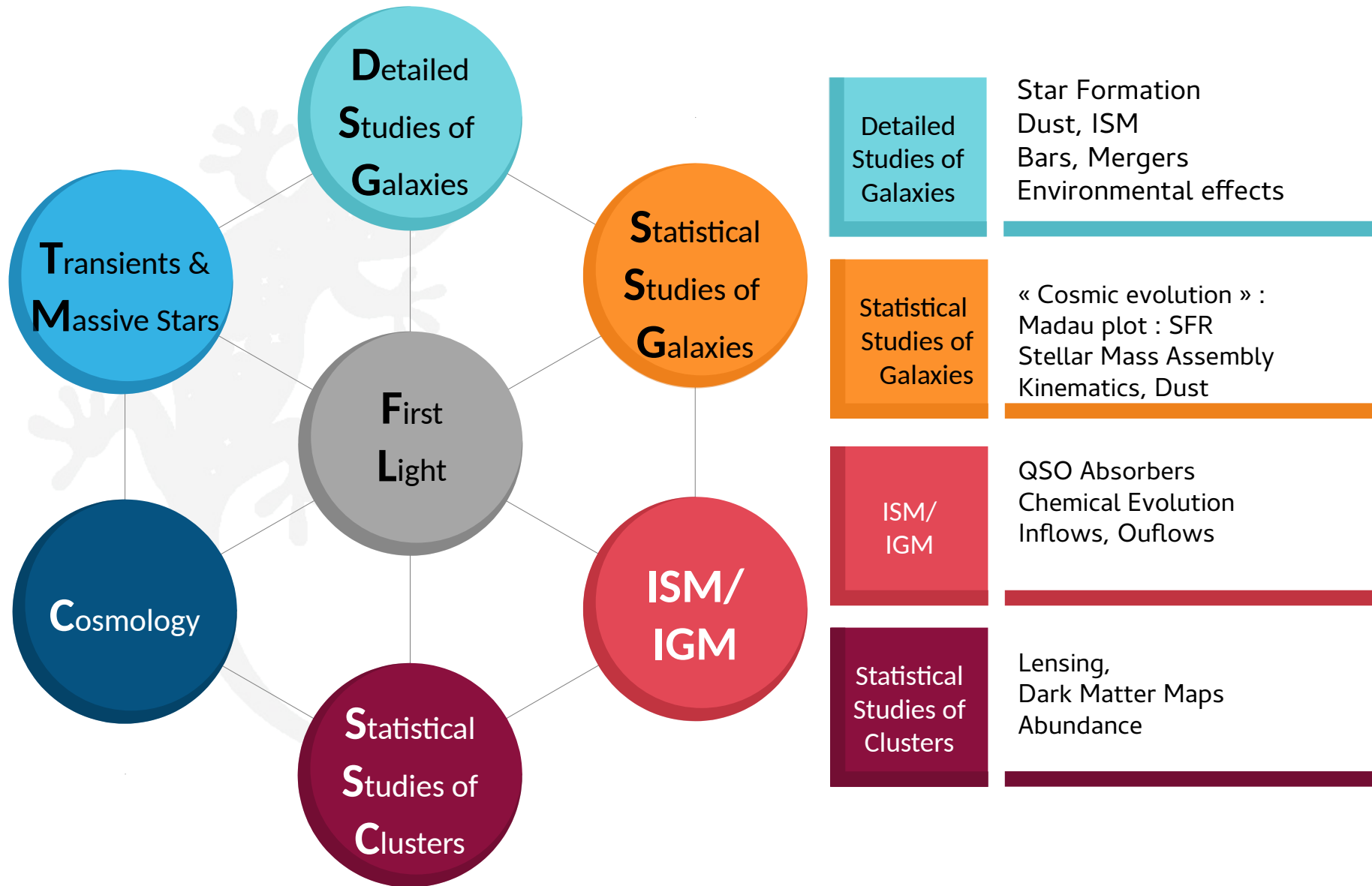


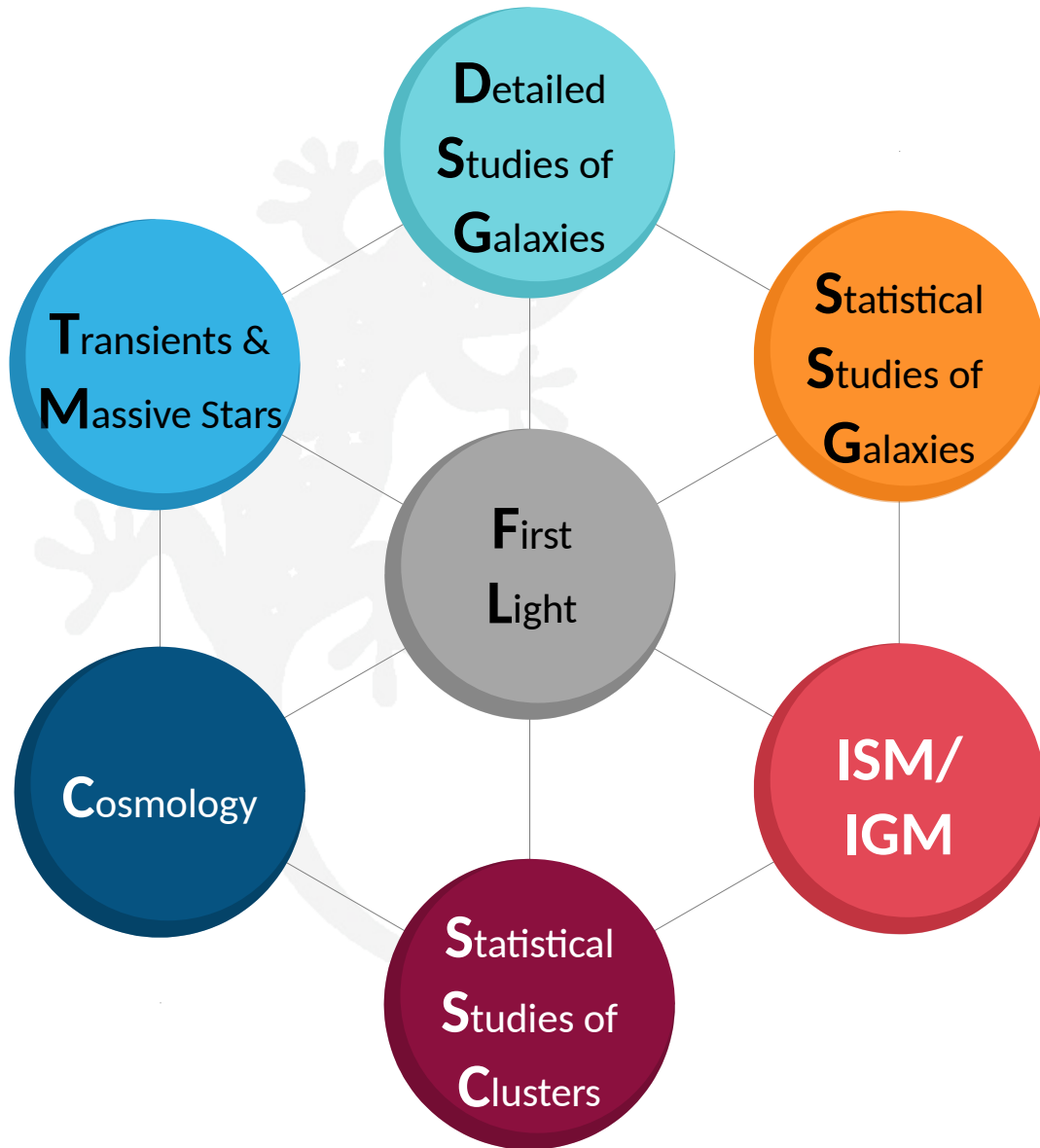
# Galaxies, Étoiles et Cosmologie (GÉCO)

This presentation :

- is based on the «HCERES » document version circulated earlier. « Final » version mid-July for the University
- may be used in part for next CS, HCERES visit
- describes GECO activities and results
- introduces perspectives for GECO science

- Team formed on January 1<sup>st</sup>,  
fusion of 5 previous teams  
(MIS, Pdg, Cosmologie, PSEG, DynGal)
- 36 staff
- 19 PhD students
- 12 post-doctoral researchers.





