR

Alain Omont
(IAP)

Je discuterai les potentialités post-Herschel de la fenêtre 20-500 micron - entre JWST et ALMA - pour l'exploration de l'Univers très jeune, entre des redshifts 0.5 et 20. A cause de la confusion des sources et en attendant l'interférométrie spatiale, la spectroscopie présente un net avantage pour les prochaines missions spatiales, en attendant l'interférométrie spatiale. Dans le contexte de la situation actuelle et prévisible de la cosmologie observationnelle et de ses principaux problèmes, je mettrai donc l'accent sur les potentialités d'un grand (8-10m) télescope cryogénique optimisé pour l'infrarouge lointain, pour les principaux objectifs scientifiques à grand z : 1) formation des galaxies et des étoiles à l'époque de la réionisation (z 6-20) ; 2) propriétés et évolution des galaxies dans tout l'intervalle z = 0.5-6 : raies interstellaires, formation stellaire, formation des galaxies, (proto-)amas, etc. ; 3) évolution des galaxies à noyau actif (AGN) par l'étude de l'interface entre le trou noir et la galaxie hôte. J'évoquerai aussi le besoin à long terme de l'interférométrie spatiale dans l'infrarouge lointain pour une exploration profonde à très grand z, ainsi que l'intérêt d'un relevé complet du ciel submillimétrique.

N.B. On peut trouver des discussions détaillées sur ces thèmes sur la page web du colloque "New perspectives for post-Herschel far infrared astronomy from space", Madrid 1-4 septembre 2003, http ://damir.iem.csic.es).

I will consider the potentialities of the deep 20-500 micron window - between JWST and ALMA - for the exploration of the young Universe, between redshifts 0.5 and 20-30. Because of source confusion and waiting for space interferometry, spectrometry should be privilegiated for the next missions. In the context of recent and expected advances in cosmology and galaxy evolution, and pending key problems, I will highlight the capabilities of a large aperture (8-10m), cryogenic, far-infrared telescope, and of smaller telescopes, for the main high-z science objectives : 1) galaxy and star formation at the reionization epoch (z 6-20) ; 2) galaxy properties and evolution in the whole range z = 0.5-6 : interstellar lines, star formation, history of energy generation, formation of galaxy (proto-)clusters, etc. ; 3) AGN evolution, through studies of the obscured interface between the black-hole and the host galaxy. I will also discuss the long-term need for far-infrared space interferometry for deep high-z exploration, and the interest of a whole sky submillimeter survey.

Molecular survey in the Galactic Center

N. J. Rodriguez-Fernandez, F. Combes
(LERMA, Obs. Paris)

Up to 10% of the neutral gas of the Milky Way is located in the 500 central pc of the Galaxy. This gas is mainly molecular and exhibit particular physical properties (turbulence, widespread high gas temperatures,...) and a rich chemistry (extended emission and high abundances of molecules like SiO or ethanol). The origin of these properties can be related to shocks induced by the large scale dynamics of the Galaxy in the context of a bar potential. To investigate this possibility we have observed the dense and shocked gas in some clouds with outstanding kinematics. The first results confirm the influence of the galactic dynamics in the physics and the chemistry of the molecular gas.

Nano-diamonds in the Active Galactic Nucleus NGC1068 ?

Daniel Rouan, D. Gratadour, Y. Clénet, E. Gendron, F. Lacombe
(LESIA)

L and M diffraction-limited images of NGC 1068, obtained with NAOS+CONICA at VLT/YEPUN reveal dust with high color temperature (T_{col} = 550-650 K) distributed in several regions. The most intriguous structure Consists in a set of parallel elongated nodules (wave-like) on each side, albeit mainly at north, of the radio jet, at a distance of 50 to 70 pc from the central engine. It suggests a tubular clumpy shell around the radio jet. This structure which was not known until now, exhibits too high a temperature for "classical" grains ; it is most probably the signature of transiently heated very small dust grains (VSG). The most recent observations using a coronagraphic device to hide the bright central nucleus, also reveal the nodules at K (2.2 μm). This put strong constraints on the color Temperature. Nano-diamonds, which are highly resistant and can form in strong UV field or in shocks, are very attractive VSG candidates. The "waves" could be condensations triggered by jet induced shocks, as predicted by recent models. First estimates, based on a simple transient heatin VSG model and on a detailed radiative transfer model, do agree with those interpretations, both qualitatively and quantitatively.

Cold molecular gas in cooling flows

P. Salomé & F. Combes
(IRAM)

With the recent results of the X-ray satellites XMM-Newton and Chandra, the very existence of the so-called cooling flow phenomenon has been highly debated. We present here a millimetric study of central cluster galaxies (CGG) we lead to probe the cooling flow problem. An IRAM 30m telescope survey of a large sample of cooling flow clusters showed the presence of cold molecular gas in the core of several CGGs. The corresponding molecular gas masses derived are between 3.10e8 and 4.10e10 Msun. Synthesis aperture imaging of two strong CO detected clusters have then been performed with the IRAM Plateau de Bure array : Abell 1795 and RXJ0821+07. The CO morphologies and dynamics in these peculiar objects are presented and discussed in order to explore whether the molecular gas origin may consistent with a cooling flow scenario.

Dust and molecules in nearby galaxies

Marc Sauvage (SAp, CEA)
(CEA)

Although they do not compose but a weak part of the mass of the galaxies or of their interstellar environment, dust and molecules intervene for an essential part in the galactic cycle : star formation. ISO and the millimetre-wave observatories enormously taught us on the chemical composition, abundance, spatial distribution and energy sources of these two phases. By concentrating on the observations of nearby galaxies, primarily in the Local Group, I will discuss our projections in these four fields, with a more important accent related to information which is still lacking.

Poster contributions

D2 STICKING COEFFICIENT AND DESORPTION RATE ON VARIOUS FORMS OF WATER ICE FILMS UNDER INTERSTELLAR CONDITIONS

L. Amiaud, S. Baouche, F. Dulieu, J-H Fillion, A. Momeni, J-L.Lemaire LERMA UMR 8112, Observatoire de Paris & Université de Cergy-Pontoise, France
(Université de Cergy-Pontoise et Observatoire de Paris)

Gas-grain interactions play a key role in the formation of molecular hydrogen in the ISM. An experimental facility named FORMOLISM (Molecular Formation in the Interstellar Medium) has recently been developed in our laboratory in order to investigate the catalytic role played by the grain in the chemical reaction producing H2 in conditions similar to the interstellar medium. A differentially pumped atomic beam of H or D is directed to surface sample which can be cooled down to 8K, in the centre of an ultra high vacuum chamber (<10-10 mBar). Temperature-Programmed Desorption experiments (TPD) can be performed and the desorbing molecules can be selectively probed in their individual (v, J) levels, thanks to the (2+1) Resonance Enhanced Multi-photon Ionisation (REMPI) method. Ions are detected by using a Time-Of-Flight mass spectrometer. Our experiment gives access to fast reactions mechanisms that can not be probed in conventional TPD experiments. REMPI coupling with TOF detection and atomic dosing can be performed simultaneously. In order to determine H and H2 interaction on water ice surfaces, we are conducting a detailed study of D2 adsorbed on different forms of water ice films using both TPD and REMPI techniques. The ice morphology is controlled by changing vapour deposition temperature and subsequent annealing. Variations of D2 sticking coefficients and desorption rate with surface temperature are compared in high density amorphous water ice, and low density amorphous water ice of different porosity.

The dynamics of associative desorption of chemisorbed deuterium atoms on graphite (0001)

S. Baouche L. Hornekær V.V. Petrunin A.C. Luntz J.L. Lemaire T. Zecho J. Küppers A. Baurichter
(LERMA UMR8112, Observatoire de Paris & Université de Cergy Pontoise)

Understanding the mechanisms for H2 formation from H atoms in the interstellar medium is an important problem in astrophysics. The large abundance of H2 cannot be explained by either three-body collision or radiative association mechanisms, and it is generally accepted that H atom recombination takes place on interstellar dust particles [1]. We applied Laser Assisted Associative Desorption (LAAD), to study the dynamics of the recombinative desorption of chemisorbed deuterium atoms on HOPG (0001). The translational energy distributions obtained with this technique are extremely hyperthermal (1-2eV), proving the strong exothermicity of the recombination reaction which occurs at around 500 K in the TPD. Measured angular distributions of the desorbing molecules, including desorption from defect sites and isotope effects will also be presented. All results will be compared to recent ab-initio calculations, suggesting that the D (H) atoms recombine from next nearest adsorption sites on top of carbon atoms, which pucker out of the surface plane by several tenths of an Angstrom [2]. [1] D. H. Hollenbach and E. E. Salpeter, J. Chem. Phys. 53, 79 (1970) ; Astrophys. J. 163, 155 (1971). [2] T. Zecho et al, J. Chem. Phys. 117, 8486(2002)

C and CO lines in nearby galaxies, study of interstellar medium cooling

E.Bayet, M.Gerin, T.G. Phillips et A. Contursi
(LRA-LERMA-OBSERVATOIRE DE PARIS)

We observed galaxies (NGC 253, Henize 2-10, M83, IC342 and NGC 6946) with the Caltech Submillimeter Observatory in various rotational lines of carbon monoxide : ^{12}CO(J=3-2), (J=4-3), (J=6-5) and (J=7-6) and also ^{13}CO(J=3-2) and in the $^3P_2$-$^3P_1$ and $^3P_1$-$^3P_0$ fine-structure transitions of atomic carbon [CI] at 809 GHz and 492 Ghz, respectively. Some of these observations have been made previously, but the present multitransition study (including data found in the literature) is the most complete to date for these galaxies. From these observations, we have derived the properties of the warm and dense molecular gas in the galaxy nuclei. We used an LTE analysis and an LVG radiative transfer model to determine physical conditions of the interstellar medium in NGC 253, Henize 2-10, M83 and IC342 and predicted integrated line properties of all CO transitions up to CO(15-14). We found the observations to be in good agreement with a medium defined by $T_k \approx 50-100\,K$, $\frac{^{12}CO}{^{13}CO} \approx 30$, $n(H_2) \gtrsim 10^4\,cm^{-3}$ and $N(^{12}CO) = 3.5 \pm 1 \times 10^{18}\,cm^{-2}$ for Henize 2-10 and defined by $T_k \approx 70-150\,K$, $\frac{^{12}CO}{^{13}CO} \approx 40$, $n(H_2) \gtrsim 10^4\,cm^{-3}$ and $N(^{12}CO) = 1.5 \pm 0.5 \times 10^{19}\,cm^{-2}$ for NGC 253. A PDR model has also been used and here the data are well fitted by a model cloud (within 20 %) with a gas density of n(H)= 8.0±1× $10^5\ cm^{-3}$ and an incident FUV flux of χ ≈20000 for Henize 2-10. For NGC 253, we deduced n(H)= 3.0±0.5× $10^5\ cm^{-3}$ and $\chi \approx 20000$ for the modelled cloud. M83 and IC342 have just finished to be studied with a LVG model. For M83, we found the observations well fitted with the following models : $T_k \approx 100-150\,K$, $\frac{^{12}CO}{^{13}CO} \approx 40$, $n(H_2) \gtrsim 10^4\,cm^{-3}$ and $N(^{12}CO) = 3.0 \pm 1 \times 10^{18}\,cm^{-2}$. For IC342, We reproduced well observations with a LVG model of $T_k \approx 100\,K$, $\frac{^{12}CO}{^{13}CO} \approx 40$, $n(H_2) = 1000\,cm^{-3}$ and $N(^{12}CO) = 5 \times 10^{18}\,cm^{-2}$ or with a LVG model of $T_k \approx 170\,K$, $\frac{^{12}CO}{^{13}CO} \approx 40$, $n(H_2) = 562.3\,cm^{-3}$ and $N(^{12}CO) = 6.0 \times 10^{18}\,cm^{-2}$. **{**We compared our results (physical properties of warm gas) with those obtained for the nucleus of Milky Way and the Cloverleaf QSO

Rotational collisional excitation of H_2O by H_2 : collisional rate coefficients and pressure broadening/shifting coefficients between 5K and 300K

F. Daniel, M.L. Dubernet et A. Grosjean
(LERMA, observatoire de Meudon)

Water is a key molecule for the chemistry and the energy balance of the gas in cold clouds and star forming regions, thanks to its relatively large abundance and large dipole moment. Chemical models have predicted for a long time the water abundance to be around 10^{-7} in cold clouds[1], i.e. among the most abundant O-bearing molecules. Yet, in warm regions water is expected to become the main reservoir of oxygen, thanks to both evaporation of the icy grain mantles[2] and endothermic reactions that transform all the gaseous oxygen not in CO into H_2O[3]. For this reason, water modeling deserves a particular attention. In this respect, collisional rotational and ro-vibrational excitation rates of H_2O by H_2 are essential for the interpretation of excitation conditions and for the determination of chemical composition in the different media.

The study has been motivated not only by the intepretation of the data recently acquired by ISO [4] and SWAS [5], but also by the future ESA mission, the Herschel Space Observatory (hereinafter HSO) : several water lines will be observed with unprecedent sensitivity in different environments, from the interstellar medium to the stellar or planetary atmospheres.

Our projet is a thorough theoretical study of the collisional excitation rates of H_2O by H_2 on a wide range of temperature (5K - 1000K) and for all transitions of interest. We use a new potential energy surface averaged on the fondamental vibrational states of both H_2O and H_2[6]. Preliminary results show that the new rate coefficients might differ by as much as 100% from previously calculated rate coefficients[7,8,9]. Our goal is to get the best possible accuracy on the whole range of temperature and for all levels of interest. This is a challenge that we will first tackle through optimization of the codes and careful use of approximations. We will present calculations up to 300K and tests of various approximations up to 1000K. The line parameters calculations at 300K will be compared to experimental results, they will provide a valuable test of the new potential energy surface.

[1] H.-H. Lee, R. P. A. Bettens, and E. Herbst, Astron. Astrophys. Sup. 199, 11 (1996). [2] A. G. G. M. Tielens and L. J. Allamandola, in Physical Processes in Interstellar Clouds (1987), pp. 333-376 ; in ASSL Vol. 134 : Interstellar Processes (1987), pp 397-469. [3] M. M. Graff and A. Dalgarno, ApJ 317, 432 (1987). [4] M. F. Kessler et al., A&A 315, L27 (1996). [5] G. J. Melnick et al., ApJ 539, L77 (2000). [6] P. Valiron and al., to be submitted to JCP (2004). [7] T. R. Phillips, S. Maluendes and S. Green, ApJS 107, 467 (1996). [8] M.-L. Dubernet and A. Grosjean, A&A 390, 793 (2002). [9] A. Grosjean, M.-L. Dubernet, and C. Ceccarelli, A&A 408, 1197 (2003).

Ro-vibrational Collisional Excitation Database
http ://basecol.obs-besancon.fr or http ://boum.obspm.fr/basecol)

M.L. Dubernet, B. Debray, A. Grosjean, D. Flower, A. Faure, T. Stoecklin, P. Valiron, F. Daniel, N. Feautrier, E. Roueff, A. Spielfi edel
(LERMA, observatoire de Meudon)

Numerical and bibliographical Databases in Atomic and Molecular Physics are essential for both the modelling of various astrophysical media and the interpretation of astrophysical spectra provided by ground or space-based telescopes. We will present the current status of a numerical and bibliographical database concerning collisional ro-vibrational excitation rate coefficients of molecules (basecol.obs-besancon.fr). This is part of a EU effort towards the scientific preparation of the HIFI instrument of the Herschel Space Observatory (HSO) [1] and ALMA [2].

An identification of needs for data on collisional ro-vibrational excitation of molecules has been specified in a recent report [3]. These first steps have triggered different groups to carry out calculations on collisional ro-vibrational excitation of molecules and to build a related bibliographic and numerical database. This database, called BASECOL [4] is devoted to collisional ro-vibrational excitation of molecules by colliders such as atom, ion, molecule or electron. We have constituted a international working group of molecular physicists involved in the calculations of ro-vibrational cross-sections, in order to ensure the continuity and the quality of the database. We are primarily focusing on collisional systems of interest for various astrophysical media. The database is composed of several parts : a bibliographic database (papers are read and associated to very precise keywords), calculated collisional rates or cross-sections, information on the molecular data used in the cross section calculations, various information on ro-vibrational excitation of molecules. For the systems of astrophysical interest, we will provide full information on the chain of errors of the data and give some recommendations. We will improve and enlarge the content of the bibliographic database and provide more collisional rates.

Access is currently available via a classical WEB interface with an interactive query page for the bibliographic database. An interactive access to the collisional rates and cross-sections is underway. We are also addressing the issue of compatibility of the output of the database within the framework of the Virtual Observatories [5], in relation both with WEB tools for spectral analysis and with other databases.

The final version should be released in June 2004.

[1] http ://www.sron.nl/divisions/lea/hifi/ [2] http ://www.alma.nrao.edu/ [3] http ://www.lra.ens.fr/˜ pcmi/herschel-alma.html [4] http ://basecol.obs-besancon.fr [5] http ://www.ivoa.net

Search for methyl carbamate in hot cores.

Demyk Karine, Wlodarczak Georges, Dartois Emmanuel
(PhLAM)

Complex organic molecules containing up to 10 atoms have been detected in several hot molecular clouds such as Orion or SgrB2. Glycine (NH2CH2COOH), the simplest amino acid, has been extensively searched in hot cores and in molecular outflows but has not been firmly detected yet.
Using the 30m IRAM antenna at Pico Veleta, we have searched for the methyl carbamate (NH2COOCH3), the isomere of glycine, in the hot molecular cloud W51e2 and in the intermediate mass protostar IRAS21391+58502. This molecule, if present in molecular clouds, should be more favorable to detect than glycine thanks to its strong dipole moment. This poster presents the results from these observations.

Compared photolysis of the two isomers of astrophysical interest, allene and propyne, studied by the synchrotron VUV radiation.

K. ALNAMA, S. BOYE, S. COURIS, S. DOUIN, V. DRACOPOULOS, F. INNOCENTI b, L. ZUIN b, A.-L. ROCHE, N. SHAFIZADEH, et D. GAUYACQ.
()

Propyne (CH3C≡CH), allene (H2C═C═CH2), one of its isomers, and their photodissociation products have been identified in several astrophysical media such as atmospheres of carbonated stars or interstellar molecular clouds. Propyne is also a good candidate for the production of the C3 radical observed in comets after photodissociation induced by the solar radiation. The Super-ACO synchrotron radiation at ORSAY, providing VUV photons ranging from 180 to 40 nm and simulating solar and galactic radiation, has been used to study the relaxation dynamics of these hydrocarbonated molecules. Absorption spectra of the mother molecules and visible fluorescence excitation spectra of the neutral photodissociated fragments have been recorded as a function of the VUV photon energy. The neutral excited fragments CH, C2 and H have been identified after dispersion of the fluorescence signal and their apparition threshold have been determined. Surprisingly, the first results show that these 2 isomers does not exhibit the same photodissociation pathways above 12 eV excitation energy, unlike what was commonly suggested in many reported works. This might indicate that, among the different relaxation pathways (internal conversion, dissociation and isomerisation), dissociation is at least as fast as isomerisation in this high energy region.

Compared photolysis of the two isomers of astrophysical interest, allene and propyne, studied by the synchrotron VUV

K. ALNAMA, S. BOYE, S. COURIS, S. DOUIN, V. DRACOPOULOS, F. INNOCENTI , L. ZUIN , A.-L. ROCHE, N. SHAFIZADEH, et D. GAUYACQ.
(Laboratoire de photophysique MOLECULAIRE)
cf Poster DOUIN

The compact star forming region N88 in the Small Magellanic Cloud*

J.L. Lemaire1, G. Testor2, D. Field3, G. Callejo1 1 LERMA, UMR 8112 du CNRS, Observatoire de Paris, 92195 Meudon and Université de Cergy-Pontoise, 95031 Cergy Cedex, France. 2 LUTH, UMR 8102 du CNRS, Observatoire de Paris, 92195 Meudon, France. 3 Institute for Physics and Astronomy, Aarhus University, 8000, Denmark.
(Observatoire de Paris et Université de Cergy-Pontoise)

We report the first observations at near infrared wavelengths of the Small Magellanic Cloud region N88 (of scale 50 pc and located at 63 kpc) containing the compact star forming region N88A (1pc). New K band imaging in N88 (HW81 and HW82) provides accurate photometry of the stellar content and our analysis reveals a population of evolved stars of low and intermediate masses. Spectroscopic measurements in Z, J, H and K bands allow, in conjunction with visible measurements, a full spectral coverage from the visible to the infrared (0.37 to 2.45 μm). AV was revisited using a large wavelength interval from H to P. Our observations show for the first time precise locations of the molecular clouds in this vicinity, traced through vibrationally excited H2 emission. It appears that large H2 clouds extend up to 1-2 pc eastwards from the central N88A core with a good S/N ratio and fainter traces to the north and south-east up to 7-8 pc. Long slit spectroscopy through N88 and the nebulosity to the east clearly distinguishes a steep ionization zone in N88 characterized by HI and HeI emission with pure H2 emission clearly delineated in the cloud nearby. The H2 emission borders the peak flux of an extended CO cloud detected through radio astronomy. The morphology of H2 and CO (J=1-0 and J=2-1) emissions supports a PDR model in this region, located 8" (2.6 pc) from N88A.
* Based on observations obtained at the ESO-VLT with ISAAC both in imaging and spectroscopic modes.

Cross sections and collision rates for interstellar deuterated ammonia

Léandre Machin, Evelyne Roueff
(LUTh - Observatoire de Meudon)

NH3 is very abundant in interstellar clouds and is considered as a good temperature diagnostic. Its di- and tri-deuterated forms were recently detected in IRAM and in CSO (Lis, Roueff et al., ApJ, 571, L55, 2002) in cold and dense cores with a spectacular isotopic enrichment. The knowledge of rotational excitation rates by collision with H2 and He is required to interpret properly the observations. We propose to calculate cross sections and collision rates with He and H2 of NH3, ND3, NH2D, ND2H. Here we present theoretical results on rotational excitation of NH3 by He. We can compare them with previous works which were done with different treatments and potential energy surfaces. This comparison is impossible for the deuterated forms. We have used a full close coupling treatment with the molecular collision code of S. Green and J.M. Hutson, MOLSCAT and a recent molecular potential surface calculated by Hodges and Wheatley (J. Chem. Phys, 114, 8836, 2001).

Absorption of X-Rays by Nanoparticle Aggregates

J.B.A. Mitchell, J.L. LeGarrec, C. Rebrion-Rowe, D. Travers, B.R. Rowe, L. Biennier P.A.L.M.S., U.M.R. no. 6627 du C.N.R.S. Université de Rennes I, 35042 Rennes cedex S. di Stasio, Instituto Motori, Naples, Italy and M. Wulff, A. Plech, R.J. Randler ESRF, BP 220, 38043 Grenoble cedex
(Université de Rennes 1)

In a series of recent synchrotron radiation experiments, [1-4] the absorption of high energy x-ray and VUV photons by flame generated soot nanoparticle aggregates has been examined. The structure of these aggregates is similar to that of interstellar dust grains. It is found that an intense ionisation process is produced by the absorption of an x-ray photon. The mechanism for this ionisation has been given by astrophysical models [5,6] that predict that the dust grain disintegrate due to runaway electrostatic charging. The results of a small angle scattering measurement will be presented that reveal the diameters of the primary and sub-primary particles in the aggregates.

1. J. B. A. Mitchell, C. Rebrion-Rowe, J-L. LeGarrec, G. Taupier, N. Huby and M. Wulf, Combustion and Flame, 131 (2001) 308. 2. J. B. A. Mitchell, C. Rebrion-Rowe, J-L. LeGarrec, G. Taupier, N. Huby and M. Wulf, Astronomy and Astrophysics 386 (2002) 743. 3. J.L. LeGarrec, J.B.A. Mitchell, D. Travers and J.M. Bizau Nucl. Instrumen. Meth. B (2004) In press. 4. J.B.A. Mitchell in Electron Scattering from Atoms, Molecules, Nuclei and Bulk Matter (ed. C.T. Whelan) Kluwer Academic/Plenum Publishers, Dordrecht, 2003 5.W.D. Watson and E.E. Salpeter, Astrophys. J. 174 (1972) 321. 6. B.T. Draine and E.E. Salpeter, Astrophys. J. 231 (1979) 77.

This work has been supported by EOARD (European Office of Aerospace Research and Development), PCMI, the ESRF and LURE.

Participation of PAH to the visible part of the interstellar extinction curve

Thomas Pino, Philippe Bréchignac
(Laboratoire de Photophysique Moléculaire-CNRS)

During the few last years, thanks to neat experimental studies, the electronic spectroscopy of the molecules considered as potentially responsible for Diffuse Interstellar Bands (DIBs) was carried out under conditions such as laboratory data could be compared without ambiguity with astronomical data. The work presented here concerns more particularly the species recognized to carry the bands observed in emission in the average infra-red (the "AIBs"), the polycyclic aromatic hydrocarbons (called astro-PAHs). Although no identification of a PAH could be obtained through DIBs, decisive steps for the comprehension of their electronic structure and of their intramolecular dynamics, especially for the cations, were recently accomplished. This last property, qualitatively understood, and quasi-quantitatively rationalized within the framework of "Energy Gap Law", allows, with the structural data available, to explore the form and the importance of the contribution expected on the visible- infra-red part of the interstellar extinction curve, resulting from absorption in the electronic transitions from a broad distribution of PAHs.

Molecular gas maps of the RXJ0821+07 cluster core

P. Salomé & F. Combes
(IRAM)

We report inteferometric mapping of RXJ0821+07. Aperture synthesis observations of the CO(1-0) and CO(2-1) line emission have been performed in this cooling flow cluster, using the PdB Millimeter Array. The inferred molecular hydrogen column densities is derived and the molecular gas mass is compared to previous 30m telescopes estimates. The morphology and the dynamics of the cold molecular gas is then discussed and compared to higher energy data. Finally, we review the implications of these results in relation with the cooling flow model expectations.

A large-scale, unbiased survey of the high-mass star forming molecular gas in Cygnus X

N.Schneider, S.Bontemps, R.Simon, F. Motte
(OASU (Observatoire de Bordeaux))

In order to probe the processes by which rich clusters and high-mass stars form, the most active nearby GMCs need to be studied in different wavelengths. We selected the Cygnus X region for such an investigation since it is one of the richest closeby (1.7 kpc), active HII complexes where a large number of high-mass star formation signposts have been recognized (e.g. GL2591, DR21, DR21(OH), W75-N).

Using the FCRAO and KOSMA radiotelescopes, we started a large-scale survey in molecular lines (13CO 3-2,2-1, CS 2-1, N2H+ 1-0) in order to reveal the velocity and spatial structure of the molecular gas and to determine its physical properties (Tex, optical depth, (column) density, mass). These maps are compared to dust continuum images obtained with MAMBO-II, covering the same area (approx. 3 sq. degrees in total), from which we have derived a large sample of possible massive protostars.

