1. Science aim/goal: the stellar mass and how it is built over cosmic times is needed to understand the mass assembly and the formation and evolution of galaxies.

2. Description

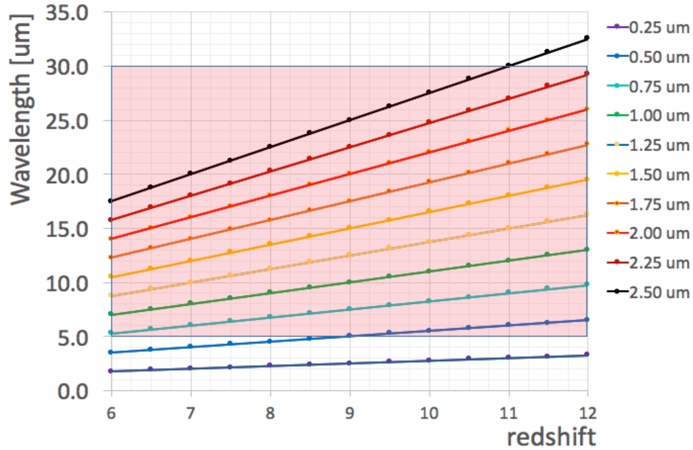
(i) Scientific Importance: the evolution of the stellar mass of galaxies is relatively slow over times. So, the stellar mass provides a good and practical basis for evolutionary studies. The stellar mass plays a crucial role in determining the evolutionary state of a galaxy: we know that it is correlated to the luminosity, to the star formation rate via the main sequence of galaxies, to the velocity dispersion, to the metallicity via the mass-metallicity relation, to the dust attenuation via the IRX-stellar mass, etc. This means that beyond the physical significance of stellar mass itself, its measure allows to predict quite a large number of galaxy global properties. Measuring the stellar mass is crucial to understand the physical processes that govern the galaxy formation and evolution processes. In 2025 – 2030 or anytime, our knowledge of new galaxies (i.e. where star formation began) will not be complete without an information on their stellar masses.

(ii) OST Observations Required: Although single-band luminosities derived from, e.g., near-IR bands can be used to estimate the stellar mass of galaxies, the best stellar mass estimates are optimally obtained by fitting stellar population models to spectral energy distributions. Wide-field (the widest the better) observations from the rest-frame UV - IR are preferred (**MIR Imaging mandatory**) to detect the maximum number of objects (density is low at $z > 12$). We need assumptions on the star formation history, the initial mass function, the metallicity, etc. This is something that is routinely performed using some codes available to the community that combines several options to select the various components (e.g., *CIGALE* (http://cigale.lam.fr). Ideally, we also need to perform the best correction for dust attenuation which means we need to estimate the shape of the dust attenuation law (**MIR Low Resolution Spectroscopy**) and the amount of dust attenuation to estimate the total star formation rate (**40 – 240 μm simultaneously but up to 660 μm would be better** considering the redshift).

(iii) Uniqueness to OST 5μm to 700 μm wavelength facility: stars emit photons over the entire wavelength range (depending on their type) but the main emission is concentrated in the rest-frame ultraviolet, optical and near-IR (roughly 0.25 – 2.5 μm). If we are to measure the stellar mass of galaxies in the early universe at $6 < z < 12$, this translates into a wavelength that uniquely matches OST/MISC, i.e. 5 – 30 μm (see Fig.). We note that the rest-frame UV part of the spectrum will provide an access to the young stars that are likely to be predominant at $z > 6$ but, if we want to perform a complete census, included potential older stars, we also need the rest-frame optical and near-IR. After JWST, the only way to get this type of data will be from a wide-field, large collecting area. OST equipped with MISC is therefore the one and only facility able to efficiently detect and identify these objects via spectroscopy and to follow-up and measure the flux density of objects identified with other OST instruments and other ground-based or space facilities. The EELT might bring some information, though, but mainly below 2.5μm.

(iv) Longevity/Durability: (with respect to expected 2025-2030 facilities) No telescope on the ground or in space under study (to our knowledge although projects have been submitted in Japan, Europe and in the US) is able to meet this objective.

3. Figure: *OST/MISC λ range (red transparent region) where the rest-frame wavelength is plotted from 0.25 to 2.5 μm as a function of the redshift at 6 ≤ z ≤ 12. OST/MISC λ range is particularly adapted to this science objective by providing the ideal coverage to estimate stellar masses of galaxies in the early universe.*



4. Table:

Medium Resolution Scanning Spectrometer (MRSS) modes	Check all that apply to your program
Spectral Survey 30-660 μm R=500	✓
High-resolution FTS mode 30-660 μm, R~40,000	

Far-Infrared Imaging Polarimeter (FIP) Modes	Check all that apply to your program
Survey mapping: 40, 80, 120 and 240 μm simultaneously	✓
Pointed observations: 40, 80, 120 and 240 μm simultaneously	✓

Mid-Infrared Imager Spectrometer and Coronagraph (MISC) Modes	Check all that apply to your program
MIR Imaging	✓
MIR Low Resolution Spectroscopy	✓

5. Descriptions of an observing plan

The number of galaxies is extracted from Mason et al. (2015) but the figures are in agreement with other predicted LFs (e.g. Mashian et al. 2016, Behroozi et al. 2015).

Name	# of galaxies (z=10)	# of galaxies (z = 14)	Survey area[deg^2]	Depth [m_{AB}]	Exposure time
Ultra-Deep Survey	200	20	0.01	34	TBD
Medium-Deep Survey	300	10	0.1	32	TBD
Wide-Field Survey	200	5	1	30	TBD

6. Key references:

- Mashian et al. 2016
- Mason et al. 2015
- Behroozi et al. 2015