Cosmology

Dark Matter Distribution & Nature  
Dark Energy, & Cosmological model

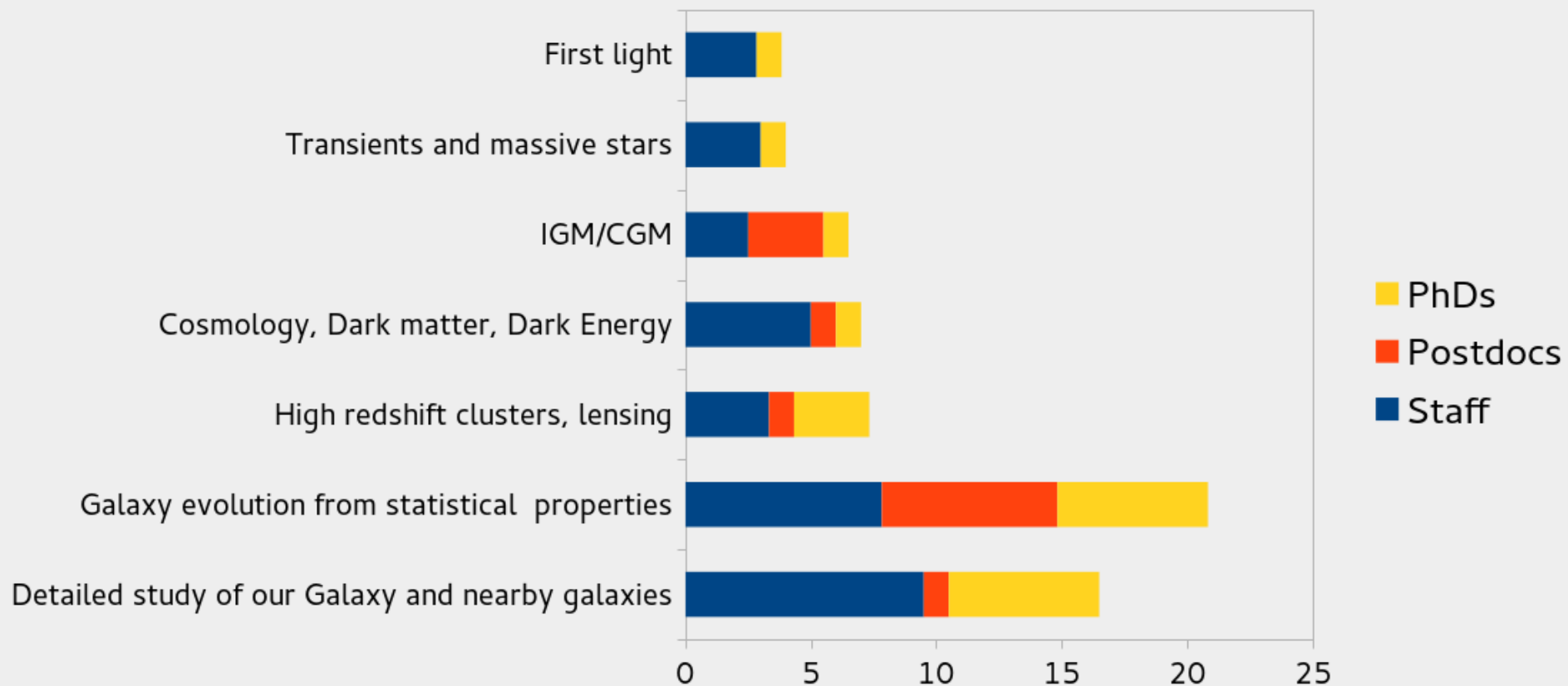
Transients & Massive stars

Observations of O stars and population III stars  
SuperNovae models  
Gamma Ray Bursts