We will present the most important results of the mapping projects (i.e. correlation between N2H+/CS and mm-continuum and the detection of outflows from 13CO), try to disentangle the distance problem for objects in Cygnus X using overlays with mid-IR emission (MSX) and visual extinction maps, and give an overview of the cloud parameters (density, mass etc.) from the CO mapping.

Rotational excitation of SO by He at low temperature

F. Lique, A. Spielfi edel, M.L. Dubernet, N. Feautrier
(LERMA, Observatoire de Paris)

In the next five years, Herschel and ALMA will open the universe to high spatial and spectral resolution studies at infrared and submillimeter wavelengths : interpretation of the observations in terms of physical and chemical characteristics of the sources will require experimental and theoretical determination of new atomic and molecular data, in particular collisional excitation rates. In this poster, we present new results on collisional excitation of SO by He at low temperature. In a first step, we have studied the electronic ground state of SO(X3Sigma-) and more precisely the fine structure of the rotational levels that is needed to interpret the observations. The fine structure constants being large, we calculated the eigenvalues and the eigenvectors of the effective hamiltonian, including the fine structure couplings, in order to obtain the energies of the rotational levels. A new potential energy surface was calculated for the SO(X3Sigma-)+He system, with the RCCSD(T) method and the aug-cc-pVTZ (AVTZ) basis set, using the MOLPRO code. The collisional cross sections were calculated in a close-coupling approach, using the MOLSCAT computer program of Hutson and Green (1995) modified to treat collisions with molecules of 3Sigma- symmetry. The cross sections were obtained for energies up to 200cm-1 which allows to determine rates until 20°K. We have shown that the recoupling approximation [Green, ApJ, 434, 188 (1994)] often used to obtain cross sections between fine structure levels from cross sections calculated without fine structure, is not valid at low temperature.

Session PNC

Oral contributions

Evolution of galaxies along the Hubble Sequence : secular evolution, galaxy interactions, and gas accretion
F. Bournaud, F. Combes
(LERMA - Observatoire de Paris)

The evolution of galaxies is governed by three major mechanisms : inner dynamics, galaxy interactions and mergers, and accretion of intergalactic gas by galaxies. Spiral galaxies can be classified as late-type (small bulge) and early-type (massive bulge) systems. Inner secular evolution makes spiral galaxies evolve towards early types, while in the same time gas accretion, predicted by cosmological simulations, make them return to late-type classes. Both phenomenon govern the evolution the bulge-to-disk mass ratio and the presence of spiral arms and bars in the disk. Minor galaxy mergers (with mass ratios larger than 10 :1) only cause small disturbances to the morphology of spiral galaxies. At the opposite, major mergers (mass ratios 1 :1 to 4 :1) form elliptical galaxies. We have shown that intermediate mergers (10 :1-4 :1) form disk galaxies with elliptical-like kinematics, similar to the observed lenticular S0s. We have also shown that several successive mergers in the range of mass ratios 10 :1-4 :1 can form elliptical galaxies with a larger efficiency than single major mergers. The study of all these phenomenon enables us to give an overview of the various mechanisms that make galaxies evolve along the Hubble sequence.

Chameleons and quintessence
Philippe Brax
(spht cea saclay)
We will present some properties of chameleon fields and their link with quintessence.

Non gaussianities in inflationnary models
Tristan Brunier
(Service de Physique Théorique, CEA/DSM/SPhT)
Most of inflationary models predict a scale invariant power spectrum and gaussian primordial fluctuations. However primordial non-gaussianities may
exist and their detection would impose strong constraints and exhibit specific signatures. I will describe some inflationary models and their main features. I will especially pay attention to the generation of non-gaussian fluctuations and show that a significant deviation from gaussianity implies the coupling of two scalars fields at least.

GALEX, hyper-luminous UV sources, star formation and dust
Denis Burgarella
(OAMP LAM)
The first scientific results of GALEX in the ultraviolet (130nm - 300nm) will be présented. In particular, the spectroscopic aspect will be developped : 1) UV spectroscopy of LIRGs 2) Dust extinction determination : SFR UV & IR 3) Detection of objects at $z > 1$

Generalized macroscopic Schrodinger equation in scale relativity
Marie-Noelle Celerier et Laurent Nottale
(Observatoire de Paris-Meudon)
The scale transformation laws produce, on the motion equations of gravitating bodies and under some peculiar assumptions, effects which are anologous to those of a "macroscopic quantum mechanics". When we consider time and space scales such that the description of the trajectories of these bodies (planetesimals in the case of planetary system formation, interstellar gas and dust in the case of star formation, etc...) is in the shape of non-differentiable curves, we obtain fractal curves of fractal dimension 2. Continuity and non-differentiability yield a fractal space and a symmetry breaking of the differential time element which gives a doubling of the velocity fields. The application of a geodesics principle leads to motion equations of Schrodinger type. When we add an outside gravitational field, we obtain a Schrodinger-Poisson system. We give here the derivation of the Schrodinger equation for chaotic systems, i.e., with time scales much longer than their Lyapounov chaos-time.

Low-energy effective action and cosmological evolution of a Gauss-Bonnet brane world
Nicolas Chatillon
(Service de Physique Théorique, CEA-Saclay)
We consider a warped brane world scenario with two branes, higher order Gauss-Bonnet gravity terms in the bulk, and induced curvature terms on the branes. We derive the low-energy action of this setup, where the two brane positions are the low-energy degrees of freedom. With matter on the branes, we find consistency with the tests of General Relativity for far apart branes only. We study the cosmological evolution and show that General Relativity is an attractor.

Vlasov Poisson in phase-space : 1D-1D prototypes
S. Colombi, C. Alard, J. Touma
(CNRS)
With increasing power of modern supercomputers, it becomes possible to consider resolving Vlasov-Poisson equations directly in phase space. In the framework of the search for optimal numerical schemes, we present two 1D-1D prototypes. The first one is based on a decomposition of the distribution function on a basis of Gaussian ellipticals. The second one follows with polygons the evolution of contours of domains where the distribution function is a constant. In both cases, adaptive refinement is implemented in order to describe accurately, if necessary, the details appearing during evolution.

Host galaxies of gamma-ray bursts and galaxy formation
Stéphanie Courty
(Science Institute/University of Iceland)
Long duration gamma-ray bursts are powerful energetic transient events and are expected to result from the core collapse of massive stars. The issue of their relevance as tracer of galaxy formation is addressed here, investigating the nature of their host galaxies. After discussing the notion of star formation efficiency in hydrodynamical/N-body simulations of large scale structure formation, host candidates identified as the most efficient star forming galaxies, are shown to be low mass, late-type galaxies with a moderate star formation rate. The cosmological evolution of the host properties is examined.

The CLEF-SSH simulation project
Antonio da Silva and the CLEF collaboration
(Institut d'Astrophysique Spatiale)
The CLEF-SSH (CLuster Evolution & Formation using Supercomputer Simulations with Hydrodynamics) simulation project is an international collaboration involving the Institut d'Astrophysique Spatiale (IAS), the Laboratoire d'Astrophysique Toulouse Tarbes (LATT), and the University of Sussex (UK), to produce one of the present largest simulations of Large Scale Structure using Lagrangian SPH techniques that implement realistic models of radiative gas cooling and energy feedback. The simulation, which features $2(428)^3$ gas and dark matter particles inside a comoving volume of $(200 Mpc/h)^3$ has been run at the national parallel computing facility of CINES (France). The objective is to use this simulation to study the physics of Galaxy Clusters and to construct large angular sized maps of the Sunyaev-Zel'dovich (SZ) effect for the preparation of future CMB/SZ experiments. In this talk we will briefly describe the CLEF-SSH project and report on the simulation status.

How to extract photons from dark matter ?
Pierre de Marcillac, Noel Coron, Jacques Leblanc, Gérard Dambier
(IAS)
Scintillating bolometers may be one of the most promising technology to unvail the nature of the pervading dark matter. This unique technology combines the high energy resolution of bolometers with the high rejection power of the mixte "heat and light" technique, while allowing for an unprecedent choice of modular targets. We will present the status of our research and developments efforts on selected crystals, chosen either from their scintillating properties at room temperature, or for their use in searches for rare events with massive bolometers cooled at very low temperature (below 20mK). These developments will directly benefit to our underground experiment ROSEBUD, made in collaboration with the University of Zaragoza, and installed in the Canfranc tunnel in the spanish Pyrenees. The high discovery potential of this new technique out of the field of dark matter search will be highlighted, as proven by our recent measurement of the extremely rare natural alpha decay of 209-Bi.

First Results from IR Extragalactic Surveys with Spitzer
Herve Dole
(IAS, Universite Paris Sud, Orsay)
I will review the first results from the cosmological surveys conducted with Spitzer from space between 3 and 160 microns. I will focus on number counts at 24, 70 and 160 microns, and their interpretation, as well as the nature of the detected galaxies, some of them having complete IR Spectral Energy Distribution to redshifts 2.5 or higher.

The initial spectrum of fluctuations
Douspis M
(LATT/OMP)
I will describe various means to derive the initial spectrum of fluctuations from CMB observations. Departures from a power-law spectrum will be discussed.

An XMM-Newton view of the greedy cluster Abell 85

F. Durret, G.B. Lima Neto, W. Forman
(IAP)

We have observed the cluster of galaxies Abell 85 with XMM-Newton and determined new temperature and metal abundance maps for the main part of the cluster. These maps show the existence of various hot regions which often - but not always - have metal abundances lower than the average value, and suggest that Abell 85 has had an active life and is in the process of cannibalising smaller galaxy groups. The radial temperature profile shows a clear rapid decrease towards the centre and a slower decrease towards the exterior. Taking this profile into account we determined new dynamical mass and baryon fraction profiles. Finally, for a number of selected regions we have estimated individual metal abundances and compared the observed ratio of alpha-elements and Ni with respect to iron to the theoretical ratios derived from supernova yields. We conclude that the enrichment of the intra-cluster medium cannot be explained either by an early burst of SN II or by a continuous enrichment by SN Ia, but that both kinds of supernovae must have contributed metals to the ICM.

Galaxy groups in the direction of lensed quasars

Cecile Faure, Jean-Paul Kneib
(Universidad Catolica de Chile)

I shall present the results of my PhD thesis (Faure 2003) : using uptodate modeling tools and an extensive dataset of VLT/FORS1 and ISAAC deep images, together with public HST/WFPC and NiCMOS data, I have unveiled the nature of the total lensing potential (galaxies and galaxy groups) toward 10 lensed quasars in the southern sky. Such deep observations and such a complete analysis (strong and weak gravitational effects) allow to improve the set of observational constraints and to reduce systematic errors in the modeling of the total gravitational potential. Then combining these new mass models with time-delay measurements, one can derive a value of the Hubble constant from this homogeneous sample of lensed quasar. So far, I will describe the method and the results of such an investigation.

Characterisation of dark energy with supernovae in General Relativity with a massive scalar field

Stéphane Fay
(LUTH - Observatoire de Paris/Meudon)

Using the supernovae data, one will show how to characterize the dark energy properties within the framework of the General Relativity with massive scalar field. To proceed, one will consider various forms of its state equation according to the redshift. One will see that it is degenerated on the contrary to other observational (redshifts of the dark energy domination and expansion acceleration) and theoretical (scalar field potential) data.

The remote universe, with Integral Field spectroscopy.

Foucaud et al.
(IASF-MI)

Current generation of large Integral Field Spectrographs (IFU), such as the VIMOS-IFU, are ideally suited for performing studies of the high redshift Universe. I will describe several current projects, based on complete surveys of a sky area (total coverage of the HDF-S field thanks to the VIMOS-IFU), and also studies of peculiar high redshift objects (for example study of neutral gas halos around z 3 galaxies). The releavence of the scientific issues which can be addressed by these different projects demonstrates that the next generation of IFUs will allow significant progress in our knowledge on the distant Universe and evolution of galaxies.

About the discrimination of quintessence models with structure formation

J.-M. Alimi, A. Füzfa
(LUTH (Observatoire de Paris-Meudon) - Gamasco (Université de Namur, Belgique))

In a time when there are increasing observational evidences in favour of the acceleration of the cosmic expansion, it appears crucial to find some discriminant criteria for the numerous theoretical models that have been suggested to explain this singular feature of our Universe. By using N-body simulations, we have studied the large-scale clustering of dark matter in several models of quintessence, where the cosmic acceleration is explained by the dynamics of a neutral scalar field coupled to ordinary matter only through its gravitational influence. We will show how the statistical properties of matter distribution on large-scales are sensitive to the type of quintessence, and more precisely to the self-interaction potential of the scalar field, and how different is a quintessence cold dark matter scenario from a usual LCDM.

The X-Shooter Spectrograph

P. Goldoni, Ph. Filliatre
(DSM/DAPNIA/SAp)

X-shooter is a second generation VLT instrument whose construction has been approved by ESO council in October 2003. It will be realized by a consortium formed by Institutes from four countries : Denmark, Italy, The Netherlands and France, and ESO.
It is a two-dimensional wide-band single target spectrograph covering in a single exposure the spectral range from the UV to H band (0.32 to 1.9 microns). The instrument is designed to maximize the sensitivity in this spectral range and to allow a fast response to transient sources with unknown spectral distribution. It operates at intermediate resolution (R 10000) which is sufficient to adress quantitatively many astrophysical questions.
Gamma-ray Bursts and Type Ia Supernovae, along with their host galaxies, are among the main scientific objectives of X-Shooter. Thanks to its fast response, high efficiency and high sensitivity, X-Shooter will observe these rapidly varying objects with unprecedented precision. Its sensitivity allows to detect type Ia Supernovae up to redshift 1.7. Moreover an early detection of a high-redshift gamma-ray burst with X-shooter will allow to study the Star Formation Rate at redshifts that cannot be probed otherwise.
I will discuss X-shooter main characteristics, the French contribution to the project and the main scientific questions that will be investifated with this new instrument.

D/O, D/N, and D/H with FUSE : a new vision of the interstellar abundance of deuterium

Guillaume Hébrard
(Johns Hopkins University / Institut d'Astrophysique de Paris)

Deuterium is thought to be produced during primordial nucleosynthesis and then destroyed by astration. It is thus a key element in cosmology. The present-epoch deuterium abundance can be measured in the interstellar medium but those measurements have shown dispersion, interpreted as the result of unexpected spatial variations or underestimation of systematic errors. Final resolution will have implications for our understanding of the physics of the interstellar medium, galactic chemical evolution, and Universe baryonic density. The FUSE mission (NASA/CNES/CSA) has brought significant progress on these issues. It now appears likely that D/H presents a single value in the Local Bubble, in the range (1.3 - 1.5) 10^{-5}. However, the D/O, D/N, and D/H measured far beyond the Local Bubble suggest a canonical, present-epoch D/H in the range (0.5 - 1.0) 10^{-5}. This is significantly lower than the local value, which was often assumed to be representative of the Galactic disk. These new lower values may challenge deuterium evolution models.

Structure Formation by Hartree equation

Thierry Lehner, Laurent Nottale, Laurent di Menza, Daniel Da Rocha, David Ceccolini Laboratoire Luth, UMR CNRS , Observatoire de Paris-Meudon, Meudon. * Laboratoire de mathématiques, équipe EDP et analyse numérique, Université de Paris XI, Orsay.*
(Laboratoire LUTH , observatoire de Paris-Meudon)

The Scale Relativity theory predicts that the formation of structures in gravitational interaction can be described by an Hartree equation or equivalently by a set of coupled Schrodinger and Poisson equations. This system is similar to the one used in quantum gravity (with matter only being quantized not the field), but with the substitution of the ratio of the Planck constant to the mass (hbar/m) by a parameter depending of the system under study. By a change of coordinates we get the hydrodynamical equations of Euler and continuity which make appear a term of potential energy (which is understood as a quantum pressure in the case of Bose-Einstein condensation) which would play here the role of a "dark potential". As applications we show the formation of structures in a medium with a homogenous density and the formation of a disk from dust around a central star. The linear (equilibrium) solutions will be recalled in both cases and they compare favorably with the observations, but we describe also the phase of non linear dynamical evolution which is thought to converge asymptotically in time towards the equilibrium linear solutions (under current study). In particular the Hartree equation has no singularity of blow-up kind in finite time since the dark potential, which is the manifestation of the fractality of space, prevents from gravitational collapse. We make use of variable in time, with 2D and 3D variations in space numerical codes to solve this problem, by setting as initial conditions either the asymptotic states or localized structures of the soliton type.

LCDM dark matter in elliptical galaxies ?

Gary Mamon (IAP) & Ewa Lokas (CAMK, Warsaw)
(IAP)

Density profiles (NFW and similar) of structures found in cosmological LCDM N-body simulations cannot represent the total matter distribution in elliptical galaxies, or else their local mass-to-light ratio would be smaller than the value expected from the stellar component, and also their central velocity dispersions averaged within a circular aperture or thin slit would be lower than expected from what is observed through the Faber-Jackson relation. This implies that the stellar component dominates in the observed regions of ellipticals and it is therefore more difficult to reject the hypothesis that elliptical galaxies have a dark matter component similar to what is observed in the cosmological simulations or to infer the inner slope of the dark matter density profile. One must measure line-of-sight velocity dispersions out to 5 effective radii and with 15 km/s accuracy to infer the dark matter content within a factor of 3 inside the virial radius. The new density profile and slight radial orbit anisotropy found in recent cosmological simulations imply that, for a given M/L within the virial radius, the line of sight velocity dispersions at 5 effective radii are smaller than inferred with NFW dark matter and isotropic orbits, and conversely, the low velocity dispersions recently measured at 5 effective radii for the planetary nebulae around ellipticals are explained by global mass-to-light ratios within the virial radius that are 60% higher than inferred when the dark matter is supposed NFW and the orbits isotropic.

Neutralino annihilation in caustics of dark matter halos

Roya Mohayaee and Sergei Shandarin
(Observatoire de Nice)

Cold dark matter halos contain caustics : structures with formally infinite density in the limit of zero thermal velocity dispersion. However, the finite velocity dispersion of cold dark matter puts an upper limit on their densities. We derive analytic expression for density profile in the vicinity of the caustics within the framework of the spherical secondary infall model. We then obtain the emission measure from the caustic regions that determines the intensity of radiation if the dark matter particles annihilate. We estimate the gamma-ray flux from neutralino annihilation in the caustic regions and make comparison with the intensity from the central cusp or substructures for Milky Way and Andromeda.

Status of the EDELWEISS dark matter search

G. Nollez for the Edelweiss collaboration
(CNRS/IAP)

The EDELWEISS collaboration searches for WIMP dark matter using germanium cryogenic detectors. The first phase of the experiment with a total mass of 1kg of germanium is now completed. Its results will be summarized. To gain two orders of magnitude in sensitivity EDELWEISS is being upgraded and will first work with 28 Ge detectors (total mass of about 10kg). The design of the experiment and the expected performances will be presented.

Scale relativity and "dark potential"

Nottale L.
(CNRS, LUTH, Observatoire de Paris-Meudon)

In the framework of the theory of scale relativity, one considers a geometry that is not only curved, but also non-differentiable and therefore fractal, i.e. structured along scales. The equation of dynamics (i.e. of geodesics) in such a space can be integrated in terms of a generalized Schrodinger equation. Then one can show that, in analogy with the curvature manifesting itself as the Newton potential (to first approximation), the fractality leads to the appearance of a new potential energy. This result allows one to suggest a new alternative solution, of geometrical nature, to the problem of the effects that are usually attributed to unseen, non baryonic dark matter.

Formation and evolution of quasar absorbers

Celine Peroux, Miroslava Dessauges-Zavadsky, Sandro D'Odorico, Tae Sun Kim and Richard McMahon
(European Southern Observatory)

The column density distribution of quasar absorbers is believed to evolve over time so that different classes of quasar absorbers dominate the neutral gas content in the Universe at various redshifts. At z<3.5, damped Lyman-alpha systems (DLAs) are the major component of the HI mass. But it has been suggested that at z>3.5, 45% of the HI lies in systems below the traditional DLA definition, in "sub-DLAs" with $10^{19} < N(HI) < 2 * 10^{2}0$ cm^{-2}. A new sample of UVES spectra composed of 18 z>4 quasars is used to search for and analyse high redshift sub-DLAs. These data, together with another 22 UVES spectra from the ESO archives, allow to directly establish the column density distribution function down to $N(HI) = 10^{19}$ cm^{-2} at various redshifts. Its evolution combined with measurements of the total amount of neutral gas are used to probe the formation epoch of damped Lyman-alpha systems.

Precise measurement of CMB polarisation from Dome-C : the BRAIN and CLOVER experiments
M. Piat, BRAIN/CLOVER collaboration
(CdF-PCC/APC P7)
The characterisation of CMB polarisation is one of the next challenge in observationnal cosmology. This is especially true for the so-called B-modes that are at least 3 order of magnitude lower than CMB temperature fluctuations. A precise measurement of the angular power spectrum of these B-modes will give important constraints on inflation parameters. In this talk, I will describe two complementary experiments, BRAIN and CLOVER, dedicated to CMB polarisation measurement. These experiments are proposed to be installed in Dome-C, Antarctica, to take advantage of the extreme dryness of the atmosphere and to allow long integration time.

The population of galaxy clusters in the XMM-LSS survey
M. Pierre
(SAp CEA Saclay)
We describe the scientific motivation of the XMM-LSS survey and associated multi-WLfollow-up programmes. We present the X-ray observing and optical identification procedures. We discuss the properties of our current sample, reaching redshifts out to unity. We are finding the high-z counterparts of the well studied local low mass clusters.

The production of adiabatic perturbations in the primordial universe
D. Blais D. Polarski A. A. Starobinsky
(Universite Montpellier II)
There has been much interest recently in the production of adiabatic perturbations through mechanisms (like the curvaton scenario, for example) different from the usual production during the inflationary stage. We will report on recent progress in the computation of the adiabatic perturbations which are generated in some of these scenarios

Polarization with Archeops and implications for future CMB polarization measurements
Nicolas Ponthieu, on behalf of Archeops collaboration
(IAS)
Archeops is a balloon borne instrument dedicated to measuring the cosmic microwave background temperature anisotropies. In addition to CMB dedicated channels at 143 and 217 GHz, Archeops had 6 bolometers at 353 GHz mounted in ortho mode transducers to measure dust polarization. Archeops therefore provided us wih the first map of IQU Stokes parameters on large angular scales with a high angular resolution (13 arcmin) at frequencies of interest for future CMB polarization experiments. We present here the significant detection of polarization we obtained both in dense clouds and diffuse regions near the galactic plane. We discuss the implications of the dust polarized contamination to future CMB polarization measurements at high frequencies.

Archeops power spectrum and comparison with WMAP
C. Renault on behalf of the Archeops collaboration
(LPSC)
Archeops is a balloon-borne instrument conceived as a precursor of the Planck-HFI instrument by using the same optical design and the same technology for the cooling and for the detectors at four frequency bands (143, 217, 353 and 545 GHz).
A new analysis was performed using the 6 most sensitive photometers (with respect to two bolometers for previous analysis) of the two CMB bands 143 and 217 GHz.Data are improved compared to the previous published work : 20% sky coverage, higher resolution (nside = 512), better beam modelization, more accurate ozone substraction, high-frequency decorrelation.
It leads to a high signal-to-noise ratio determination of the temperature power spectrum comparable to the WMAP ones over angular scales from l=10 to l=500.

Cosmological Diffuse Background and topology of the Universe
Alain Riazuelo
(IAP)
The CMB anisotropies seem to exhibit a number of unexpected features on large angular scales. These features are not compatible with statistical isotropy and Gaussianity of the cosmological perturbations and are not expected to come from foregrounds. Among the possible explanation, a multi-connected topology of the Universe could possibly give some of the observed anomalies at low multipoles. We shall give in this talk a brief update of the status of cosmic topology.

Density structure in host galaxy of quasars from the longitudinal proximity effect
E. Rollinde
(IUCAA (Pune, Inde) - IAP (Paris))
We investigate the density structure in host galaxies of quasars using the longitudinal proximity effect in a large sample of high luminosity quasars observed at the VLT-UT2 Kueyen ESO telescope. The sample consists of 13 quasars at 2.2<3.3 with a mean luminosity of 2.7 10^{31} h-2 ergs/s/Hz. We analyse the evolution of the absorption level in the vicinity of the quasar through the optical depth probability distribution function (PDF). This evolution is driven both by the density enhancement in the host galaxy and by the ionising flux emitted by the quasar. The data are consistent with a matter density PDF as derived analytically from void expansion by Miralda-Escude et al. (2000), whose shape does not vary in the vicinity of the quasar. We derive then the evolution of the mean gas over-density as a function of the distance to the quasar. It can be described with a power law of slope -1 from 0.1 to 5-10 h-1 Mpc proper. Using the same density structure, and neglecting QSO anisotropy and variability, the transverse proximity effect observed with the SDSS quasars may be explained. (based on a paper in preparation by E. Rollinde, R. Srianand, P. Petitjean and H. Chand)

The baryon fraction in remote galaxy clusters observed with XMM
Sadat,R., Blanchard, A., Vauclair, S., et la collaboration XMM-Omega project
(LATT, Observatoire midi-pyrenees)
Clusters of galaxies are unique cosmological probes which statistical properties represent major sources of information for understanding the history of structure formation as well as for the determination of the cosmological parameters. In the simplest picture of purely gravitationally driven formation of virialized systems like galaxy clusters, it is expected that such objects exhibit self-similarity. In this model physical properties of galaxy clusters obey scaling laws. Moreover, self-similar models predict that the radial profile of any physical quantity should be similar independently of the cluster mass and redshift.We present the study of the gas mass fraction, shape of a sample of distant ($z \sim 0.5$) clusters of median luminosity observed with XMM-Newton as part of the XMM-Omega project. This sample is expected to be fairly representative of the cluster population at high redshift, allowing a systematic analysis of the gas mass profiles and therefore allowing to address the issue of gas mass fraction self-similarity and its implication for constraining the cosmological parameters.

Matière noire, neutralinos et rayons cosmiques
Pierre Salati
(Laboratoire LAPTH)
The presence of large amounts of unseen material in the universe has been puzzling astronomers – and resisted them – for decades. The very nature of the so–called astronomical dark matter is still disputed. The neutralinos – a neutral and weakly interacting species predicted by the supersymmetric or extra–dimension extensions of the standard subnuclear model – arise as natural candidates. Would neutralinos pervade the Milky Way as well as extra–galactic systems, they should still annihilate today and produce gamma–rays, antiprotons and positrons which may be detected through the corresponding distortions in the various energy spectra of the cosmic radiation. I will discuss the status of the various ongoing efforts to reveal these indirect astrophysical signatures, paying particular attention to the propagation and diffusion of cosmic rays throughout our galaxy as well as to the clumpiness of neutralino dark matter.

XMM View of Merging Clusters
J.L.Sauvageot, E. Belsole, G.W. Pratt, H. Bourdin
(Service d'Astrophysique Dapnia/CEA)
We present detailed analyses of several XMM-Newton observations of merging clusters of galaxies, focussing on the use of temperature maps as a diagnostic of the dynamical state of each system. The object sample was defined to span several merger epochs (early to late), on a morphological basis from ROSAT imaging observations. With the addition of the XMM-Newton temperature maps (derived using several different methods), we find evidence for high-temperature shocked and/or compressed regions in all the clusters, indicating strong dynamical activity. In addition, we find that one of the subclusters in our early merger stage candidate shows signs of itself being a merger. We compare the temperature structure of all the clusters with the predictions from numerical simulations.
We will discuss the results in the context of the hierarchical scenario for structure formation in the Universe, and in particular how the past formation history of a cluster can influence the present-day morphology and temperature structure.

