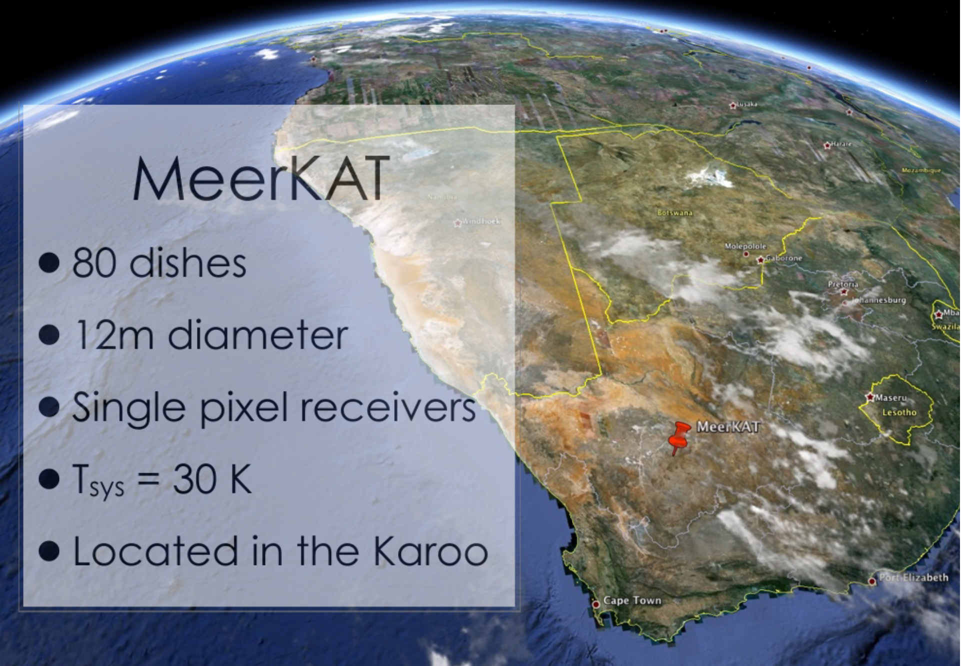
Survey profond COSMOS avec MeerKAT

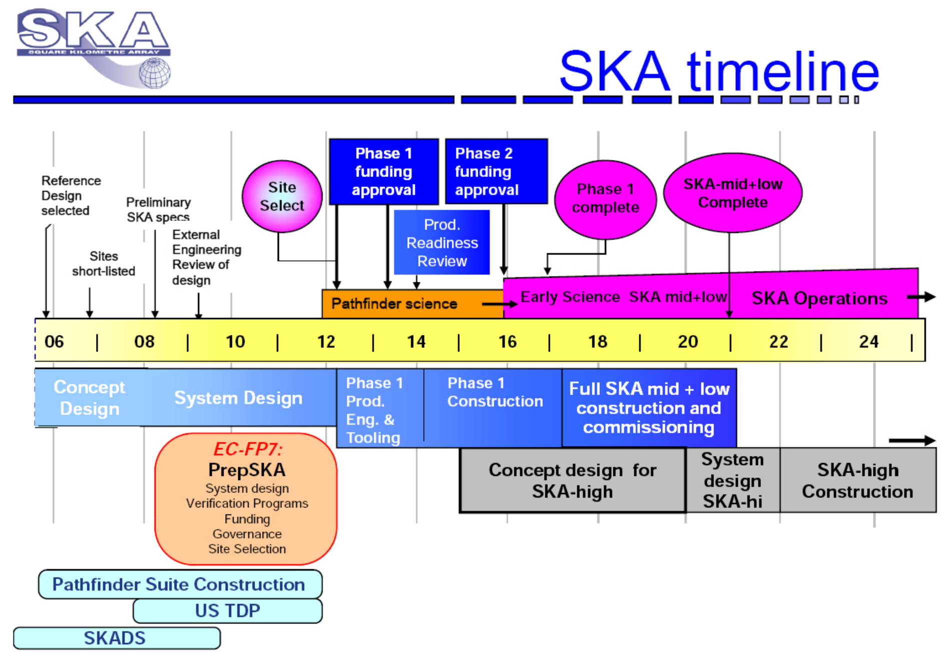
A. Bosma

LAM/OAMP Marseille

1. MeerKAT & COSMOS
2. Que peut-on faire ?
3. Modalités

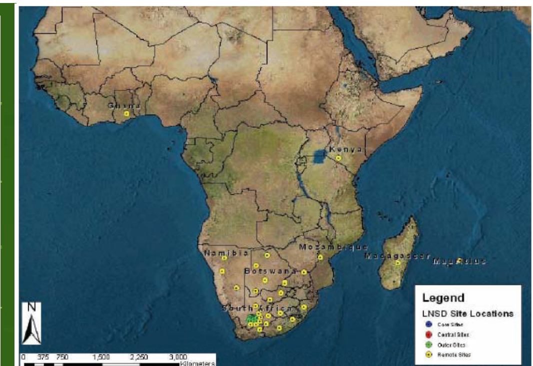
travail basé sur talks de
Erwin de Blok
Sara Blight





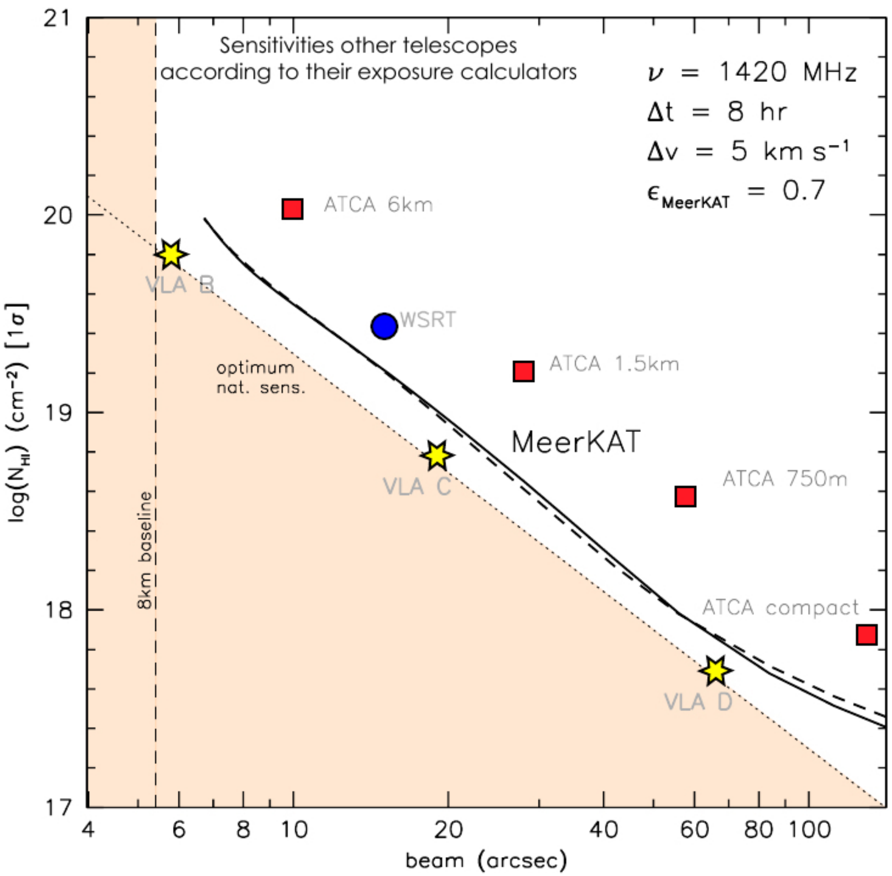
MeerKAT specifications

Frequency range:	Designed for 580 MHz - 15 GHz. Initially 580 MHz - 2 GHz
Sensitivity (A_e/T_{sys}):	200 m^2/K
Imaging dynamic range:	60 dB
Spectral dynamic range:	50 dB
Polarization purity:	-25 dB
Field of view:	1 deg^2 at 1.4 GHz 6 deg^2 at 580 MHz 0.5 deg^2 at 2 GHz
Bandwidth:	Initially 1 GHz. Upgrade to 4 GHz
Velocity resolution:	< 1 km/s
Minimum baseline:	20 m
Maximum baseline:	50 km

