



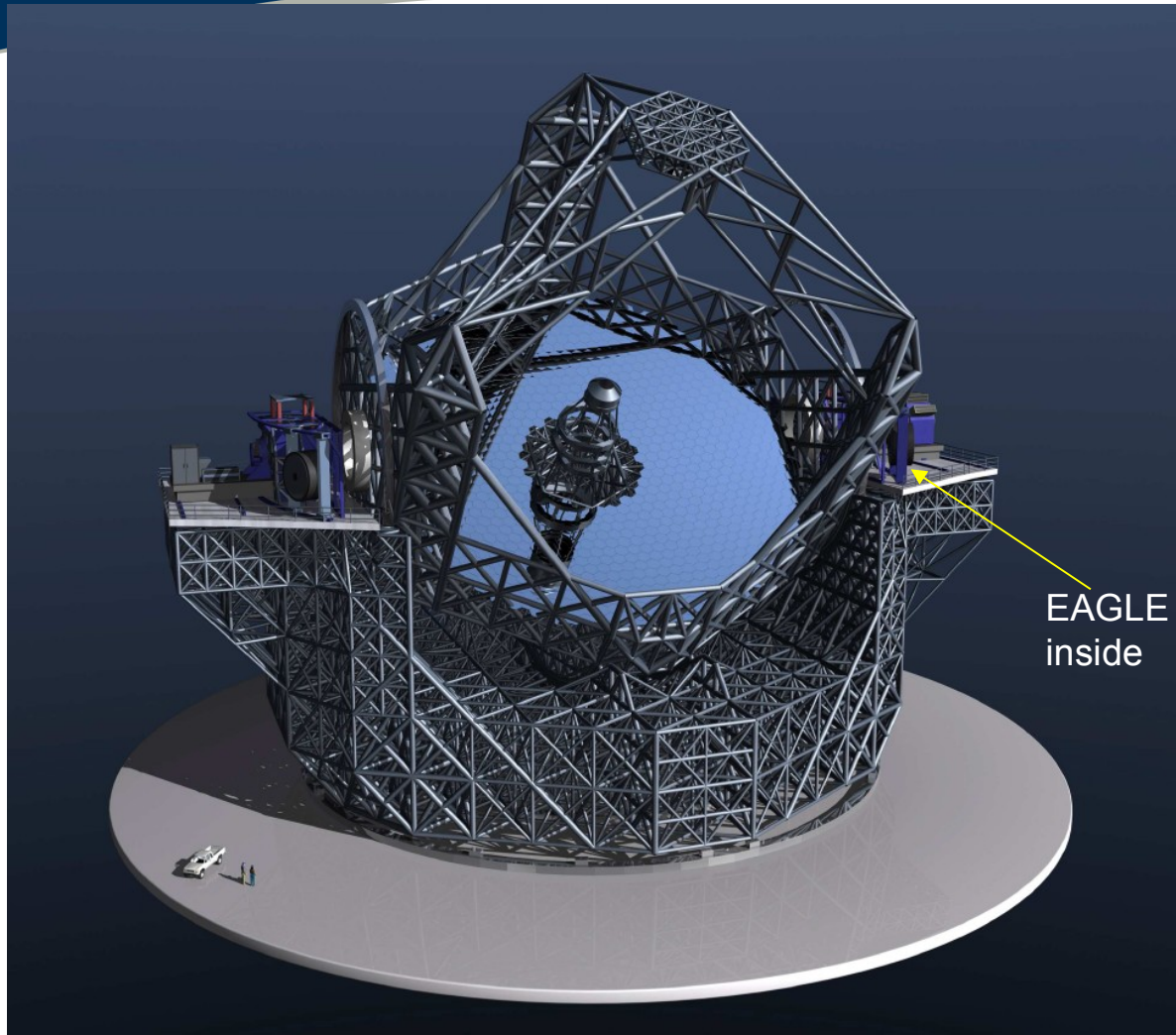
EAGLE: an MOAO fed dIFU working in the NIR on the E-ELT

J.-G. Cuby (LAM)