XMM-Omega project : High redshift X-ray galaxy clusters, cosmological implications
S.C. Vauclair, A. Blanchard and the XMM-Omega project collaboration
(LA2T-OMP)

Poster contributions

Singularities in spherically symmetric cosmological models and the horizon problem
Marie-Noelle Celerier et Peter Szekeres
(Observatoire de Paris-Meudon)
The horizon problem develops sooner or later in any cosmological model exhibiting a spacelike singularity, such as that occuring in standard FLRW universes. Any permanent solution to this problem much involve models with timelike or null singularities. We show that such singularities can either be a shell cross which is timelike and is the characteristic of delayed Big-Bang models or occur in spherically symmetric inhomogeneous primordial universes satisfying the dominant energy condition and exhibiting a singularity of power-law type and the stress-energy tensor of a radiative perfect fluid.

Stellar populations in the z=0.64 cluster CL 0048-2942
Margarida Serote Roos Catarina Lobo Florence Durret Angela Iovino Isabel Marquez
(IAP)
CL 0048-2942 was detected in the optical at intermediate redshift (z = 0.64) and followed up with BVRI deep imaging and VLT spectroscopy. These data allowed us to perfrom a combined study of the system, placed at an important epoch for structure formation : the assembly of rich galaxy clusters. This consisted, among other studies, in performing a stellar population synthesis analysis of member galaxies, in particular to ascertain the percentage and radial distribution of K+A galaxies, which are rather frequent in clusters at similar redshifts. We have found some populaiton gradients within the cluster as well as differences in stellar populations between cluster and field galaxies observed at the same time and used as a comparison sample.

The Supernova program of the cfht Legacy Survey - Supernovae spectroscopy
Filiol Melanie
(Laboratoire d'Astrophysique de Marseille)

Gravitino dark matter in gauge mediated supersymmetry breaking theories
M. Lemoine
(IAP)
I discuss the possibility that gravitinos with mass between 10keV and 10 MeV provide the right amount of cold dark matter in scenarios of gauge mediated supersymmetry breaking.

Last results from the XMM-Newton observations of Hi-Lx clusters
Marty, P. ; Kneib, J.P.
(IE2)
We present an updated analysis of the clusters observed by XMM-Newton as part of our survey of 17 of the most X-ray luminous clusters of galaxies at z ~ 0.2, selected for a comprehensive and unbiased study of the mass distribution in massive clusters.

SNIFS status report
Pécontal, E. and the SNIFS consortium
(CRAL)
SNIFS is a spectrograph dedicated to the spectrophotometric study of a large sample of nearby type 1a supernovae (300 SN 1a followed from 15 days before maximum to 30 days after maximum). Built in collaboration between Berkeley and France laboratories, it has been mounted in April 2004 on the University of Hawaii 2.2 meter telescope, and will be operated during the 3 next years. 20 % of the observing time of this telescope will be used for the SNIFS survey. The instrument has now seen its first light, and I will present in this talk its report status as well as its scientific goals.

BAX : a data base for galaxy clusters in X
R. Sadat and the BAX team
(LATT, Observatoire midi-pyrenees)
We introduce BAX, Base de Données Amas de Galaxies X (http ://webast.ast.obs-mip.fr/bax), a multi-wavelength database dedicated to X-ray clusters and groups of galaxies allowing detailed information retrieval. BAX is designed to support astronomical research by providing access to published measurements of the main physical quantities and to the related bibliographic references : basic data stored in the database are cluster/group identifiers, equatorial coordinates, redshift, flux, X-ray luminosity (in the ROSAT band) and temperature, and links to additional linked parameters. The clusters and groups in BAX can be queried by the basic parameters as well as the linked parameters or combinations of these. We expect BAX to become an important tool for the astronomical community. BAX will optimize various aspects of the scientific analysis of X-ray clusters and groups of galaxies,from proposal planning to data collection, interpretation and publication, from both ground based facilities like MEGACAM (CFHT), VIRMOS (VLT) and space missions like XMM-Newton, Chandra and Planck.

CIB and cirrus in low sky brightness regions

M. SOREL, G. LAGACHE, J.-L. PUGET, H. DOLE
(IAS)

Analysing the sky components in the low brightness regions, we find a I(60)/I(100) color variation for cirrus, certainly due to VSG abundance, compared to bright regions. After a cirrus subtraction, we find, in the FIRBACK fields, residual structures correlated from band to band (60, 100 and 170 microns), that are interpreted as the cosmic far-infrared background fluctuations. But it is still difficult to separate both components with the means of color only.

Session PNG

Oral contributions

Discovery of type 2 QSO with the AVO prototype
Mark Allen, Paolo Padovani, Peiro Rosati, Nic Walton
(Observatoire de Strasbourg)
We show how the Astrophysical Virtual Observatory (AVO) prototype has been used to indentify high redshift type 2 AGN in the GOODS fields. Using an empirical estimator for the X-ray luminosity, we find many high power candidates which qualify as QSO-2 objects, significantly increasing the number of known objects, and providing new estimates for the QSO-2 number density. This work shows how the first Virtual Observatory interoperability gains are leading to scientific discoveries.

The Gaia Instrument and Basic Image Simulator
C. Babusiaux
(Universite Libre de Bruxelles)
Gaia will map one billion stars, throughout the Galaxy and beyond, to unprecedented levels of precision. Detailed and accurate simulations are needed to be able to test and optimise the design according to the scientific needs, develop the on-board algorithms, prepare the reduction studies and study the final performances and challenges. To this aim, a pixel-level simulator of the Gaia observations has been developed. It combines a model of the astrophysical sources that Gaia will observe with a model of the satellite and its instruments. It has been developed to allow a progressive enhancement of the simulations towards representative Gaia data. I will present here this simulator, how it is being built and used by the Gaia community, and its current applications.

GALEX : observations and database
Denis Burgarella (or Veronique Buat)
(OAMP LAM)
We will present the GALEX survey, its present status as well as the observations scheduled and the plan for the public data releases. We will focus on the (future) database, which will be included in MAST (Multimission Archive at Space Telescope), the pipeline data products, and the tools available to reduce the data. Some examples of the GALEX data will also be presented.

Atomic and Molecular Databases and their integration in Virtual Observatories
M.-L. Dubernet, E. Roueff
(LERMA, Observatoire de Paris)
An easy access to reliable data of atomic and molecular physics is essential for both the modelling of astrophysical media and the interpretation of astrophysical spectra provided by ground or space-based telescopes. We report here on our current project concerning the integration of Atomic and Molecular Physics Databases in Virtual Observatories.

MIGALE/DisGal : Virtual Instrument for Distant Galaxies
H. Flores, M.Puech
(GEPI, Obs. de Paris-Meudon)

The GalICS virtual data base
B. Guiderdoni, J. Blaizot, J. Devriendt
(Institut d'Astrophysique de Paris)
I will present the first relational data base of virtual galaxies and halos obtained from a semi-analytical treatment of heavy cosmological simulations. The data base is accessible on http ://galics.iap.fr

Spectroscopic survey with Gaia
D. Katz on behalf of the RVS team
(Observatoire de Paris)
Gaia's payload will be made of three instruments : an astrometric instrument, a multi-band photometer and a medium resolution spectrograph : the "Radial Velocity Spectrometer" (RVS). During the five years of the mission, the RVS will collect about 100 to 250 million spectra down to V=17-18. I will briefly present the characteristics of the RVS, its impact on Galactic structure and the on-going and future works to develop the RVS data calibration and analysis methods.

Tools for population synthesis

D. Le Borgne, B. Rocca-Volmerange, M. Fioc, Ph. Prugniel, A. Lançon, C. Soubiran
(University of Toronto - Institut d'Astrophysique de Paris)

The high spectral resolutions and the good sensitivities reached by the current instruments on large telescopes both require accurate tools to model the stellar populations that we observe in local or distant galaxies. We make a picture of the tools available for this purpose, presenting in particular the power of the evolutionary synthesis with the code PEGASE at high spectral resolution.

Extracting star formation histories from large, medium resolution spectroscopic surveys

H. Mathis, S. Charlot, J. Brinchmann, S. D. M. White and C. Tremonti
(Universite d'Oxford)

We adapt an existing data compression algorithm, MOPED, to the extraction of median-likelihood star formation histories from medium-resolution spectra of galaxies.By focusing on the high-frequency component of the galaxy spectra, we circumvent potential uncertainties arising from the spectrophotometric calibration and intrinsic attenuation by dust. We validate our method using a set of model galaxy spectra spanning the wavelength range from 3650 to 8500 Åat a resolving power of 2000, for which we can recover the star formation history over the full range of stellar ages to within an accuracy that depends on signal-to-noise ratio.

As an example of application, we use this method to derive the star formation histories and light-weighted metallicities of a magnitude-limited sample of 23,000 galaxies drawn from the Early Data Release of the Sloan Digital Sky Survey (SDSS). We find that early-type galaxies in this sample experienced more than 80 per cent of their star formation at z>1.1, while late-type galaxies had roughly constant star formation history, independent of mass. Light-weighted metallicities are generally well constrained, with evidence for the metallicity-luminosity relation in early-type systems. Overall, the high-frequency components of nearby galaxy spectra indicate that 70 percent (+/- 30 percent) of the stars in these galaxies formed prior to z=1.1.

ELODIE-SOPHIE : Spectroscopic archive

J. Moultaka ; S. Ilovaisky, Ph. Prugniel ; C. Soubiran
(Universite de Cologne (Allemagne))

We present the ELODIE archive which is a complete collection of high resolution echelle spectra obtained at the 1.93m telescope of the Observatoire de Haute Provence (OHP). The archive is open to the public since September 2003. By the end of 2005, the ELODIE spectrograph will be replaced by a new instrument SOPHIE with improved capabilities. Data obtained with SOPHIE will be included in an extended version of the present archive.

Constraining stellar populations with high resolution spectra

Ocvirk, P. Pichon, C. Lancon, A.
(Observatoire de Strasbourg)

We propose a method for recovering the star formation history of a population from its observed high or medium resolution spectrum. We then discuss the data quality needed for such a reconstruction to be reliable in a general, method independent context and finally show some applications.

MIGALE : Virtual Instrument to study galaxy evolution

Ph. Prugniel et al.
(Observatoires de Paris et de Lyon)

The MIGALE project builds and maintains databases and analysis tools to help studies of the evolution of galaxies between z=1 and z=0.

At z=0 MIGALE offers the whole-sky multiparametric HyperLeda database and the new HIgi database (see this G. Theureau and J.-M. Martin, this conference) dedicated to HI observations. At larger distances we are developing the Disgal database discussed by H. Flores and M. Puech at this conference.

MIGALE is also operating the Giraffe Archive (F. Royer, this conference) containing the reduced spectra produced by the VLT spectrograph Giraffe.

These systems provide altogether a very fine multi-wavelength and multiparametric description of galaxies. The data collected and distributed are either compilations or original surveys, catalogues or pixels (spectra and images). These services offer several facilities for processing and analysing the data (on-line pipeline).

This constellation of services share a common software (Pleinpot) providing some general low-level layers (access to database and to FITS data), some specialized astronomical recipies (like models to study stellar populations) and the Virtual Observatory interface required for inter-operability with other projects.

Online modeling of the Galaxy and its applications
C. Reylé, A.C. Robin, S. Picaud
(Observatoire de Besancon)
The Besançon model of the Milky Way gives a detailed description of the large scale structure and evolution of the Galaxy. It is widely available and can be accessed via the net. We propose to show how such a tool can be integrated into the Virtual Observatory as well as suggesting possible applications.

Photometric redshifts with neural networks
Davide Rizzo
(Laboratoire d'Astrophysique de Toulouse-Tarbes)
We present NeuroZ, a new software library to compute photometric redshifts with neural networks. The library is coded in standard C++ and can be incorporated into newly written software, or used together with the provided graphical user interface. We present the library internals and show the results of the tests made so far. Future developments are outlined, including the optimization for parallel architectures.

The RAVE Project
Siebert, A.
(Steward Observatory)
RAVE (RAdial Velocity Experiment) is an ambitious program to conduct an all-sky survey (complete to V = 16) to measure the radial velocities, metallicities and abundance ratios of 50 million stars using the 1.2-m UK Schmidt Telescope of the Anglo-Australian Observatory (AAO), together with a northern counterpart, over the period 2006 - 2010. The survey would represent a giant leap forward in our understanding of our own Milky Way galaxy, providing a vast stellar kinematic database orders of magnitude larger than any other survey proposed for this coming decade. As a by product, a database of medium resolution spectra for our targets will also be provided to the community. I will present the preliminary phase covering the period 2003-2005 that will observe 100,000 stars using existing facilities at the AAO.

Stellar spectra and fundamental parameters for galaxies
C. Soubiran
(L3AB-OASU)
Several databases of high resolution stellar spectra are now available and make it possible to build empirical libraries for the stellar population synthesis, the validation of synthetic spectra or the automated parametrization. One aspect of the quality of a stellar library is the accuracy of (Teff,logg,[Fe/H]) assigned to each spectrum. Unfortunatly atmospheric parameters collected from the literature suffer from a great heterogeneity and the lack of certain types of stars. An effort is being made, in relation with several projects, to centralize all the information about stellar fundamental parameters, homogenize the scales and fill the gaps by new observations.

HI galaxies and the Nancay Archive
G.theureau, J.M.Martin
(Observatoire de Paris, GEPI)
The HI extragalactic database (HIgi) of the Nançay radiotelescope (NRT) is associated with the KLUN+ survey, the cosmological key project of the instrument since July 2000. Our goal is to collect a wide homogeneous and complete sample of 20,000 spiral galaxies distributed on the whole sky, both from new HI observations and from an exhaustive review of the literature. This database programme is a subset of a wider project of virtual instrumentation and datamining : the MIGALE database (see P.Prugniel, this conference). The last HI compilation contains 16,600 galaxies (Paturel et al 2003), among which about 6000 observed with the Nançay antenna. The spectroscopic archive provides today the on-line acces to 4000 21-cm line (reduced) profiles, and for the most recent observations (acquired with FORT, 1000 objects), a visualization of the raw dynamical spectra from the autocorrelator. In a near future, the complementary NRT archive should allow the manipulation of all the raw data produced with the various backends (autocorrelator, numerical spectrometer/RDH, and pulsar's dedispersors).

Base de donnees VVDS & CENCOS
Laurence Tresse on behalf of the VVDS team
(LAM-OAMP Marseille)
The talk will give an overview of the databases VVDS & CENCOS.

Large extragalactic databases

B. Vollmer
(CDS, Observatoire astronomique de Strasbourg)

The two major extragalactic data bases in the world are NED and the 3 services SIMBAD/VIZIER/ALADIN at the CDS. Whereas NED is exclusively extragalctic, the CDS services also include galactic objects except for objects of the solar system.

Both data bases allow to find astronomical objects via their names or positions. They provide positions, radial velocities, bibliographic references, and images (jpeg or FITS) for these objects. There is the possibility to search objects on a defined region on the sky by using constraints on their radial velocities or luminosities at a given wavelength.

NED is a very rich data base. It contains many links towards external archives and provides compiled flux measurements over the whole wavelength range from which an SED is derived. Whereas NED has a rather static architecture, the CDS services are more flexible. The SIMBAD astronomical database provides basic data, cross-identifications
and bibliography for astronomical objects outside the solar system. VIZIER provides access to the most complete library of published astronomical catalogues and data tables available on line, organized in a self-documented database. ALADIN is an interactive software sky atlas allowing the user to
visualize digitized images of any part of the sky, to superimpose entries
from astronomical catalogs or personal user data files. The great advantage of the CDS services is their interoperability, i.e. the three services communicate with each other. For example, one can search for an object in SIMBAD, visualize its position and make an overlay with a DSS image within ALADIN. VIZIER catalogues can be queried using various constraints on the entry columns. The results can be directly displayed on the sky and superimposed on an astronomical image within ALADIN. ALADIN has its own image data base, but it has also access to NED and many major archives and image data bases. This interoperability gives the CDS services a great flexibility, which will allow them to respond efficiently to the requirements of the virtual observatory.

Spectroscopic databases and their use in the analysis of astrophysical spectra.

Adam Walters
(CESR)

A list of the principal spectroscopic databases in the microwave, submillimetre and infrared is presented along with their major characteristics. The advantages, limitations and problems of the use of these databases for the analysis of astrophysical spectra are discussed with particular emphasis on the challenge of large spectral surveys to be produced by HIFI/HSO. The CASSIS project concerning the use of a combination of databases for the analysis of astrophysical spectra will also be presented.

Poster contributions

The spiral structure of the Galaxy as seen from near infrared star counts

Amôres, Eduardo Robin, Annie
(Instituto de Astronomia Geof. e Ciências Atmosféricas - USP (1) - Observatoire de Besançon (2))

Star counts models constitute an important usefull tool to study galactic structure and evolution. In particular, the Besançon Model provides a description of the Galaxy in the evolutive point of view joining both the kinematics and dynamical properties. In the present work, we study the spiral structure of the Galaxy doing comparisons between the predicted and observed (2 MASS data in J, H and K bands) color-color and color-magnitude diagrams in the tangential directions of spiral arms. The main objectives are : study how the stellar population changes when a spiral arm is crossed, elaborate a spiral model in which reproduce adequately the star counts in the arms and interarms regions. Our main procedure consists in adjust the parameters of spiral arms (initial radius, inclination angle, phase, amplitude) in order to reproduce the observed color-color and color-magnitude diagrams. The spiral model is also made consistent with others tracers of spiral galactic structure, such as the longitudinal profile in the K band obtained by DIRBE/COBE experiment. In order to do this we use a genetic algorithm, which is a robust optimization technique to fit several parameters. We present here the method used to adjust the parameters of the spiral arms, a comparison with other spiral models and also the analysis of color-color and color-magnitude diagrams of tangential directions of spiral arms.

Near-Infrared red clump distances to the Galactic Bar

C. Babusiaux, G. Gilmore
(Universite Libre de Bruxelles)

A deep near-infrared survey of the inner galactic bulge has been made with the Cambridge Infrared Survey Instrument (CIRSI). The primary aim of this project is the study of the expected asymmetry caused by the galactic bar. Using red clump stars as distance indicators, the structure of the bar and the dust distribution are constrained, and the presence of a second structure, a double bar or a inner ring is suggested.

Globular clusters and dwarfs in the intracluster medium of the Fornax cluster of galaxies

G. Bergond, C. Balkowski, V. Cayatte, E. Athanassoula, L. Chemin, H. Flores, R. Guzman, F. Hammer, S. Leon, G. Meylan, & Ph. Prugniel
(MSU)

We present the first results of our FLAMES survey of globular clusters (GCs) and dwarfs in the Fornax cluster of galaxies. Based on radial velocities, more than 60 confirmed members are found, including new likely ultra compact dwarf galaxies. These bona fide “satellites” lying around or between giant galaxies, in 2 fields chosen 100 kpc apart from the cD, give for the first time a clear indication of a genuine population of intracluster clusters which may probe the overall potential of Fornax.

Extinction and Star Formation in spiral galaxies

Samuel Boissier
(Carnegie Observatories)

Galactic evolution models for spirals depend strongly on the star formation rate used. Observational efforts yet allow to constrain them. In particular, GALEX results will help us, although UV observations are affected by interstellar exctinction.
I shall present recent results on these two topics and evoque the future of GALEX.

A study of dark matter distribution in Low Surface Brightness Galaxies

L. Chemin, P. Amram, C. Carignan, C. Balkowski, W. van Driel, V. Cayatte, O. Hernandez
(Université de Montréal)

Integral field spectroscopy observations of the ionized gas in Low Surface Brightness Galaxies (LSBs) are presented. The goal of this study is to map their kinematics at high angular resolution and to study their dark matter (DM) distribution. For that purpose, we have used Fabry-Perot observations obtained at the CFH and ESO 3.6m telescopes. The new contribution of highly resolved velocity fields is crucial to study the role of non-circular motions on the dynamics of LSBs, and particularly on the shape of their DM halo profile (cusp- or core- dominated halo). Here are shown some examples of galaxies in which such motions exist in their central parts and prevent from determining the accurate shape of their DM halo.

A high resolution survey of Virgo Cluster galaxies

L. Chemin, C. Balkowski, V. Cayatte, et al.
(Université de Montréal)

Results of a survey dedicated to a kinematical study of Virgo Cluster spirals are presented. Using high resolution observations of the ionized gas by Fabry-Perot interferometry, we are interested on the role of environemental effects on their kinematics and dynamics. Velocity fields of perturbed galaxies (eg NGC 4438, NGC 4579) are discussed.

Molecular gas in NUclei of GAlaxies (NUGA) : interstellar gas an torques in NGC 4579, 4826 and 6951
Garcia-Burillo S., Combes F., Boone, F., Schinnerer E., Baker A.J., Hunt L.K., Eckart A., Tacconi L.J., Neri R., Leon S., Englmaier P.
(LERMA, Observatoire de Paris)
We present the molecular gas distribution in the center of active galaxies NGC 4579, NGC 4826 and NGC 6951 obtained with the IRAM interferometer, with arcsecond resolution. Distortions m=2 and m=1 are dominant in those galaxies ; computing the torques exerted on the gas by the stellar component (gravitational potential derived from the red images), we show how the gas is radially driven and confined into rings or pseudo-rings, and discuss how this can affect the feeding of AGN.

Host galaxies of gamma-ray bursts and galaxy formation
Stéphanie Courty
(Science Institute/University of Iceland)
Long duration gamma-ray bursts are powerful energetic transient events and are expected to result from the core collapse of massive stars. The issue of their relevance as tracer of galaxy formation is addressed here, investigating the nature of their host galaxies. After discussing the notion of star formation efficiency in hydrodynamical/N-body simulations of large scale structure formation, host candidates identified as the most efficient star forming galaxies, are shown to be low mass, late-type galaxies with a moderate star formation rate. The cosmological evolution of the host properties is examined.

Dynamics of binary galaxies.
da Rocha D.
(Luth - Observatoire de Meudon)
Isolated pairs of galaxies represent ideal structures to probe gravitational potentials at various scales. The questions of the dynamical masses, of the mass to light ratios and of the halo components are still subject to many discussions. Regrouping a maximum of available informations, we have built an overall catalog of binary galaxies, based on the compilation of several catalogs of isolated pairs published since 1970's. This first step led to an initial set of 5564 galaxies. Unresolved galaxies, galaxies in groups and recurrent pairs have been rejected, leading to the selection of a final sample of 1922 updated galaxy pairs. The catalog includes informations about PGC numbers, coordinates, morphologies, magnitudes (B and Ks band), radial velocities and their related uncertainties. We conclude by giving the results of a preliminary analysis of the collected data.

RFI MITIGATION WITH A DIGITAL RECEIVER
Cedric Dumez-Viou, Andrée Coffre, Pierre Colom, Laurent Denis, Alain Lecacheux, Jean-Michel Martin, Rodolphe Weber, Philippe Zarka
(Observatoire de Paris, Station de Radioastronomie de Nançay)
RDH (Reconquête du Domaine Hertzien) is a high dynamic receiver currently developed at the Nançay Observatory in France. It is currently connected to the Nançay Radio Telescope (NRT), a telescope that observes radio waves at 1.1-3.5 GHz, and to the Nançay Decameter Array (NDA) which observation frequency ranges from 10 to 100 MHz.
The receiver embeds algorithms that allow real-time automatic detection and elimination of RFI. It has been successfully tested to eliminate interferences from the Iridium satellite constellation. It enabled the re-observation of the IIIZw35 megamaser. Developments are on their way to provide equivalent results with RFI such as radars.
The NDA is currently driving a full time survey of signals generated by the Sun and Jupiter. Soon, the new system will continuously provide high time and frequency resolution spectra (down to 500 microseconds spectra of 8192 channels over a bandwidth ranging from 875 kHz up to 14 MHz located between 10 MHz and 100 MHz). Automatic detection of bursts is currently under development to store high quality data only when needed.

Method of stellar population synthesis dedicated to the IR range
J. Frémaux, C. Boisson, M. Joly, D. Pelat
(LUTH-Observatoire de Meudon)
The importance of the IR domain in determining stellar populations from the integrated light of galaxies will be shown. A new code dedicated to these investigations and based on flux measurement, including emission by dust, will be presented. The method used is a revival of the quadratic programming first intriduced by Faber (1972). It is required to perform proper error analysis, both for the statistical and the systematic errors.

Wolf-Rayet stars in Active Galactic Nuclei

A. C. Gonçalves, M. Serote Roos, T. Contini
(LUTH/Obs Paris-Meudon, CAAUL/Obs de Lisbonne)

Terlevich & Melnick (1985) suggested that many nuclei classified as Seyfert 2s could be associated with WR stars recently formed in a powerful starburst. Since then, the signature of WR stars has been claimed to be observed in several Seyfert 2s and LINERs. Gonçalves et al (1999) have shown that a small number of Seyfert 2s have very weak [N II]6548,6584 lines, suggesting that these objects could be partly ionized by WR stars.

We have obtained high S/N spectra of such "Weak-[N II] Seyferts" to investigate if WR stars can be observed in galaxies without any other evidence for a starburst nebulosity. Amongst other findings, we have detected the presence of emission features such as Si II 5056,6347 and Ni II 7380. Other lines, such as [Ar IV]4711,4740 and [Fe III]4658 are possibly present, mimicking the Bowen blend.

The detection of WR stars in AGN poses interesting questions concerning the link between nuclear activity and star formation, providing another angle to the study of the Starburst-AGN connection. However, one must be very careful in interpreting the available data ; for the time being, the role played by WR stars in these AGN remains an open debate.

The Luminosity-Metallicity relation in the local universe from the 2dF Galaxy Redshift Survey

F. Lamareille, M. Mouhcine, T. Contini, I. Lewis & S. Maddox
(LA2T - Observartoire Midi-Pyrénées)

We investigate the Luminosity - Metallicity (L - Z) relation in the local universe (0<0.15) using spectra extracted from the 2dF Galaxy Redshift Survey. We use « standard » diagnostic diagrams to distinguish star-forming galaxies from AGNs, and propose new diagnostic diagrams using « blue » emission lines only. Oxygen-to-hydrogen (O/H) abundance ratios are estimated using the « strong-line » method. We confirm the existence of the luminosity-metallicity relation over a large range of abundances (2dex) and luminosity (9mags). Our L - Z relation is much steeper than previous determinations using samples of « normal » irregular and spiral galaxies. This difference seems to be primarily due to the choice of the galaxy sample.

Spectrophotometric properties of galaxies : automatic measurement and analysis tools for large surveys.