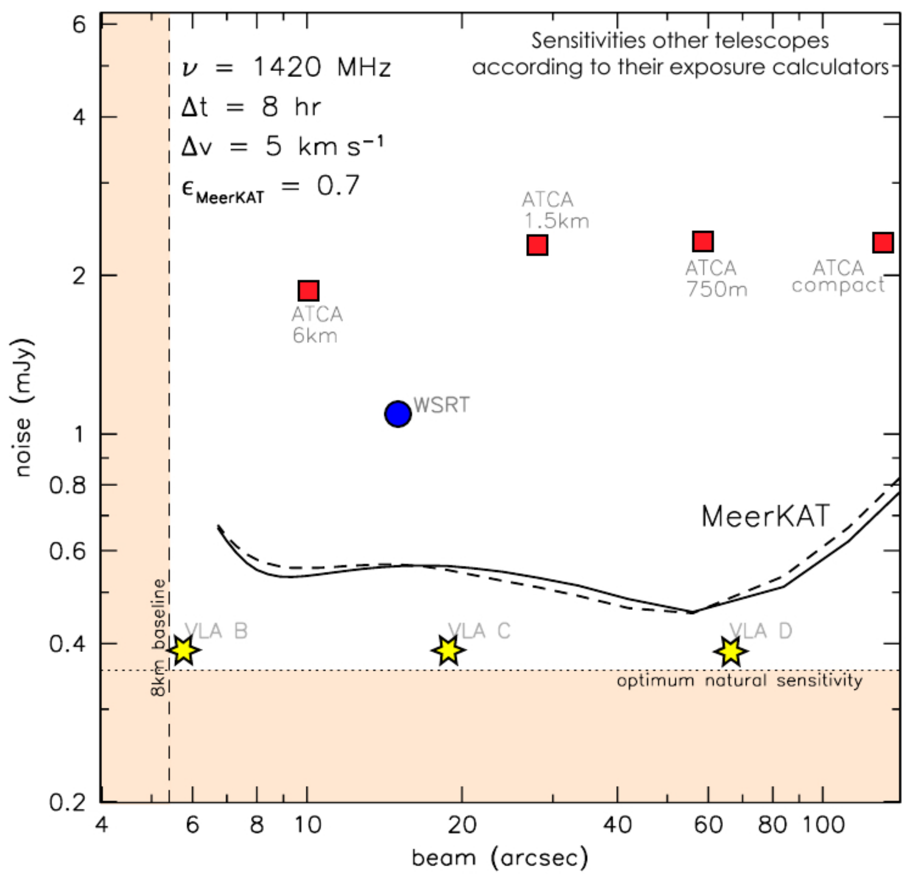


MeerKAT > original KAT (Karoo Array Telescope)

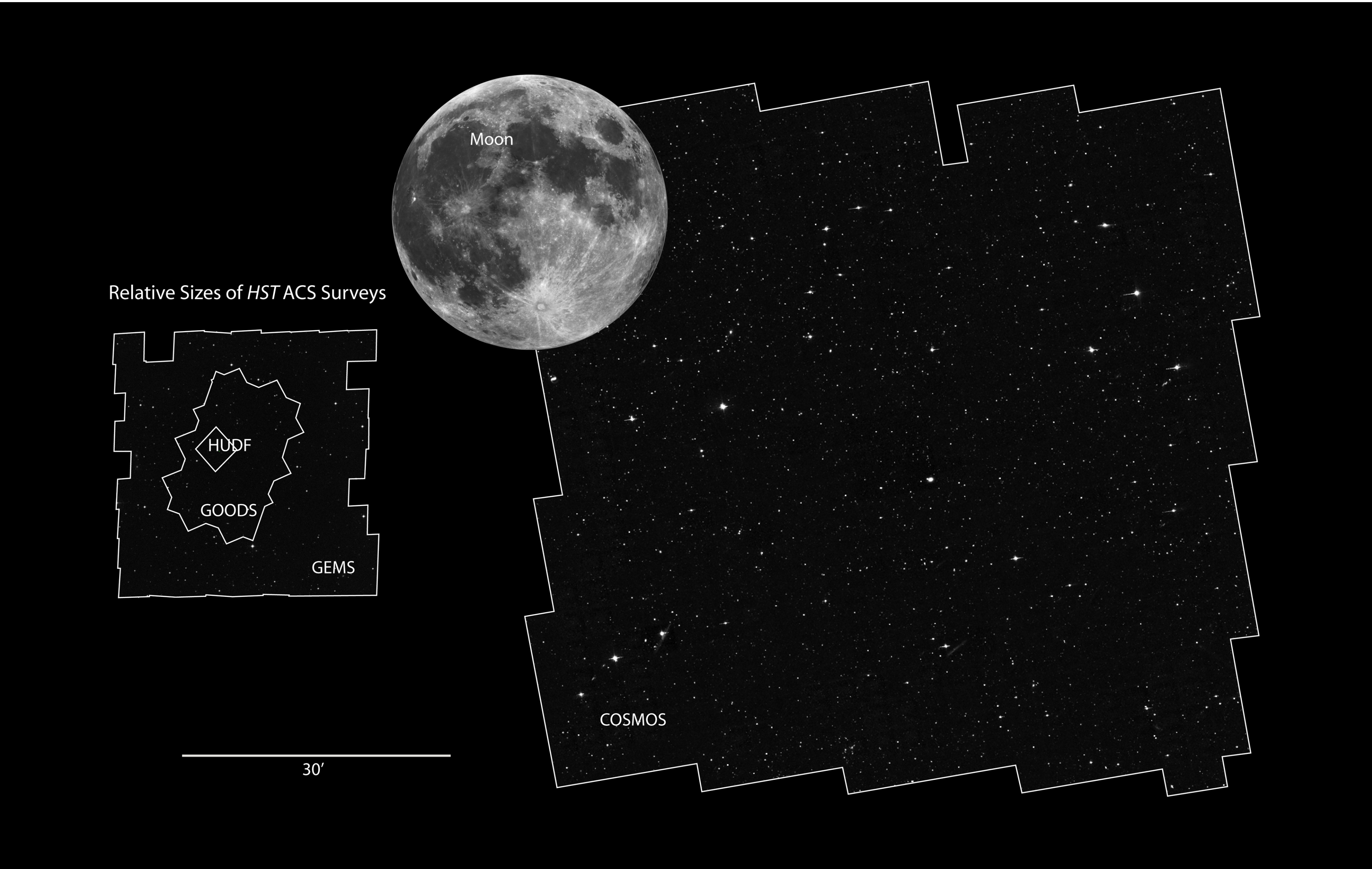
Column density sensitivity



Point source sensitivity



The COSMOS survey - Scoville et al. ~80 papers



zCOSMOS – redshift survey (Lilly et al. 2009)