Au nom du consortium EAGLE



The European Extremely Large Telescope

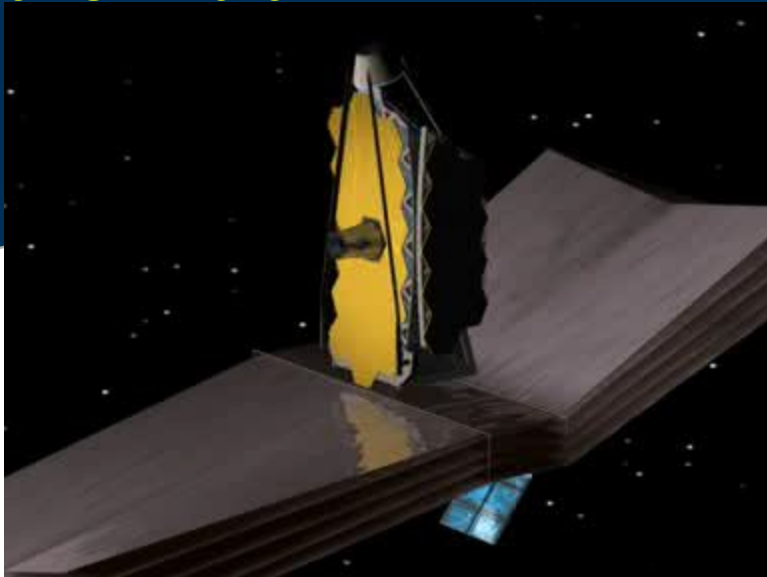


E-ELT baseline design
November 2006

M1 42m segmented
M2 6m monolithic, active
M4, M5 adaptive

Schedule:
2007-2009 Phase B
2010-2017 Construction

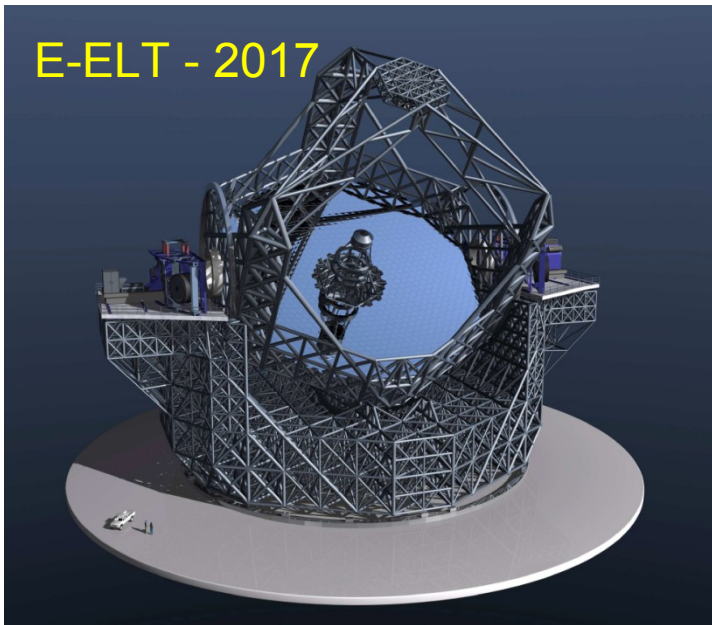
JWST - 2013



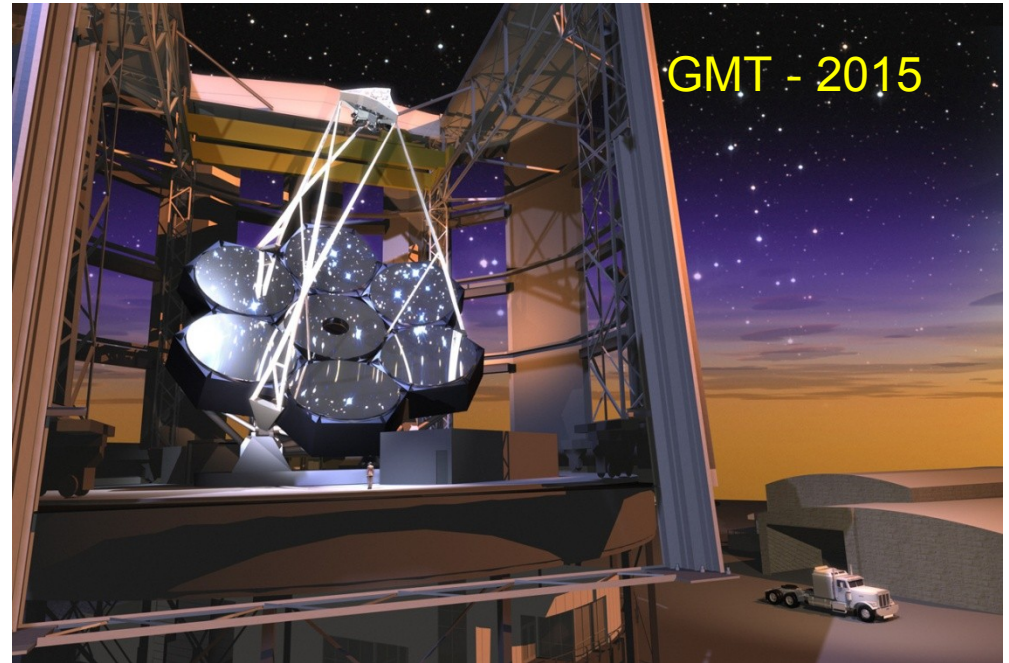
TMT - 2015



E-ELT - 2017



GMT - 2015

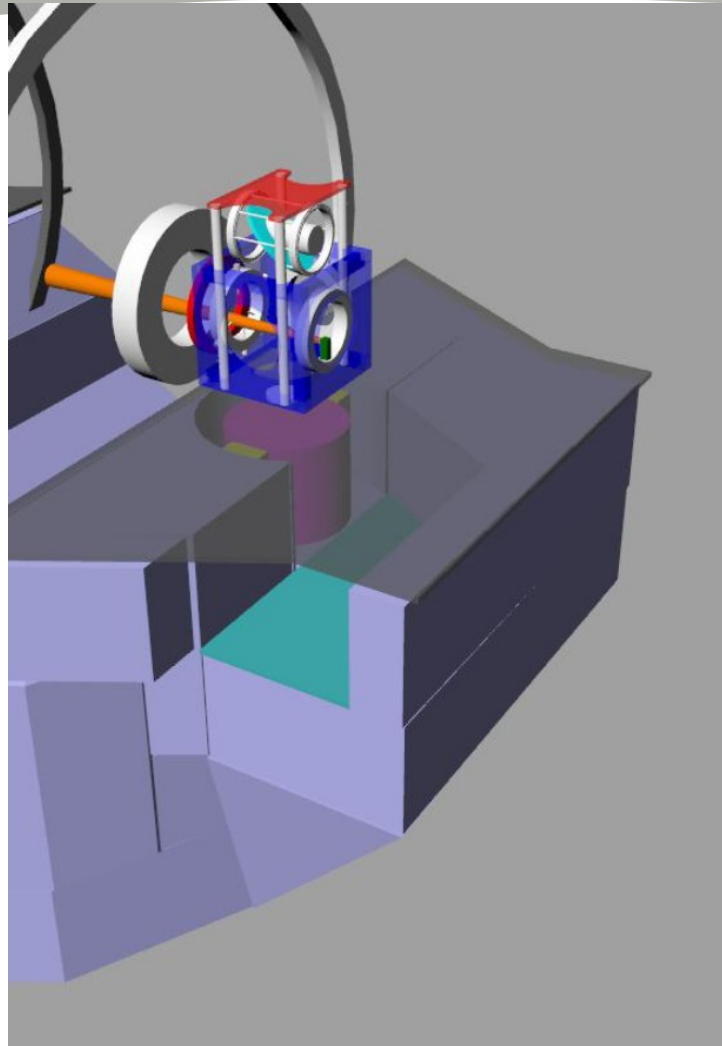


E-ELT Instruments

- CODEX – High R visible spectrograph
- **EPICS** – High contrast imager
- **EAGLE** – Multi-field near IR spectrograph
- **HARMONY** – Single Field Wide Band Spectrograph
- **METIS** – Mid IR Imager and Spectrograph
- **New concept** – MOS
- High Angular Resolution Camera
- New concept – TBD

- All in Phase A !

The European Extremely Large Telescope



The Gravity Invariant Nasmyth Focal Station

1 arcsec = 3.25 mm

5 arcmin ~ 1m

(purple cylinder,
8m diameter)

(mass limit of 20 tons)

The EAGLE Science Case

E-ELT 'Prominent' Science Cases

- Planets and Stars:
 - Extrasolar Planets (S3)
 - Circumstellar disks (S8)
 - **IMF in Stellar Clusters (S5)**
- Stars and Galaxies:
 - **Resolved Stellar Populations (G4)**
 - Black Holes/AGN (G9)
- Galaxies and Cosmology
 - **First light-the highest redshift galaxies (C4)**
 - Studies of Absorption lines: Dynamical measurement of universal expansion,
 - **IGM studies (C2, C7)**
 - **Physics of high redshift galaxies (C10)**

Red Cases have common instrument requirements well served by EAGLE

Notes:

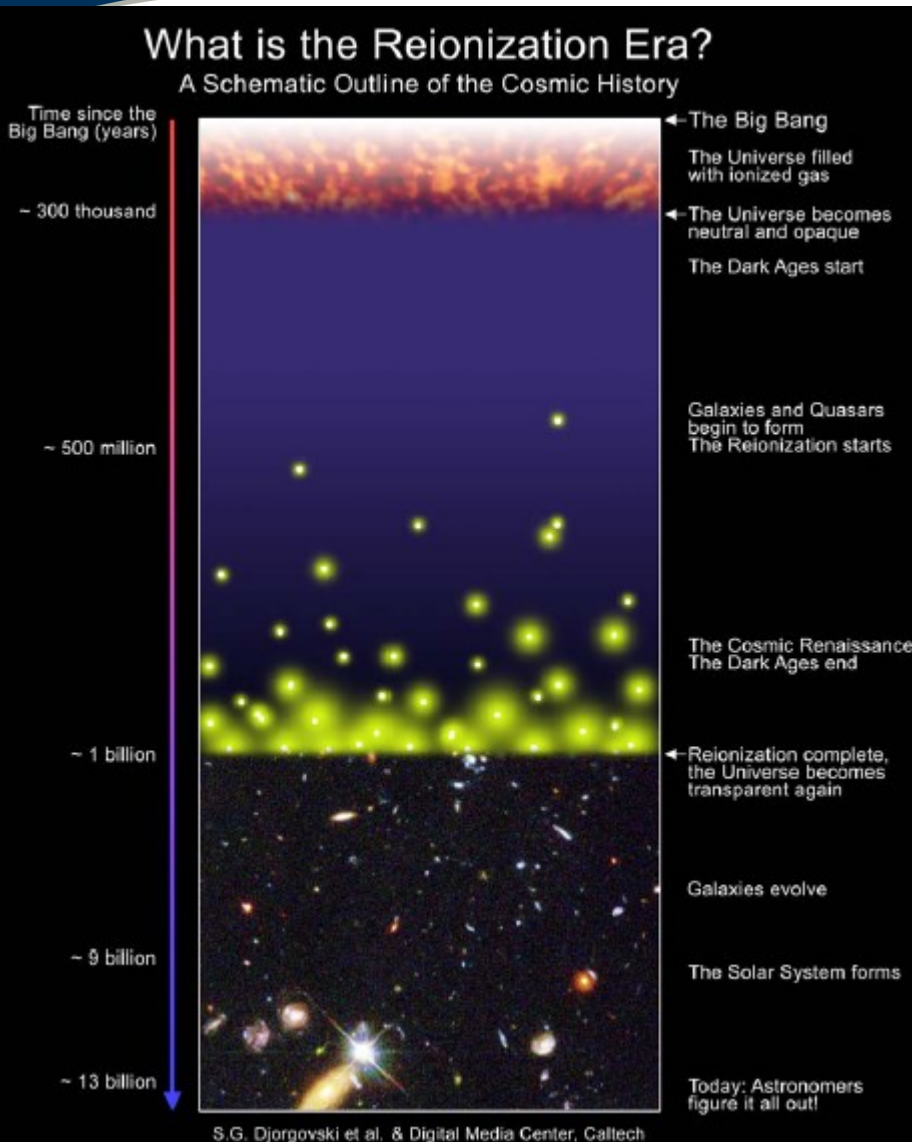
- Design Reference Mission (see ESO web site)
- Match to the Astronet Science Vision