F. Lamareille, T. Contini, J.-F. Le Borgne, J. Brinchmann, S. Charlot & J. Richard
(LA2T - Observartoire Midi-Pyrénées)

We present a new pipeline designed to derive the physical properties of emission-line galaxies from ongoing massive spectroscopic surveys (e.g. VVDS, z-COSMOS, ...). The first tool performs a stellar continuum fitting and substraction of a large amount of spectra in a minimum waste of time. It then measures all the parameters (flux, EW, etc) of emission-lines together with the "spectroscopic" magnitudes and colors. The second software takes all these measurements and derive a number of physical properties like chemical abundances, dust extinction, spectral classification, etc. The pipeline is designed to be fully automatic and flexible, with many configurable options.

As an example, we show the first results of a project aiming to derive the physical properties of emission-line galaxies at intermediate redshifts

(z=0.2 0.7). The sample has been selected mainly among CFRS galaxies with the addition of galaxies observed in and behind lensing clusters. Optical medium-resolution spectra have been acquired with the FORS1/2 spectrographs on the VLT. We took advantage of this sample to test the efficiency of our pipeline compared to manual measurements. We also check that it will give good results on lower resolution spectra, which is the case of ongoing large surveys. We finally present a set of scientific results drawn from this sample.

Chemical abundances derivations in extragalactic HII regions using FUSE : the status
Lebouteiller, V. ; Kunth, D. ; Lequeux, J. ; Lecavelier des Etangs, A. ; Désert, J.-M. ; Hébrard, G. ; Vidal-Madjar, A.
(IAP)
The Far Ultraviolet Spectroscopic Explorer (FUSE) offers the possibility to study the extragalactic interstellar medium (ISM) in the lines of sight toward UV-bright HII regions where stars are forming. From the absorption lines of species such as HI, OI, NI, FeII, ... we are able to derive the chemical composition of the neutral gas and compare it to the HII region composition. A major aim is to know whether HII regions truly reflect the ISM abundances of a galaxy or whether these regions are self-polluted with metals ejected by massive stars during the present tarburst episode.
Our team has studied 4 Blue Compact Dwarfs galaxies (BCDs). The situation remains however still unclear : oxygen abundance is either equal within the neutral and ionized ISM (in IZW18, IZW36 and SBS0335-052) or 10 times lower in the neutral ISM (in Markarian 59). It seems also that nitrogen (using NI as a tracer in the neutral gas) and argon (using ArI) are always lower in the neutral phase.
Conscious of the potential problems due to the complexity of the lines of sight and the ionization structure, we have obtained high quality spectra of individual HII regions in spiral galaxies. The situation is much easier to understand, allowing us to compare the abundances derived with FUSE with the abundances computed with PDR models and photoionization models (CLOUDY). We compare also the results on NGC604, a HII region in M33, with those of the 4 BCDs already studied. In NGC604, we find a global underabundance of the heavy elements (N, O, Ar, Fe) suggesting the presence of primordial gas in the line of sight. We find also that NI and ARI should be good tracers respectively of nitrogen and argon in the neutral gas.

Photometry simulator
T. Lejeune, J. Fernandes
(Observatoire de Coimbra (P))

Study of the coronal line region of emission in a sample of AGN using NACO, the VLT adaptive optics system.
Marco, O.
(ESO Paranal)
The coronal line region of emission (CLR) in AGN is located in the vicinity of the central source, where higly ionized gaz is detected. The emission lines of silicon are very brights in the infrared, in particular it is detected [SiVI] 1.96μm, [SiVII] 2.48μm, and [SiIX] 3.93μm in several AGN. Because of their high level of ionization potential, these lines are produced by photoionization or excitation by energetics shocks. The typical size of the CLR is of the order of a few tens of parsecs, and it is located at the interface between the BLR and the NLR (depending on the species). Thanks to the high angular resolution acheived with adaptive optics systems, we could study a sample of a few AGN. These new data, combined with other existing images from the HST and radio VLA maps, allow to build a sketch of the central region of the AGN.

A dwarf galaxy remnant in Canis Major : the fossil of an in-plane accretion onto the Milky Way
N. F. Martin, R. A. Ibata, M. Bellazzini, M. J. Irwin, G. F. Lewis, W. Dehnen
(Observatoire de Strasbourg)
We present an analysis of the asymmetries in the population of Galactic M-giant stars present in the 2MASS All Sky catalogue. Several large-scale asymmetries are detected, the most significant of which is a strong elliptical-shaped stellar over-density, close to the Galactic plane at (l=240, b=-8), in the constellation of Canis Major. A small grouping of globular clusters (NGC 1851, NGC 1904, NGC 2298, and NGC 2808), coincident in position and radial velocity, surround this structure, as do a number of open clusters. The population of M-giant stars in this over-density is similar in number to that in the core of the Sagittarius dwarf galaxy. We argue that this object is the likely dwarf galaxy progenitor of the ring-like structure that has recently been found at the edge of the Galactic disk. A numerical study of the tidal disruption of an accreted dwarf galaxy is presented. The simulated debris fits well the extant position, distance and velocity information on the Galactic ring, as well as that of the M-giant over-densities, suggesting that all these structures are the consequence of a single accretion event. The disrupted dwarf galaxy stream orbits close to the Galactic Plane, with a pericentre at approximately the Solar circle, an orbital eccentricity similar to that of stars in the Galactic thick disk, as well as a vertical scale height similar to that of the thick disk. This finding strongly suggests that the Canis Major dwarf galaxy is a building block of the Galactic thick disk, that the thick disk is continually growing, even up to the present time, and that thick disk globular clusters were accreted onto the Milky Way from dwarf galaxies in co-planar orbits.

A survey for distant AGB carbon stars in the Galactic halo
Nicolas Mauron
(CNRS)
The results of an on-going survey aiming at finding luminous AGB stars in the galactic halo are presented. We select AGB carbon rich stars through their near-infrared 2MASS colors and systematically verify their nature through medium resolution spectroscopy. The distances are estimated by comparison to templates taken in the Sgr dwarf galaxy or the Magellanic Clouds, and range from 10 to 100 kpc. The radial velocities are also obtained. These rare objects are useful for tracing the tidal streams such as the Sgr one, and will also contribute to better know the distribution and mass of dark matter in the halo (i.e. the total mass of the Galaxy, which is uncertain by a factor of about 5, e.g. Clewley et al. astro-ph/0310675). More details on the halo carbon star survey are given in the recent paper : Mauron N., Azzopardi M., Gigoyan K., and Kendall T. 2004, Astron. Astrophys. 418, 77 .

The process of gravitationnal collapse : Consequences and perspectives
J. Perez et F. Roy
(ENSTA-Luth)

Damped Lyman-alpha Absorbers in public databases : impact of their discovery techniques on Omega_HI at z<1.7
Celine Peroux, Jean-Michel Deharveng, Vincent Le Brun and Stefano Cristiani
(European Southern Observatory)
The Damped Lyman-alpha systems (DLAs), seen in absorption in the spectrum of background quasars, are believed to contain a large fraction of the neutral gas in the Universe. Paradoxically, these systems are more difficult to observe at z<1.7, since they are rare and their HI feature then falls in UV spectra. In order to overcome this observational difficulty, a method based on MgII-selected DLAs has been proposed. We use data from the HST and ESO public databases as well as new observations undertaken at the TNG to build samples of low redshift absorbers classified according to the technique used for their discovery. We find that the MgII-selected sample contains a larger fraction of absorbers with log N(HI)>21.0 than seen otherwise at low redshift. This property will in turn affect estimates of neutral gas mass, Omega_HI, which is dominated by the highest HI column densities at low redshift. Investigations on the source of the discrepancy will be presented.

Dynamics of the Galactic Bulge using a new Planetary Nebulae sample
Peyaud A, Acker A, Parker Q, Siebert A
(Observatoire de Strasbourg)
We present new Planetary Nebulae (PNe) discovered towards the Galactic Bulge from the UKST/Halpha survey. The population of PNe are thought to be dynamically relaxed and therefore are suitable for test particles of dynamical models in equilibrium (Dejonghe et al, 1997). Before our survey
about 423 PNe in the bulge region were known. With our survey we have already added 500 new ones and by the time our survey is completed (July 2004) we will bring the total bulge region PNe to 1000. We are currently in the process of constructing a bar-bulge model of our inner galaxy which we will be able to
constrain efficiently.

A new computational method for gravity and potential in razor thin, finite-size discs
Pierens A. and Huré J.M.
(LUTh/Observatoire de Paris-Meudon)

Structure and dynamics of the Shapley Supercluster

Dominique Proust, Andreas Reisenegger, Hernan Quintana, Eric Slezak, Hernan Muriel, Laerte Sodre, Michael Drinkwater, Quentin Parker
(Observatoire de Meudon - GEPI)

We present the first results of our wide-field redshift survey of galaxies in a 285 square degree region of the Shapley Supercluster (SSC) based on a set of 8341 galaxy velocities obtained from various telescopes and literature. Our data reveal that the main plane of the SSC (v 14500km/s) extends further than previously realised, filling the whole extent of our survey region of 12 degrees by 30 degrees on the sky (42 Mpc by 105 Mpc, Ho=75 km/s/Mpc). There is also a significant structure associated with the slightly nearer Abell 3571 cluster complex (v 12000km/s) with a caustic structure evident out to a radius of 6 Mpc. These galaxies seem to link two previously identified sheets of galaxies and establish a connection with a third one at = 15000km/s near R.A.= 13h. They also tend to fill the gap of galaxies between the foreground Hydra-Centaurus region and the more distant SSC. In the velocity range (9000 < cz < 18000km/s) of the Shapley supercluster, we calculate galaxy overdensities of 7.0 +/- 0.2 over the 225 square degree central region and 4.8 +/- 0.2 in a 192 square degree region excluding rich clusters. Over the large region of our survey the inter-cluster galaxies make up 48% of all galaxies in the SSC region and may contribute a similar amount of mass to the cluster galaxies. We discuss the completeness of the velocity catalogue, the results obtained of a spherical collapse model used to estimate the SSC mass profile and its contributions to the peculiar motion of the Local Group with respect to the cosmic microwave background.

DisGal3D : a new tool to recover velocity fields from Integral Field Units

M. Puech, H. Flores, F. Hammer
(GEPI - Observatoire de Paris-Meudon)

Multi-Integral Field Spectroscopy is now available on 8-meter class telescopes. With GIRAFFE on the VLT, we have recently shown that velocity fields of distant galaxies at intermediate redshifts (z < 1) can be derived with a spatial resolution of 0.4 arsec. To reach such an accuracy, we have written a dedicated software which combines IFU reduced 3D data cubes with high resolution HST images. This new package -DisGal3D- is briefly presented.

The GIRAFFE Archive : “à la carte” reduced spectroscopic data from the VLT multi-object and high-resolution instrument

Royer, F. (Observatoire de Genève, Suisse) Prugniel, P. (Observatoire de Lyon / Observatoire de Paris-Meudon) Flores, H. (Observatoire de Paris-Meudon) Jégouzo, I. (Observatoire de Paris-Meudon)
(Observatoire de Genève)

The GIRAFFE multi-object spectrograph on VLT/UT2 has been working for more than a year. The first oberved data are already available as raw files in the ESO Archive. The GIRAFFE Archive project aims at providing to the community the observed spectra, reduced in a standard way. The GIRAFFE Archive will allow, within MIGALE, selection and on-the-fly reduction of data according to the user’s choices and publicly available observations.

Mid-IR observations at high spatial resolution : constraints on the IMF in very young embedded super star clusters

Leticia Martin-Hernandez Daniel Schaerer Marc Sauvage
(Observatoire de Geneve, Observatoire Midi Pyrenees)

Observations of mid-IR fine-structure lines in external galaxies are widely used as diagnostics of starformation providing e.g. constraints on the IMF, starburst age etc. However as these observations are taken through large apertures (e.g. ISO, even SPITZER and in the near future Herschel) the line measurements are likely to consist of contributions from super star clusters (SSCs), the diffuse ISM and other sources rendering their interpretation in the above terms difficult. In addition, photoionization models are strongly underconstrained in such conditions given the lack of observable constraints e.g. on the size, geometry etc. of the emission regions.

To determine reliable constraints on the upper part of the IMF we have undertaken high spatial resolution mid-IR imaging and spectroscopy of young starburst galaxies with TIMMI2 on the ESO 3.6 m. Results on the prototypical starburst NGC 5253 are presented here using detailed photoionization models to reproduce a large number of observables including mid-IR to radio observations at various spatial resolutions. In particular we show that results based on large aperture observations cannot yield accurate constraints on quantities such as the upper mass cut-off and age.

Measuring the proper motions of the dwarf galaxies around the Milky Way

M. Segall, R.A. Ibata
(Observatoire de Strasbourg)

I present work in progress aimed at measuring the proper motions of dwarf spheroidal galaxies of the Milky Way. We have developed a method based on a Fourier cross-correlation to measure the positions of faint galaxies in the background of these nearby satellite galaxies. This allows us to define an extragalactic reference frame with respect to which we measure the proper motions of the stars in the foreground Galactic satellite. We have begun with a study of the Draco dSph, using HST images. The ultimate aim of this project is to measure the 3-dimensional kinematics of the dwarf spheroidal galaxies, thereby gaining an insight into the interactions between these galaxies and the Milky Way, and on the formation of galaxies.

Session PNP

Invited talks

Valley networks and lakes during early Mars

V. Ansan & N. Mangold
(Laboratoire Orsay Terre - FRE2566)

The Mars surface displays numerous valley networks. They are essentially located on the densely cratered terrain dated noachian (>3.8 Gyr), like the southeastern area of Tharsis bulge called Thaumasiahighlands. As they cut noachian terrains, they formed during the Hesperian time (3.8 - 2 Gyr). Warrego Valles is the most known valley network since the Viking mission. It was characterised by a parallel pattern associated with a low drainage density, which suggested that it developed by groundwater flows. The Mola data and infrared Themis images give new evidence for a water atmospheric origin involving rainfalls or snowfalls, surface runoff, seepage and groundwater flows. In the same region, lakes identified from topographic data andgeomorphic features such as deltas are consistent with the persistence of liquid water at the surface. This result implies that a water atmospheric cycle existed until Hesperian epoch, about 3Gyr ago.

APPLICATION TO THE CASE OF THE DARK SLOPE STREAKS PROCESSES.

D. BARATOUX, P.C. PINET and HRSC team
(Laboratoire Dynamique Terrestre et Planétaire)

Dark slope streaks are among the surface processes which are active at the present time on the Martian surface (with dust devils). While their mechanism of formation and triggering is still debated, they may involve liquid water. This object is an example for which the estimation of the contribution of the photometric effect in the observed contrast is essential, and would strongly benefit from combining HRSC and OMEGA observations.

Mars perennial and seasonal ices and frosts, identified by the OMEGA/Mars Express spectral imager

Jean-Pierre Bibring and the OMEGA Team
(IAS)

Over the first 4 months of operation, OMEGA has acquired VIS/NIR spectral images of the Mars South polar cap and North polar latitudes, just before and after the Southern Fall equinox. H2O and CO2 ices and frosts are clearly identified, and mapped with a spatial resolution a few kilometers, which enable to unambiguously characterize the composition and extent of the South perennial ices and winter Northern seasonal frosts, and to monitor their variation with time. We will present the first preliminary results obtained, and their relevance to the understanding of short and long-term Mars climate evolution.

WEATHERING OF IRON RICH PHASES IN A MARTIAN ATMOSPHERE

V. Chevrier, P. Rochette, P.E. Mathé, O. Grauby
(CEREGE)

The origin of iron bearing phases in the Martian regolith is usually interpreted as the coexistence of titanomagnetite inherited from the primary magmatic rocks with neoformed phases from Fe2+ solutions (mainly maghemite, hematite and goethite). Many interprations are funded on the use of natural terrestrial analogues which do not acknowledge the fundamentally different nature of Earth and Mars atmosphere, resulting essentially from the replacement of O2 by CO2 and the possible presence of peroxides in the Martian atmosphere. Moreover, due to the lack of tectonic recycling of the Martian crust, a part of the regolith could be of exogenic origin as a result of accumulation of meteorites and IDPs. These objects, which usually contain 10-20 % of iron rich phases (Fe-Ni alloy, sulfides and magnetite) compared to 1-2% in Martian rocks, could thus explain a part of the iron enrichment of the Martian regolith. Sulfides may also be more common in primary Martian rocks than on Earth. Finally some recent studies explain the anomalous low oxygen content of the Martian atmosphere as resulting from its interaction with the regolith. Therefore we undertook an experimental weathering of pure elemental iron and magnetite, as well as natural hexagonal and monoclinic pyrrhotites. Weathering was performed at room temperature and 0.8 atm, in a pure CO2 atmosphere, saturated either with vapor of water or water mixed with 30% hydrogen peroxide H2O2. Magnetic properties of neoformed products and primary minerals were investigated and completed using X-ray diffraction, TEM and SEM observations.

These 450 days experiments show that magnetite remains stable in both atmospheres, and thus is likely to be inherited from the primary rocks through weathering processes. The only neoformed iron (oxy)hydroxide is goethite which crystallizes on all substrate and in both atmospheres. However the goethite exhibits various textures and grain size according to the atmosphere and substratum, but depending mainly from the water partial pressure available during the crystallization. Application of a kinetic model evidences a progressive blocking of the weathering of iron, which could appear as a relict in the Martian regolith and thus explain a part of its magnetic properties. Moreover the evolution of iron induces the formation of metastable siderite (FeCO3) evolving progressively into goethite. Therefore, the presence of disseminated carbonates in the Martian regolith could result from the presence of kinetically stabilised siderite, due to lower temperatures occurring on Mars. Weathering of pyrrhotite induces formation of sulfates and elemental sulfur, which may account for a part of the strong sulfur enrichment of the Martian regolith. These sulfates are mainly iron-sulfates, gypsum and jarosite (KFe3+3(SO4)2(OH)6), indicating the weathering of the silicate traces present in these natural pyrrhotites. Thus our experimentally produced phases are well representative for the various in situ measurements, demonstrating that atmospheric weathering may occur on Martian surface, without requiring liquid water and an atmosphere composition different from the present one. Moreover this type of weathering pathway is particularly relevant to Pathfinder or MER Spirit lander sites, which show clear evidence for a weathering induced regolith associated to primary rocks.

Observations of Mars' atmosphere by OMEGA/Mars Express

P. Drossart, T. Encrenaz, R. Melchiorri, T. Fouchet, B. Bézard, M. Combes, F. Forget, J.P. Bibring, Y. Langevin and the OMEGA team
(LESIA, Observatoire de Paris)

Observations of Mars with the imaging spectrometer OMEGA on board the ESA/Mars Express spacecraft have started in January 2004. The infrared spectra have been analyzed to search for atmospheric variations in pressure, composition in CO and H2O, and for dust opacity. Limb scans have provided the first spatially resolved observations of non-LTE CO2 emissions in the fundamental band at 4.3 micron. These emissions provide important clues on the radiative transfer of the mesospheric layers at 90 km altitude, a still poorly observed atmospheric layer where important energy transfer take place.

Minor species in the Martian atmosphere from ground-based and PFS Mars Express spectroscopy

Th. Encrenaz
(LESIA, Observatoire de Paris)

After several years of unsuccessful research,hydrogen peroxyde H2O2 has been recently detected in the Martian atmosphere by two ground-based observations, in the sub-millimeter range (Clancy et al., 2004) and in the infrared range, using the TEXES high-resolution spectrometer at IRTF (Encrenaz et al., 2004). The TEXES observations, obtained for Ls = 206°, have been used to retrieve the spatial distribution of H2O2 on Mars. The mean abundance of H2O2 is 40 ppb, in agreement with photochemical models. This result is about 10 times higher than our previous upper limit, obtained for a different season (Ls = 112° ; Encrenaz et al., 2002). The new results appear consistent with the 3D-modelling obtained with the GCM developed at LMD (Forget et al., 1999).

In addition, a tentative detection of CH4 has been announced using the PFS instrument aboard Mars Express. A weak absorption is present in the mean spectrum of Mars, integrated over all orbits, at the position of the nu3 fundamental band of CH4 at 3.3 microns. This feature can be fitted with 10 ppb of CH4 (Formisano et al., 2004). More PFS observations will be required to confirm this result.

References :

Clancy R T, Sandor B J, Moriaty-Schieven G H, 2004. A measurement of the 362 GHz absorption line of Mars atmospheric H2O2, Icarus 168, 116.

Encrenaz T, Greathouse T K, Bezard B, Atreya S K, Wong A S, Richter M J, Lacy J H, 2002. A stringent upper limit of the H2O2 abundance in the Martian atmosphere. Astron. Astrophys. 396, 1037.

Encrenaz T, Bezard B, Greathouse T K, Richter M J, Lacy J H, Atreya S K, Wong A S, Lebonnois S, Lefevre F, Forget F, 2004. Hydrogen peroxide on Mars : evidence for spatial and seasonal variations. Submitted to Icarus.

Forget F, Hourdin F, Fournier R, Hourdin C, Talagrand O, Collins M, Lewis S R, Read P, Huot J-P, 1999. Improved general circulation models of the Martian atmosphere from the surface to above 80 km. J. Geophys. Res. 104, 24155.

Formisano F, Atreya S K, Encrenaz T, Ignatiev N, Giuranna M, 2004. In preparation.

Climate simulation of the climate on Early Mars

F. Forget, R.M. Haberle, F. Montmessin, E. Marcq, J. Schaeffer
(LMD, IPSL)

The environmental conditions that existed on early Mars during the Noachian period are subject to debate in the community. While some authors suggest that the difference resulted from a stronger geothermalism during that period, and that a warm climate was not necessary to explain the valley network, others claim that a warm, wet early climate capable of supporting rainfall and surface runoff is the most plausible scenario for explaining the entire suite of geologic features in the Martian cratered highlands. To help understand this key issue in Mars science, we have developped a 3D general circulation model similar to the one used on current Earth or Mars to study the details of the climate today. Our first objective is to answer the following questions : how is the Martian climate modified if 1) the surface pressure is increased up to several bars (our baseline : 2 bars) and 2) if the sun luminosity is decreased by 25% like 3.8 Billion years ago. We did not take into account the heat possibly released by impacts during short periods, although it may have played a role. Preliminary results obtained assuming a 2 bars atmosphere suggest that, even without taking into account the radiative effect of CO_2 clouds, temperature near or above the freezing point of water may be obtained seasonally in the summer hemisphere. The diurnal amplitude of surface temperature is small, and therefore warm temperatures may last for long periods. CO_2 ice clouds are found to form almost everywhere on the planet in the upper atmosphere above 40 km. Their radiative effect on the climate is very model dependent but, in most cases, should correspond to a warming of the surface. Ultimately, such a model may enable us to simulate the water cycle by applying parameterisations currently used in Earth models. It will be interesting to investigate wether snow or rain could have occur on such a planet.

MARTIAN SURFACE COMPOSITION FROM MARS ODYSSEY GAMMA-RAY SPECTROMETER

Olivier Gasnault
(CESR - Observatoire Midi-Pyrénées)

The distribution of non-volatile elements on Mars will be presented using the lastest results from the Mars Odyssey Gamma-Ray Spectrometer.

To date, the global composition seems to be closely related to hydrogen. Second order variations in composition are faint. Individual abundance maps can be combined to tentatively define broad provinces of homogeneous composition at the spatial resolution of the instrument.

On new SNCs from the Sahara : NWA 480, NWA 817, NWA 856, NWA 1068, NWA 1669.

Albert Jambon, Jean Alix Barrat, Pierre Beck, Karim Benzerara, Marc Chaussidon, Etienne Deloule, Bertrand Devouard, Hassna Chennaoui-Aoudjehane, Christa Göpel, Philippe Gillet, Hughes Leroux, Daniel Neuville, Bruno Reynard, Violaine Sautter
(MAGIE)

The search for meteorites in hot deserts has been a real success, the case of SNCs from Northwest Africa (NWA), with 7 finds, being a good illustration. The Théodore Monod Consortium had the opportunity to study 5 of those, its major results being summarized here. The variety of rocks studied permits to increase our understanding of martian magmatic rocks : One nakhlite and 4 shergottites (one picritic shergottite, one single pyroxene Shergottite, two 2 pyroxene shergottites -one with augite the other with pigeonite on the liquidus-). Among the specific new aspects of the studies are essentially 1) the role of water in the petrogenesis in NWA 1669. The presence of 2 pyroxenes with augite alone on the liquidus indicates a partial pressure of water in excess of 0.2 GPa. 2) hydrothermal alteration of olivine and pyroxene in the nakhlite NWA 817 has been shown to be a primary feature with an isotopic composition very different from martian atmospheric value. 3) the study of shock effects in shergottites has permitted the identification of several high pressure phases : high pressure silica glass, stishovite, post-stishovite ; hollandite, ringwoodite, majorite. Further studies are still in progress. 4) the description of thermal and shock history of the NWA 856 shergottite from pyroxene microstructure.

The chemistry of Mars atmosphere simulated by a 3D model

Franck Lefèvre, Sébastien Lebonnois, Franck Montmessin, et François Forget
(IPSL/Service d'Aéronomie)

Water and carbon monoxide in Mars' atmosphere from Mars Express /PFS measurements

E. Lellouch, T. Encrenaz, T. Fouchet, F. Billebaud et l'equipe PFS/MEX
(LESIA, Obsevatoire de Paris)

Water and carbon monoxide in the Mars' atmosphere from Mars Express /PFS measurements
The Planetary Fourier Spectrometer (PFS) instrument of the Mars Express mission observes the infrared spectrum of Mars from 1.2 to 5.2 micron and 6 to 45 micron with a spectral resolution of 1.5 cm-1 and a spatial resolution of 35 mrad. Typically 250 spectra have been collected per orbit since January 10, 2004. The spectra clearly show the signatures of H2O at 1.38, 2.6, and 30-50 micron and CO at 4.7 micron. The strong H2O bands at 2.6 micron and CO at 4.7 micron are used to map and monitor the abundances of these gases as a function of location (latitude, longitude) and season. We will present results from the first months of observation. Focus will be on the study of the seasonal variation of H2O and on the variation of H2O and CO mixing ratio with topography. First analyses indicate lower CO mixing ratios on high-altitude regions.

Climatic models and obliquity variations

Levrard, Benjamin, Forget Francois., Montmessin, Franck et Laskar Jacques
(Observatoire de Paris-IMCCE)

The suite of the Gamma-Ray Spectrometer (GRS) instrument onboard Mars Odyssey spacecraft has suggested the presence of vast reservoirs of near-surface ice in the high latitudes (55-90°) of both martian hemisphere (Mitrofanov et al., 2002, Boyton et al., 2002, Feldman et al., 2003) supported by morphologic observations of water-ice rich, meters thick, smooth layered deposits and periglacial-like features restricted to these latitudes. However, large uncertainties still exist about their formation. GRS data indicate a latitudinal-averaged increase of ice concentration ranging from 40 % to more than 90 % in the polar areas, that is conflicting with ground ice abundance issued from diffusive exchange between the regolith and the atmospheric water vapor. Alternatively, ice-rich deposits have been proposed to form by transport of ice from the polar reservoirs and direct redeposition in high-latitudes during periods of higher obliquity (35°) (Mischna et al., 2003). Here, using the LMD General Circulation Model, we propose instead that during periods of low obliquity (< 25°), high-latitudes ice deposits can form by direct precipitation of ice as a result of sublimation of an equatorial ice reservoir formed during a previous prolonged high obliquity excursion and poleward transport of atmospheric water. Results from the LMD GCM suggest that frequent high obliquity excursions (> 35°) of the 5-10 Ma interval and favorable orbital parameters may lead to more than 3-4 km thick glaciers on equatorial Tharsis Montes, consistent with geological observations of possible ancient cold-based glaciers (Head and Marchant, 2002). Transition towards a lower mean obliquity value (25°) around 4 Ma yieds the formation of an unstable equatorial ice reservoir which is progressively redistributed and condensated in high-latitudes and polar areas. The robustness of this scenario was tested for several locations and extents of equatorial ice sources. High-latitudes and polar ice accumulation may reach several millimeters per year wich is consistent with the formation of meters thick sedimentary-layered deposits over each single obliquity cycle before the equatorial reservoir disappeared.