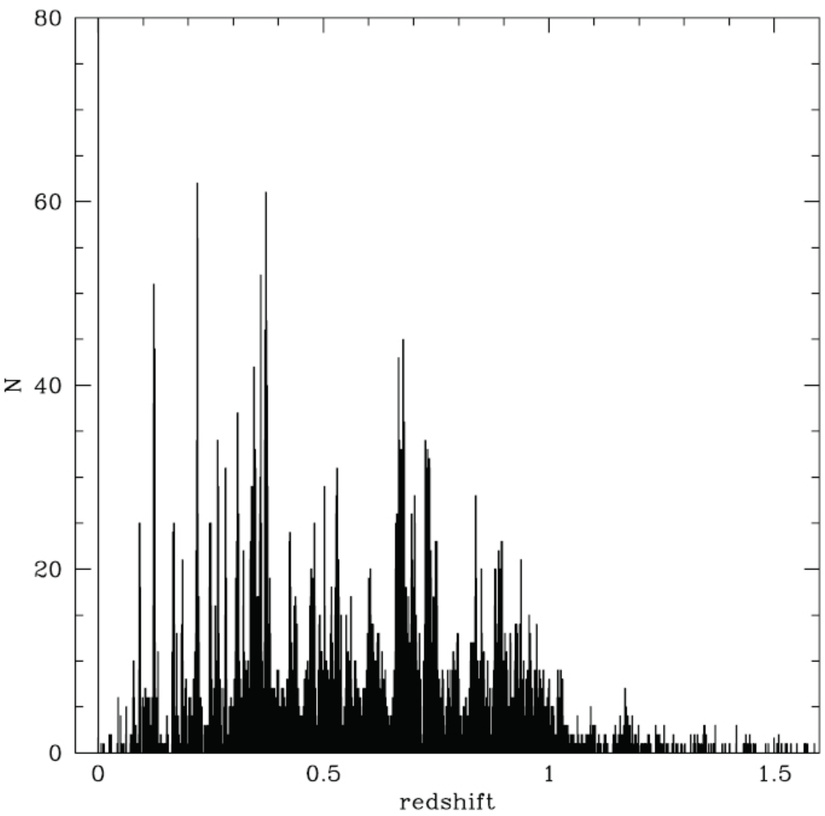


Figure 8. Redshift distribution of extragalactic objects in the zCOSMOS-bright 10k sample with secure redshifts, binned in intervals $\Delta z = 0.001$, which is larger than the redshift uncertainty by a factor of about three at $z = 0$ and of 1.5 at $z \sim 1$. The redshift distribution shows structure on a large range of scales. See Kovac et al. (2009a) for a full reconstruction of the density field.

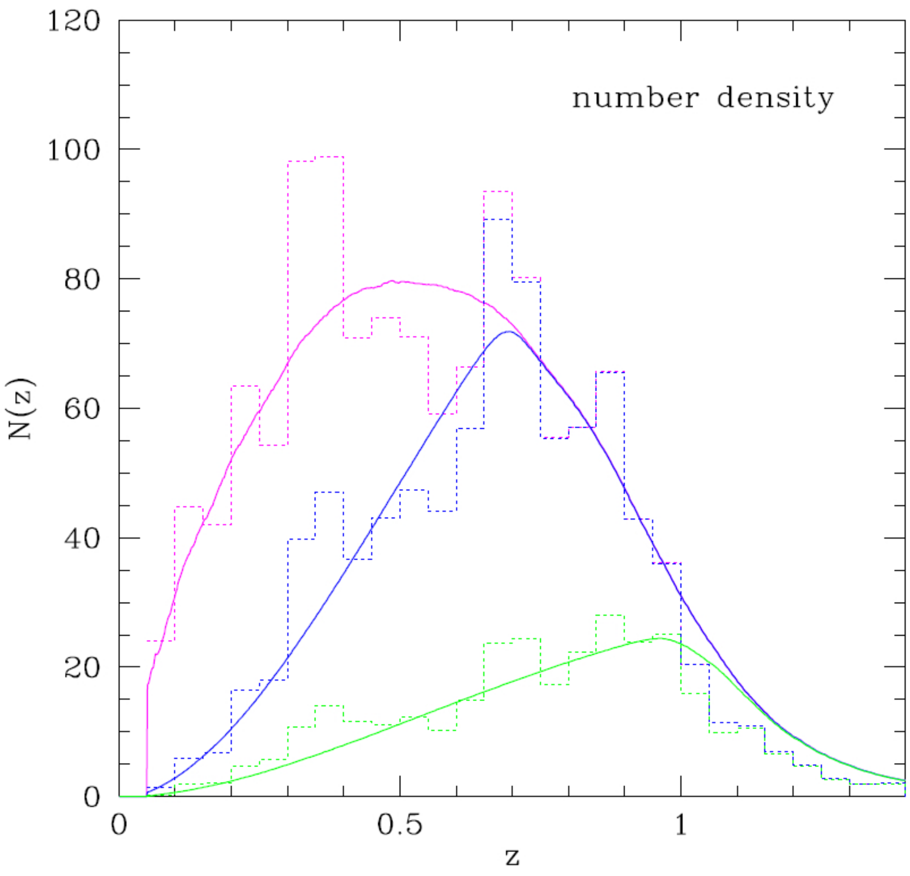


FIG. 2.— Redshift distribution of galaxies in the zCOSMOS area. The continuous lines correspond to the smoothed N(z) distributions obtained by weighting galaxies according to their $\Delta V(z)/V_{max}$ contribution in $\Delta z = 0.002$ intervals as described in the text. The dotted lines correspond to the histogram distributions of tracer galaxies in the redshift bins of $\Delta z = 0.05$ and they are divided by 25 to match the redshift bin of the smoothed N(z). Magenta represents the flux limited sample of tracer galaxies, blue represents the sample of galaxies with $M_B < -19.3 - z$ and green represents the sample of tracer galaxies with $M_B < -20.5 - z$. The last two samples are volume limited up to $z < 0.7$ (blue curve) and $z < 1$ (green curve), respectively.