The EAGLE Science Requirements

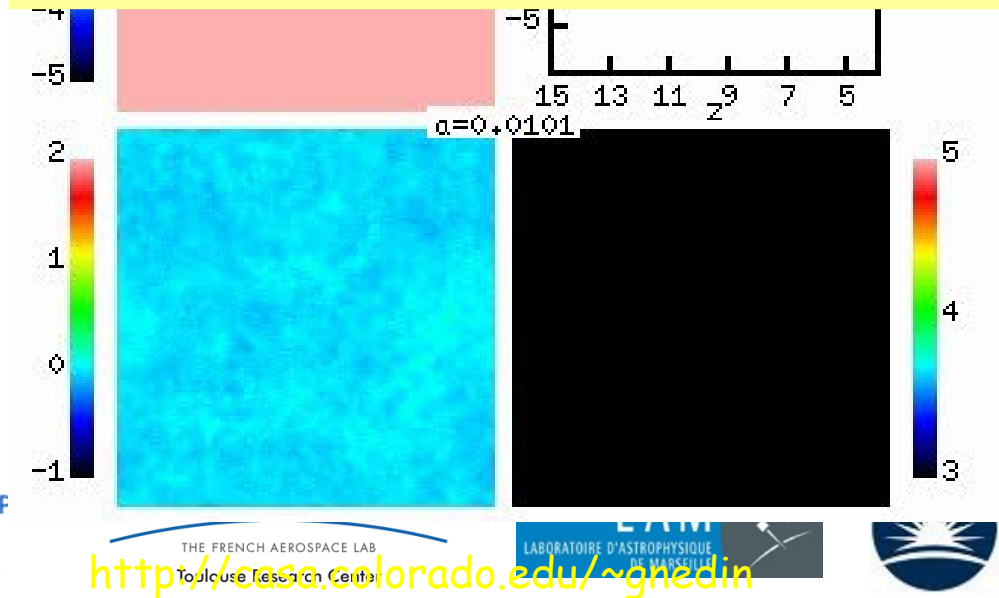
- **High spatial resolution (~ 75 milli-arcsec)**
 - Adaptive Optics needed
- **Extended sources ($\sim 2 \times 2$ arcsec)**
 - For galaxies, clustered stellar objects etc
 - Integral Field Units needed
- **Source count for statistics etc**
 - Multi-object instrument (20+)
- **Spectral range: $0.9 - 2.4 \mu\text{m}$ (near IR)**
- **Efficiency**
 - Wide-field (5 arcmin) to ensure all IFUs are used for each observation
- **$R \sim 4,000$ main spectral resolution (OH + 1 band in 2000 pix), but also $R \sim 10,000$ being considered for stellar physics**