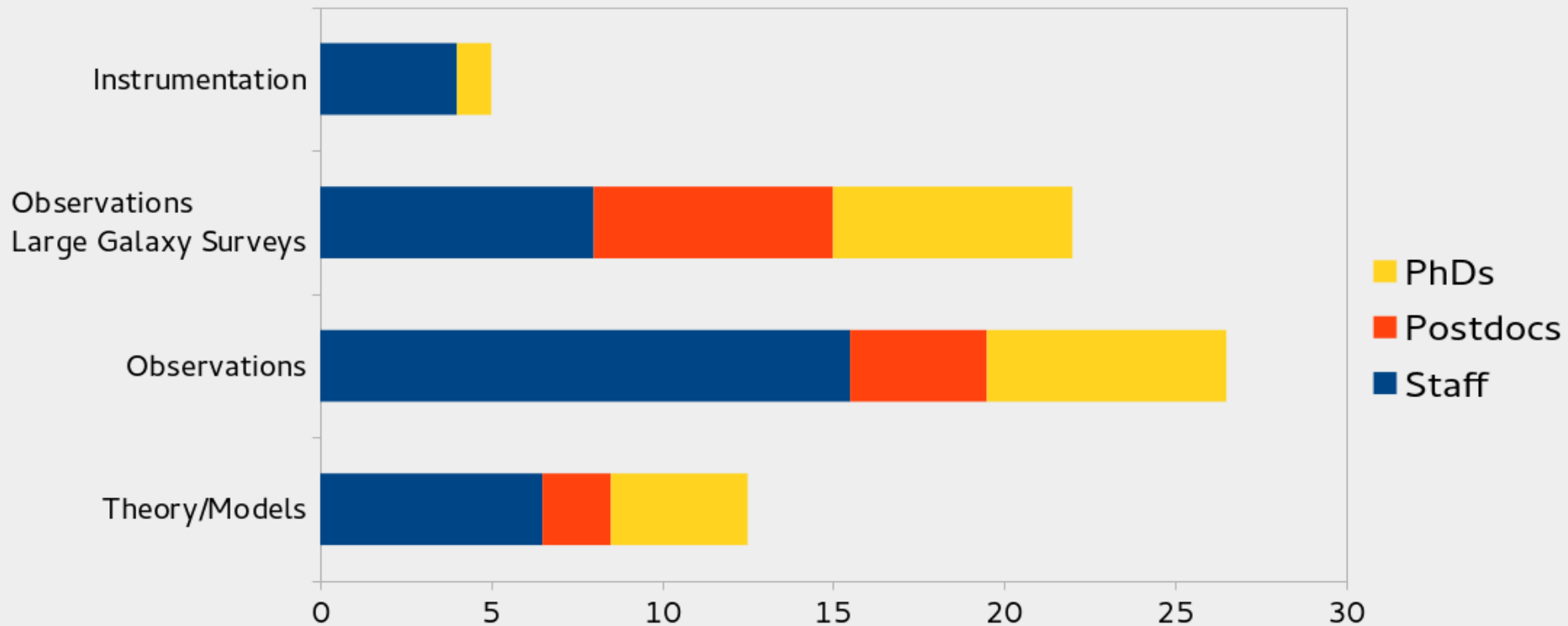
First Light

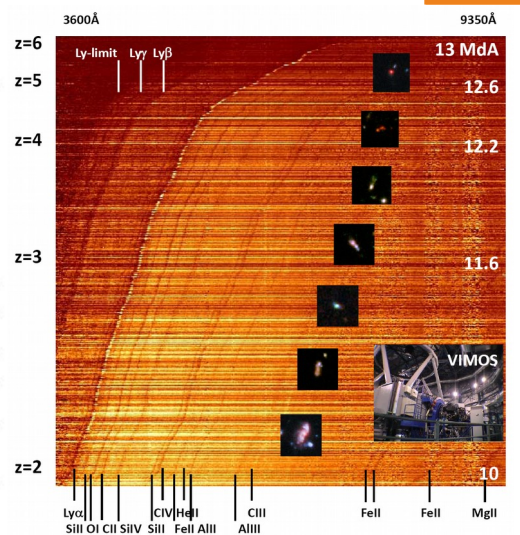
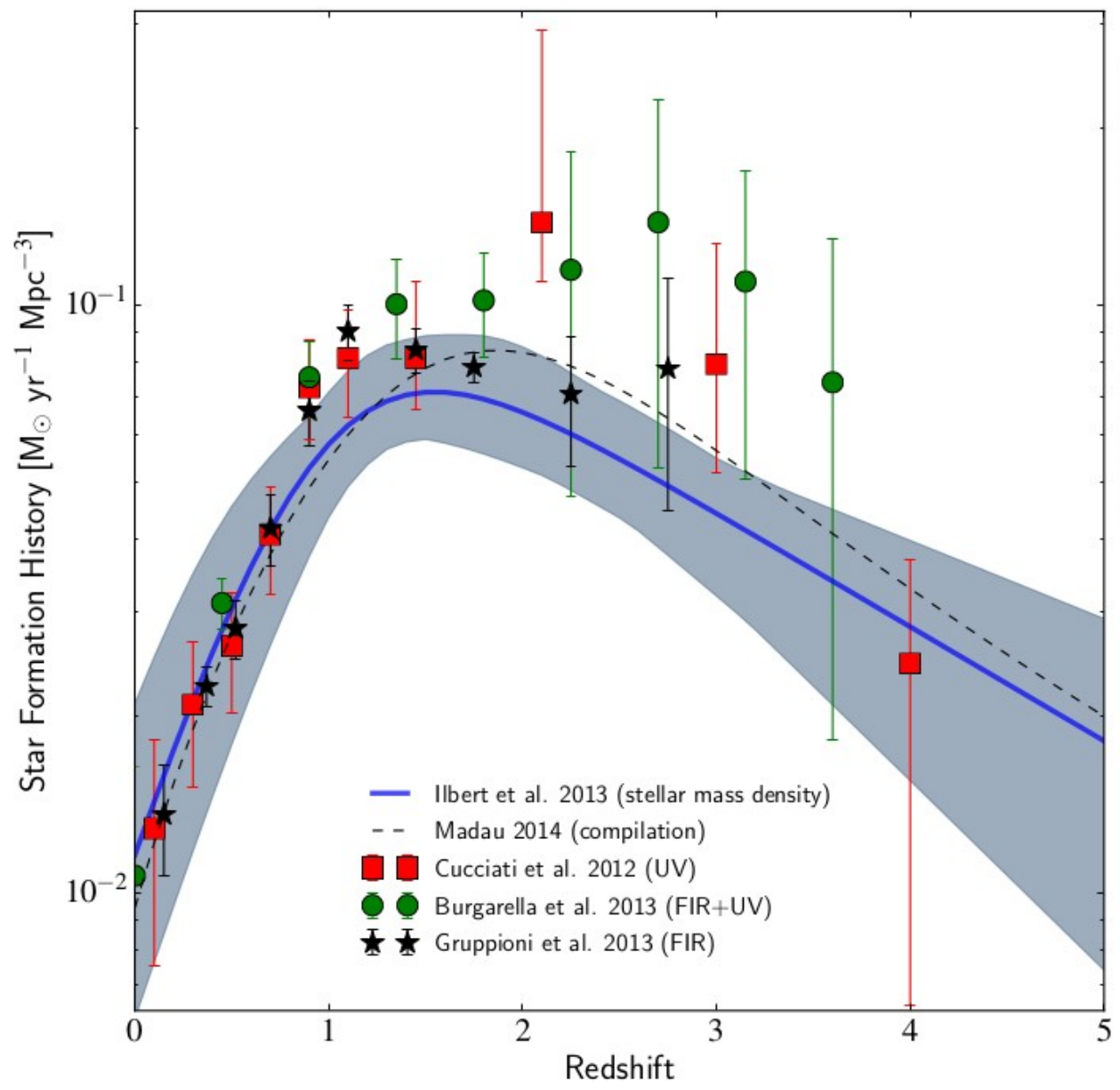
Search for very high  $z$  Galaxies (Narrow band, Deep surveys, Hosts of GRBs, Lensed)

- Ressource distribution on the different themes

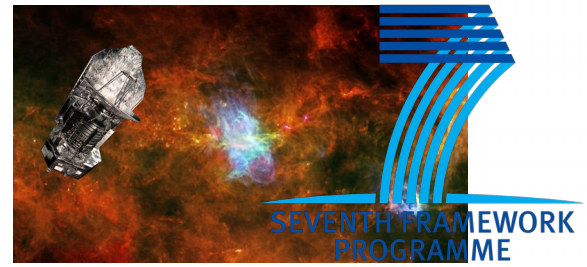


- Ressource distribution on the different themes
- And with different methodologies





VUDS  
ERC EARLY



Herschel surveys  
2 FP7 programs in the team



Perspective for GECO.