HI dans les galaxies

très proche : diamètre ~ 50 kpc aisément détectable

z = 0.1	1.3 Gyr	50 kpc ~ 28 arcsec
z = 0.2	2.3 Gyr	16
z = 0.5	4.9 Gyr	8.5

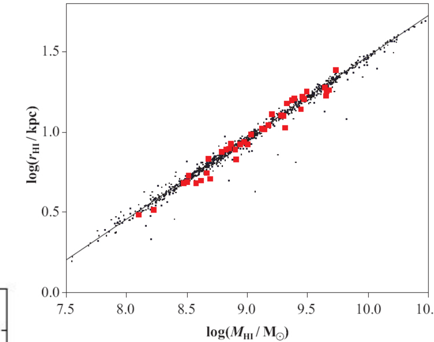
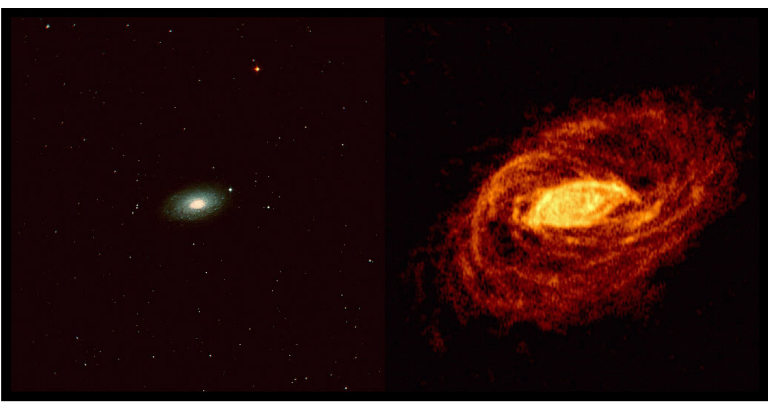


FIG. 8.— Relation between HI-mass $M_{\rm HI}$ and HI-radius $r_{\rm HI}$ for galaxies at redshift $z = 0$. The black dots represent 10^3 simulated galaxies and the solid line their linear regression. The slope of this power-law is 0.5, thus indicating a universal average HI-surface density for all disk galaxies. The simulated data are identical to those plotted in Fig. 7a. Red squares show measurements in the Ursa Major group by Verheijen (2001), who used the same definition of $r_{\rm HI}$ as this paper.

Obreschkow + 2009



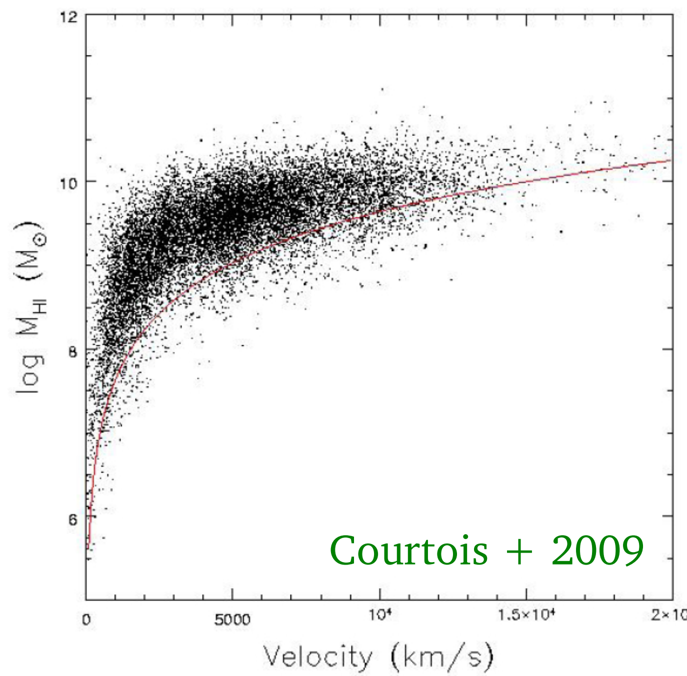
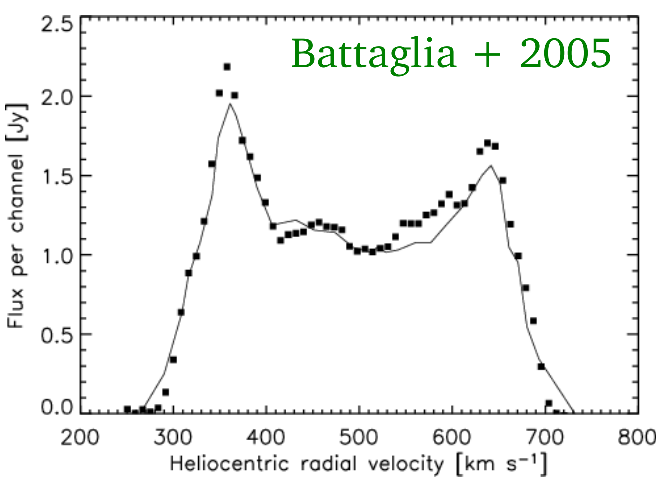
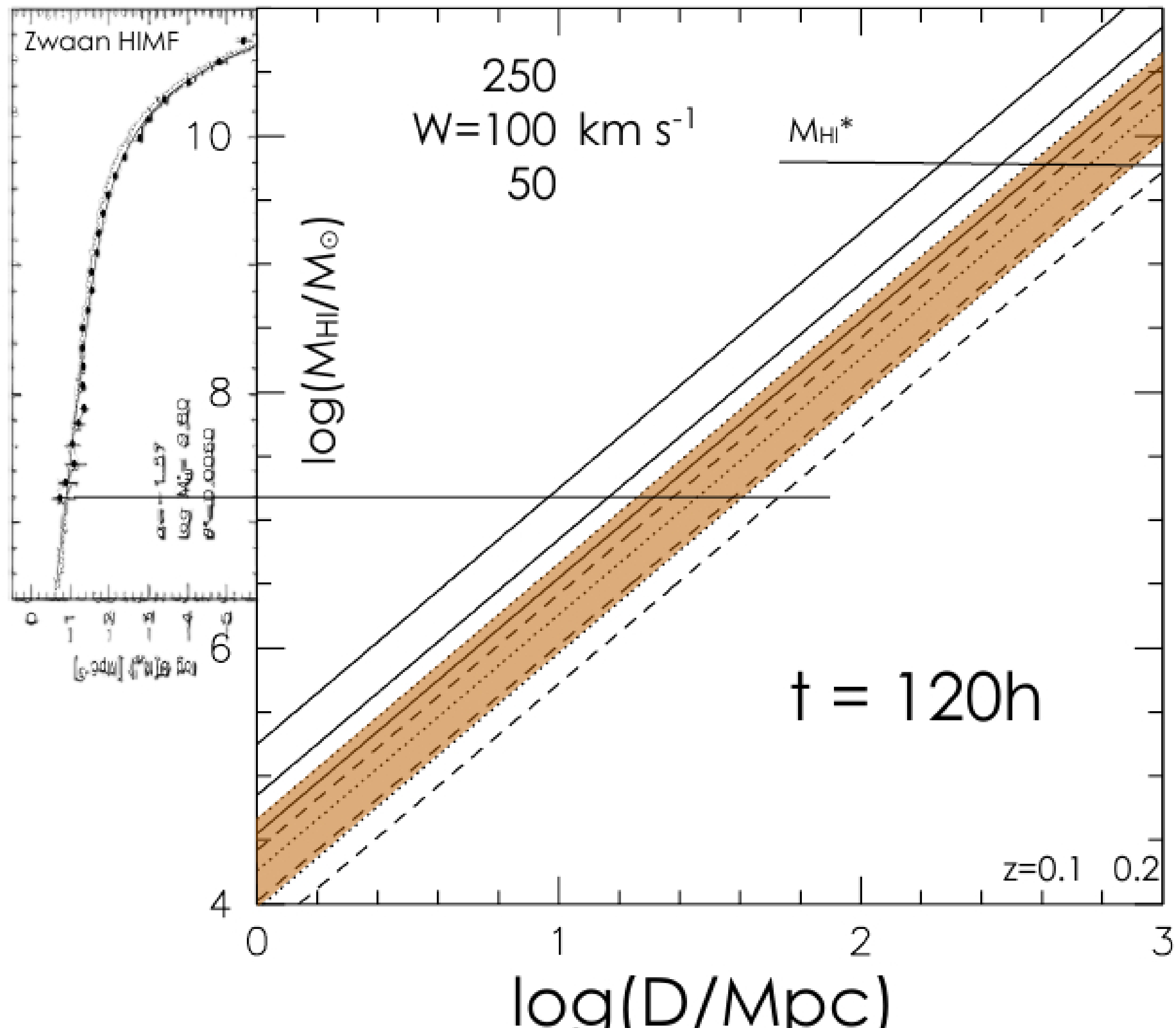