Highlight ELT Science Case

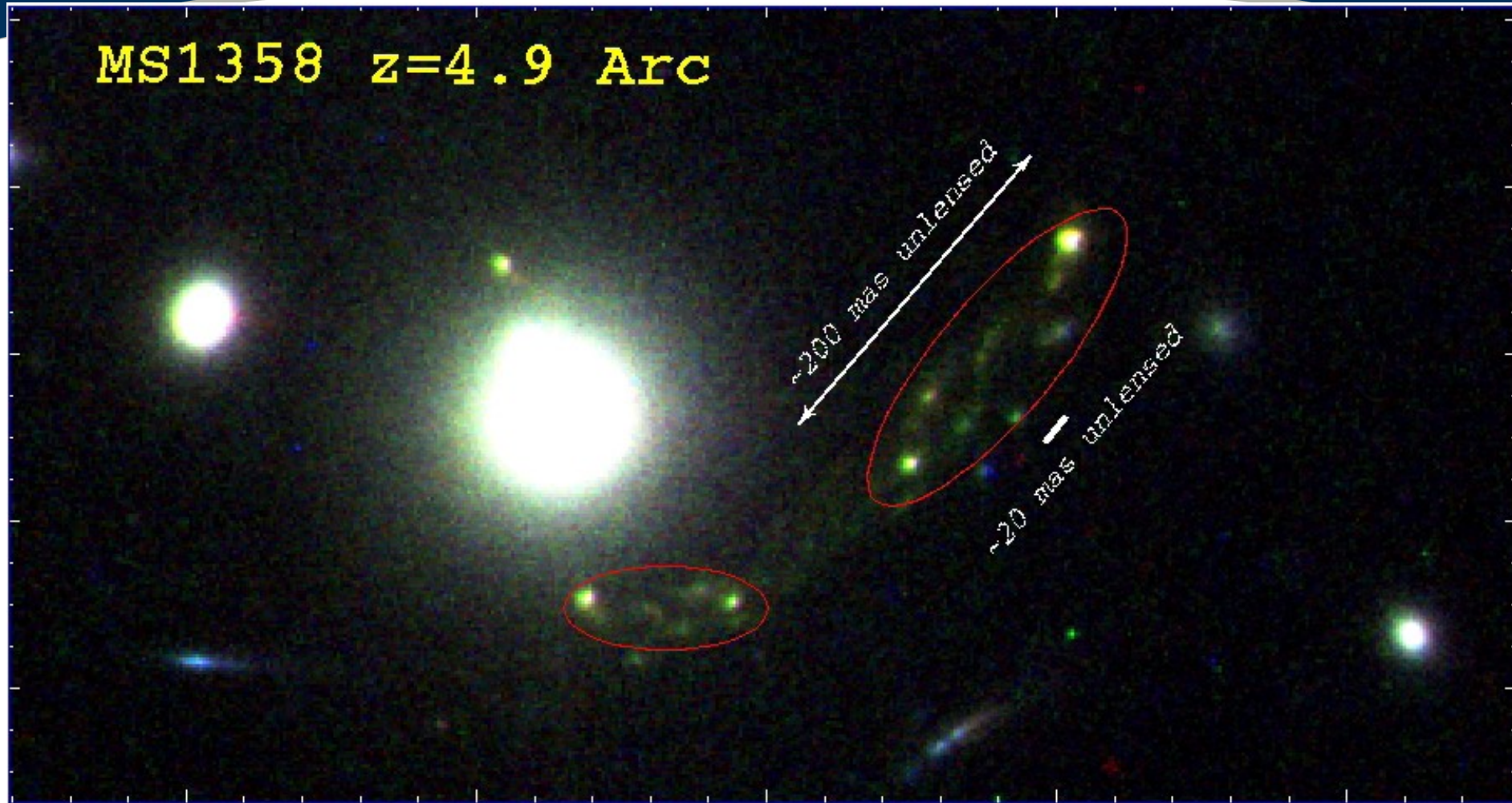
First Galaxies in the Universe



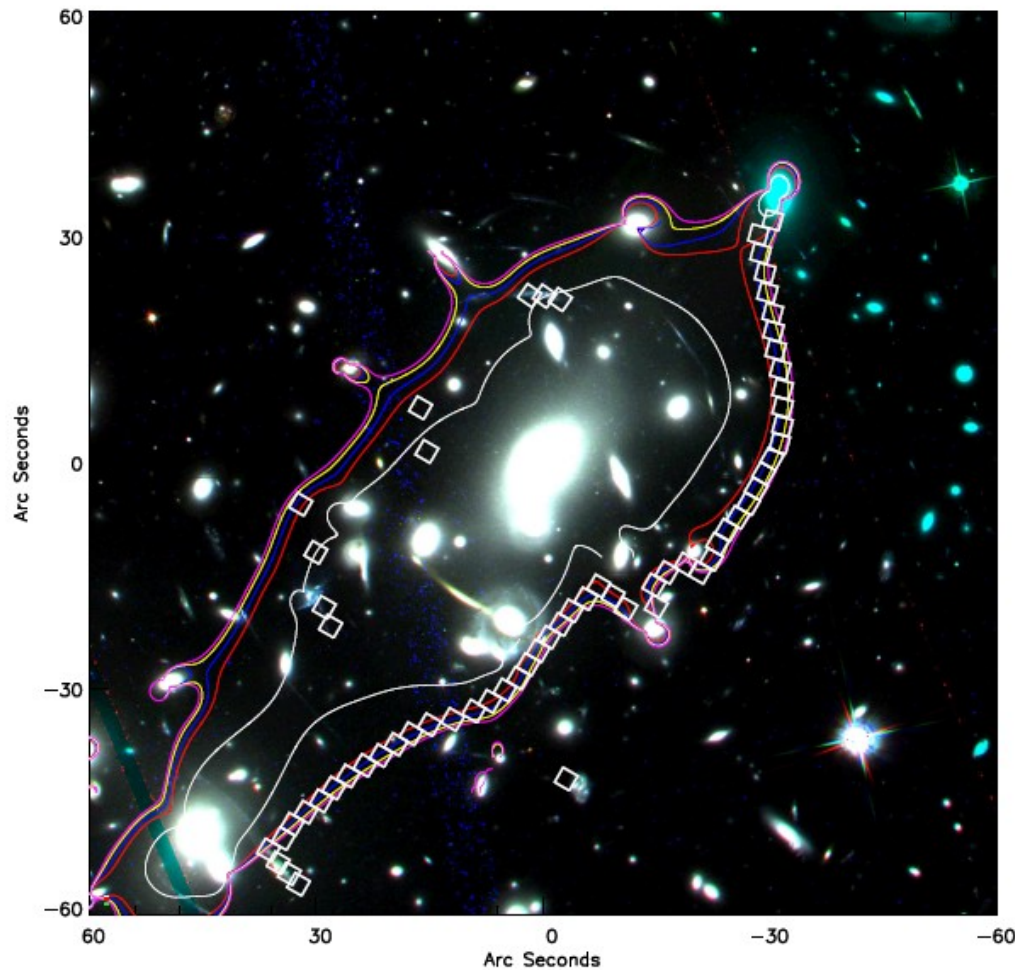
- What are the first galaxies ?
- When and how did reionization occur?
- What sources caused reionization?



The EAGLE Science Case (including why observe in the Near Infra-Red)