## A) The continuation of ongoing efforts along themes in the road-maps of agencies:

1)

### Cosmic First Light :

Highest redshift galaxies, first stars, population III, Gamma Ray Bursts. More generally link with Star formation.

2)

### Cosmic Mapping :

How the large scale matter distribution (gas, galaxies, DM) relates to the cosmic history of galaxies

3)

### Dark Sector:

Nature of Dark Matter, Dark Energy, and acceleration of the expansion. Cosmological model

Perspective for GECO.

## B) Preparing your long-term future

0)

**Transients :**

SVOM, F-GFT, MISTRAL. LSST (subject to politics)

Not discussed further today

1)

**Radio/Sub-mm/mm :**

Legacy of Herschel, switching to ALMA and NOEMA

The future of SKA and related projects ?

2)

**UV :**

Large scientific/technical expertise and interest in the laboratory.

Long-term road-maps.

3)

**X-ray:**

Athena is selected. Interests in the team (cosmic mapping theme)

Insertion in the technical activities of the laboratory ?



1)

**Cosmic First Light :**

Highest redshift galaxies, first stars, population III, Gamma Ray Bursts. More generally link with Star formation.

**Under the spotlights :**

- Study the reionization epoch
- Detect the first galaxies and QSOs
- Measure the cosmic Star Formation Rate up to this epoch

**Related studies in GECO:**

- Look for pop III stars and relics
- Reionization era with intensity mapping (Lagache et al.)
- Find first stars and galaxies:
  - Luminosity Functions up to the highest redshifts
  - Faint galaxies at redshift 7-8 with lensing (Atek et al. 2015)
  - High redshift Lyman alpha emitters (Clément et al. 2012)
  - Host galaxies of the most distant GRBs

1)

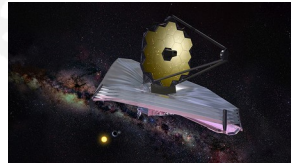


## Cosmic First Light :

Highest redshift galaxies, first stars, population III, Gamma Ray Bursts. More generally link with Star formation.

### JWST Launch

6.5m, studying very high redshift galaxies.  
Co-lead of 2 ANOs (MIRI, NIRSpec)



### ELT

Observing primordial galaxies and the first structures during the reionization period.

- HARMONI (co-Is : Epinat, Péroux) : integral field instrument.
- MOSAIC (co-Is : Cuby, Lefèvre) : multi-object spectrograph.

2016

### FLARE

*First Light and Reionization Explorer.*

ESA M5 proposal (PI : D. Burgarella) for a launch ~2030

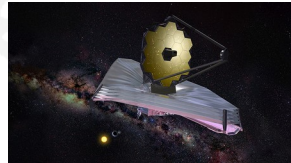
Deep surveys to detect first galaxies and quasars.

2.0m telescope, 900 arcmin<sup>2</sup> wide-field camera, 1-arcmin IFU. wavelength range 1-5 micron.

2018

### JWST Launch

6.5m, studying very high redshift galaxies.  
Co-lead of 2 ANOs (MIRI, NIRSpec)



2021

### SVOM Launch

White paper, in prep. 3yrs (at least) MISSION,

detecting very high  $z$  star forming galaxies from the explosion of massive stars