FIG. 2.— HI mass assuming distance = cz km s^{-1}/ 75 km s^{-1} Mpc^{-1} vs. systemic velocity for 15,000 galaxies in the Lyon Extragalactic Database (LEDA). The solid curve traces the locus of an integrated flux of 1 Jy km s^{-1}, a practical limit with the Arecibo Telescope.



HI Mass limits

- Assume unresolved galaxy with width W, top-hat profile and 5σ peak flux



solid lines : 8 h
dotted lines : 120h
dashed lines : 360h

Question importante : densité du gaz neutre en fonction de z

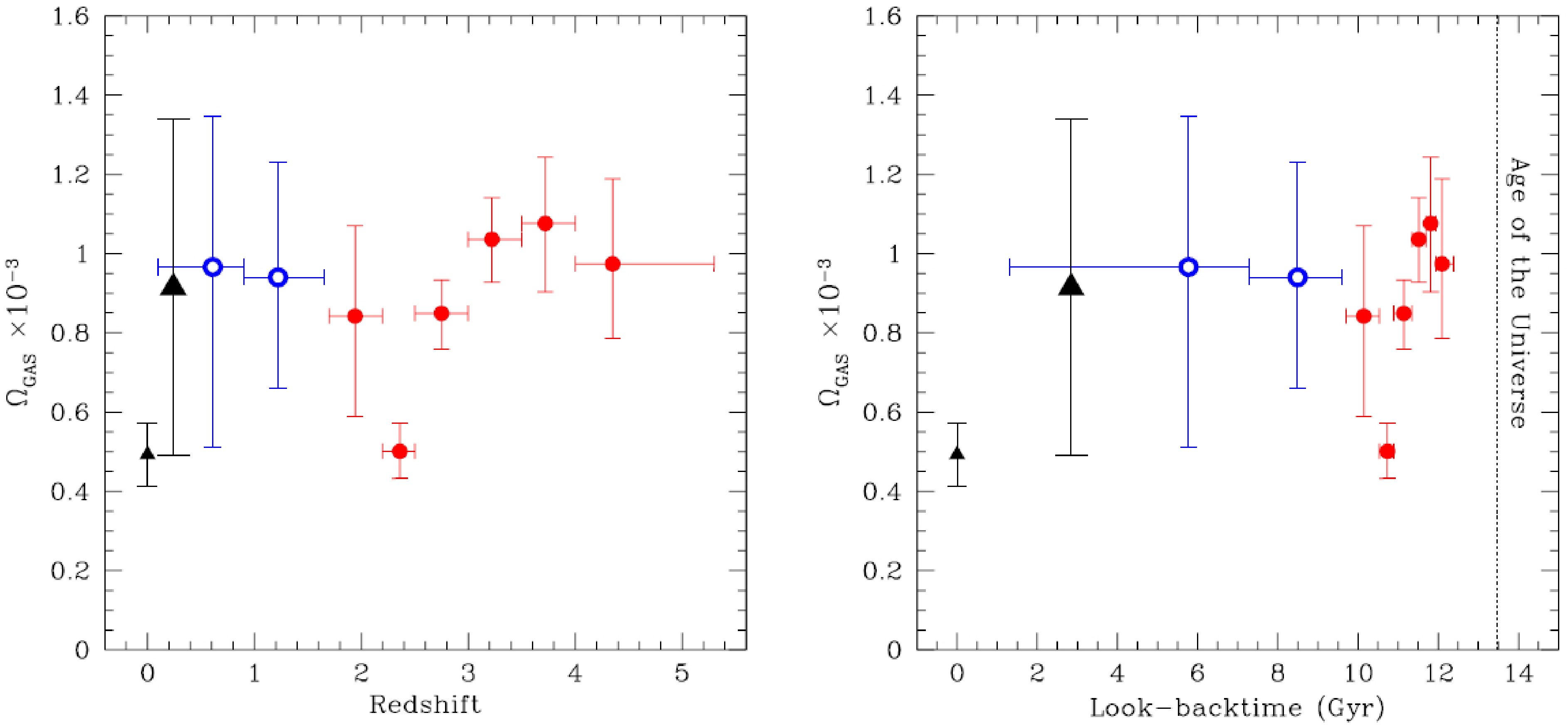


Figure 8. The neutral gas density of the universe as a function of redshift (on the left) and look back time (on the right). The small triangle at $z = 0$ is the HIPASS 21 cm emission measurement from Zwaan et al. (2005). The filled circles are damped Lyα measurements from Prochaska et al. (2005). The open circles are damped Lyα measurements from Rao et al. (2006) using HST. The large triangle at $z = 0.24$ is our HI 21 cm emission measurement made using the GMRT. All results have been corrected to the same cosmology and include an adjustment for the neutral helium content.

Lah et al. (2007)

Obreschkow + 2009

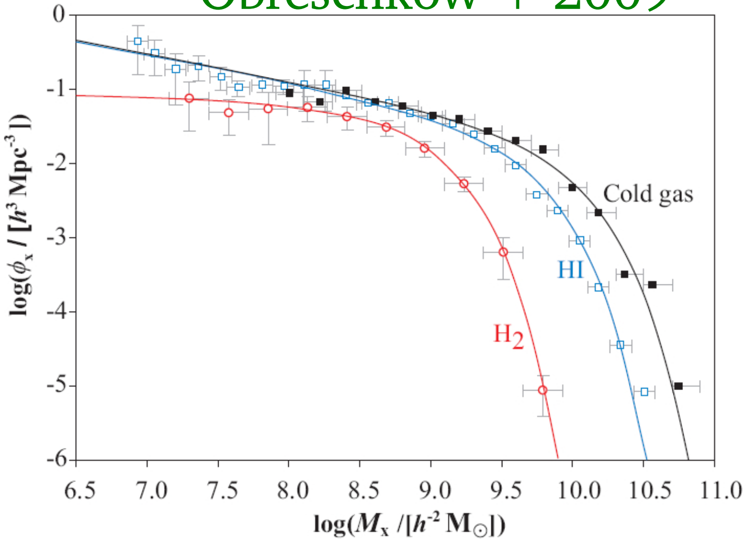


Figure 11. Filled squares represent the integral cold gas-MF (HI+H_2+He) derived from the HIPASS data using our best phenomenological model for the H_2/HI-mass ratio (Eq. 13); empty squares represent the observed HI-MF (Zwaan et al. 2005) and empty circles represent our best estimate of the H_2-MF (Section 3). Solid lines are best fitting Schechter functions.