The EAGLE Science Case

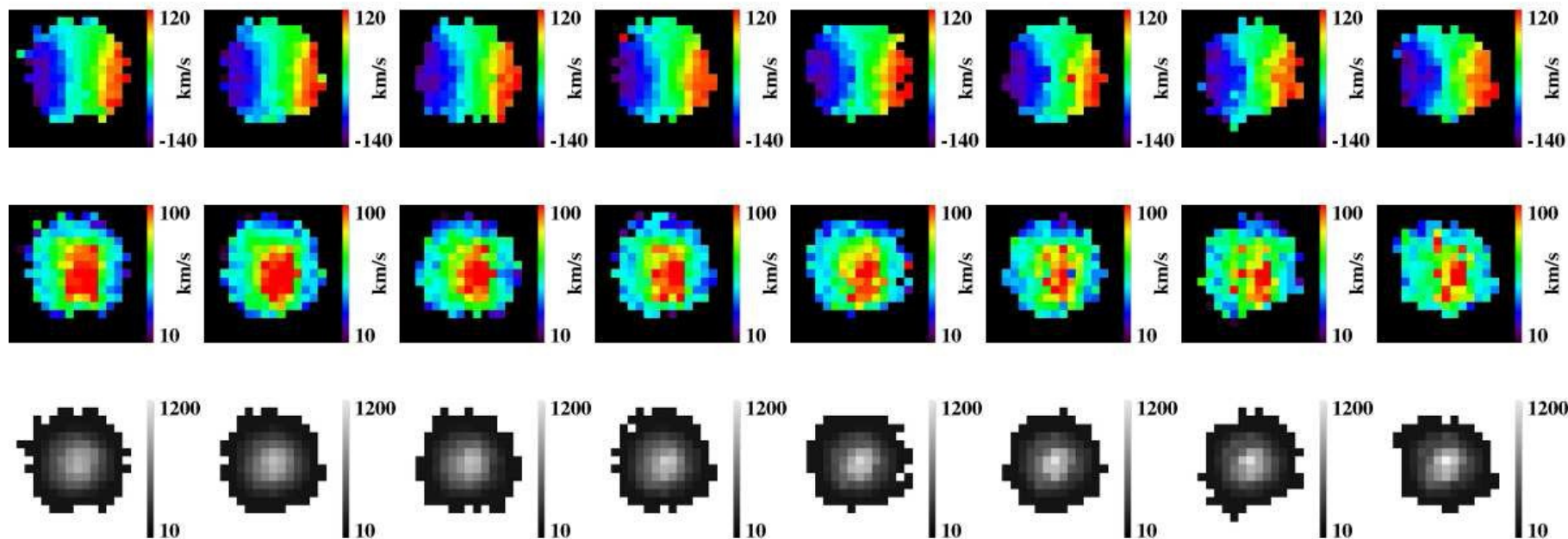


A2218
Z=2, 5, 10 & 20
critical lines shown

Boxes show possible
EAGLE IFU
Mapping of high z
Critical lines

The EAGLE Science Case

Rotating Disk Simulation

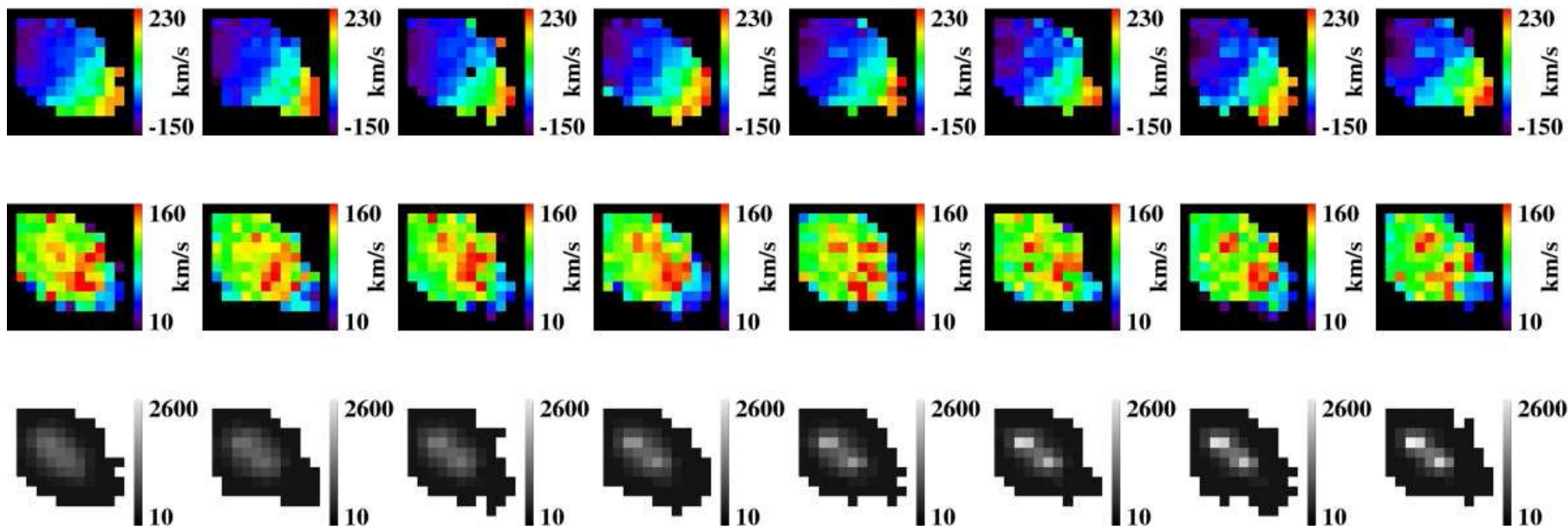


Puech et al., 2007

Improving AO correction =>

The EAGLE Science Case

Merger Simulation



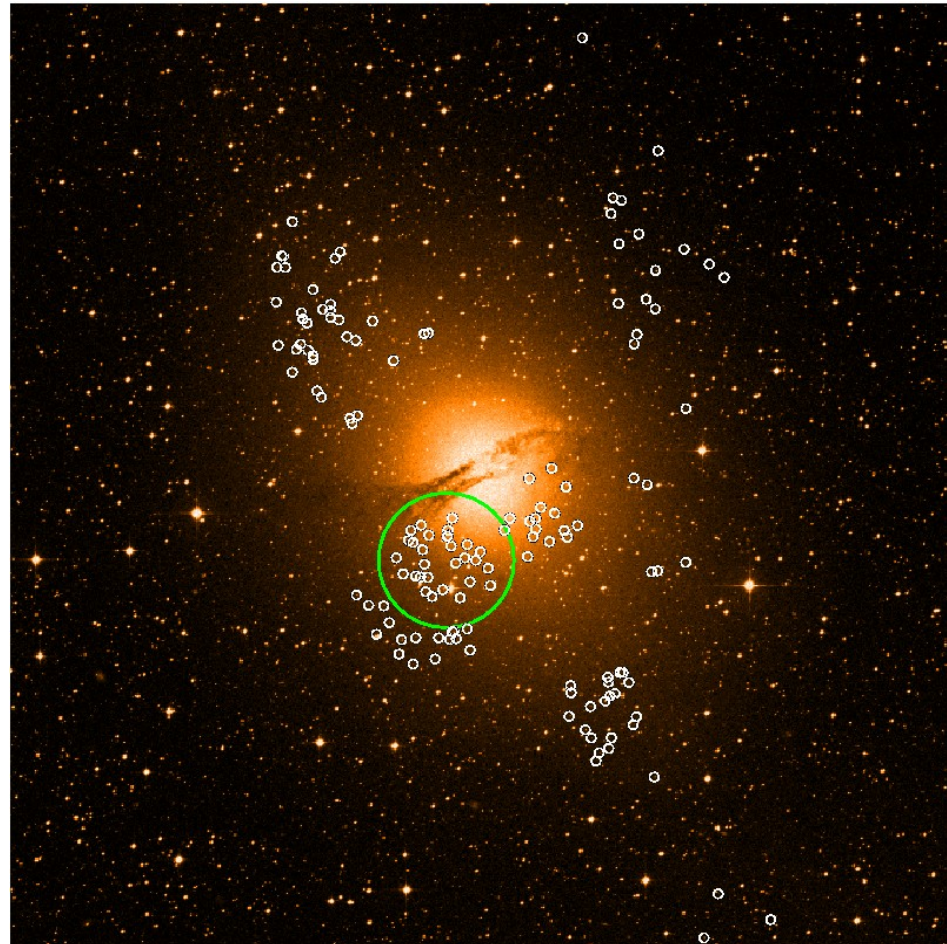
Improving AO correction =>