ORBITAL IMAGING PHOTOMETRY AND SURFACE GEOLOGIC PROCESSES.

P.C. PINET, D. BARATOUX and HRSC team
(Laboratoire Dynamique Terrestre et Planétaire)

Particle size and rock abundances at the sub-meter scale is critical for the determination of geological processes that affects the planetary surface. Indeed, the geological processes controlling the size or being controlled by the size of particle include the volcanic and aeolian activity, the landslides, impact cratering and the formation and emplacement of ejecta, fluvial erosion. One of the objectives that can be addressed with the multi-angular HRSC dataset is to use the surface photometric characteristics to map the variation of the soil/bedrock physical properties of Mars and to relate them to the spectroscopic and thermal observations produced by OMEGA and THEMIS instruments.

Dense valley network within Valles Marineris

C. Quantin, P. Allemand, N. Mangold, G. Dromard, C. Delacourt
(Laboratoire Sciences Terre)

The history of Valles Marineris, the equatorial canyon of Mars, is complex attested by many erosional and depositional figures. The presence of liquid water at the surface after the Hesperian formation of the canyon remains controversial. Infrared and visible Themis images reveal the presence of a dense valley network associated with a paleolake within the canyon. The characteristics of this network give evidences of surface runoff and sapping. These observations imply the persistence of the liquid water at the surface and water of atmospheric origin during a period of the canyon history.

Mars polar ices and seasonal condensations observed by the OMEGA spectro-imager

Bernard Schmitt, Sylvain Douté and the OMEGA Team
(Laboratoire de Planetologie de Grenoble, CNRS/UJF)

The knowledge of the physical state and distribution of the ices at the surface of the Mars polar caps and of the seasonal condensations should allow us to better understand the microphysics of the sublimation/condensation/deposition processes of volatiles on Mars.

Four observations covering the bright south polar cap and part of the surrounding terrains have been recorded by OMEGA before the southern autumn equinox. They already leaded to the first direct observation of nearly pure H2O ice in several areas surrounding the bright cap on which CO2 ice is mainly concentrated [Bibring et al. 2004]. In addition observations extending to the north monitor the evolution of the seasonal deposits overlying the circumpolar terrains and the northern permanent cap.

We will present preliminary results concerning the physical state, the coexistence modes and the spatial distribution of CO2 and H2O ices on the south polar cap and in the northern seasonal condensations. In particular we try to derive the relative abundances of these molecules at selected locations using our radiative transfer code in layered media fed with laboratory spectra of ices.

Poster contributions

Formation of giant planets - An attempt in matching observational constraints

Yann ALIBERT, Christophe MORDASINI, Olivier MOUSIS, Willy BENZ
(Universite de Bern)

We present models of giant planet formation, taking into account migration and disk viscous evolution. We show that migration can significantly reduce the formation timescale bringing it in good agreement with typical observed disk lifetimes. We then present a model that produces a planet whose current location, core mass and total mass are comparable with the one of Jupiter. For this model, we calculate the enrichment in volatiles and compare them with the one mesured by the *Galileo* probe. We show that, reconciling both the measured surface enrichments and the constraints derived by Guillot et al. (2004) is only possible if we assume accretion of purely icy planetesimals (containing no rocks) and a N_2/NH_3 ratio equal to 1. Furthermore, a slightly better agreement is obtained if one assumes core erosion and/or volatiles release from the planetesimals during core formation.

How would a ring around an extrasolar planet change the unresolved planet photometry ?

Arnold Luc, Schneider Jean
(CNRS - Observatoire de Haute-Provence)

The next generation of high-contrast imaging instruments will deliver the first unresolved image of an extrasolar planet. While the emitted infrared light from the planet in thermal equilibrium should show no phase effect, the reflected visible light will vary with the orbital phase angle. We study the photometric variation of the reflected light with orbital phase of a ringed extrasolar planet. We show that a ring around an extrasolar planet, both obviously unresolved, can be detected by its specific photometric signature. A simple quantitative model is discussed, taking into account the basic optical and geometrical properties of the ringed planet.

Observations of H2O, H2-18O and CO in Mars with Odin

N. Biver, A. Lecacheux, J. Crovisier, E. Lellouch, T. Encrenaz (LESIA, Obs. de Paris), , U. Frisk (SSC, Sweden), A. Hjalmarson (OSO, Sweden) and Aa. Sandqvist (Stokholm Observatory, Sweden)
(LESIA, Observatoire de Paris)

Odin is a small astronomy and aeronomy space observatory, equipped with a 1.1 m radiometer and 5 receivers, comprising 4 tunable submillimetric receivers in the 480–560 GHz range. It was launched successfully in Sun-synchronized Earth orbit on 20 February 2001. Due to solar elongation constraints, Odin could not observe the red planet in August 2003, but did it twice, on June 14–18 and November 2–9. Thanks to the versatility of its system it has been each time possible to get a full 4 GHz wide spectrum of the fundamental water line at 557 GHz. The presence of water vapour in Mars atmosphere has been known for several decades but it had never been observed with both a high spectral resolution (1 MHz) and a wide band of over 4 GHz allowing us to see the line entirely. The spectrum is actually the result of five consecutive different tunings each covering 1 GHz. In parallel, other receivers were used to look for O_2 at 487 GHz in June, and to measure the line profile of $H_2^{18}O$ and CO(5–4) in November. Although Odin lacks spatial resolution (its beam measures 2.2' while Mars apparent diameter was around 14"), these results are complementary to the spacecraft observations in Mars orbit. Thanks to the simultaneous observation of strong (H_2O at 557 GHz) and weaker ($H_2^{18}O$ at 548 GHz) water vapour lines with high spectral resolution, it will be possible to constrain the average vertical distribution of water vapour in Mars atmosphere. The CO(5–4) line will also provide further constraint on the atmosphere vertical temperature profile. In addition, strong seasonal variations take place on Mars, and the two Odin observations were obtained at the time of martian southern spring (June) and southern summer (November) when most of the seasonal southern polar cap had melted. Results on the average amount of water vapour responsible for the absorption line profile and its vertical distribution will be given.

Petrochemistry of a basalt from the reflectance spectroscopy

G. Bonello, F. Poulet, J. M. Bardintzeff, S. Erard, L. d'Hendecourt, B. Platevoet
(INAF - IASF)

Many embarked instruments use the reflectance spectroscopy as remote analysis of the ground composition. On Mars, ISM on board PHOBOS allowed a first analysis in the beginning of the nineties. Currently, OMEGA on MARS-EXPRESS carries out the first cartography at large scale of the planet in the visible and near infra-red (0.35 to 5.1μm). If the detection of specific signatures allows to identify without ambiguity the presence of particular minerals, to deduce the precise nature of the rocks present at the surface requires a more precise modeling of the micro and macroscopic mixtures. At present, the models do not allow to inverse the spectra acquired to yield the composition of the grounds in a univocal way. It is then essential to carry out simulated measurements in laboratory to improve the interpretation of the spectra in terms of petrology of the grounds. We have studied a Basalt sample of the mountain chains of the French "Central Massif". The Orsay-Terre laboratory collected, prepared and analyzed the samples. We used the Fourier transform spectrometer BRUKER IFS66V present at the IAS (Orsay) to carry out the spectra in reflectance on Basalt samples, reduced down to powder of various grain sizes, as well as on on solid samples presenting polished plane surfaces at various roughness. We then separated this Basalt in its various mineral phases in order to model the spectra of the rock under various physical conditions according to the spectra of the various mineral phases. For that we used a model of radiative transfer derived from the approach of Skuratov. From these results, we discuss the inverse approach consisting in deriving petrochemistry of this Basalt from the spectra of the powders and the solid sections of the rock. This work enables us to evaluate the capacities and the limits of the spectroscopy of reflectance to study in remote the petrology of the rocks.

Direction-Finding of Jovian Quasi-Periodic bursts using the Cassini RPWS/HFR radio reciever

Baptiste CECCONI Philippe ZARKA
(LESIA - Observatoire de Paris-Meudon)

We present a study of the source localization and emission polarization for the jovian Quasi-Periodic Bursts. We have applied direction-finding techniques on the Cassini RPWS/HFR data recorded during the Cassini Jupiter flyby. A total of 6 month of data has been used. The Quasi-Periodic Bursts is the jovian low frequency radio emission for which we have the poorest knowledge in terms of the emission processes. Beside the direction finding analysis, we also show the variation of the emission band and flux density.

Determination of water outgassing rates in comets with ODIN and the Nançay Radio Telescope.

P. Colom, N. Biver, J. Crovisier, A. Lecacheux, D. Bockelée-Morvan
(Observatoire de Paris)

Recent advances in cometary research are related to the search for cometary complex molecules (see the contribution of Crovisier et al., this conference), as well as to the study of chemical diversity among comets (Biver et al., 2002, Earth, Moon, and Planets, 90, Issue 1, p. 323).

These studies closely rely upon measurement of the water production rate, as it allows abundances determination and, hence, comparison between comets.

Recently, the water line at 557 GHz and the OH 18-cm hyperfine transitions were measured with the Odin satellite and the Nançay radio telescope, respectively, in comets 2P/Encke, C/2002 T7 (LINEAR) and C/2001 Q4 (NEAT).

Both water and OH production rates can be estimated and compared, since the cometary OH radical is a product of water photolysis.

In addition, these observations allow the variable activity of the comets to be monitored, and coordinated multi-wavelength campaigns to be supported.

The search for complex molecules in comets

J. Crovisier, N. Biver, D. Bockelée-Morvan, P. Colom (Observatoire de Paris), D. Despois (Observatoire de Bordeaux) and D.C. Lis (Caltech)
(Observatoire de Paris)

From radio spectroscopic observations of comets, more than 22 molecules, radicals and ions, plus several isotopologues, were detected, the majority of them being recently revealed in comets C/1996 B2 (Hyakutake) and C/1995 O1 (Hale-Bopp). Among them were acetic acid, formic acid, methyl formate... detected in radio spectra obtained at the IRAM 30-m telescope and Plateau de Bure interferometer and at the Caltech Sumillimeter Observatory in spring 1997 (Bockelée-Morvan et al., 2000, Astron. Astrophys., 353, 1101). In addition, upper limits were obtained for several species, including complex organic molecules such as ethanol, acetic acid, glycolaldehyde, glycine... (Crovisier et al., 2004, Astron. Astrophys., 418, 1141).

Ethylene glycol (HOCH2CH2OH) was recently identified from about ten rotational lines in the archival spectra of comet C/1995 O1 (Hale-Bopp) (Crovisier et al., 2004, Astron. Astrophys., 418, L35). The identification was made just after the rotational lines of this molecule were included in the Cologne Database for Molecular Spectroscopy. The production rate of ethylene glycol is 0.25% that of water, making it one of the most abundant organic molecules in cometary ices. This detection strengthens the similarity between interstellar and cometary material. It outlines the possible role of cometary impacts in the origin of life by seeding the early Earth with prebiotic molecules.

20 microns views on some intermediate Haebe dust disks

Doucet coralie, Pantin Eric, Lagage Pierre-Olivier
(CEA/DSM/DAPNIA/SAp)

Circumstellar disks are ubiquitous around stars with intermediate ages around a few million years. They are a natural outcome of the star formation process, because of the need of angular momentum conservation durind the collapse of the natal molecular core. Herbig Ae/Be stars represent a class of intermediate mass, pre-main sequence stars. By studying the characteristics and evolution of these disks i.e their dust composition and structure, one can put constraints on disk and planet formation models. Thanks to 20.5 microns imaging data obtained with the CAMIRAS instrument installed on the CFHT, we could resolve a set of disks around HD150193, HD 135344, HD 163296, HD 98800 showing unexpected disk structures in emission at distances of more than 100 AU from the central star.

Distribution of Orbital Elements of Planets and Exoplanets in Scale Relativity

P. H. M. Galopeau, L. Nottale, D. Ceccolini, D. Da Rocha, G. Schumacher and N. Tran-Minh
(CETP - CNRS - IPSL)

In the framework of scale relativity, we describe the motion of planetesimals in the protoplanetary nebula in terms of a fractal and irreversible process. As a consequence the equation of dynamics can be transformed to take a Schrödinger-like form. Its solutions yield a planetesimal distribution showing peaks of probability for particular values of conservative quantities such as the energy and the Runge-Lenz vector. After accretion, this results in expected probability peaks of the semi-major axis distribution at $a_n = (GM/w^2)n^2$, and of the eccentricity distribution at e = k/n, where k and n are integer numbers, M is the star mass and w is a constant having the dimension of a velocity. The current observational data in our solar system and extrasolar planetary systems support these predictions in a statistically significant way : we show that these systems are hierarchically organized in terms of a sequence of constants which are multiples and submultiples of w = 144.7±0.5 km/s. New validations of the theoretical predictions are given concerning the very inner solar system including the Sun itself, the distant Kuiper belt and exoplanets recently discovered very close to their star (at about 0.02 AU/M_sol).

Efficiency of Cyclotron Maser Instability and Jovian Active Longitudes

P. H. M. Galopeau, M. Y. Boudjada and H. O. Rucker
(CETP - CNRS - IPSL)

A great part of the jovian decameter radio emission is modulated by two dominant factors : the planetary rotation, which indicates that the occurrence probability of the radiation depends on the observer's longitude, and the orbital phase of Io, which controls part of the emission. The cyclotron maser instability is assumed to be at the origin this decameter radiation. Within this context we have calculated the maximum growth rate of the waves produced by this theoretical mechanism at the footprint of the Io flux tube during a complete revolution of the satellite around Jupiter. We have made the assumption that electrons are accelerated in the neighbourhood of Io and follow an adiabatic motion along magnetic field lines carried by this Galilean satellite. We suppose that the free energy needed by the cyclotron maser instability to produce the radiation results from a loss-cone distribution function. Our study suggests the existence of some specific longitudes in the northern and southern jovian hemispheres favouring the radio decameter emission and implying a higher occurrence probability. Finally we compare our results to the occurrences observed for the sources Io-A, Io-B, Io-C and Io-D in the usual CML-Io phase diagram.

A Characterization of the martian ionosphere-solar wind interface with MARS-EXPRESS

Philippe Garnier(1), Jean-André Sauvaud(1), Pierre-Louis Blelly(2), Dominique Toublanc(1), Christian Mazelle(1), Andrei Fedorov(1), Rickard Lundin(3), Stas Barabash(3), David Winningham(4), and the ASPERA3 team 1) CESR, BP 4346, 31028 Toulouse, France 2) LPCE, Orléans, France 3) Swedish Institute of Space Physics, KIRUNA, Sweden 4) SwRI, San Antonio, USA
(CESR/CNRS)

The ASPERA-3 experiment onboard MARS-EXPRESS analyses the martian environment since January 2004 and already provides a wealth of information. The first data coming from the Electron Spectrometer and from the Ion Mass Analyzer allow to characterize the Photoelectron Boundary(PEB) encountered in the dayside and at average altitudes of the order of 600 km. This boundary corresponds to the separation of solar and planetary electrons. We observe a clear photochemical signature at the boundary level. The very good energy resolution of the ELS experiment allows indeed to systematically measure here and at lower altitudes spectral peaks around 25-30 eV with stable fluxes as a function of altitude. This boundary results from the photoionization of oxygen and carbon dioxyde by the solar emission at 304 A. Using ionospheric models, the sharp structure of the boundary with altitude is interpreted as indicating the sudden cancellation of the vertical transport of the ionospheric electrons due to the pile-up of the magnetic field around the planet. These first data also give evidence that the crustal magnetic field is responsible for the increase of the boundary altitude owing to the additional magnetic pressure. We also show how the ion escapes are linked to the motions/ meso-scale structures of the ionosphere interacting with the solar wind.

Pressure waves and Jovian tropospheric clouds

Patrick Gaulme Benoît Mosser
(LESIA – Observatoire de Paris))

The receipt for a successful study of the Jovian interior structure is given by the association of seismology and precise visible photometry. In this framework, the micro-satellite project Jovis, presented to the French space agency (Mosser et al, these proceedings), is for Jupiter a copy of what the Europen space mission COROT is for the stars. The Jovian visible flux being dominated by the albedo map, an accurate analysis of the cloud response to a seismic wave is needed. Therefore, we have revisited the propagation of sound waves in the Jovian troposphere, in order to estimate how they affect the clouds layer.

We suppose a vertical wave propagating in a plane parallel atmosphere including an ammonia ice cloud layer. First, considering Jupiter as a mirror, we establish the variations of the reflected solar flux due to the smooth distorsions. Second, introducing thermodynamics, we determine the phase transitions induced by the waves in the clouds. These phase changes are linked to the ice particles growth, and limited by kinetics. A Mie model associated to a simple radiation transfer model allows us to estimate the final albedo fluctuations of the cloud perturbed by a seismic wave. We are then able to quantify the albedo response to a pressure wave.

A Multiple Low Frequency Radar Sounding Approach for the Unambiguous Detection of Water in the Martian Subsurface

E. Heggy & S.M. Clifford
(Lunar and Planetary Institute)

On Earth, radar sounding from surface, aerial and orbital platforms has been successfully employed to investigate a variety of terrains and subsurface environments, including hot arid deserts, Arctic permafrost, glaciers, and polar ice sheets. Low frequency radar techniques (1 to 25 MHz) are also being employed to explore the lithology, stratigraphy and search for subsurface water on Mars. In comparison with terrestrial studies, it is anticipated that the interpretation of the Mars data will prove far more challenging, due to the lack of available ground truth. To help resolve some of the ambiguities associated with this type of investigation, we have recently conducted a Ground Penetrating Radar survey of a well-characterized arid, dune field near Yucca Mountain in southwest Nevada using a multifrequency technique. The investigation utilized two GSSI bistatic antenna systems, a multiple low frequency (MLF) system which was used to conduct sounding at 16, 20, 40, and 80 MHz and a separate 100 MHz system. The aim of the survey was to map the interface between the semi-dry homogeneous sand and the underlying wet alluvium on which the dunes rested. The depth of this interface ranged from 3 to 25 meters. The different frequencies and acquisition modes yielded significant differences in penetrations depth and resolution. Data acquired in a continuous mode provided an important complement to the point to point soundings conducted with the MLF antenna, offering a limited substitute for ground truth. Our results also demonstrate the benefit of combining sounding data taken at different frequencies to unambiguously identify internal structural and stratigraphic features as well as the depth of a water rich interface.

Evaporation of Hot-Jupiters. Observations and models.
A. Lecavelier
(IAP-CNRS)
Among the more than one hundred extra-solar planets known, over 15% orbit closer than 0.1 AU from their parent star. We will present the observations and models of the evaporation of these "Hot-Jupiters".
The observations started with the discovery made with HST that the planet orbiting HD209458 has an extended atmosphere of escaping hydrogen. More recent observations obtained with HST confirm the escape of the gas. And, even more, they show the presence of oxygen and carbon at very high altitude in the upper atmosphere. This shows that the escape mechanism is not a pure Jeans' escape, but an hydrodynamical blow-off of the atmosphere.
To interpret these observations, we developed a comprehensive model to investigate the leading mechanisms and to evaluate the escape rate. The high temperature of the upper atmosphere heated by the far and extreme UV combined with the tidal forces allow a very efficient evaporation of the upper atmosphere. The results of this model nicely fit the observational estimates of the escape rate from HD209458b. Moreover, this give a new explanation to the very low number of planets inside 0.04 AU, distance below which we could predict the presence of a new kind of planets made from the remaining core of evaporated giant planets which would have migrated inside this limit.

Detectability of Debris Disks around Red Dwarfs by Future Submillimeter Satellites
Lestrade, J.-F.
(Observatoire de Paris/LERMA)
Two thirds of the stars in the vicinity of the Sun are red dwarfs and the frequency of planetary systems around them has not been estimated yet, not even preliminarily as for solar-like stars. Detection of cold dust of debris disks around these stars at submillimeter wavelengths would provide estimation of this frequency. We investigate the sensitivity of the future space missions Herschel/PACS, SAFIR and GISMO to the mass of the dust expected in these disks.

Detection of Methane in the Martian atmosphere with the CFHT/FTS
J.P. Maillard, W. Krasnopolsky, T. Owen
(CNRS)
Using the FTS on the Canada-France-Hawaii Telescope a high resolution spectrum of Mars at a resolving power of 180,000 was obtained in the P-branch of the ν_3 band of methane at a maximum of geocentric radial velocity. Summing up the shifted spectral intervals of the 15 strongest potential Martian lines, an absorption exactly centered at the expected position is detected at a 4-sigma level. This absorption translates into a CH4 mixing ratio of 10 ± 3 ppb. The origin of this trace of methane in the Martian atmosphere is discussed.

JOVIS : a microsatellite dedicated to the seismic analysis of Jupiter
B. Mosser, P. Gaulme (LESIA) and the JOVIS team
(Observatoire de Paris)
The measurement of frequencies and amplitudes of p-modes oscillations provides a unique insight into the internal structure of objects like the Sun, solar-like stars or giants planets. The examples of the European missions Soho for the Sun and Corot for the stars tell us that visible precise photometry is one of the most efficient way for such measurements.
Jovis is a micro-satellite project presented to the French space agency, derived from the COROT project and dedicated to the seismic analysis of the interior of the Jovian planets. The scientific goals are concerned with such crucial points as the hydrogen equation of state at high pressure (and the possible transition from molecular to metallic state), the planetary formation scenario and the determination of the pressure-density profile.
We will develop these points and present the scientific specifications required for obtaining conclusive responses by the seismic analysis. The observation principle, based on the thermodynamics analysis developped by Gaulme and Mosser (these proceedings), will be briefly presented. The payload concept and the mission profile will be exposed.

An inventory of major volatiles trapped in Ceres
O. Mousis
(Physikalisches Institut, Universitaet Bern)
We determine the nature and the composition of ices incorporated in the interior of Ceres, assuming that icy planetesimals produced beyond 5 AU in the solar nebula took part in its formation (Cyr et al. 1998). We argue that volatiles were trapped under the forms of clathrate hydrates and hydrates in the outer solar nebula prior to have been incorporated in icy planetesimals and subsequently in Ceres. Under the assumption that planetesimals that formed Ceres did not outgas during its accretion phase and its thermal evolution, we predict the per mass abundances with respect to H2O of CO, CH4, N2, NH3, Ar, Kr, and Xe in the interior of the asteroid. The prediction of the presence of ammonia in Ceres is compatible with the hypothesis of existence of a deep liquid layer (McCord and Sotin 2004) and may be tested by the DAWN space mission in 2014.

Modelisation of the transmission spectrum of Mars' atmosphere to treat hyperspectral images from OMEGA

Roger Oliva, Sylvain Douté, Bernard Schmitt and the OMEGA Team
(Laboratoire de Planétologie de Grenoble)

The recent observations of the imaging spectrometer OMEGA («Observatoire Martien pour l'étude de l'Eau, des Glaces et de l'Activité») in the near infrared on board Mars Express will give us new information about the composition and physical state of Mars surface and atmosphere. Indeed OMEGA sends reflectance spectra marked by absorption features related to both of them. One of our first aims is to be able to distinguish the effects due to the atmosphere from those due to Mars surface. Based on a line by line radiative transfer model [ref 1] and on pressure and temperature profiles extracted from the Mars Climate Database [ref 2,3], our algorithm serves to compute, as effectively as possible, synthetic transmission spectrum of the atmosphere for each pixel in an OMEGA image. Next step is to divide this synthetic spectrum from the reflectance spectrum of Mars. Results are expected to be just the contribution of the surface to the reflected solar light reaching the instrument. Therefore, better surface composition studies will be achieved as modelled absorption features would be removed from the received images. Used methods and preliminary results of atmospheric correction will be presented in a poster and in a short exposition speech.

[ref1] Clough, S.A., and M.J. Iacono, Line-by-line calculations of atmospheric fluxes and cooling rates II : Application to carbon dioxide, ozone, methane, nitrous oxide, and the halocarbons. J. Geophys. Res., 100, 16,519-16,535, 1995.
[ref 2] Forget, F., Hourdin, F., Fournier, R., Hourdin, C., Talagrand, O., Collins, M., Lewis, S.R., Read, P.L. and Huot, J.-P. (1999) "Improved general circulation models of the Martian atmosphere from the surface to above 80 km," J. Geophys. Res., 104, 24,15524,176.
[ref 3] Lewis, S.R., Collins, M., Read, P.L., Forget, F., Hourdin, F., Fournier, R., Hourdin, C., Talagrand, O. and Huot, J.-P. (1999) "A Climate Database for Mars," J. Geophys. Res., 104, 24,17724,194.

Terrestrial exoplanet's atmospheres modelisation

Paillet J., Allard F., Selsis F., Hauschildt P.H.
(CRAL ENS Lyon)

In this poster we explore the eventual spectral features due to methane (CH4), carbon dioxide (CO2), dioxygen (O2) and ozone (O3) in the reflection and emission spectra of Earth-like exoplanets. We especially focus on the detectability of these species at the low spectral resolutions expected for the future Darwin/TPF space observatories. This is done using the radiative transfer code PHOENIX in a spectral synthesis mode developed for this purpose. We used density, temperature and chemical profiles of the atmosphere measured in Earth's present atmosphere but also atmospheric models for terrestrial exoplanets and early Earth's atmosphere. We investigate the variability of the spectral features due to changes in density and abundance and the detection threshold for given resolutions. We also discuss the relevance of some of these spectral lines or bands as biomarkers.

Exploring subsurface geology using radar techniques : modeling, experiments and consequences for Mars exploration

Ph. Paillou, Y. Lasne, G. Grandjean, E. Heggy, T. Farr
(OASU - UMR 5804)

For several years, we have conducted a quantitative study of radar penetration performances in various desert arid environments. This study combines both SAR (Synthetic Aperture Radar) imaging from orbital and airborne platforms and in situ GPR (Ground Penetrating Radar) measurements. Laboratory characterization of various minerals and rocks are used as input to electromagnetic models such as IEM (Integral Equation Model) and FDTD (Finite Difference Time Domain) that describe the subsurface scattering process for inversion purposes. Several test sites were explored, mainly the Sahara. Our first experiment was realized in Republic of Djibouti, an arid volcanic area which is a good analog to Mars. We observed a very little radar penetration there because of the presence of iron oxides and salts in the subsurface that make the soil conductive. A more favorable site for radar penetration was then explored in southern Egypt : the Bir Safsaf area where buried river channels were discovered using orbital SAR images. We showed how to combine SAR and GPR in order to obtain a complete description of subsurface geology down to several meters. Such field experiments were the basis for more systematic laboratory measurements of the electromagnetic properties of various rocks and minerals which were used in numerical models in order to simulate the performances of future Martian radars, e.g. MARSIS and WISDOM low frequency radars. More recently, new explorations were conducted in Mauritania in order to demonstrate radar capacities for geologic mapping and in Libya where radar discovered a double impact crater in the southern desert. More local radar experiments were also conducted on a test site located in France, the Pyla sand dune, where we observed and modeled a radar signature of subsurface water. All of these results shall be used in the context of "terrestrial analogs to Mars" studies in order to prepare for future Mars exploration using radars : it concerns both GPR instruments onboard rovers and landers devoted to the exploration of the deep subsurface and SAR imaging systems onboard orbital platforms for global mapping of the shallow subsurface geology.