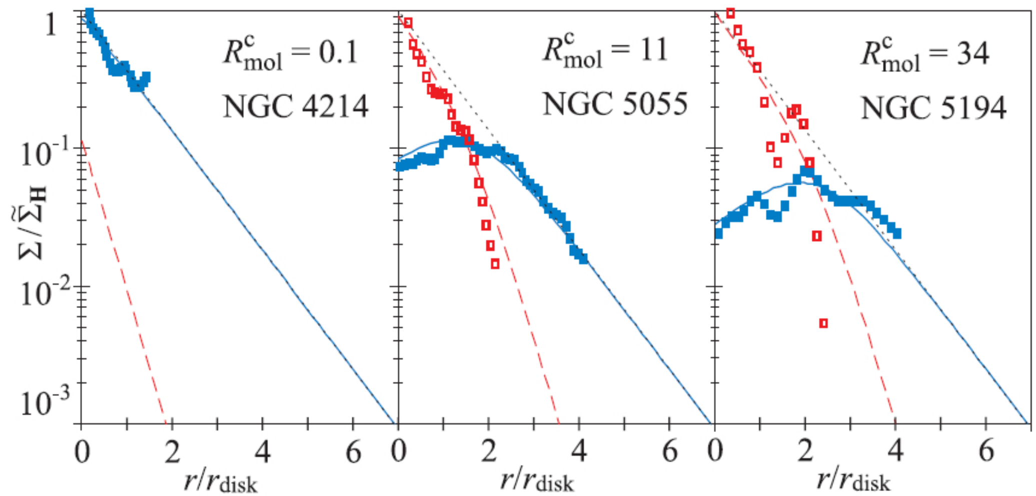
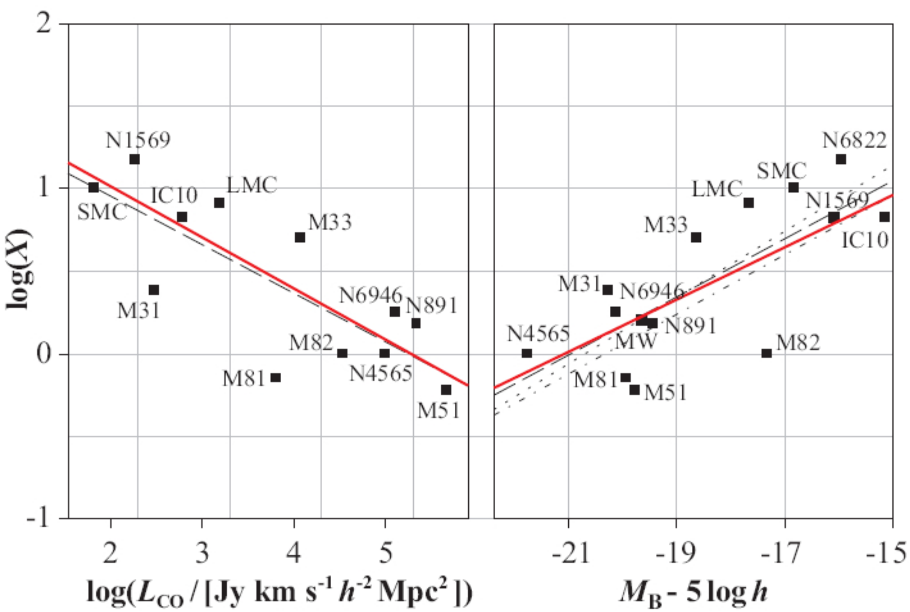
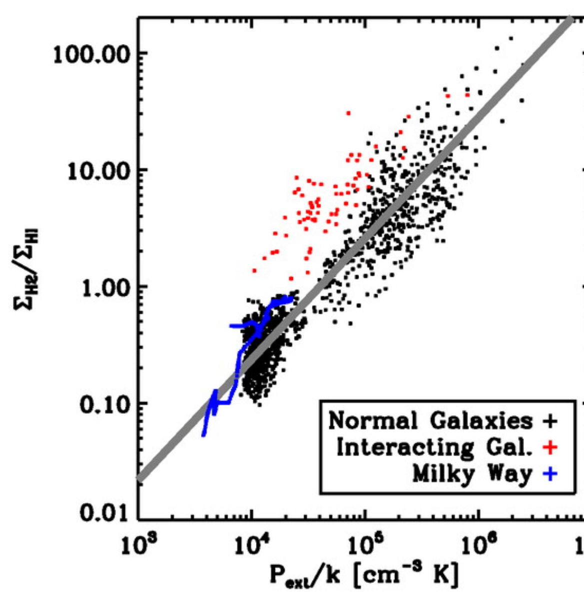


Figure 1. Surface densities of galactic cold gas as a function of galactic radius. Lines show the predictions of Eqs. (1, 2) for $\Sigma_{HI}(r)$ (solid), $\Sigma_{H_2}(r)$ (dashed), and $\Sigma_{HI}(r) + \Sigma_{H_2}(r)$ (dotted) for different values of R^c_{mol}. Dots represent the observed counterparts (Leroy et al. 2008) for $\Sigma_{HI}(r)$ (filled) and $\Sigma_{H_2}(r)$ (empty), inferred from CO(2–1) observations.





