Galaxies, Étoiles et Cosmologie (GÉCO)

Aix*Marseille université

cnrs LAM LABORATOIRE D'ASTROPHYSIQUE DE MARSEILLE

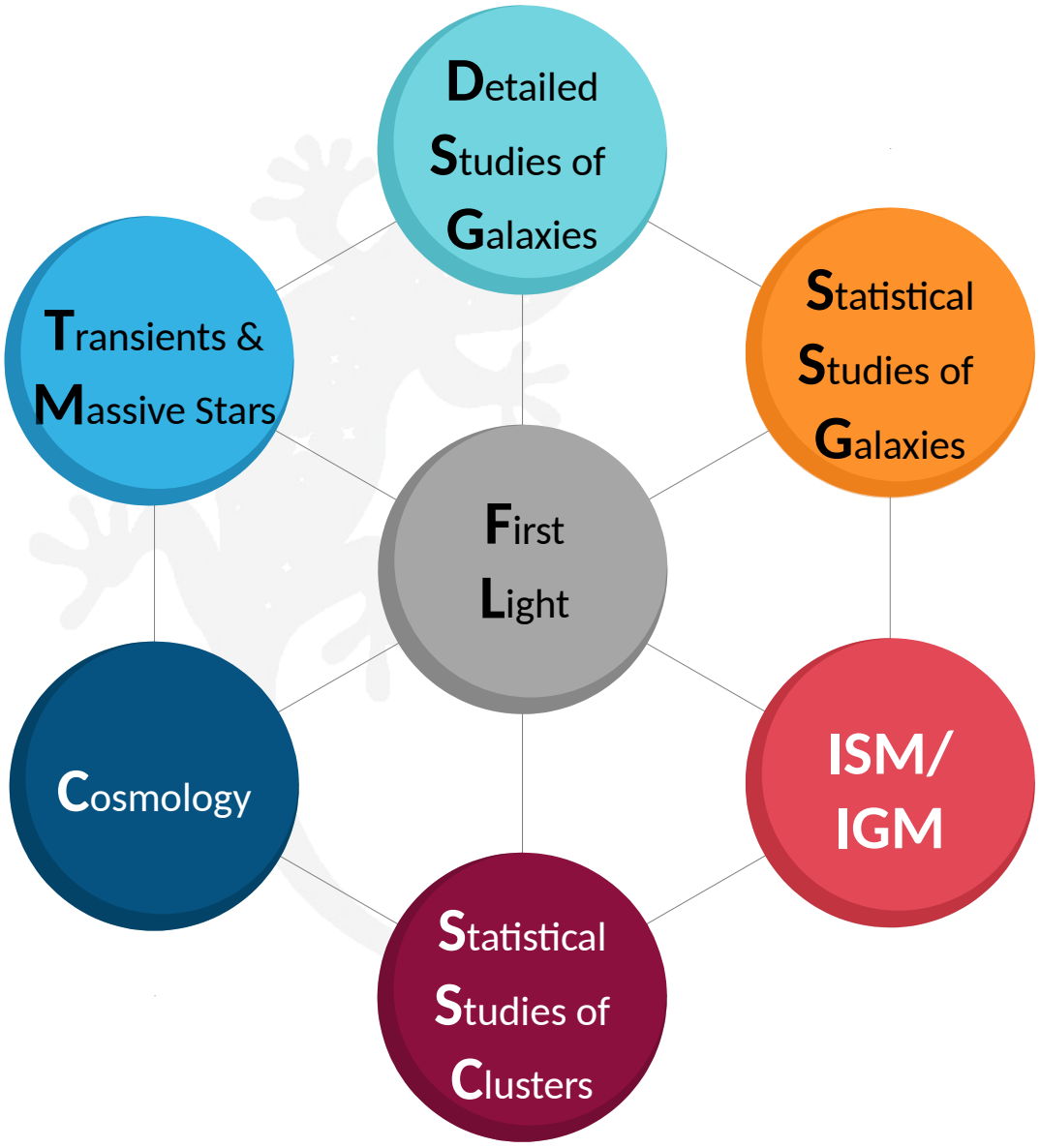
GECO

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 1st, fusion of 5 previous teams (MIS, Pdg, Cosmologie, PSEG, DynGal)
- 36 staff
- 19 PhD students
- 12 post-doctoral researchers.