Eastern Sahara geology from orbital radar : potential analog to Mars

Ph. Paillou, T. Farr, A. Rosenqvist, E. Heggy
(OASU - UMR 5804)

Much of the surface of Mars has been intensely reworked by aeolian processes and key evidence about the history of the Martian environment seems to be hidden beneath a widespread layer of debris (paleo lakes and rivers, faults, impact craters). In the same way, the recent geological and hydrological history of the eastern Sahara is still mainly hidden under large regions of wind-blown sand which represent a possible terrestrial analog to Mars. The subsurface geology there is generally invisible to optical remote sensing techniques, but radar images obtained from the Shuttle Imaging Radar (SIR) missions were able to penetrate the superficial sand layer to reveal parts of paleohydrological networks in southern Egypt. Radar remote sensing allows a unique access to subsurface information down to a depth of several meters for L-band (25cm wavelength) in arid regions. However, the very incomplete geographical coverage of SIR missions did not allow regional scale mapping of hidden hydrological and tectonic structures of East Sahara, and scientific interpretations of available data remain partial and incomplete. Nevertheless, a complete L-band radar coverage of eastern Sahara exists and has still to be exploited : it is constituted by the archives of JERS-1, a Japanese satellite for Earth observation that was operated by NASDA from 1990 to 1998. We have produced the first global radar mosaic of East Sahara (Egypt, northern Sudan, Libya, northern Chad) using JERS-1 radar data at a final resolution of 100 meters. Detailed geological analysis of the SAHARASAR mosaic is still in progress, but several promising results were already obtained. The JERS-1 radar mosaic reveals for instance a very detailed paleo-hydrological network in northern Sudan which is hardly visible on the LANDSAT-ETM scene. JERS-1 data also reveals numbers of unknown E-W faults covered by sand in southern Egypt. Finally, the radar mosaic of eastern Sahara allowed the discovery of new impact craters : a double impact in South-East Libya and a large impact field in southern Egypt. Results obtained at a continental scale for eastern Sahara indicate that a radar imaging system for Mars exploration, as the one proposed within the MEEM project, would allow a high resolution, global exploration of the near subsurface geology inaccessible to any other kind of sensor : laboratory measurements performed on terrestrial analogs for Martian soils and rocks, combined with numerical modeling, indicate that a P-Band (70 cm wavelength) SAR should penetrate at least 5 meters into the Martian surface. Such an imaging radar mission would also allow the use of radar interferometry to produce high resolution DEMs of Mars in order to improve the work initiated by MOLA with a density of measurement points at least 400 times higher. A Mars radar mission would also permit the high resolution mapping of the surface roughness that could be used as a new tool to map ? and even to perform relative dating of Martian geological units, and help define future landing sites and rover paths. An imaging radar would then provide unique data to address the origin of many enigmatic features related to the history of climate and water on Mars.

Effective Surface Temperature of Exoplanets Measured by Differential Thermal Infrared Photometry

Sarkissian Alain
(Service d'Aeronomie)

Surface temperature of exoplanets indicates the possibility of an atmosphere, with resultant implications for planet formation and evolution schemes. Seen from the Earth on orbital plane parallel to the line-of-sight, hot dynamically locked Jupiters show alternatively their day and night faces. The ratio between hot Jupiter's size and Sun like parent star radiances increases strongly with wavelength to reach values of up to 0.25 % at 10 micron for a day side at 1600 K. We present here calculations showing that harmonic signature of such amplitude with identified period can be detected by differential photometry in the infrared if geophysical parameters - air temperature, ozone and CO2- are measured simultaneously.

Gravitational clustering in a disk of planetesimals

P. Tanga, S.J. Weidenschilling, P. Michel, D. Richardson
(Observatoire de la Côte d'Azur)

The real importance of the gravitational instability in the dust disk of the early Solar System is still debated. However, in other planetary systems or in specific regions of the primordial nebula, they could have been relevant. Here we present a numerical study of a gravitationally unstable layer. Numerical limitations impose the use of large bodies, resulting in a strong gravitational stirring. However, the presence of gas drag can yield large clusters of planetesimals, observed in our numerical simulations. Inside those clusters, particle growth can take place.

Session PNPS

Oral contributions

Spectral Properties of Brown Dwarfs and Extrasolar Planets

France Allard, CRAL, Ecole Normale Supérieure, Lyon, France, Jimmy Paillet, CRAL, Ecole Normale Supérieure, Lyon, France, Travis S. Barman, Department of Physics, Wichita State University, Kansas, USA
(Centre de Recherche Astronomique de Lyon (CRAL))

We have modeled, using the atmosphere code Phoenix, the photosphere structures and spectral distribution of brown dwarfs and of all known Extrasolar Giant Planets (EGPs) to this day. Since EGPs are often brighter, more massive and larger than telluric planets, they will be more readily detected in the future transit surveys (COROT, KEPLER, SIMS, Eddington), and be the most directly observable using current technology (e.g. by nulling interferometry with the GENIE experiment). In this paper we summarize the spectral properties of EGPs as a function of their orbital distance, phase as viewed from the earth, mass and age, and type of primary star. We establish the most favorable observation conditions (i.e. maximum luminosity contrast of the planet to the primary star). We also explore uncertainties tied to the chemical composition of the atmosphere, and the presence of cloud layers, and study constraining cases such as HD209458b, OGLE-TR56b and Jupiter.

New observations of solar-like oscillations in red giant stars

C. Barban (1), J. De Ridder (1), A. Mazumdar (1), F. Carrier (2), P. Eggenberger (2), S. De Ruyter (1), J. Vanautgaerden (1), F. Bouchy (3), C. Aerts (1) (1) Katholieke Universiteit Leuven, Instituut voor Sterrenkunde, Leuven, Belgium (2) Observatoire de Geneve, Switzerland (3) Laboratoire d'Astrophysique de Marseille, Marseille, France
(Instituut voor Sterrenkunde, Katholieke Universiteit Leuven)

The study of solar oscillations or helioseismology has demonstrated the power of this tool to test the physical conditions in stellar interiors. Solar oscillations are excited by turbulent convection near the surface. Similar oscillations might then expected in stars with an external convective envelope. The detection of such oscillations in distant stars requires very high precision and stable instruments due to the very low level signal, typically from few cm/s to few m/s, in radial velocity measurements with periods ranging from a few minutes up to a couple of hours. Thanks to recent great progress in instrumentation, such oscillations have now been detected clearly in several stars on the main sequence or close to it. There have also been tentative claims of detection of such oscillations in a couple of red giants. We present here new results obtained for two red giant stars during a 2-month bi-site campaign using the CORALIE and ELODIE spectrographs.

Towards measuring dust settling in protoplanetary disks

Barriere-Fouchet, L., Pinte, C., Ménard, F., Gonzalez, J. F., Maddison, S. T.
(CRAL)

High resolution images of a few protoplanetary disks are available over a wide wavelength range, from the optical with HST , NIR with ground-based adaptive optics, to millimeter with long-baseline interferometers. Model fitting of these images have been usually restricited to one wavelength. Attempts to simultaneously fit all wavelengths with a single model indicate that the grain size distribution is likely more complex than the simple ISM one. In particular, a dependence of the maximum grain size with vertical distance above the disk midplane (vertical settling) appears to be needed.
In this contribution we present synthetic images that include more realistic vertical grain size distributions obtained from recent hydrodynamical (SPH) calculations. The calculations are three-dimensional, they include the effects of hydrodynamical forces and gas drag upon an evolving dusty gas disk. We briefly describe the numerical method. In particular, the SPH code provides vertical density profiles for the dust as a function of grain size. Radiative transfer is done with a 3D multiple scattering code to produce synthetic images in all four Stokes parameters.
Comparison with observations of a sample of resolved disks will help validate the hydrodynamical simulations and to constrain grain growth and evaporation processes in these disks, a crucial step towards understanding planet formation. We present here the case of GG Tau. Such a combination of hydrodynamical and radiative transfer calculations is needed to prepare observations with future instruments like Planet Finder or ALMA.

Probing the atmosphere of the bulge G5III star OGLE-2002-BUL-069 by analysis of microlense H alpha line
Cassan A., Beaulieu J.P., Brillant, S., Coutures C., Fouque P. et al. (PLANET Collaboration)
(Institut d'Astrophysique de Paris)
We discuss high-resolution, time-resolved spectra of the caustic exit of the binary microlensing event OGLE 2002-BUL-69 obtained with UVES on the VLT. The source star is a G5III giant in the Galactic Bulge. During such events, the source star is highly magnified, and a strong differential magnification around the caustic resolves its surface. Using an appropriate model stellar atmosphere generated by the NextGEN code we obtained a model light curve for the caustic exit and compared it with a dense set of photometric observations obtained by the PLANET microlensing follow up network. We further compared predicted variations in the H alpha equivalent width with those measured from our spectra. While the model and observations agree in the gross features, there are discrepancies suggesting shortcomings in the model, particularly for the H alpha line core, where we have detected amplified emission from the stellar chromosphere as the source star's trailing limb exited the caustic. This achievement became possible by the provision of the OGLE-III Early Warning System, a network of small telescopes capable of nearly-continuous round-the-clock photometric monitoring, on-line data reduction, daily near-real-time modelling in order to predict caustic crossing parameters, and a fast and efficient response of a 8m-class telescope to a "Target-Of-Opportunity" observation request.

Statistical and Physical properties of binaries of low-mass stars and brown dwarfs
Herve Bouy, Jerome Bouvier, Wolfgang Brandner
(LAOG/MPE)

I will present my PhD results concerning the statistical properties (frequency of binarity, distributions of separation, and mass ratio) and physical properties (orbit calculation and dynamic mass, physical properties of the individual components of binaries), for binaries of low-mass stars and brown dwarfs.

Flows around low and high mass young stellar objects : Effects of opacity and magnetic field
C. Combet, G. Murphy et T. Lery
(LUTh, Meudon et DIAS, Dublin)
During star formation, both infall of gas towards the protostar and outflows (jets ans molecular outflows) are present around class 0 and 1 young stellar objects (YSOs). Here, we present a self-similar model describing accretion and bipolar molecular outflows from one single set of equations. The gas composition directly influences the solutions. Indeed, the density in the equatorial region is inversely increasing with metallicity. This gives rise to large accretion rates onto massive protostars, such as primordial stars. We also show preliminary numerical simulations of YSO jets.

Planet migration in protoplanetary magnetized disks
S.Fromang, C.Terquem
(IAP)
About 20% of the extrasolar planets detected fo far have an orbital radius in the range 0.038-0.1 astronomical unit. However, it is likely that these planets have formed at larger distances from their host star. Tidal interaction with the disk in which they were embedded has probably led them to migrate toward the disk center. In this context, there has to be a mechanism to prevent a migrating planet from falling onto the central star. A recent analytical study has shown that the presence of a magnetic field can slow down, halt or reverse the migration of terrestrial mass planets.
Here I present 2D numerical simulations of planet migration in a magnetized disk. The results confirm the existence of magnetic resonances near the planet which modify the torque exterted by the disk on the planet. It is shown that, when the magnetic field decreases fast enough with radius, the planet migrates outward.

The solar radiative interior : gravity modes and future instrumentation
R.A. Garcia, S. Turck-Chieze, S. Couvidat, J. Ballot, S. Mathur and the GOLF-NG Team
(Service d'Astrophysique CEA-Saclay)
Today, the knowledge of the solar radiative interior is obtained by the solar acoustic modes. Thanks to the latest modes detected by SoHO the sound speed has been determined down to 0.06 Ro with a resolution of 3%. This profile is used to improve the solar model and its deviations from a static vision. The rotation profile is now clearly established down to the limit of the core (Garcia et al. 2004).
In order to progress toward the core and reduce the uncertainties in the radiative region, gravity modes should be measured. Recently, Turck-Chieze et al. (2004) have identified some patterns using GOLF data during the last solar minimum, that can be interpreted in terms of gravity modes. These candidates, with an amplitude of 2 mm/s, are at the limit of the signal-to-noise ratio and are difficult to follow when the activity increases. Their research will continue until the end of the SoHO lifetime in 2008 during the next solar minimum. In the best case, only a few mixed and gravity modes will be detected with SoHO. This is the reason why a French-Spanish collaboration is now building a prototype of a new spatial instrument, GOLF-NG, that will be tested during the Summer 2005 in the Observatorio del Teide. GOLF-NG will directly address the problem of the solar convective background noise to improve the g-mode detection.

Collapse and fragmentation of self-gravitating filaments
Hennebelle P., Peretto N., Andre P.
(0bservatoire de Paris-ENS (LERMA))
Since stars form in molecular clouds, it is rather important to understand
the physical processes that drive their evolution. However, molecular clouds are turbulent and irregular which makes comparison between the models and the observations difficult. Inside the molecular clouds, filaments are very often observed. Since these objets are simpler and more geometrical than molecular clouds, comparison between theory and observations is easier for these objects. We have undertaken the numerical modelisation of one of these filaments located in the Monoceros cloud (NGC2264C) and observed at the IRAM 30m telescope. Detailed comparisons between the model and the observational data both for the density and the velocity fields are presented and discussed.

Radiative shocks experiments with high energy density lasers : 3D geometric effects on the radiative transfer
Sébastien Leygnac
(LUTH, Observatoire de Paris-Meudon)
High Mach number (supercritical) shock waves have been studied in laboratory experiments. Observations reveal that the radiation emitted by the shock front ionizes the medium ahead of the shock. Numerical computations of the radiation field are presented, assuming a plan parrallel stationary hydrodynamic structure and considering an approximate atomic physics of the gaz (xenon) in which the shock wave propagates. This result and simple analytical solutions in cylindrical symetry are compared to 1D computations and 1D analytical solutions.

Mixing in stellar radiation zones : new theoretical results
S. MATHIS & J.-P. ZAHN
(Observatoire de Paris - LUTH)
We briefly recall the physical background of the rotational mixing occuring inside stellar radiation zones and its importance for stellar evolution. We describe its present modelization, its successes and its weaknesses. Next, we introduce the new theoretical results which allow us to treat the hydrodynamical processes simultaneously in the bulk of radiation zones and in the tachoclines, and we present our new prescription for the horizontal turbulent transport which has been derived from Couette-Taylor laboratory experiment. Finally, we show how to introduce self-consistently the effect of an axi or non-axisymmetric magnetic field, which may be responsible for the angular momentum transport in low-mass stars (internal gravity waves are another candidate). This research is aimed at improving the modelization of stellar interiors in the perspective of future astero and helioseismology missions such as COROT, EDDINGTON and GOLF-NG, and of new powerful ground-based instruments as ESPADON.

Massive star forming regions in the Magellanic Clouds : results from recent observations
F. Meynadier, M. Heydari-Malayeri
(LERMA - Observatoire de Paris)
During the last few years, we have gathered optical and near-infrared data from various massive star forming regions of the Magellanic Clouds searching for "blobs", which are high excitation Hii regions that are a particular type of Hii regions in the Magellanic Clouds.
Although a detailed scheme of massive star formation still has to be sketched, these regions are believed to bear very interesting information concerning the formation of this kind of stars. Our goal is to characterize the Magellanic "blobs" themselves, as well as their environment. Due to their small typical size of 1–5 pc, the observation of "blobs" at the distance of the Magellanic Clouds requires high angular resolution. Therefore we have used the HST and large ground-based telescopes, NTT and VLT, to study various aspects of objects and their environments. We will present our most recent results in this field.

Massive protostellar cores : Galactic distribution and dynamics
Minier V., Burton M.G., Pestalozzi M.R.
(Service d'Astrophysique, CEA Saclay)
Massive stars are born in very obscured regions, far away from us and within dense (proto)stellar clusters. For these reasons, the study of the earliest phases of massive star formation requires the use of high angular resolution tools and cold gas probes. Methanol masers and (sub)millimetre continuum emission satisfy these requirements. Methanol masers are exclusively associated with the earliest stages of massive star formation, and appear before the development of any type of HII regions. (Sub)millimetre emission traces cold dust, and potentially reveals the youngest protostellar objects. The combination of both maser and mm continuum observations has allowed us to identify massive protostars in the Galactic plane at different evolutionary phases. SEDs were built for the protostellar cores and massive "class 0" protostars were observed. Moreover, high angular resolution observations of masers were carried out to probe the dynamics (disks, shocks) of the protostellar cores at scales of 1-1000 AU.

Brown dwarfs and the substellar mass function of young open clusters

E. Moraux, J. Bouvier
(IoA, Cambridge, UK)

From the detection of several tens of brown dwarfs in young open clusters (Pleiades, NGC 2516, Blanco 1), we derived new estimates of the substellar mass function down to 30 Jupiter masses (0.03 solar masses). Implications for the brown dwarf formation process and for the universality of the IMF will be discussed.

Asteroseismology with HARPS : first observations and new insights on a Corot target

B Mosser, E Michel, R Samadi, C Catala, A Baglin (LESIA) F Bouchy (LAM), F Thévenin (OCA)
(Observatoire de Paris)

A 10-night asteroseismic observation programme has been conducted in January 2004 with the new spectrometer HARPS at ES0 3.6-m telescope. This instrument, dedicated to the search of exoplanets, presents currently the best performance for radial velocity measurements. The selected target, the 6th magnitude F2V star HD 49933, was chosen among the prime targets of Corot, the European space mission dedicated to characterize stellar oscillations mode with high precision photometry measurements.

We will present the first results, and develop them in different directions. We first obtain unique indications on the solar-like oscillations of the target, in a previously unexplored region of the HR seismic diagramme. We will relate these observations to the preparation of the Corot mission. The capability of Harps for ground-based asteroseismologic observations will be discussed : even if the data reduction is still in progress, it is already clear that simultaneous measurements (in network, or from the South Pole) are necessary to make the most of ground-based asteroseismology.

Shear Alfvén modes in magnetized spherical shells

D. Reese, F. Rincon, and M. Rieutord
(Laboratoire d'Astrophysique de Toulouse et Tarbes)

An investigation of shear Alfvén waves inside a spherical shell is carried out, in which the background magnetic field is dipolar and resistive effects are taken into account. Numerical results indicate two basic behaviours for both the axi-symmetric and non-axisymmetric cases. Poloidal modes appear to remain regular, except for internal shear layers, when kinetic and magnetic diffusivities become arbitrarily small, whereas toroidal modes become singular. Analytical results are provided for the axisymmetric toroidal case. The corresponding eigenvalues also exhibit different behaviours in the two cases.

Poster contributions

Metallicity of the pre-main sequence double-lined, eclipsing binary RS Cha

E. Alecian, C. Catala, C. Van't Veer, M.J. Goupil, L. Balona
(Observatoire de Paris)

A large number of spectra of the PMS eclipsing binary RS Cha (Herbig Ae star) were obtained with the GIRAFFE pectrograph at the SAAO, at 35000 resolution. We use these spectra to measure the metallicity of both components of his binary system. Knowledge of this metallicity, together with determinations of mass and radius for both components, will serve as powerful constraints for the modelling of the internal structure and evolution of this system, as well as validation for the CESAM stellar evolution code for the PMS phase at intermediate masses. In this poster, we present the method we use for measuring the metallicity of both components, as well as the first results.

New far-wing line profiles of alkali metals perturbed by H2 for brown dwarfs

Allard, N. F., IAP, 98 bis, Boulevard Arago, 75014 Paris, Allard, F., CRAL, Ecole Normale Supérieure, Lyon, et al.
(Centre de Recherche Astronomique de Lyon (CRAL))

Alkali metals are the last optical opacity source to condense out to grains in cool sub-stellar atmospheres. Their resonance lines provide a pseudo-continuum that shapes the emited spectrum from the UV to the Near-Infrared spectral range. Model atmosphere, synthetic spectra and color predictions rely therefore on an adequate treatment of the far wings of alkali resonance lines in presence of high densities of H2 perturbers. In this poster, we present new calculations of far-wing profiles of alkali lines perturbed by H2 for the conditions prevailing in brown dwarf atmospheres.

FeII emission lines in Be stars

Arias, M.L., Zorec, J., Ballereau, D., Chauville, J., Cidale, L.
(Observatoire de Paris-Meudon)

FeII emission lines in spectra of early Be stars have FWHM fairly large,
which reveal that these lines are formed in regions of the circumstellar envelope which are not far from the central star. Some FeII emission line
profiles have a peculiar shape called steeple-like. Current interpretations
of this line shapes evoke eccentric or ellipsoidal circumstellar envelopes.
We show in this paper that steeple-like profiles can be formed by rotating
and expanding circular gaseous rings probably produced by discrete mass ejections of the star.

Convection/rotation interaction in young solar-like stars : 3-D hydrodynamic simulations

J. Ballot, A.S. Brun & S. Turck-Chièze
(SAp/CEA - Saclay)

The study of the relationship between X-ray emission and rotation in young stars (Feigelson et al. 2003) and observations of magnetic-field topology of such stars with Zeeman-Doppler Imaging (Donati et al. 2003) indicate that the dynamo processes differ from those operating in main sequence stars. In this context, 3-D numerical simulations have been started. The first step is to study the purely hydrodynamic case. We have simulated the convective shell of a young sun (10 Myr) with the Anelastic Spherical Harmonic (ASH) code. We have studied the angular momentum transfer, the meridional circulation and the differential rotation in this shell. We have also studied the effects of different rotation rates (1, 2 and 5 solar rate).

Simulation of convection in pulsing stars : description of the problem and difficulties.

I. Baraffe
(ENS-Lyon, CRAL)

The goal of this presentation is to analyse the problem of the convection in pulsing stars, of radial oscillating type excited by the kappa-mechanism (Cepheids, RR-Lyrae, AGB, etc...) and describe the difficulties encountered to resolve this problem by multi-dimensional numerical simulations.

The PLANET microlensing campaign : Implications for planets around galactic disk and bulge stars

Beaulieu, J.P., Cassan A., Coutures C., Fouque P. et al., (PLANET Collaboration)
(Institut d'Astrophysique de Paris)

With round-the-clock monitoring of galactic bulge microlensing events, the PLANET experiment constrains the abundance and can yield the discovery of planets down to the mass of earth around galactic disk and bulge stars. Data taken until 1999 imply that less than 1/3 of bulge M-dwarfs are surrounded by jupiter-mass companions at orbital radii between 1 and 4 AU. The current rate of microlensing alerts allows 15-25 jupiters and 1-3 earths to be probed per year with the set up we have from 2003. We will present the current status of the search combining the results obtained during the 2000-2003 campaign.

Survey for the earliest phases of the formation of OB stars, and OB clusters
Sylvain Bontemps, Frederique Motte, Nicola Schneider
(L3AB/Observatoire de Bordeaux)
The results of the first unbiased survey for precursors of OB stars in their earliest protostellar phases will be presented, mainly from a large-scale dust continuum imaging of the Cygnus X molecular complex at only 1.7 kpc from sun. I will put these results in the perspective of the formation of OB clusters, and in the global framework of questioning the main process of forming OB stars, namely by coalescence or by a direct collapse.

Stellar magnetic activity and dynamo effect
A.S. Brun
(CEA-Saclay - Service d'Astrophysique)
We will present our efforts to understand magnetic activity of stars starting from three-dimensional numerical simulations with massively parallel computers of the heart and convective enveloppes with MHD ASH codes. We will classify in terms of dynamo alpha^2, alpha-Omega or alpha^2-Omega the various types of dynamo and magnetic surface activity present in the various stellar types. We will show that the 22 years solar cycle is certainly related to the presence of a strong shearing zone at the base of the convective zone (known as tachocline) and that without it magnetic activity is certainly irregular.

Interactions between shock waves, turbulence and magnetic field in the atmospheres of post-main sequence stars.
Merieme Chadid
(OCA - GEMINI)
We know from laboratory experiments that the turbulence level of gas incrases when it is crossed by a shock wave. Theory correctly predicts the amplification when the mach number is small. But for larger Mach numbers, the only three available theories predict amplification rates that diverge by few orders of magnitude ! Due to technological limitations, laboratory experiments cannot provide a test. In particular, the existence of a supersonic turbulence is still unknown. We propose to determine the amplification for a Mach number in the range 10-15 by observing the strong shock wave that occurs within the pulsating atmosphere of of the largest amplitude pulsating stars.

Sub-arcsecond dusty environment of Eta Carinae
O. Chesneau, M. Min et al.
(Max-Planck Institut für Astronomie)
The core of the nebula surrounding Eta Carinae has been observed with the VLT Adaptive Optics system NACO and with the interferometer VLTI/MIDI. Narrow-band images at 3.74 and 4.05 micron reveal the butterfly shaped dusty environment with an unprecedented spatial resolution. A void region around the central source was discovered, whose radius corresponds to the expected dust sublimation radius. Fringes have been obtained in the Mid-IR which reveal a correlated flux of about 100 Jy situated 0.3" south-east from the photocenter of the nebula at 8.7 which corresponds with the location of the star as seen in other wavelengths. This correlated flux is partly attributed to the central object and these observations provide an upper limit for the SED of the central source from 2.2 micron to 13.5 micron. Moreover, we have been able to spectrally disperse the signal from the nebula itself at PA=318 degree, i.e. in the direction of the bipolar nebula (310°) within the MIDI field of view of 3". A large amount of corundum (Al2O3) is discovered, peaking to the south-east from the star, whereas the dust content of the Weigelt blobs is more dominated by silicates.

A micro-glitch observed on a recycled millisecond pulsar
Cognard I. Backer D.C.
(LPCE)
We report on the observation of a very small glitch observed for the first time in a millisecond pulsar, PSR B1821-24 located in the globular cluster M28. Timing observations were mainly conducted with the Nançay radiotelescope (France) and confirmation comes from the 140ft Green Bank telescope data. This event is characterized by a rotation frequency step of 3nHz or 10^{-11} in fractional frequency change. This glitch follows the main characteristics of those in the slow period pulsars, but is two orders of magnitude smaller than the smallest ever recorded. Such an event must be very rare on millisecond pulsars since no other glitches have been detected when the cumulated number of years of millisecond pulsar timing observations up to 2001 is around 500 for all these objects. We should however keep in mind that the pulsar PSR B1821-24 is one of the youngest among the old recycled ones. While this event happens on a much smaller scale, the required adjustment of the star to a new equilibrium figure as it spins down is a likely common cause for all glitches.