Blitz & Rosolwsky 2006

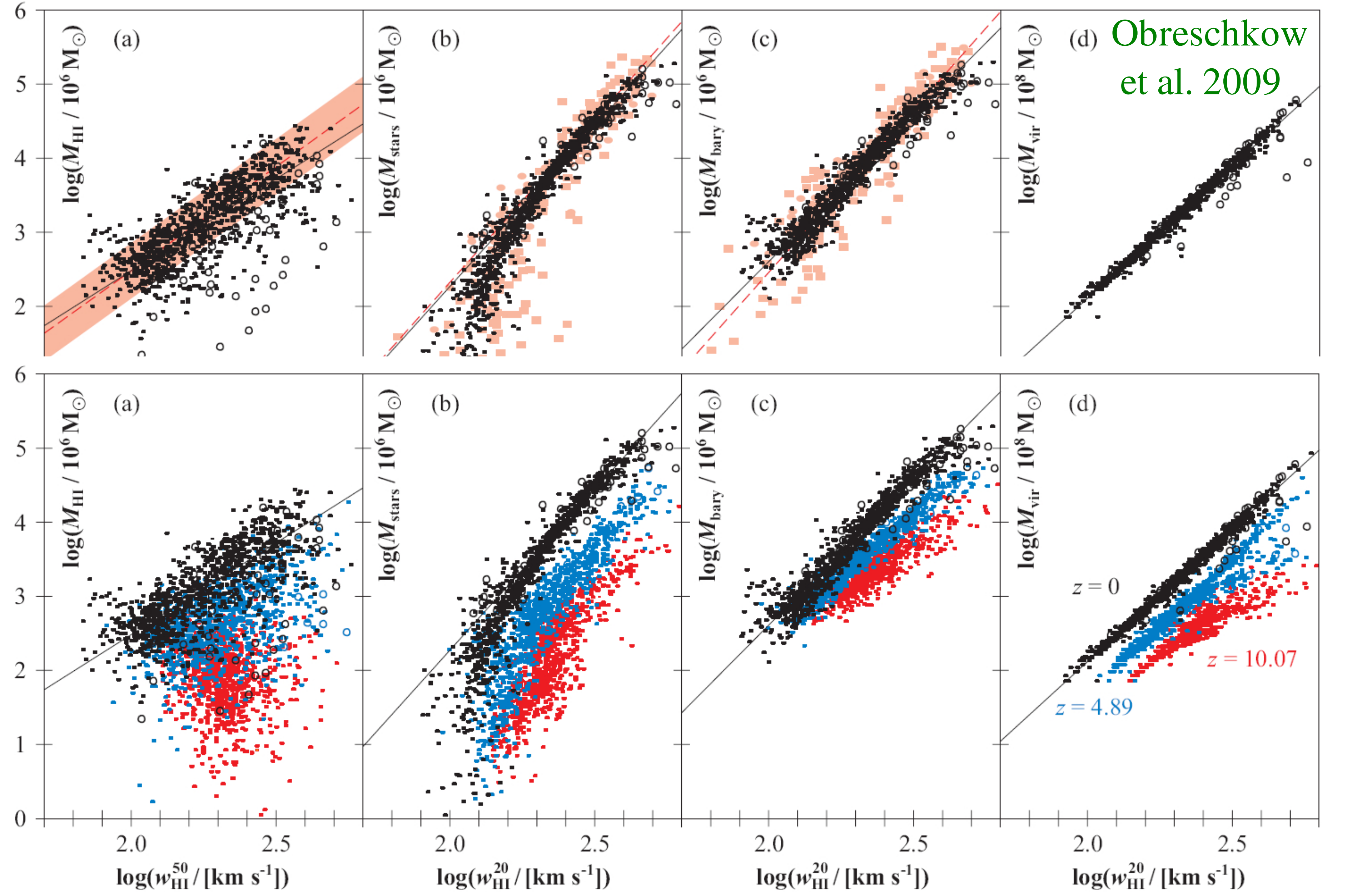


FIG. 14.— Simulated cosmic evolution of the different line width–mass relations shown in Fig. 13. Spiral and elliptical galaxies are respectively represented by dots and circles. Black color corresponds to redshift $z = 0$ (identically to Fig. 13), while blue and red color respectively represent $z = 4.89$ and $z = 10.07$. The solid black lines are power-law fits to the spiral galaxies at $z = 0$, where in case of Fig. 14b only galaxies with $M_{stars} > 10^9$ $M_\odot$ have been considered. The number of elliptical galaxies decreases with redshift – a consequence of the merger- and instability-driven prescriptions for bulge formation in the DeLucia-catalog.

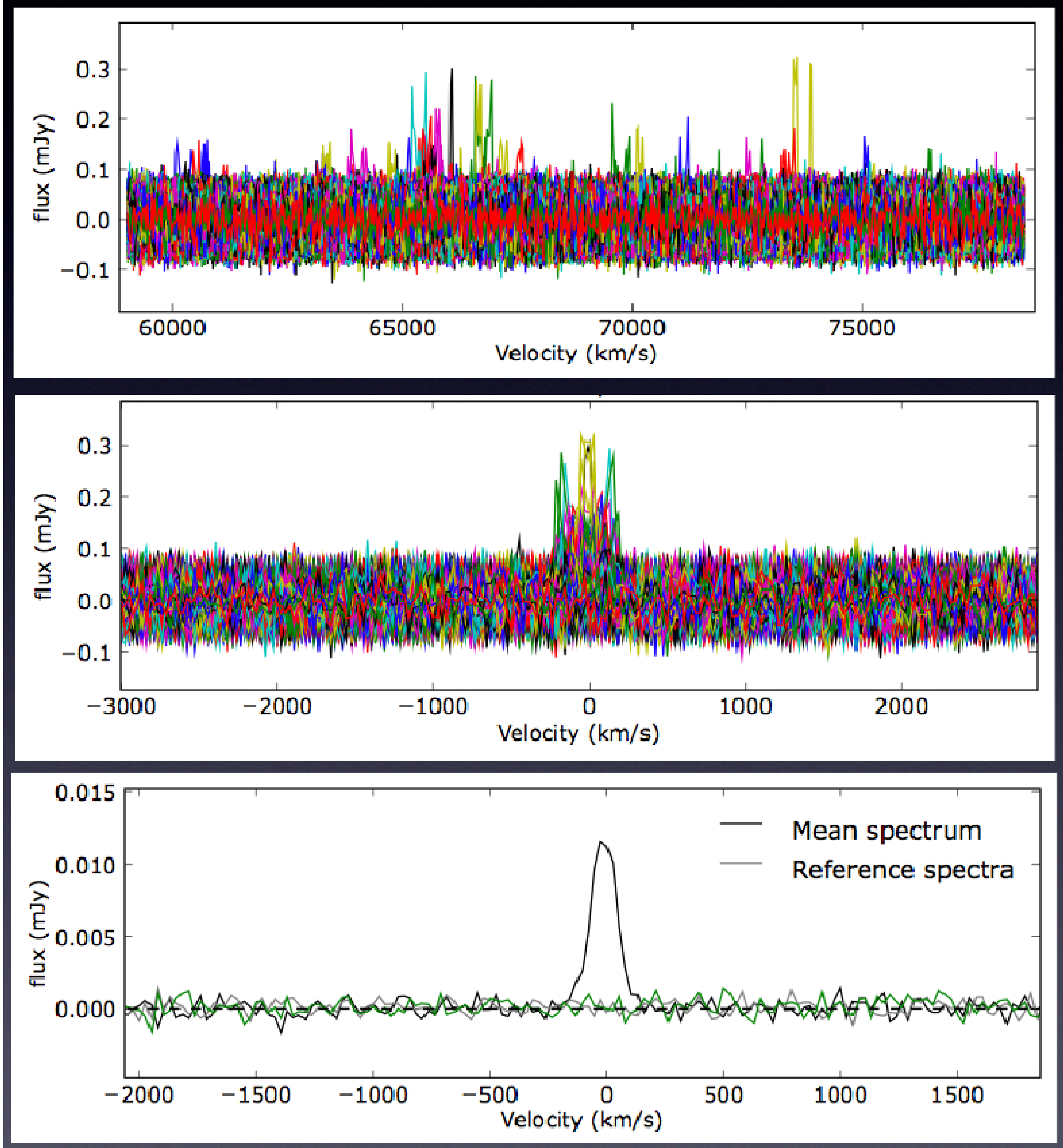
Stacking :