Galaxies, Étoiles et Cosmologie

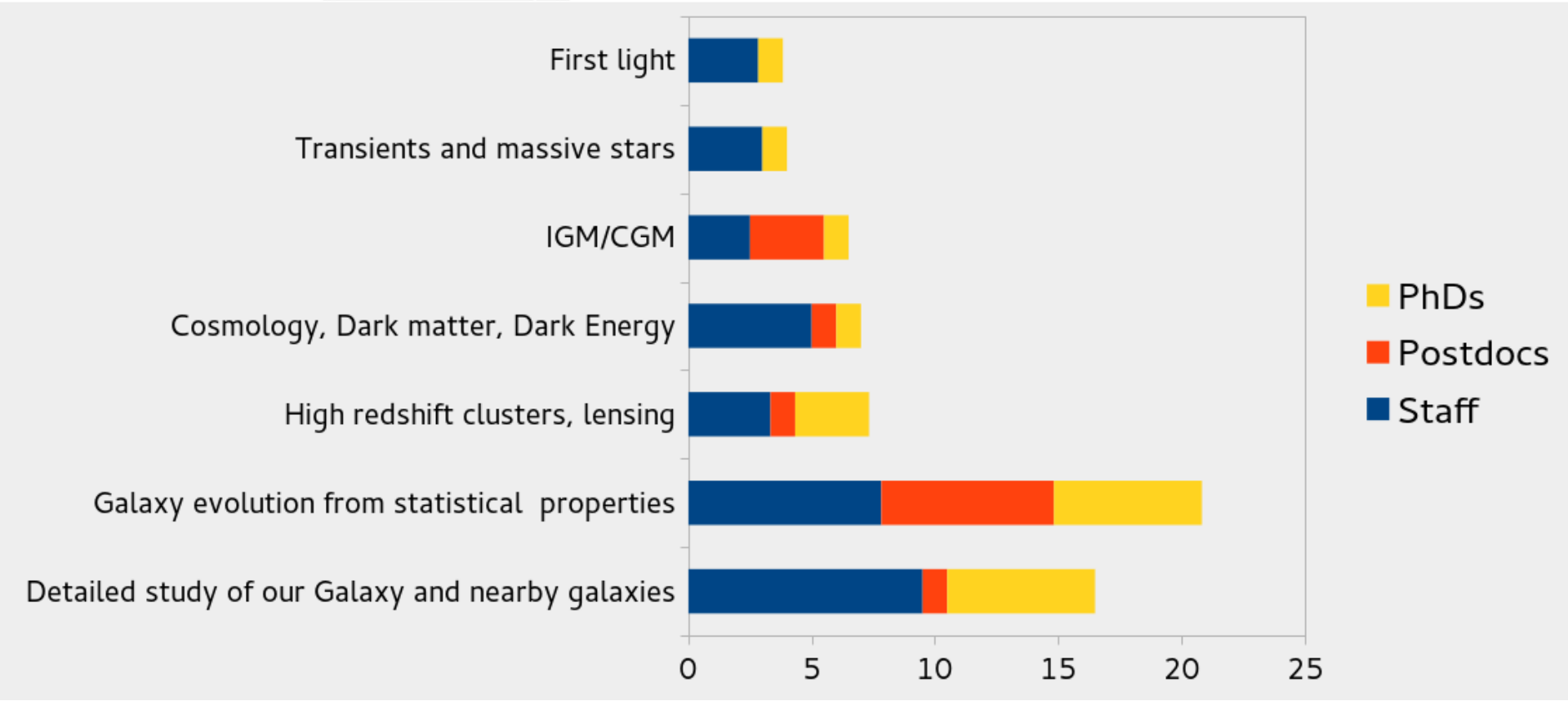


Detailed Studies of Galaxies	Star Formation Dust, ISM Bars, Mergers Environmental effects
Statistical Studies of Galaxies	« Cosmic evolution » : Madau plot : SFR Stellar Mass Assembly Kinematics, Dust
ISM/ IGM	QSO Absorbers Chemical Evolution Inflows, Ouflows
Statistical Studies of Clusters	Lensing, Dark Matter Maps Abundance