The GAIA mission : short presentation and progress report

F. Crifo, for the GAIA team
(Obs. de Paris, GEPI)

After the success of HIPPARCOS, the GAIA mission has been selected as a cornerstone by ESA , and is expected for a launch around 2010. About 1 billion stars will be observed (up to magnitude 20), as well as galaxies, quasars, and Solar System objects. I will describe briefly : - the 3 instruments (astrometry, photometry, radial velocities), and their presently expected performances ; - the french contribution ; - the progress of the work and the choices still to be made ; - a few close-ups concerning stellar physics.

Structuring of stellar flows in the scale-relativistic approach - Application to Planetary Nebulae.

da Rocha D., Nottale L.
(Luth - Observatoire de Meudon)

A large class of astronomical stellar systems (e.g., planetary nebulae (PNe), supernovae, LBV stars or young stars in formation..) shows a similar behavior in their accretion/ejection phase. We generalize the standard equations of hydrodynamics by including the effects of the fractality of particle trajectories and of local irreversibility, which allows us to integrate them in terms of a macroscopic generalized Schrodinger equation. The geometric structures allowed by the solutions (which are analogous to the incoming and outcoming spherical waves of a scattering process in a central Kepler potential) are related to the conservative quantities : E, L^2, and Lz. We find that the resulting matter density is characterized by a probability distribution of ejection angles that have peaks for some specific values. A morphogenetic classification of the obtained shapes is presented. These results are supported by the structures observed in the latest HST images. We theoretically predict a discretization of the most probable morphologies, including the values of angles and intensities, in connection with the quantization of the possible values of the energy and angular momentum : these predictions could be checked by future observations of high resolution images and of velocity fields.

Models of low metallicity AGB stars

T. Decressin, L. Siess, C. Charbonnel
(Observatoire de Genève)

We compute models of intermediate mass stars from the pre-main sequence up to the end of the thermal pulse phase on the asymptotic giant branch with the code STAREVOL. Models of 6 solar masses are presented for two metallicities which correspond respectively to the metallicity of the LMC and of the most metal-poor globular clusters (Z=0.008 and 0.0001). These models include the most up-to-date input physics (nuclear reactions, eos, mass loss, ...). We focus on the the nucleosynthesis that occurs in these objects and on the corresponding stellar yields.

Stellar differential rotation and inclination angle of hot fast rotators from spectro-interferometry

Domiciano de Souza, A., Zorec, J., Vakili, F., Jankov, S.
(Max Planck Institut fur Radioastronomie)

Differential interferometry (DI) combines high spectral and spatial resolutions. It is particularly suited to study large scale motions in stellar atmospheres. In this paper We investigate the use of the DI combined with the Fourier transform to study the latitudinal differential rotation in early type stars with fast rotation. The use of spectral lines sensitive to changes of temperature and surface gravity help to disentangle clearly the differential rotation parameter and the stellar aspect angle.

ESPaDOnS the new generation stellar spectropolarimeter

Donati JF, Catala C, Landstreet JD
(Laboratoire d'Astrophysique, Observatoire Midi-Pyrenees)

Designed and constructed at Observatoire Midi-Pyrénées (OMP) in France, ESPaDOnS, the new generation stellar spectropolarimeter, is now fully operational at OMP and is waiting for being installed at CFHT. I will present the result of the extensive series of laboratory tests that has been carried out demonstrating that the instrument behaves as expected.

Search for abundance stratification in the atmosphere of the HgMn star HD143807

Dubaj D., Monier R., Alecian, G. and LeBlanc F.
(Observatoire de Strasbourg)

Selected lines of Ti,Cr,Mn,Fe,Y and Zr have been observed with GECKO spectrograph attached to the 3m60 telescope at CFH for 2 HgMn stars and 2 normal B stars. These lines are located shortwards and longwards of the Balmer discontinuity in order to probe the atmosphere at different optical depths regimes and look for the putative vertical stratification of these elements. We discuss here preliminary adjustements of the observed profiles to synthetic spectra computed for homogeneous atmospheres for the HgMn star HD143807.

A high angular resolution survey for multiple systems among protostars

Gaspard Duchene, Jerome Bouvier, Sylvain Bontemps, Philippe Andre, Frederique Motte
(LAOG)

We are conducting a systematic survey of embedded young stellar objects in four nearby star-forming regions (Orion, Taurus, Ophiuchus and Serpens) to derive the frequency and properties of multiple systems immediately after the prestellar cores have fragmented and collapsed but before dynamical interactions within young clusters can destroy the wider systems. We have already used the wide-field infrared camera at CFHT (CFHT-IR) and the adpative optics system on VLT (NAOS) to cover the 15-1400 AU separation range and will extend in the upcoming weeks our survey to even tighter separations with VLTI/MIDI observations, down to a scale of a few AUs only. We will present our first results and their implication on the star formation process.

Far-wing profiles of the Lyman alpha line of H perturbed by H : quantum calculations

F. Lique, W.-Ü L. Tchang-Brillet, A. Spielfi edel and N. Feautrier
(LERMA)

In the so-called one-perturber approach, free-bound and free-free transitions contribute to absorption in the wings of atomic lines perturbed by collisions. In this poster, we present new calculations for the conditions prevailing in stellar atmospheres. Application to the calculation of the Lyman alpha quasi-molecular satellite due to H-H collisions is presented. The initial and final wave functions of the binary complex are quite general, taking into account non-adiabatic effects between the adiabatic electronic states. We compare the results that include the rotational coupling between the upper $B1Sigma_u^+$ and $C1P_u$ states with the results obtained in an adiabatic approach. It is shown that no significant difference between these results is obtained so that the total absorption coefficient may be calculated by summing up the contributions of the different electronic transitions calculated in the Born-Oppenheimer approximation. As expected, discrepancies between quantal and semi-classical results appear at low temperatures, which are reduced as the temperature increases.

The behaviour of the Fe II emission lines of RR Tel, a symbiotic mira, during an obscuration event

M. Friedjung. D. Kotnik-Karuza,K. Exter, F,P. Keenan, D.L.Pollacco
(Instituit d'Astrophysique)

RR Tel, like other symbiotic miras, is a binary containing a giant, which is a mira variable, and a compact component. According to present day ideas, the latter is a white dwarf, accreting from the mira wind. The wind contains dust ; during "obscuration events" absorption due to this dust increases temporarily. At present we are comparing relative fluxes of optical Fe II emission lines at two dates, of which one was during an obscuration event and the other not during such an event, in order to obtain information on the changes in the distribution of dust between the two dates and the physics involved.

Evolution of massive and magnetized disks

S.Fromang, S.Balbus, C.Terquem, J.P. De Villiers
(IAP)

Protoplanetary disks are likely to be very massive in the early phases of their evolution. As a consequence, they are subject to gravitational instabilities that transport angular momentum outward. MHD turbulence resulting from the magnetorotational instability can also develop when the disk is weakly magnetized. We present the first 3D global simulations of massive and magnetized disks. These simulations show that gravitational instabilities and MHD turbulence strongly interact with each other. A high frequency mode excited by the turbulence interferes with a gravitationnally unstable mode. Their coupling causes the mass accretion rate onto the central objet to vary periodically with time.

Chandra observation of an unusually long and intense X-ray flare from a young solar-like star in M78

N. Grosso, T. Montmerle, E.D. Feigelson, T.G. Forbes
(Laboratoire d'Astrophysique de Grenoble)

LkHA312 has been observed serendipitously with the ACIS-I detector on board Chandra with 26h continuous exposure. This Halpha emission line star belongs to the star-forming region M78 (NGC2068). From the optical and NIR data, we show that it is a pre-main sequence (PMS) low-mass star with a weak NIR excess. This genuine T Tauri star displayed an X-ray flare with an unusual long rise phase (~8h). The X-ray emission was nearly constant during the first 18h of the observation, and then increased by a factor of 13 during a fast rise phase (~2h), and reached a factor of 16 above the quiescent X-ray level at the end of a gradual phase (6h) showing a slower rise. To our knowledge this flare, with 0.4-0.5 cts/s, has the highest count rate observed so far with Chandra from a PMS low-mass star. By chance, the source position, 8.2' off-axis, protected this observation from pile-up. We make a spectral analysis of the X-ray emission versus time, showing that the plasma temperature of the quiescent phase and the flare peak reaches 29MK and 88MK, respectively. The quiescent and flare luminosities in the energy range 0.5–8keV corrected from absorption (N_H 1.7E21 cm^{-2}) are 6E30erg/s and 1E32erg/s, respectively. The ratio of the quiescent X-ray luminosity on the LkHA312 bolometric luminosity is very high with $\log(L_X/L_{bol})$= -2.9, implying that the corona of LkHA312 reached the 'saturation' level. The X-ray luminosity of the flare peak reaches 2% of the stellar bolometric luminosity. The different phases of this flare are finally discussed in the framework of solar flares, which leads to the magnetic loop height from 3.1E10 to 1E11 cm (0.2-0.5 R*, i.e., 0.5-1.3 $R_\odot$).

Substellar IMF study of the Taurus region : 3 new young brown dwarfs in the Taurus star forming region

S.Guieu, J.L Monin, C.Dougados
(Laboratoire d' Astrophysique de Grenoble)

Recent studies of star formation in the substellar range reveal a deficit of brown dwarfs in Taurus, they would be twice fewer in Taurus than in denser regions like Orion. We have explored Taurus in a wide field photometric survey carried out with CFHT12K and MEGACAM. This survey covers a surface of about thirty square degrees, it will enable us to confirm if the deficit of brown dwarfs in Taurus is real or if it is the consequence of a model where the brown dwarfs are ejected from multiple systems before having accreted the 0.08 solar mass necessary for hydrogen combustion. We present here the preliminary results of the spectroscopic follow up for 45 substellar candidates of this survey. After having presented our method of spectral classification, and the criteria of selection of brown dwarfs in the young population, we will show the discovery of 3 brown dwarfs and 4 very low mass stars belonging to the Taurus, and we will conclude on the implication of these new results on the substellar IMF in Taurus.

The structure of circumstellar accretion discs : does self-gravity prevent stellar irradiation from heating up the disc ?

Lachaume, R.
(Max-Planck-Institut für Radioastronomie)

Accretion discs aroung young stars are fascinating not only because they are thought to give birth to planets, but also for the challenging complexity of the physical phenomena they conceal.
In particular, irradiation from the central star is generally accepted as an efficient heating process in the outer zones of these discs, resulting in a flared structure and a strong IR excess. In massive discs the gravity of the disc (self-gravity) tends, to the contrary, to flatten the disc around the midplane and should strongly decrease the IR excess. In some T Tauri discs (e.g. T Tau, SU Aur) the latter phenomenon is likely to have an influence at 10-100 AU from the star. However, no simulation has included both phenomena and self-gravity has been mostly studied in discs heated by the viscosity only.
Using a 1+1D transfer code after Malbet, Lachaume, & Monin (2001) taking viscous heating and irradiation into account, I investigate the influence of self-gravity in irradiated circumstellar discs.

Circumstellar atomic hydrogen

Le Bertre and Gerard
(LERMA, Observatoire de Paris)

Most of the matter in circumstellar shells around red giant stars is in hydrogen and most of this element should be in atomic or molecular form. However, up to now, atomic hydrogen has remained largely undetected due to the weakness of its emission and to the competing emission from interstellar hydrogen on the same line of sight. The low level lines of molecular hydrogen are in the infrared range and difficult to observe from the ground.
With the renovated Nancay Radiotelescope we have undertaken a new search for the atomic hydrogen emission line at 21 cm in the direction of red giants of the first branch, AGB stars and post-AGBs, including PNs. We discuss the difficulties related to the detection of the HI emission from circumstellar shells and present our results on a few illustrative cases.

L'etoile Wolf-Rayet WR137

Laure Lefevre
(Observatoire de Strasbourg)

We present the results of an optical spectroscopic study of the the $WC7pd + O9$ Wolf-Rayet binary HD192641 (WR137) from 1986 to 2000. These data cover the dust-formation maximum in 1997. Combining all available measurements of radial velocities, we derive, for the first time, a spectroscopic orbit with period 4766 ± 66 days (13.05 ± 0.18 years). In order to reveal any additional periodic patterns in the optical spectra, we apply a Temporal Variance Analysis along with periodogram analysis to all the spectra taken during the intense multi-site monitoring in 1999.
The periodogram analysis yields a small-amplitude modulation in the absorption troughs of the C 4 λ5801, 5812 and He 1 λ5876 lines with a period of 0.826 days, which could be related either to pulsations or large scale rotating structures as seen in the WN4 star EZ Canis Majoris (WR6). A wavelet analysis was also performed, which enabled us to isolate the small structures (emission subpeaks) associated with density enhancements within the wind of the Wolf-Rayet star. This analysis allows us to follow density enhancements appearing as narrow subpeaks on the tops of the strong emission lines of C 3 λ5696 and C 4 λ5801, 5812 for several hours. Adopting a β wind-velocity law, from the motion of individual subpeaks we find a β value which is significantly larger than the canonical value $\beta \simeq 1$ found in O-star winds.

Rotational inversion for specific solar-like stars

Lochard, J. Samadi, R. Goupil, M.J.
(LESIA (Obs. de Meudon) / IAS (Orsay))

We show from artificial data that it is possible to invert in rotation solar-like oscillations for specific stars. We place ourselves in the COROT mission framework and proceed to a rigorous mode selection. The rotational splittings are inverted for different conditions ranging from the ideal to more realistic cases.

Emission stars in Magellanic Clouds with ESO-WFI-spectrograph

C.Martayan,A-M.Hubert,M.Floquet,D.Baade,J.Fabregat
(Observatoire de Meudon)

-We used the ESO Wide Field Imager(WFI) in spectroscopic mode(very low resolution) in order to search and detect stars with Halpha emission line in the Large & Small Magellanic Clouds. We present our detection methods and our first results. -We used the ESO-WFI-spectro with Rc filter in order to detect new Be stars in NGC6611 and Westerlund1. We present the results of this study and compare with previous studies. -And we compare with our VLT-FLAMES studies(10/2003,04/2004).

Be stars in Magellanic Clouds, the first results with VLT-FLAMES

C.Martayan,A-M.Hubert,M.Floquet,Y.Fremat,C.Neiner, J.Fabregat,P.Stee
(Observatoire de Meudon)

We used the VLT-FLAMES in order to study B and Be stars in the Magellanic Clouds. We present our first results : new Be stars, fundamental parameters :Teff, logg, Vsini, etc.

Carbon-rich metal-poor stars.

T. Masseron, B. Plez, F. Primas, S. Van Eck, A. Jorissen
(ESO,GRAAL)

A new class of carbon-rich stars was revealed by large survey of very metal-poor objects. The abundance peculiarities of more metal-rich objects, called CHstars, were commonly explained by a mass transfer from a more evolved companion. Our present analysis of carbon enhanced objects includes both metal-rich and metal-poor objects in order to determine the link between the two classes. The determination of abundances is based on high resolution and high signal to noise spectra obtained with VLT2/UVES instrument. We will present the results and the compatibility with such an hypothesis. We will also discuss the preliminary results of our ongoing radial velocity monitoring.

Advances in the modelization of binary systems : revisiting the equilibrium tide

S. MATHIS & J.-P. ZAHN
(Observatoire de Paris - LUTH)

In this work, we present new theoretical advances in the modelization of the equilibrium tide in the convective envelope of solar-type binary stars. We take into account the two-dimensional character of the rotation law in the convection zone and the inclination of the spin of each component with respect to the orbital one. Following the method of Zahn (1966) we first derive the adiabatic tide which is in phase with the perturbing potential exerted by the companion. Next, we derive the dissipative tide which is in quadrature with it, using the crude MLT eddy-viscosity to modelize the action of turbulence on the large scale tidal flow. Finally, we discuss the impact of those processes on the dynamical evolution of binary systems. Note that our results may be applied as well to giant planets and to exo-planets, since these possess also a convection zone.

Linear Polarisation of Field M-dwarfs

Francois Menard, Xavier Delfosse
(Laboratoire d'Astrophysique de Grenoble (LAOG))

Aperture linear polarisation measurement obtained with the STERENN polarimeter, at the Pic-du-Midi observatory, are presented for 20 nearby field dwarfs spanning spectral range M1 to M6. All measurements are compatible with a null polarisation. These results extend our previous measurements of nearby qultra cool dwarfs (from M9 to L8, Menard, Delfosse & Monin 2002). They suggest that in the warmer earlier dwarfs, dust is probably either fully absent (for the warmer ones) or completely homogeneously mixed in the atmosphere, both resulting in a null net polarisation.

Abundances of A and F main sequence stars in open clusters as constraints to self-consistent models including transport processes

Monier, R. and Richard, O.
(GRAAL)

The status of an on-going program of abundance determinations in A and F dwarfs in open clusters of known ages will be sumarized. So far observing time has been alloted to obtain high reolution high signal to noise echelle spectra of A and F dwarfs in several northern open clusters observable from OHP. A number of these observations have already been carried out with the ELODIE spectrograph complemented with AURELIE spectra in the red for the Alpha Persei cluster (age : 70 Myrs) and the Pleiades (135 Myrs) and Praesepe (730 Myrs). Data for 2 other clusters : IC 2391 (45 Myrs) and M7 (299 Myrs) were retrieved from the UVES archive. Determinations of abundances for several chemical elements with $Z < 30$ allow to set constraints on the transport processes that take place in the enveloppes of these stars. Self-consistent models evolutionnary models are presented for a few of these clusters.

A high resolution spectral atlas for the sharp-lined A1V star HD 72660

Monier, R. and Dubaj, D.
(GRAAL)

The coaddition of a few well-exposed spectra of HD 72660 obtained with the ELODIE echelle spectrograph at R = 40000 and S/N = 250 has allowed us to construct a spectral atlas from 3920 A to 6800 A. This is complemented with archival IUE and STIS spectra in the UV range from 1200 A to 3200 A to provide an extended UV to optical spectral atlas of this very slow rotator. The lines have been identified by matching a synthetic spectrum calculated with Hubeny and Lanz's synthesis code.

Observations at Télescope B. Lyot (Pic du Midi)

D. Mouillet et al
(Observatoire Midi-Pyrenees)

In the late 90s, the infrastructures and the observation equipments such as the 2-m Telescope B. Lyot were re-organized. This period is over. This presentation informs the observers community (not only but mainly in stellar physics domain) on the current situation, the observing possibilities at the TBL, and the under-going evolution to ensure an international competitivity now and in the coming years. We will emphasize some specific capabilities such as : unique spectro-polarimetric measurement accuracy (with the current instrument Musicos and the development of Narval), possibility for variable phenomena surveys, possibility to accept various visitor instruments.

The conversion factor from radial to pulsation velocity and the distances determination of classical cepheids

N.Nardetto, A. Fokin, D. Mourard, Ph. Mathias, P. Kervella, D. Bersier.
(Observatoire de la Côte d'Azur)

The distance of galactic cepheids can be derived through the interferometric Baade-Wesselink method. The interferometric measurements lead to angular diameter estimations over the whole pulsation period, while the stellar radius variations can be deduced from the integration of the pulsation velocity. This latter is linked to the observational velocity deduced from line profiles, thanks to the so-called projection factor p. The knowledge of p is currently an important limiting factor of this method of distances determination. Thanks to spectroscopic observations of δ Cep, we have constrained a self-consistent and time-dependent model of this star in order to model its atmosphere dynamical structure and to synthesize the consequent line profiles. Different kinds of radial and pulsation velocities are then derived to study the projection factor. In particular, we compile a suitable average value for the projection factor related to different observational techniques, such as spectrometry, interferometry in wide band or in spectral lines. We show that the impact on the average projection factor and consequently on the final distance deduced from this method is of the order of 6%. We also study the impact of a constant or pulsation phase dependent value for the p-factor on the cepheid distance determination. We conclude on this last point that if the average value of the projection factor is correct, then the impact of the time-dependence is not significant as the error on the final distance is of the order of 0.2%.

The X-ray emission from Young Stellar Objects in the rho Ophiuchi dark cloud as seen by XMM-Newton
H. Ozawa, N. Grosso, T. Montmerle
(Laboratoire d'Astrophysique de Grenoble)
We observed the dense core F of the rho Ophiuchi dark cloud, an active star-forming region located at 140 pc, with the XMM-Newton Observatory with an exposure of 33 ks. We detect 87 X-ray sources within the 30' diameter field-of-view of XMM-Newton. We compared the positions of XMM-Newton X-ray sources with previous X-ray and infrared (IR) catalogs : 25 new X-ray sources are found from our observation ; 43 X-ray sources are detected with both the XMM-Newton and Chandra observatories ; 68 XMM-Newton X-ray sources have near-IR counterparts from comparison with 2MASS catalog. We show that XMM-Newton and Chandra have comparable sensitivity for point source detection when the exposure tie is identical. We detect X-ray emission from 7 Class I sources, 26 Class II sources, and 17 Class III sources. The X-ray detection rate of Class I sources is very high (64 %), which is consistent with previous Chandra results on this area. We show that 15 X-ray sources are new class III candidates, which contributes to the census of YSOs. We also detect X-ray emission from two bona fide brown dwarfs, GY310 and GY141, out of 3. We extracted X-ray light curves and spectra from these YSOs, and find some of them showed weak X-ray flares.

A bright impulsive X-ray flare from a T Tauri star in L1641-N region
H. Ozawa, N. Grosso, T. Montmerle
(Laboratoire d'Astrophysique de Grenoble)
We observed an active starforming region L1641-N in the Orion A giant molecular cloud with ESA's X-ray astronomical observatory XMM-Newton for 47 ks. We detected 174 X-ray sources within the 30′ diameter field-of-view of XMM-Newton. A bright X-ray flare was observed from an emission line star V988 Ori with Hα EW of 4.8 Åduring the observation.

Exact vs. Gauss-Seidel numerical solutions of the non-LTE radiation transfer problem
Carine QUANG, Frédéric PALETOU, Loïc CHEVALLIER
(OMP, LATT)
Although published in 1995 (Trujillo Bueno & Fabiani Bendicho, ApJ 455, 646), the Gauss-Seidel method for solving the non-LTE radiative transfer problem has deserved too little attention in the astrophysical community yet. Further tests of the performances and of the accuracy of the numerical scheme are provided.

The close molecular environnement of Miras and supergiants
G. Perrin, S.T. Ridgway
(Observatoire de Paris / LESIA)
We have observed Mira-type stars and supergiants with an infrared interferometer in the K and L bands as well as in bands of absorption of H2O and CO and in continuum bands. The size of objects increases in narrow bands. This is interpreted for Mira stars by a molecular layer of about 2 stellar radii at 2000 K. The same conclusion applies to supergiants albeit with a layer closer to the star. Recent measurements taken with MIDI confirm these conclusions. We show in this presentation the impact of these observations. In particular they clearly lead to the conclusion that Mira stars are fundamental pulsators.

High-angular resolution diagnostics : disc winds in young stars
N. Pesenti, C. Dougados, S. Cabrit, J. Ferreira, P.J.V . Garcia, D. O'Brien
(Thesard)
The various stellar wind models require a magnetocentrifugally accelerating process. Obtaining direct constraints on the different mechanisms is only possible by observing collimating and accelerating regions, very close to the star (10 AU). As microjets (a few hundred AU) from T Tauri stars are not very embedded, they provide good laboratories to test current ejection models. Thanks to the advent of near-infrared instruments with high angular resolution (NAOS/VLT, AMBER/VLTI), the [Fe II] ion is potentially a powerful tracer of the jet structure. We investigate [Fe II] near-IR lines and we also report a model-independent method to determine the gas phase abundance in jets. Using various types of MHD disc wind model, we compare synthetic maps and recent observations of jets in near-IR. The detection of rotation signatures in the DG Tau jet has recently opened new prospects to constrain MHD ejection models. Indeed, rotation is intrinsically associated with the launching process. We examine possible biases affecting the relation between detected rotation signatures and true azimuthal velocity.

Solar-type stars in open clusters and sismology

Laurent Piau, Jerome Ballot, Sylvaine Turck-Chieze
(Institut d'astronomie, Universite Libre de Bruxelles)

The surface oscillations of solar-like stars provide precious informations on their global characteristics (mass, composition) and structure. The open-clusters
reveal particularly interesting in this respect. We have built stellar models of Hyades stars for different masses and plausible ages and compositions of this cluster. Several seismic quantities were subsequently evaluated. I will address the question of performances necessary to complete precise seismic observations for solar-like Hyades. Then I will present our prospective work in asteroseismology and I will show how the analysis of the collective seismic effects can improve our knowledge on these stars. For instance the relation between the acoustic radius of the inner radiative core and the effective temperature reveals extremely sensitive to the convective efficiency in the superadiabatic layers. This relation should allow to set constraints on convective efficiency and therefore on the hydrodynamical simulations of convection.

On the Estimation of Grain Size Distributions in Protoplanetary Disks

Pinte, C., Menard, F., Duchene, G., Augereau, J.C., McCabe, C.
(LAOG)

Studying the scattered light intensity profiles of resolved protoplanetary disks may help to constrain the optical properties of the dust they contain. This is so because the outcome of the scattering process, i.e., the emergent intensity and polarisation profiles are strongly dependent on the scattering geometry but also on the grain properties (size, shape, composition). In this poster we will show, through two examples, that information can indeed be gathered regarding the dust properties in disks. However, because the parameter space is large, solutions are generally not unique. Nevertheless, multi-wavelenth studies, and consideration of the linear and/or circular polarisation provide additional constraints that allow to refine the solutions to a useful range.

Bimodal distributions of rotational velocities of late B and A-type stars

Royer, F. (Observatoire de Genève, Suisse) Zorec, J. (Institut d'Astrophysique de Paris) Gómez, A. (Observatoire de Paris-Meudon)
(Observatoire de Genève)

Using highly homogeneous $v \sin i$ parameters determined for a large sample of late B and A-type stars cleansed from objects presenting the Am and Ap phenomenon as well as from all known binaries, we show that late B and early A-type main-sequence stars have genuine bimodal distributions of true equatorial rotational velocities due probably to phenomena of angular momentum loss and redistribution the star undewent before reaching the main sequence. A striking lack of low rotators is noticed among intermediate an late A-type stars. The bimodal-like shape of their true equatorial rotational velocity distributions could be due to evolutionary effects.

3D simulations of stellar convection : a help for modeling the stochastic excitation of solar-like oscillations

R. Samadi, D. Georgobiani, R. Trampedach, M.J. Goupil, R.F. Stein, A. Nordlund, J.M. Fernandes
(LESIA / Observatoire de Paris)

Stars with masses in the range 1 Mo< 2 Mo have upper convective zones where the stochastic excitation of p modes takes place.
The mechanism of stochastic excitation has been modeled by several authors. These models yield the rate P at which p modes are excited by turbulent convection but require an accurate knowledge of the time averaged and - above all - the dynamic properties of turbulent convection.
The latter are represented in the approach of Samadi & Goupil (2001) by chi_k, the frequency component of the kinetic enery spectrum, which can be related to the convective eddy time-correlations.
Using several numerical 3D simulations of solar-like oscillating stars we obtain constraints on the properties of turbulent convection in such stars. Theses constraints enable us to compute - on the base of our theoretical model of stochastic excitation - P_{max}, the maximum in P, for the 1D internal models consistent with the 3D simulations.
We found that P_{max} scales as $(L/M)^s$ where s is the slope of the power law and L and M are the luminosity and the mass of the stellar model. However the slope is found to dependent significantly on the adopted representation for chi_k.
According to the expected performances of COROT, it will likely be possible to measure P_{max} as a function of L/M and to constrain predominantly the eddy time-correlation (chi_k).