Puech et al., 2007

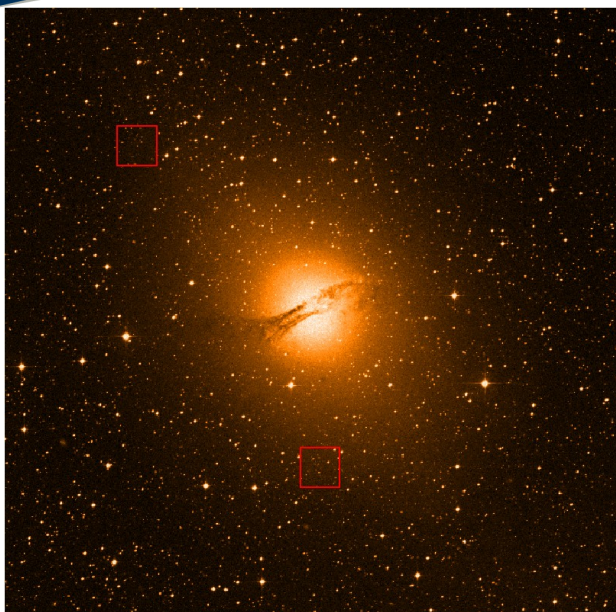
The EAGLE Science Case

Globular cluster
Candidates around
Cen A

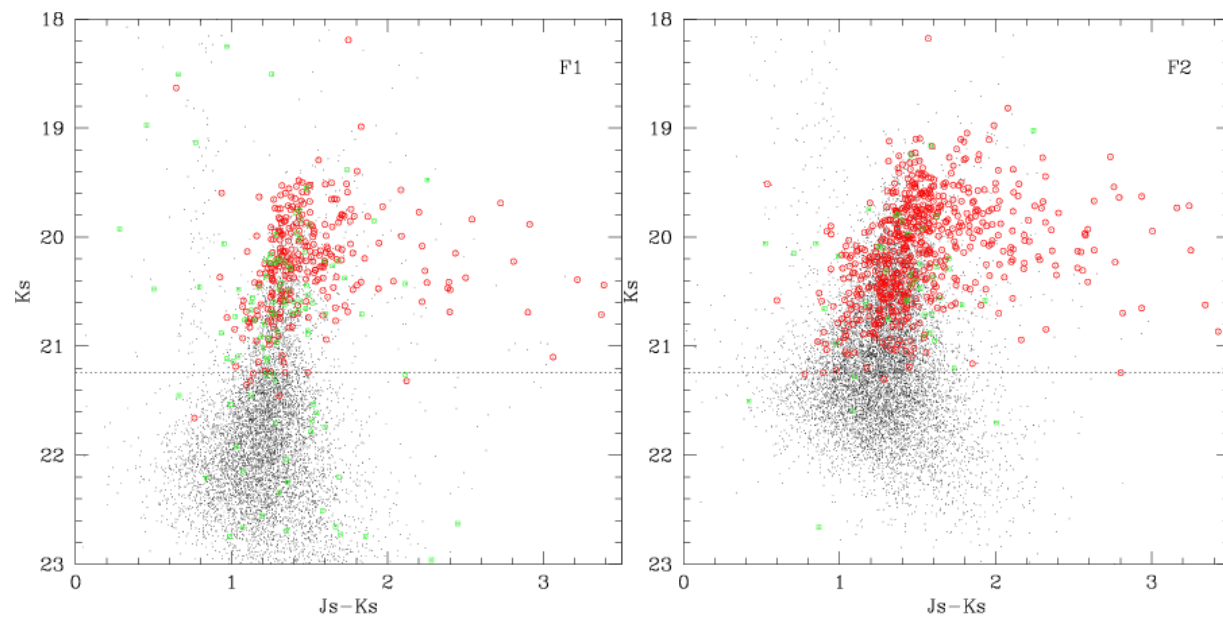
5 arcmin EAGLE
FOV green circle



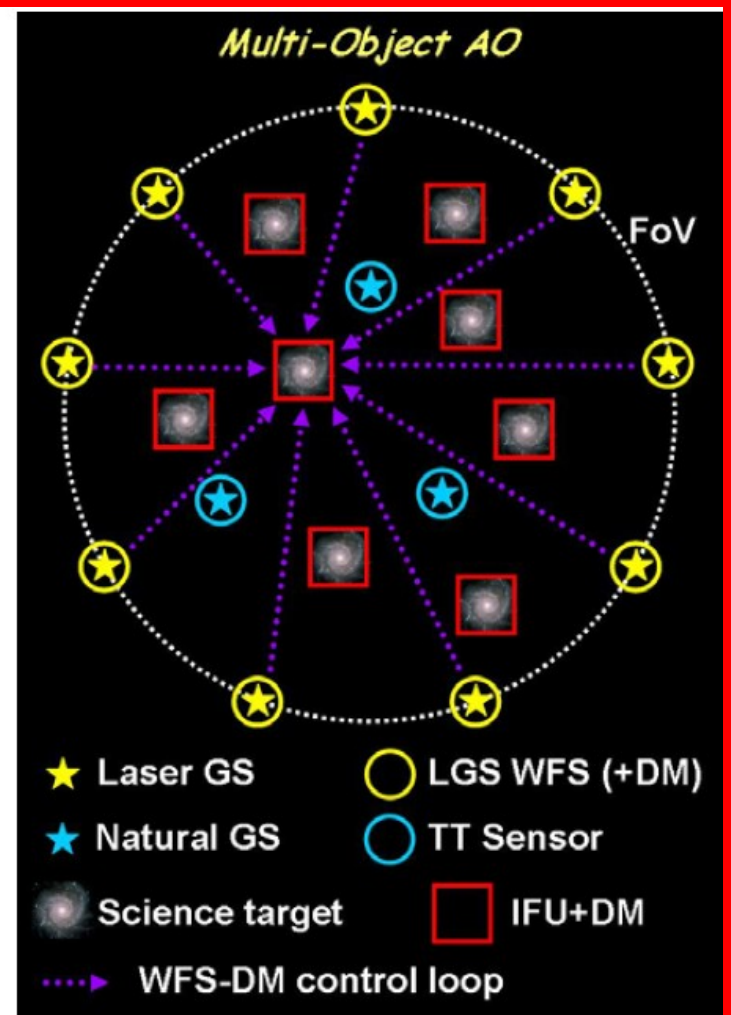
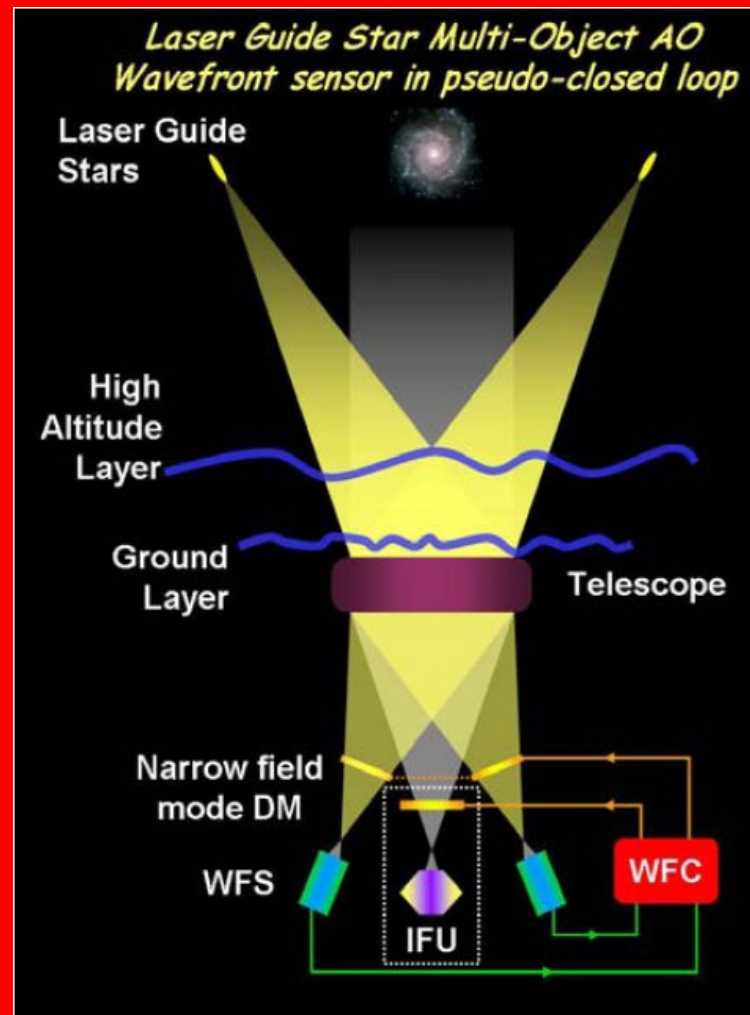
The EAGLE Science Case



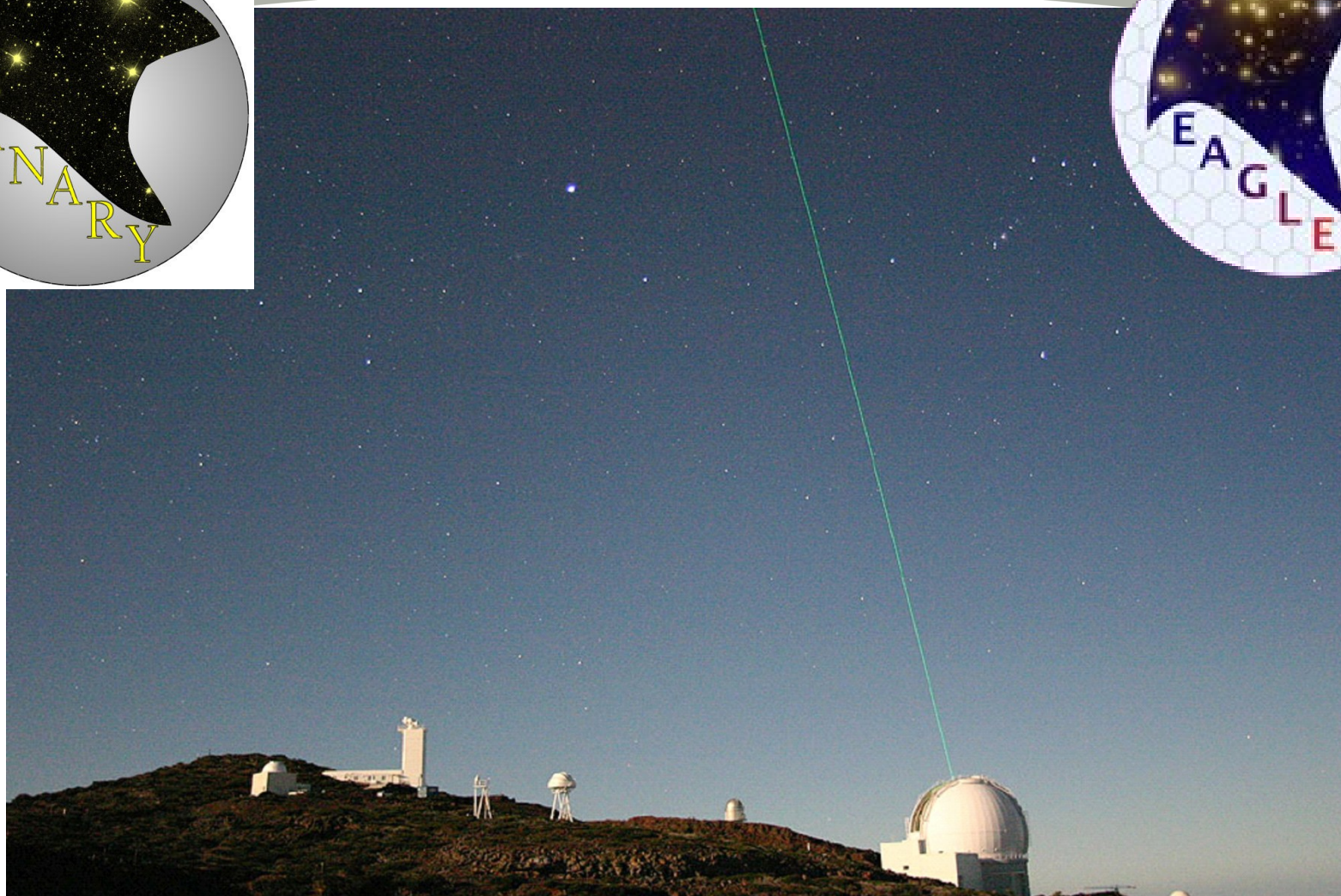
Candidate stars beyond tip of RGB for around Cen A selected on IR colours