Co-PI : S. Basa.  
4 PIs

2025

### ELT

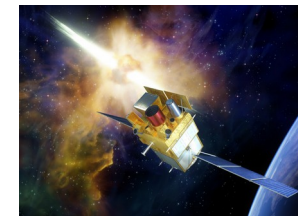
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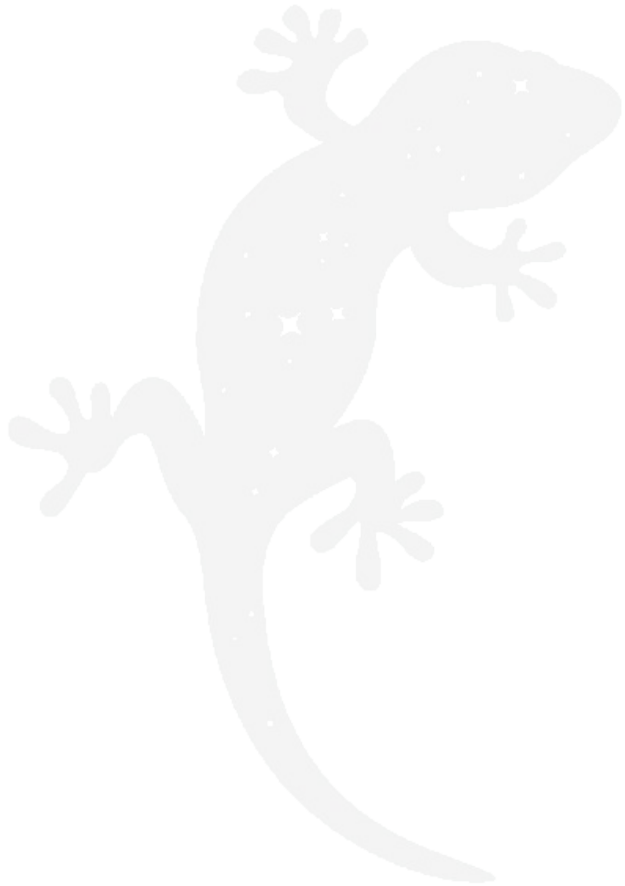
- HARMONI (co-Is : Epinat, Péroux) : integral field instrument.
- MOSAIC (co-Is : Cuby, Lefèvre) : multi-object spectrograph.

2030

### FLARE

Launch.





3)

**Dark Sector:**

Nature of Dark Matter, Dark Energy, and acceleration of the expansion. Cosmological model

**Under the spotlights:**

- Distribution of DM from Lensing : high resolution/wide fields
- Nature of Dark Energy from massive redshift surveys : BAO & RSD
- Probe combination : WL+ galaxy/quasar/LyA clustering+SN+CMB  
→ Target : analysis of Euclid and DESI in 2020-2025

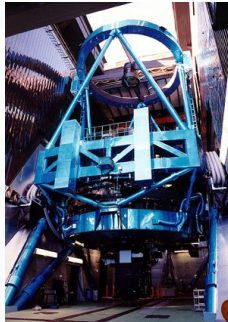
**In GECO:**

- Strong involvement in the preparation of all next-generation DE experiments
- Expertise on technical aspects (spectrographs), survey simulation, tools for scientific exploitation
- Need workforce to consolidate our position and make primary science out of these experiments

3)

**Dark Sector:**

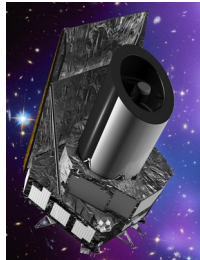
Nature of Dark Matter, Dark Energy, and acceleration of the expansion. Cosmological model

**PFS/SuMIRe**

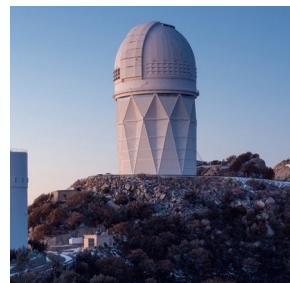
Japanese-led spectroscopic program at Subaru. Includes a cosmology survey of OII emitters over  $1400 \text{ deg}^2$  at  $1 < z < 2.4$ . LAM is building the spectrograph. Main science: BAO, RSD, and WL (w/ HSC) to probe DE. PI cosmo: M. Takada

**Euclid**

Major European mission for DM and DE (redshift and imaging survey). LAM is responsible for the spectrograph. Strong involvement of the group in its preparation at various levels: SGS, WP leads, SWGs leads etc.). Importance of legacy science.

**2016****eBOSS**

Started in 2015, SDSS-IV galaxy redshift survey for cosmology. Three tracers covering  $0.5 < z < 2.5$ : LRG, ELG, quasars. Main science: BAO and RSD to constrain DE. Closed collaboration. PI: J-P. Kneib

**2018****2020****DESI**

American DE program. Redshift survey of 35 millions of galaxies and quasars up to  $z = 3.5$  and over  $14,000 \text{ deg}^2$ . Main science: BAO and RSD. AMU participation group.

**2025****WFIRST**

Dark Energy is one of main science goals. Possible involvement?