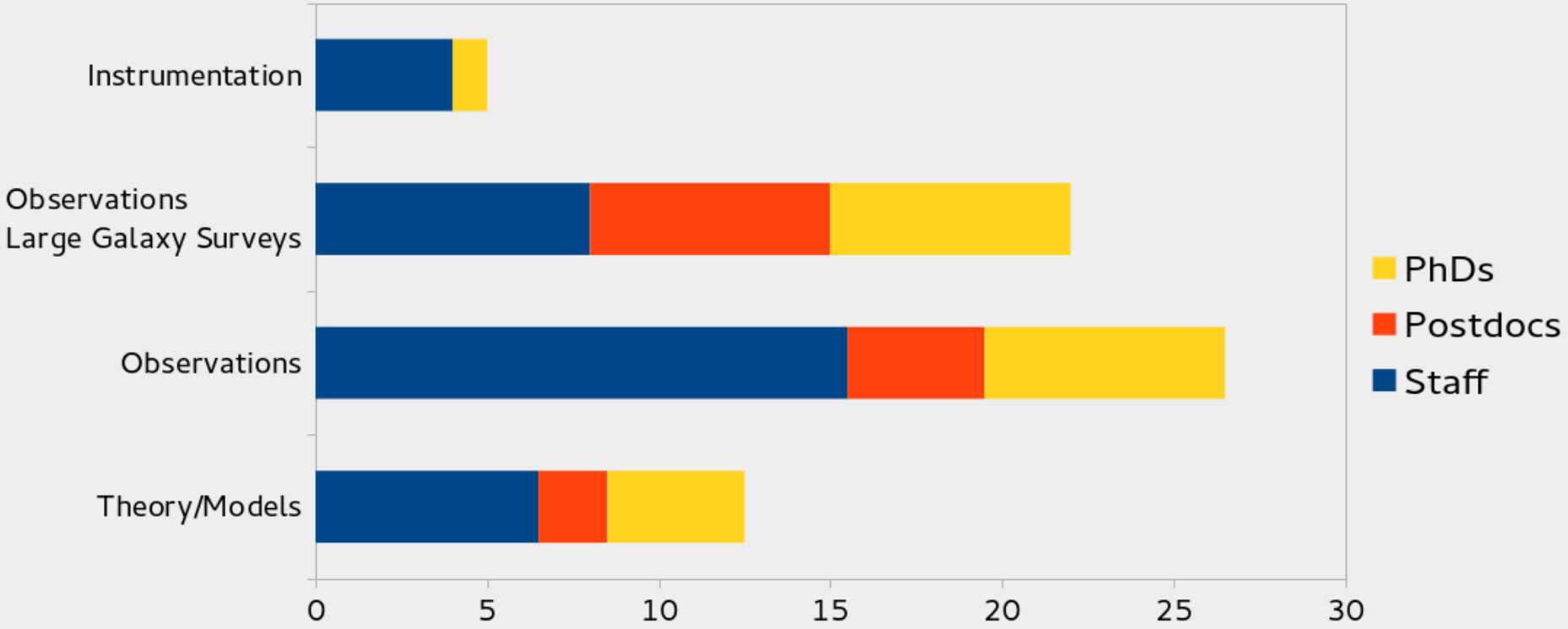
Galaxies, Étoiles et Cosmologie

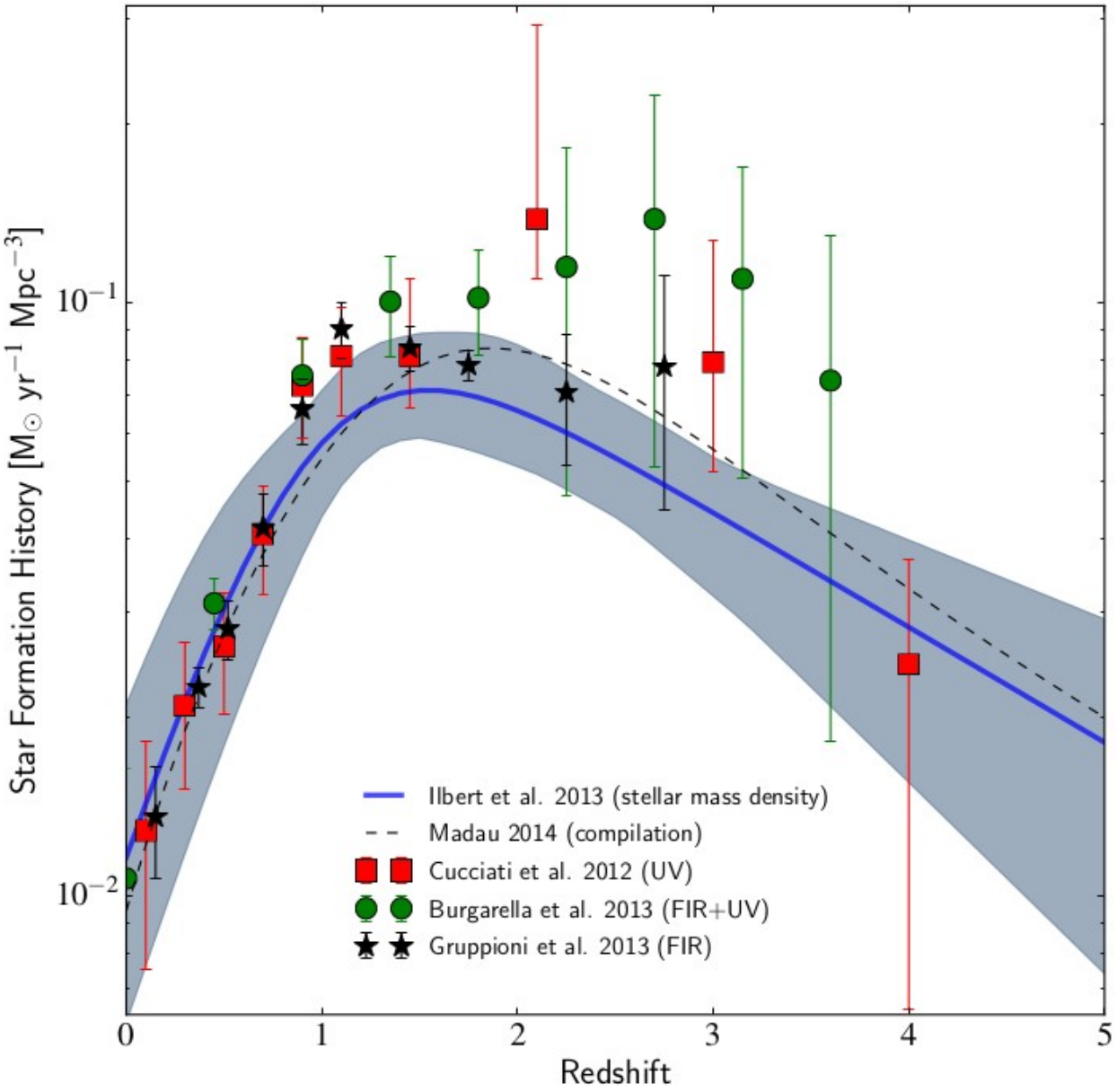
Cosmology	Dark Matter Distribution & Nature Dark Energy, & Cosmological model
Transients & Massive stars	Observations of O stars and population III stars SuperNovae models Gamma Ray Bursts
First Light	Search for very high z Galaxies (Narrow band, Deep surveys, Hosts of GRBs, Lensed)