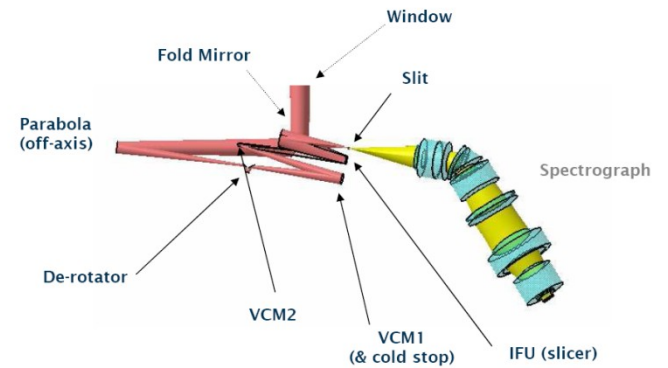
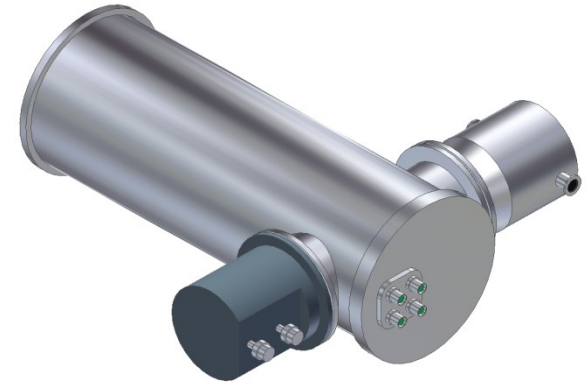
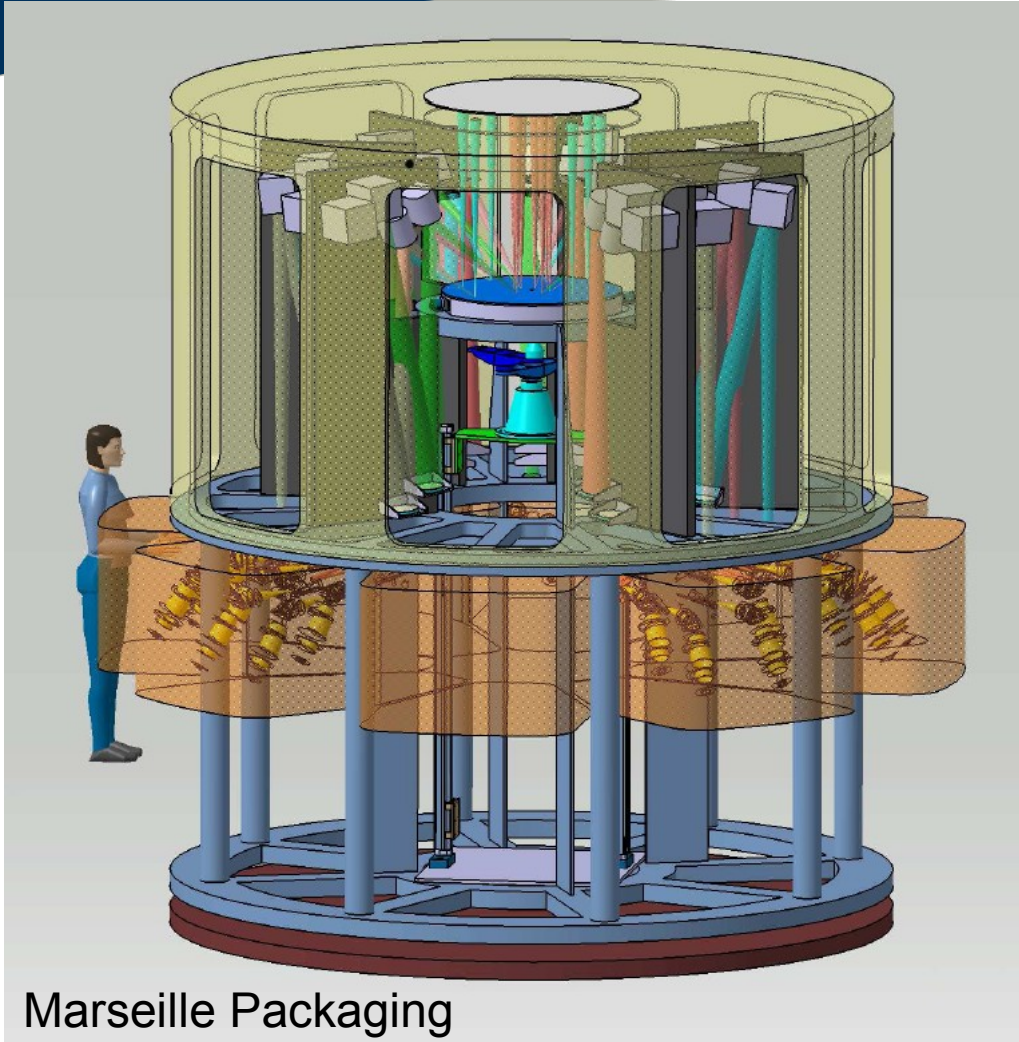
The Challenge of Multi-Object Adaptive Optics