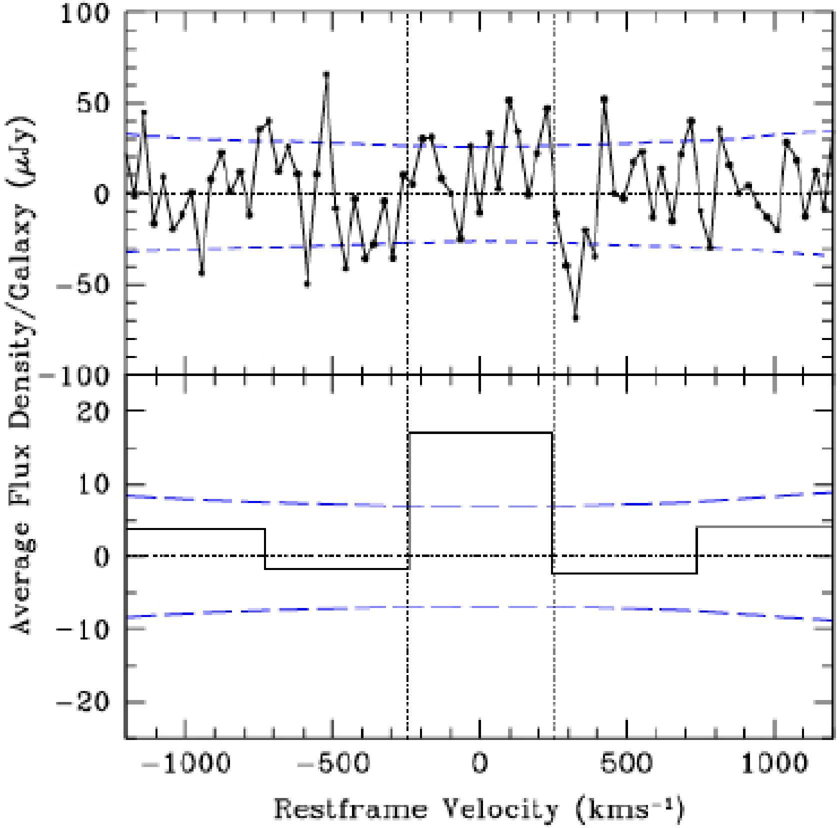
1. extract spectra using position

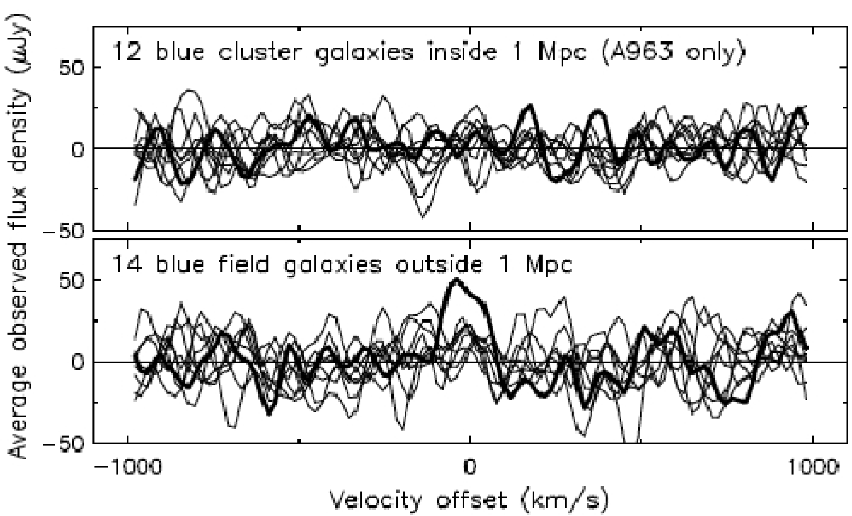
2. use known z to shift to common velocity

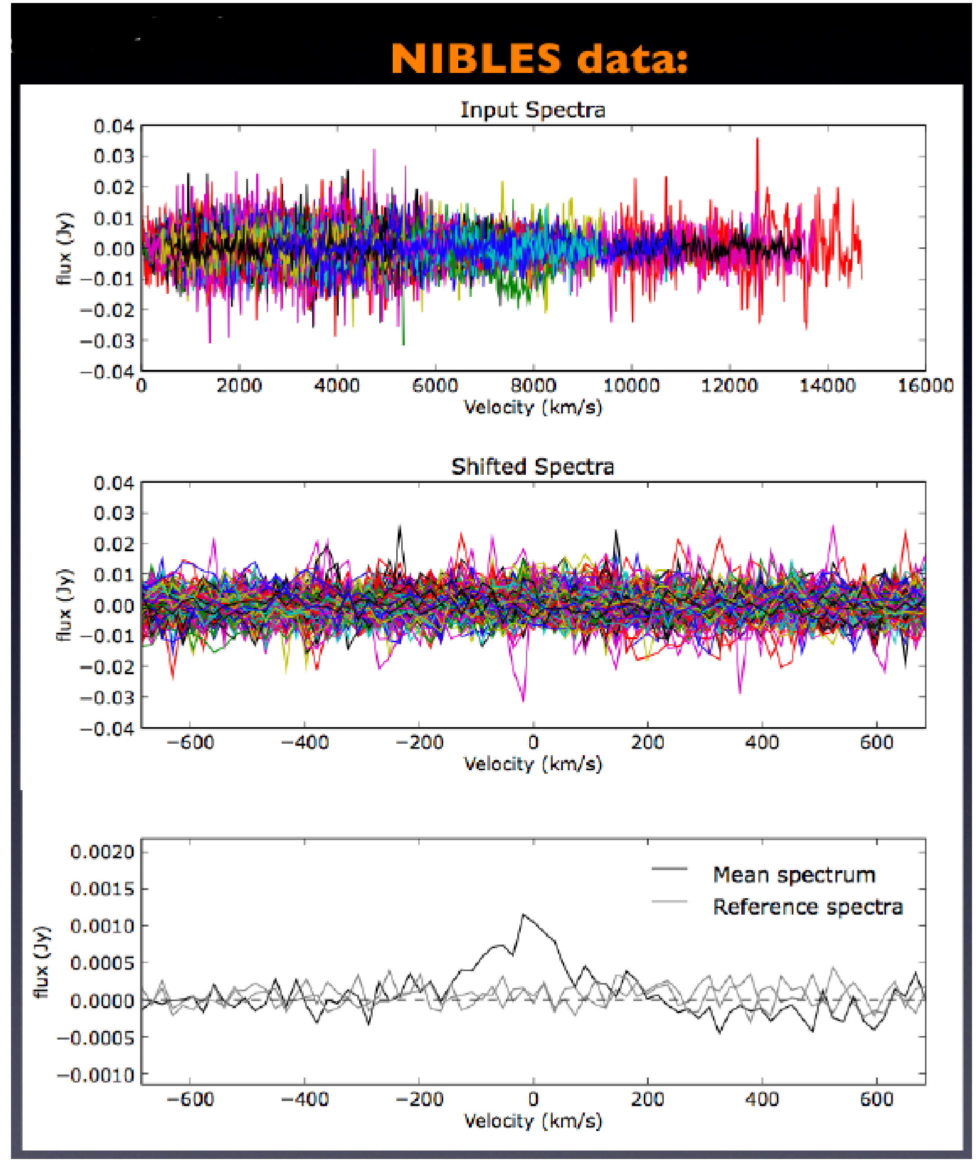
3. co-add spectra

cf. Blythe 2009









Lah et al. 2007, Verheijen et al. 2007
Blyth et al, in prep.

Participation aux propositions MeerKAT

- open call for international consortia for large projects ($>$1000h)

- key-science areas e.g. deep fields, low column density, pulsars
  - pre-proposals $\sim$ oct. 2009
  - consortia are open
  - small number of consortia

- for deep fields : could be COSMOS, or other field