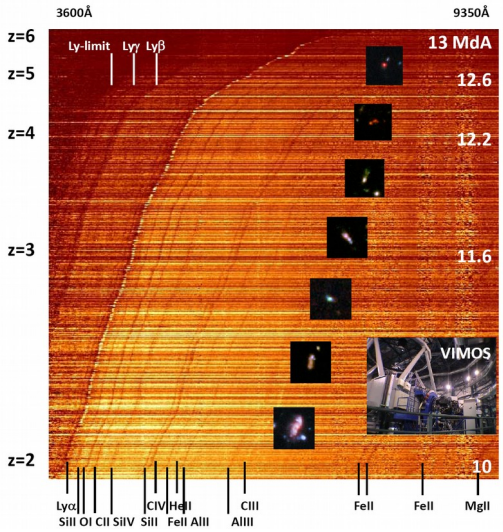
- Ressource distribution on the different themes



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







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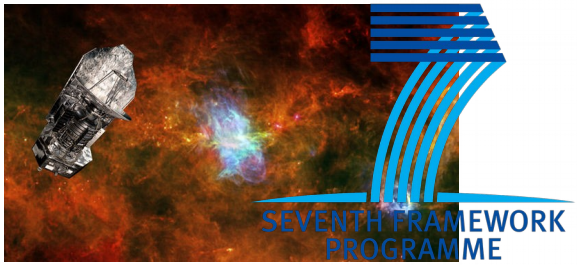


Herschel surveys
2 FP7 programs in the team

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 maping 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

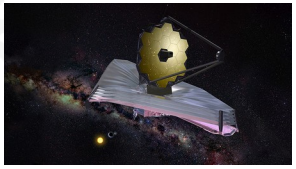
1)

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 isntrument.
- MOSAIC (co-Is : Cuby, Lefèvre) : multi-object spectrograph.

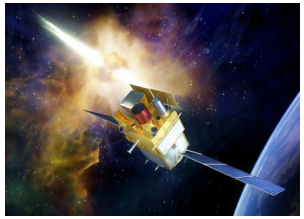
2016 | **2018** | **2021** | **2025** | **2030**

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 arcmin2 wide-field camera, 1-arcmin IFU.
wavelength range 1-5 micron.

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



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:

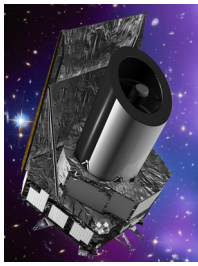
Nature of Dark Matter, Dark Energy, and acceleration of the expansion. Cosmological model

PFS/SuMIRe

Japonese-led spectroscopic program at Subaru. Includes a cosmology survey of OII emitters over 1400 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 surveyo of 35 millions of galaxies and quasars up to z= 3.5 and over 14,000 deg^2. Main science : BAO and RSD. AMU participation group.

2025

WFIRST

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