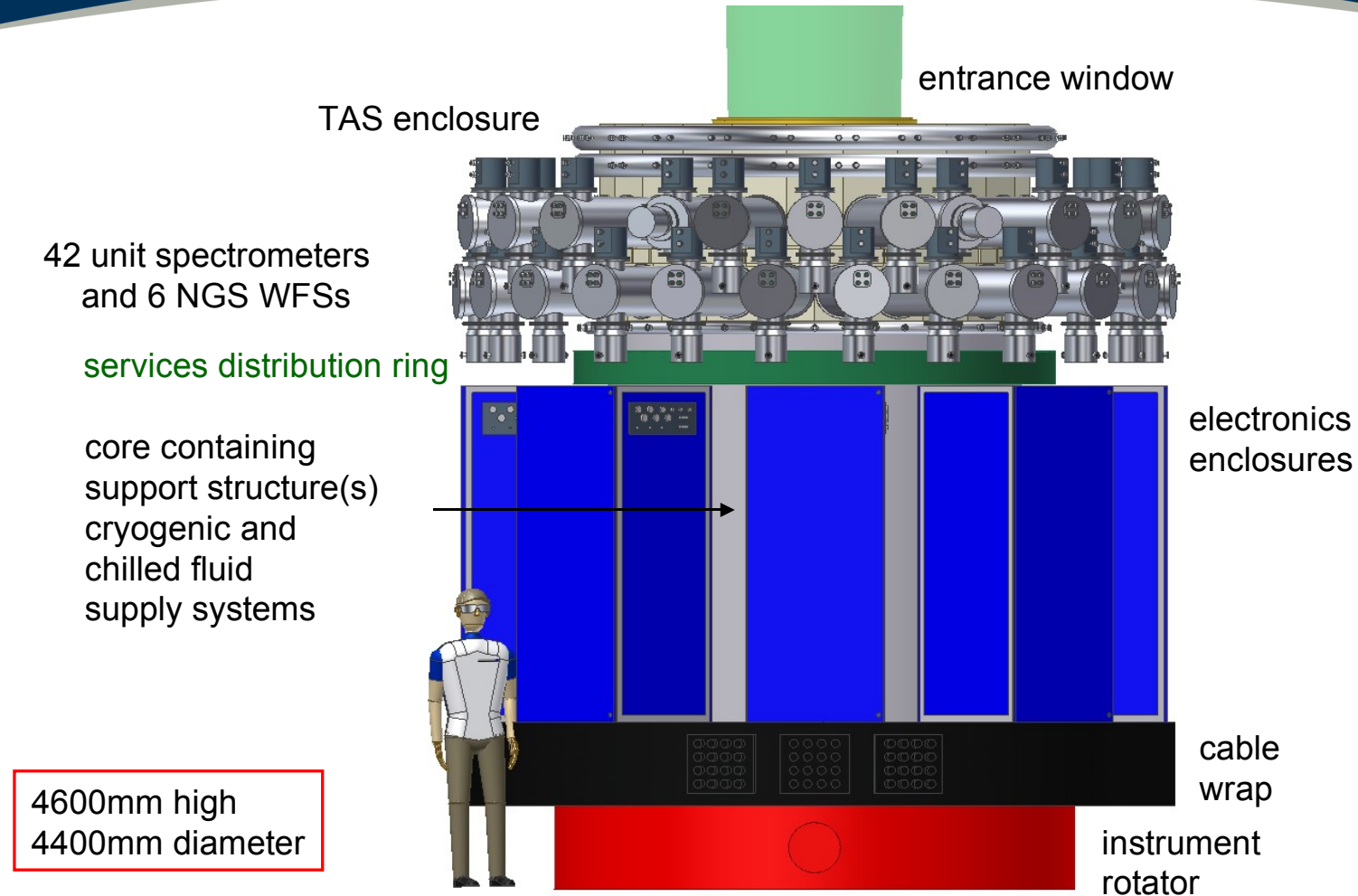
CANARY on the William Herschel 4.2m Telescope



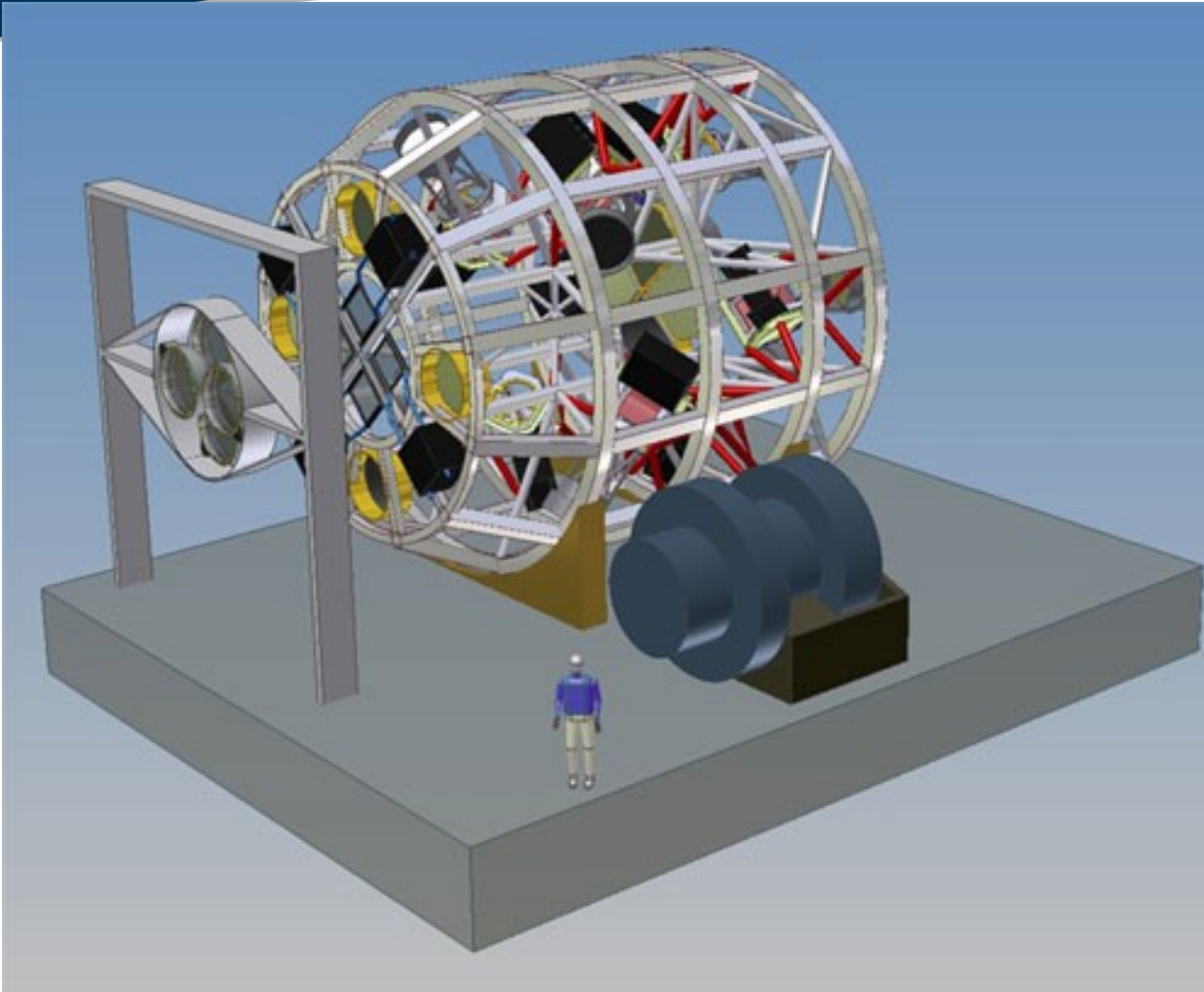
Mechanical Support, Software and Packaging



Mechanical Support, Software and Packaging



Mechanical Support, Software and Packaging



TMT WFOS
(for scale
comparison
with EAGLE)

Management, Funding and Politics

- French/UK instrument 50%/50% split
- French PI, Jean-Gabriel Cuby (Marseille)
- UK coPI, Simon Morris (Durham)
- Current French Institutions:
 - LAM (Marseille)
 - ONERA
 - Observatoire de Paris (GEPI and LESIA)
- Current UK Institutions
 - UK ATC
 - Durham (CfAI)

Conclusions

- Baseline selection June 2008
- Detailed science case 2008-2009
- End of phase A 2009
 - Design, development plan including costing
 - Evaluate phased development
- Contract for construction, if any, not expected before 2011
 - One year of intense lobbying in 2010
- Consortium extension
- National support in F and UK will be essential
 - EAGLE is supported in France by an ANR programme and in UK by STFC grants