MOLAT : Atomic and Molecular Physics Databases of the Paris Observatory

H. Abgrall, M. Bruston, M. Cornille, J. Crovisier, J. Dubau, M.-L. Dubernet-Tuckey, M. Eidelsberg, N. Feautrier, A. Lesage, F. Launay, E. Roueff, F. Rostas, S. Sahal, A. Spielfi edel, C. Stehle, W.-Ü L. Tchang-Brillet
(LERMA, Observatoire de Paris et Univ Paris 6)

MOLAT (http ://molat.obspm.fr/) is a joint project of several departments of the Paris Observatory supported by its Scientific Council. Its purpose is to make available original atomic and molecular data and compilations produced independently or in the course of collaborations by members of the Observatory. The data are of interest for the interpretation of observations made by spaceborne or ground based instruments and of laboratory experiments. The experimental data include mainly VUV spectroscopic data obtained by the Meudon group using either the 10m high resolution VUV spectrograph of the Meudon Observatory or the LURE-Orsay synchrotron facilty. The theoretical data include calculations from different groups of the Observatory concerning atomic or molecular structures, radiative transition probabilities, collisional excitation cross-sections and line broadening parameters. The bibliographic compilations are maintained by members of the Observatory. The database also provides a selection of links to other pertinent atomic or molecular databases thus serving as a gateway between atomic and molecular physicists and astrophysicists. The data formats have been kept as provided by the authors. An effort is underway to give a unified presentation.

Spectroscopic studies of heavy atoms and ions of astrophysical interest

J.-F. Wyart et W-U L. Tchang-Brillet
(CNRS)

The presence of heavy elements in stellar atmosphere is well established and their spectral characteristics are used for abundance determinations. However laboratory data of are still in an uneven state. Our contribution includes first breakthrough of the last unknown third spectra (Ta III, Azarov et al., 2003), revision and improved interpretation of old analyses (Yb IV, Wyart et al. 2001) and critical compilations (Actinides, http ://www.lac.u-psud.fr/Database/Contents.html). The VUV 10m spectrograph of the Meudon Observatory provides a great part of experimental data for ion spectra. The theoretical calculations of energy levels, transition probabilities and Landé factors are carried out in the Racah-Slater approach, using Cowan's codes. Systematic studies in long periods 4f and 5d and isoelectronic sequences display regularities which can be used for reliable predictions. Selected works on ionized lanthanides and transition metals will be presented.

Evolutionary status of Be stars

Zorec, J., Frémat, Y
(Institut d'Astrophysique de Paris)

Fundamental parameters of nearly 50 field Be stars have been determined.
Correcting these parameters from gravity darkening effects induced the fast rotation, we deduced the evolutionary phase of the studied stars. We show
that the evolutionary phase at which appear the Be phenomenon is mass dependent : the smaller the stellar mass the elder the phase in the main sequence at which the Be phenomenon seem to appear.

Discrete mass ejections in Be stars

Zorec, J., Frémat, Y., Leister, N.V.
(Institut d'Astrophysique de Paris)

HeI lines are currently used to study the atmospheric activity of Be stars, in particular their non radial pulsation phenomena. Moreover, the HeI 6678
line is quite sensitive to mass ejections, as revealed by the presence of
emission components in the wings. In the present paper we show that the highly variable aspect of the emission in the HeI 6678 line, as well as the changes of the photospheric like absorption component, can be due to orbiting clouds ejected by the star. The modeling of the variability of the HeI 6678 line
could then help to estimate the strength of the magnetic field needed to maintain the ejected clouds, as it is meant, in nearly rigid rotation with
the underlying star.

Session PNST

Oral contributions

Alfven wave instabilities : magnetosheath Cluster observations and Hybrid simulations

O.Alexandrova, A.Mangeney, N.Cornilleau-Wehrlin, J.M.Bosqued, P.Hellinger
(LESIA, Observatoire de Paris)

The magnetosheath near the bow-shock is characterized by ions anisotropy. The relaxation of the anisotropy is accompanied by the generation of electromagnetic waves and waves-particles interactions. Observations of the post shock magnetic field behaviour [Alexandrova et al., JGR, 2004] suggest that the Alfven waves observed in this region may be subject to a "filamentation" instability. The outcome of this instability, which occurs for wavelength larger but comparable to the ion inertial length and a large plasma beta, is the formation of field aligned magnetic tubes at the expanse of the initial Alfven wave energy. A recent study [Alexandrova et al., in preparation] shows that the observed field-aligned current tubes are in magnetostatic equilibrium in the magnetosheath plasma and they are distributed periodically in the plane perpendicular to the average magnetic field. Here we present also the 2D hybrid simulations (the protons are treated as particles and the electrons as a massless fluid) of the circularly polarized dispersive Alfven wave evolution. For the observed plasma parameters we don't observe the filamentation instability. On the other hand we observe modulational instability and kinetic Alfven waves generation. We shall discuss the influence of kinetic effects.

Ionosphere models : numerical methods and coupling problems in the system atmosphere-ionosphere-magnetosphere

Pierre-Louis BLELLY
(LPCE)

THEMIS Observations : longitudinal et transverse magnetic field map under a filament.

V. Bommier
(LERMA)

The objective of these measurements is first to explore the direction of the transverse field along a neutral line of the longitudinal field, on which the filament is, and second to provide data on the photospheric magnetic field vector, as a boundary condition for the extrapolation of the field in the filament. For that, the size of the area observed must be sufficient, in order to sufficiently cover the opposite polarities of the two areas separated by the neutral line. Besides these polarities must be clearly identifiable. These two conditions are met by our observations of December 7, 2003. Our map, obtained in 3 sweepings from 9h08 to 14h06 UT, is 240x340 arcsec, with a pixel of 0.45arcsec. The magnetic field is determined by the bisecting method for the longitudinal field, and by the weak field method for the transverse field. The longitudinal field is given within 5 Gauss and the transverse field with a margin of 50 Gauss. These observations, which have an unequalled space resolution in transverse field, show a narrow correlation between longitudinal field and transverse field, and a great homogeneity of the direction of the transverse field in the vicinity of the filament.

Star-disc magnetospheric interaction in T Tauri stars

J. Bouvier, C. Dougados, F. Menard
(laog)

We will present new results regarding the origin, structure and stability of the magnetic interation region between a young star and its accretion disk. Implications for inner disc warps, planet migration, jet outflow generation, and X-ray activity will be discussed.
(This presentation would be suited for the common PNPS-PNST session).

What's new about intergranular magnetic field

C. Briand
(observatoire de Paris-Meudon)

Among the most interesting results on photospheric magnetic field appeared during the last year in the litterature, we have to emphasize the progress on the knowledge on intergranular magnetic field. In this review, the progress performed in the understanding of the morphology of these structures due to the improvements of the observationnal technics will be sum up. Also, the role of the intergranular magnetic field in the coupling between the lower and upper solar layers now under discussion is exposed. If confirmed, these new results would be of importance in the frame of the solar-earth relationship.

Statistical simulations of simplified MHD

Eric Buchlin, Marco Velli, Sébastien Galtier, Jean-Claude Vial
(Institut d'Astrophysique Spatiale)

Because of the wide range of scales involved in MHD turbulence, a statistical approach may become necessary to keep a global view of this complex phenomenon. In particular, in the framework of the heating of the solar corona, the smallest events are not directly detectable by the current instruments but may be integrated to a statistical study. From the numerical point of view, the contradictory needs for computing speed and good description of MHD solutions may be addressed by simplified models, which keep the most possible of the complex and non-linear physics of the MHD equations but run sufficiently fast to produce statistics of fields, of structures, and of "events". We propose two such models which have been originally developed to represent coronal loops (with forcing and Alfvén wave reflection at the loop's foot-points), but which may be adapted to represent any region with a dominant large-scale magnetic field.
The first model consists of a set of cellular automata, in which the non-linear terms of the MHD equations are modelled by a threshold dynamics on current density (Buchlin et al. A&A, 2003). In the second model, the cellular automata are replaced by shell-models of MHD, so as to reach a greater range of wavenumbers and to model more realistically the non-linear couplings between modes at different scales. The results obtained with these models will be presented and consequences of this study for observational statistics and for theory of MHD turbulence will be discussed.

Multi-point observations of plasma waves with the Whisper of Cluster

Pierrette Décréau et PAtrick Canu
(CETP/IPSL)

In a plasma without collision, the impulsion and energy exchanges between the particles, essentially ionized, are not possible but through the electric and magnetic fields. The waves thus play a fundamental role in the dynamics of the medium. The observation of these emissions thus constitutes a particularly effective tracer of the phenomena occurring in those plasmas : heating, acceleration, currents, region crossings... The Whisper instrument onboard each satellite of the Cluster project allows a quasi continuous measurement of the electrostatic and electromagnetic emissions of the various areas of the terrestrial magnetosphere, which constitute, and for a long time, one rare astrophysical plasmas possible to study in-situ. Operating in the frequency band 2-80 Khz, it allows the detection of the waves close to the plasma frequency whose origine is related to the dynamics of the electrons. The addition of an emitter allows to stimulate the local plasma at certain characteristic frequencies and to derive in particular the electronic density in the vicinity of the satellites. In this talk, we will present some examples of the new results acquired thanks to simultaneous measurement in 4 points permitted by Cluster, such as the origin and the localization of the sources of non-thermal continuum , the measurement of the gradients and the fluctuations of density in separating regions like the plasmapause, and the characterization of isolated plasma structures in the vicinity of areas such as the magnetopause.

Structure and dynamics of the solar corona : the peculiar role of the photosphere

R. Grappin (Luth, Obs. Meudon), G. Aulanier (Lesia, Obs. Meudon)
(observatoire de paris-meudon)

The solar corona is composed of a hot plasma embedded in strong magnetic fields. The latter dominate the system since the plasma $\beta \simeq 10^{\{} - 4\} - 10^{\{} - 1\}$. These magnetic fields are believed to have emerged from the solar interior, where $\beta >> 1$. In the corona, they result in various observed structures, of quasi-static nature such as loops, prominences and sigmoids, and of dynamic nature (with characteristic time comparable to Alfvén time-scales) such as flares, accelerated particles and coronal mass ejections. The current view of the basic physics of these features will firstly be addressed. Then the talk will focus on the peculiar role of the thin photospheric layer, which fully determines the coupling of the solar interior with its corona. In this context, the detailed physics and coronal consequences of the so-called 'line-tied' condition in this layer will be discussed. This condition will then be shown to be at the origin of the coronal volumic electric currents which result in sheared and twisted structures, as well as of the collapse of thin current layers which can result in flares and at smaller scales in coronal heating.

Magnetic maps of solar prominences

A. Lopez Ariste R. Casini
(THEMIS - CNRS UPS 853)

The measurement of magnetic fields in solar prominences has seen a renewal of interest with the commisioning of new instruments (THEMIS), the use of new techniques of data analysis and the improvement in the understanding of the theory of polarization of atomic lines. We review the last results on the subject, in the form of magnetic maps of prominences and discuss near future prospects.

Numerical simulation of turbulence and acceleration in the magnetospheric auroral zones.

F. Mottez, V. Génot, P. Louarn
(CETP/IPSL)

Investigating the process of electron acceleration in magnetospheric auroral regions, we present a study of the interaction of Alfvén waves (AW) with a plasma inhomogeneous in a direction transverse to the static magnetic field. This type of inhomogeneity is typical of the density cavities, observed in the Earth magnetosphere by Viking and Fast, extended along the magnetic field in auroral acceleration regions. We use self-consistent Particle In Cell (PIC) simulations to reproduce the full nonlinear evolution of the electromagnetic waves as well as the trajectories of ions and electrons in phase space. Physical processes are studied down to the ion Larmor radius and electron skin depth scales. We show that the AW propagation on sharp density gradients, thanks to inertial effects, leads to the formation of a parallel (to the magnetic field) electric field. Its amplitude may reach a few percents of the AW electric field. This parallel field accelerates electrons up to keV energies over distance of a few hundreds Debye lengths, and induces the formation of electron beams. The beams trigger electrostatic plasma instabilities (beam-plasma and Buneman) which evolve toward the formation of nonlinear electrostatic structures : electron holes and double layers. When fully developed, the electrostatic turbulence reduces further wave/particle exchanges, and therefore saturates the plasma acceleration process. This study elucidates a possible scenario to account for the particle acceleration, the wave dissipation in inhomogeneous plasmas, and the small scale auroral arcs structure.

Flux tube emergence, from photosphere to coronna.

Pariat E., Schmieder B. & Aulanier G.
(LESIA - Observatoire de Paris)

From a campaign of multi-wavelength observations of an emerging active region, we have studied the dynamics of the solar atmosphere due to this emergence and the magnetic field topology of the active region. In addition with the observations obtained with Yohkoh, SOHO and TRACE, a balloon borne 80 cm telescope (Flare Genesis Experiment) provided us a series of high spatial resolution vector magnetograms. For the first time we highlight that magnetic flux tubes do not directly emerge with a large Ω-loop shape, as suggest the TRACE observations of the corona, but rather within an undulatory shape. We demonstrated that the resistive Parker instability allows the flux tube to go through the low atmosphere. This result has been obtained by performing an extrapolation of the field above the active region.

Dynamo processes and differential rotation in solar-type stars

Petit P., Donati J.-F.
(Max-Planck-Institut für Aeronomie)

Tomographic techniques enable one to reconstruct the magnetic topology of solar-type stars from time-series of polarized spectra. Depending on the spatial resolution accessible, the geometry of the background field or the surface distribution of individual active regions can be reconstructed, as well as their short-term evolution over a few weeks (for instance under the action of differential rotation) or their secular variations related to activity cycles. I propose here a brief review of the main results obtained to date in this framework and detail what this observing study tells us about dynamo processes at work in cool active stars. I then indicate some new directions that will be explored in the near future thanks to the larger spectral coverage and better sensitivity of the new instrumentation now available (ESPaDOnS/CFHT).

Stability of the geomagnetic tail ; Cluster observations.

A.Roux, O.Le Contel, D.Fontaine, P.Robert and J.A.Sauvaud,
(CETP/IPSL)

The central part of the geomagnetic tail ; the tail Current Sheet (CS) is known to be unstable during active periods, called substorms. During substorms the hot plasma , stored in this CS is accelerated and precipitated in the auroral region, thereby producing auroras. Simultaneously the magnetic configuration changes drastically. One of the main objectives of the Cluster mission is the study of the mechanism that accelerate these particles at the expense of the magnetic energy stored in the CS. There is no consensus yet about the nature of the instability that leads to substorms. We briefly review current models and use Cluster observations to constrain these models and try to determine the nature of the process responsible for substorm breakup. In particular we take advantage of the tetrahedron configuration of Cluster, to estimate the thickness of the CS and show that it gets very thin (ion Larmor radius), just before and during the active phase of the substorm. The spatial distribution of the current density is a clue to decide between proposed models. We use Cluster data to estimate the current density (via curlB and via the particle distribution functions) and investigate its spatial distribution, before and during the development of the instability that leads to particle acceleration and reconfiguration of the magnetic field.

First observations of solar flares at sub-millimeter wavelengths

Gérard Trottet
(Observatoire de Paris, Section de Meudon, LESIA)

It has long been known that flare accelerated electrons produce microwaves from gyrosynchrotron emission. Usually, the radio spectrum increases with frequency up to 10-40 GHz and decreases at higher frequencies. It has only been since mid-2000 that the detection of solar flares at frequencies above 100 GHz became possible. Recent observations in the 200-400 GHz domain (referred to as the sub-millimeter domain) have revealed a new spectral component which increases with the observing frequency above 200 GHz. Such a component has been recorded during both the impulsive and extended phases of flares and in the form of sub-second pulses. Flare observations obtained at sub-millimeter waves by the Solar Sub-millimeter Telescope (SST) and at the Köln Observatory for Sub-millimeter and Millimeter Astronomy (KOSMA) are briefly reviewed and compared with microwave and hard X-ray/gamma-ray measurements ; It is shown that this ensemble of observations constitutes the most direct diagnostics of electrons accelerated up to ultra relativistic energies and of energy transport processes from the corona to the low atmosphere. Possible mechanisms leading to increasing spectra at sub-millimeter waves are discussed. It is shown that measurements at higher frequencies (far infra-red) are needed to discriminate among the different possibilities.

Solar wind acceleration : relevance of kinetic collisionless models

I.Zouganelis, N.Meyer-Vernet, M.Maksimovic, F.Pantellini and S.Landi
(LESIA - Observatoire de Paris)

A major assumption inherent to the usual fluid solar wind models is that the plasma is dominated by collisions. Therefore the fluid approach implies that the particle velocity distribution functions are close to Maxwellians. However the observed solar wind electron distributions depart significantly from Maxwellians, indicating the limited validity of this hypothesis. Collisionless models are not fully justified either, but should bring some insights into the physics since heat transport is mainly driven by suprathermal particles which are virtually collisionless because of the rapid increase with energy of the Coulomb free path. A proper theory should take into account the transition from a fully collisional regime to a weakly collisional one. If we neglect interactions with waves, the existence of a transonic plasma wind depends mainly on the electrostatic field and the heat flux which are determined by the velocity distributions of particles. In this work we present recent developments of kinetic collisionless models of the solar wind and compare them with results obtained by numerical simulations that include collisions.

Poster contributions

Analysis of non-thermal velocities in the Solar Corona

Loic Contesse, Serge Koutchmy and Christian Viladrich Institut d'Astrophysique de Paris, 98 Bis Bd Arago, 75014 Paris (France)
(CNRS)

We describe new ground-based spectroscopic observations made using the 16 aperture coronagraph of NSO/SPO over a whole range of radial distances (up to 12 arcmin heights above the limb) and along 4 different radial directions N, E, S and W. The analysis is limited to the study of the brightest forbidden emission line of Fe XIV at 530.3 nm in order to reach the best possible signal/noise ratio. To make the results statistically more significant, the extracted parameters are averaged over the whole length of the slit and measurements are repeated 5 times for each position ; the corresponding dispersions in the results obtained along the slit are given, as well as the net Doppler shifts. Central line profile intensities and full line widths (FWHM) are plotted and compared to measurements published by other authors closer to the limb. We found widths and turbulent (non-thermal) velocities of significantly higher values above the polar regions, especially when a coronal hole is present along the line of sight. We do not see a definitely decreasing behaviour of widths and turbulent velocities in equatorial directions for larger radial distances as reported in the literature, although lower values are measured compared to the values in polar regions. The behaviour in the high corona is rather flat and a correlation diagram is showing that it is different for different regions and different radial distances. This is the first deep CCD analysis of the complete line profiles of this FeXIV coronal line, up to large heights above the limb for both equatorial and polar regions. Future measurements over the green line are planned at Pic du Midi Observatory with a new mirror coronagraph ; they will include polarisation analysis to look at the influence of the coronal magnetic field.

First analysis of the Compton effect on energetic beams of the solar corona

S. Koutchmy and A. Nikoghossian
(CNRS)

In a preceding paper by Koutchmy and Nikoghossian, 2002 AA, we started to consider what the W-L coronal imaging is bringing for the analysis of energetic beams of electrons. We identified linear rays in the corona. They are long straight structure with a very large aspect ratio and a small cross-section, preferably observed above active regions enhancements. The theoretical background and predictions of the intensity modulations to be observed over a W-L image of the corona is given in two papers by Nikoghossian and Koutchmy, 2000-1999, in term of Compton effect. We now consider a few concrete cases taken from the analysis of the eclipse images of 2001 to interpret the measured color effects of linear jets in term of supra-thermal electrons scattering solar photons and deduce the corresponding parameters of this high energy component of the solar corona. Both blue and red shifts are observed depending of the geometric parameters of the jet. The location of the acceleration site is tentatively proposed to be well above the inner corona.

Particle acceleration in a solar active region modelled by a cellular automat

C. Dauphin, N.Vilmer et A. Anastasiadis
(LESIA - Observatoire de Paris)

The models of cellular automat allowed to reproduce successfully several statistical properties of the solar flares. We use a cellular automat model based on the concept of self-organised critical system to model the evolution of the magnetic energy released in an eruptive active area. Each burst of magnetic energy released is assimilated to a process of magnetic reconnexion. We will thus generate several current layers (RCS) where the particles are accelerated by a direct electric field. We calculate the energy gain of the particles (ions and electrons) for various types of magnetic configuration. We calculate the distribution function of the kinetic energy of the particles after their interactions with a given number of RCS for each type of configurations. We show that the relative efficiency of the acceleration of the electrons and the ions depends on the selected configuration.

Second solar spectrum observed at the Pic-du-Midi : depth probing of the turbulent magnetic field intensity in a quiet region.

M. Derouich, J.M. Malherbe, V. Bommier, E. Landi Degl'Innocenti, S. Sahal-Bréchot
(Observatoire de Meudon, LERMA)

The installation of a new polarimeter at the Turret Dome of the Pic-du-Midi has permitted new observations of the "second solar spectrum" (which is the spectrum of the linear polarization observed near the solar limb), having a spatial resolution. On 2003 October 25, we have observed a quiet region located at the East limb equator, in the resonance line of neutral strontium at 4607 Å. The slit was positioned perpendicular to the limb : recording various limb distances provides a depth probing of the solar atmosphere. The intensity of the turbulent magnetic field has been derived from the Hanle effect interpretation, which is actually the only method for vectorial weak field determination. The theoretical profiles to be compared to the observed ones have been obtained by applying the atomic density matrix formalism (Landi Degl'Innocenti E., Bommier V., & Sahal-Bréchot S.,1990). The various collisional coefficients have been computed by applying semi-classical methods that are accurate to 20% or better : the one from Seaton (1962) and Sahal-Bréchot (1969a, 1969b) for the collisions with electrons, responsible for the inelastic transitions, and the one developed by Anstee & O'Mara (1991, 1995) for line broadening computations, generalized to the collisional depolarization by Derouich et al. (2003 ; see also Derouich, 2004), for the elastic collisions with neutral hydrogen atoms. The results have been found in full agreement with those previously obtained with THEMIS without any spatial resolution (at 9 limb distances). With the spatial resolution that we have now at the Pic-du-Midi (1 arcsec, 138 limb distances), it appears that the turbulent magnetic field intensity does not vary with depth, in the line formation region that ranges from ~200 to ~300 km above the $\tau_{5000} = 1$ level.

A SEARCH FOR SOLAR ENERGETIC PARTICLE EVENTS WITH FLARELESS CORONAL MASS EJECTIONS

C. Marqué, A. Posner, K.-L. Klein
(Observatoire de Paris)

Shock waves are well-known accelerators of energetic particles in the interplanetary space. It is widely believed that the shock waves presumably driven by fast coronal mass ejections (CMEs) are the main accelerators of large solar energetic particle events. But the ability of shock waves to accelerate ions and electrons rapidly to high energies is still subject to debate. On the observational side, the large solar energetic particle events are associated with fast CMEs, but also with flares, i.e with particle acceleration in and around active regions. Statistical association hence does not allow us to constrain the accelerator. Using COSTEP and LASCO on SoHO, we look for particle signatures (deka-MeV protons and electrons above 100 keV) in carefully selected CMEs which are fast, but not accompanied by radio emission revealing electron acceleration in the low or middle corona, and where EUV and optical images show that activity occurs on the disk. Only three events were found between 1996 and 1998. In one of them weak particle signatures are detected by COSTEP, but not in the two others. We discuss the relevance of this observation to the origin of solar energetic particle events.

TRACING SUN-EARTH MAGNETIC CONNECTIONS USING RADIO BURSTS AND MAGNETIC FIELD EXTRAPOLATIONS

G. Lointier, K.-L. Klein, S. Hoang
(Observatoire de Paris)

Energetic particles accelerated in the solar corona can be detected by spacecraft in interplanetary space provided there is either (i) a direct magnetic connection between the spacecraft and the acceleration region, or (ii) transport of particles across magnetic field lines in the corona or interplanetary space. We use type III radio bursts associated with locally produced Langmuir waves observed by the WAVES radio receiver aboard the Wind spacecraft to identify electron beams at the spacecraft and their time of release in the corona. Imaging at metre wavelengths with the Nan{c}ay Radioheliograph allows us to infer the origin of the electron beams in the corona. We thereby obtain an indication of the trajectory of electron beams from the acceleration site to 1 AU. This is compared with coronal magnetic field lines computed from a potential field model with a source surface (Schrijver and La Rosa) within 2.5 solar radii from the Sun centre and a simple Parker spiral model at greater distances. Preliminary results are presented, and their impact on the discussion of coronal and interplanetary electron transport is discussed.

Last scientific results and present status of THEMIS

A. Lopez Ariste B. Gelly
(THEMIS - CNRS UPS 853)

THEMIS has become of age with the improvements in the instrument control and in the data analysis. We present a few of the scientific highlights of the previous campaigns and give an overview of the new instrument developements for the 2004 campaign.

Fundamental process in plasma physics with a very low noise particle in cell simulation code.

F. Mottez, S. Hess, G. Belmont
(CETP/IPSL)

Because of the low number of macro-particles, particle in cell (PIC) plasma simulation codes are usually very noisy. When the particle distribution function represents a weakly perturbed equilibrium, it is possible to use the macro-particles to compute *only* the perturbed part of the distribution function. This reduces drastically the statistical noise in the simulations. Inspired by works about fusion plasmas, we have written a delta-f (or perturbative) code using this principle. The tests show that this code fills our expectations. The perturbative approach permits to compare PIC and Vlasov code simulations, but it requires much less memory than with Vlasov codes. We use the perturbative code for the study of the electron distribution function during the Landau damping of a plasma wave. We show that the perturbation of the particle distribution function (that is not trivial) is not analytical, even for velocities far above the resonance velocity. Anyway, (not a surprise, but impossible to check with an ordinary PIC code) we recover with accuracy the linear damping rate predicted by Landau.

X-ray and radio observations of energetic electrons produced during the 3 November 2003 GOES X4 flare.

N. Vilmer, C. Dauphin, S. Krucker, R. Schwartz
(LESIA-Observatoire de Paris)

X-ray and radio observations provide complementary information on energetic electrons produced in solar flares. RHESSI produced X-ray/gamma-ray imaging spectroscopy observations (up to several hundreds of keV) of the 3 November 2003 GOES X4 flare. The flare was simultaneously observed by the Nançay Radioheliograph at decimetric/metric radio wavelengths. It produced impulsive radio bursts as well as a long duration continuum extending from the low corona to the interplanetary medium which is preceded by a type II burst with an unusual high starting frequency(radio emission associated to the propagation of a shock wave). We shall present the spatial and temporal evolutions of X-ray sources above a few hundred keV and of metric/decimetric radio sources showing the fast spatial extension of the emitting sources in the course of the event. We shall also present preliminary results on the electron spectra deduced from spectroscopy in both parts of the event.