The nature and evolution of emission line galaxies at intermediate redshift

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The study of the properties of emission line galaxies (ELGs) and their evolution with redshift provides us with useful insights into the processes shaping galaxy evolution.

In this work, final part of my PhD thesis, we extend to **intermediate redshift (0.4<z<0.8)** the work performed in Lumbreras-Calle et al. 2019a on a low-redshift sample. We select ELGs in the deep, mediumband data of the **25-filter SHARDS survey**, by detecting excess emission in the **[OIII]** filter.

Performing **SED fitting**, we derive the general properties of the galaxies (mass, age, metallicity, extinction). We measure the **equivalent width (EW) of the [OIII] and [OII] emission lines**, we find that the **relations with mass and redshift** found for higher-mass galaxies extend to the low mass regime. The **luminosity function** of the sample is constrained, and found to vary little with redshift.
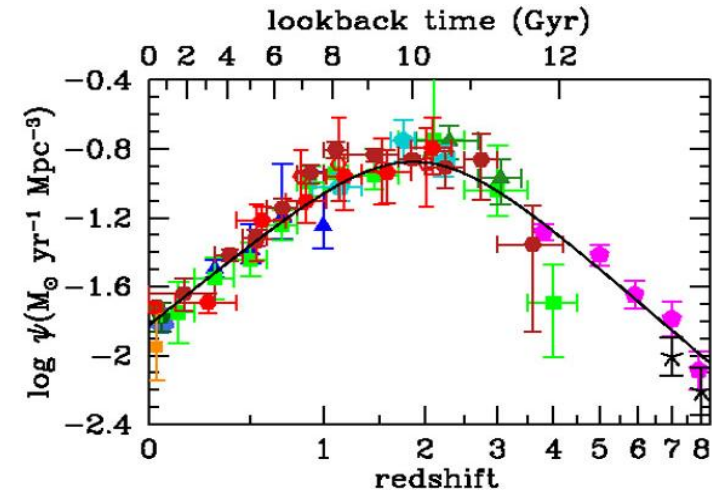
This work (Lumbreras-Calle et al. 2020 *in prep.*) can be followed up with **morphological analysis** of the host component of these galaxies, like Lumbreras-Calle et al. 2019b followed up on the lower redshift sample, and investiage if the **separation in two classes of hosts** (one being spheroidal and redder) is also found. Another possible extension is the use of **wider surveys (such as J-PLUS and J-PAS)** to search for more extreme systems and separate close emission lines using the **54 narrowband J-PAS filters**.

SEA

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Context of the research
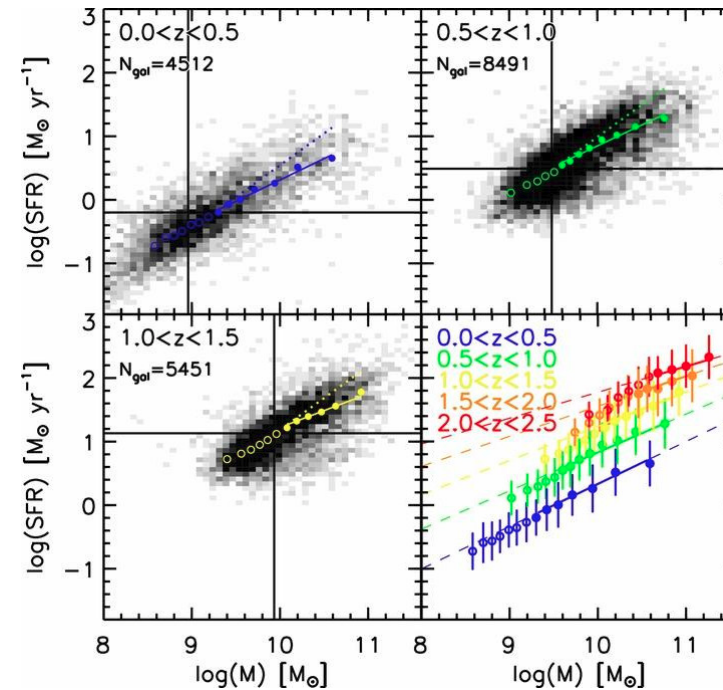
- Star formation (SF) shapes the evolutionary history of galaxies across cosmic time

- Higher cosmic density of SF until z~2

- Clumpier morphologies of high-z SF galaxies

- Evolving main sequence of star formation

- Low-mass regime is relatively unexplored

Studying the evolution of the properties of emission line galaxies (ELGs) with redshift in different mass ranges is a crucial step to understand galaxy evolution
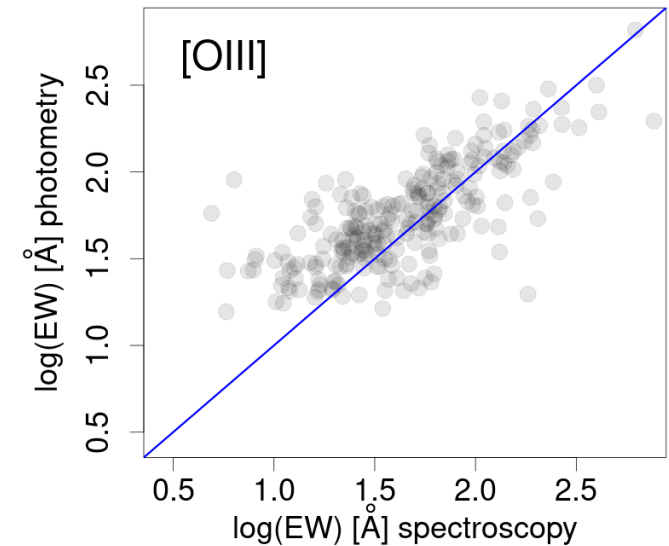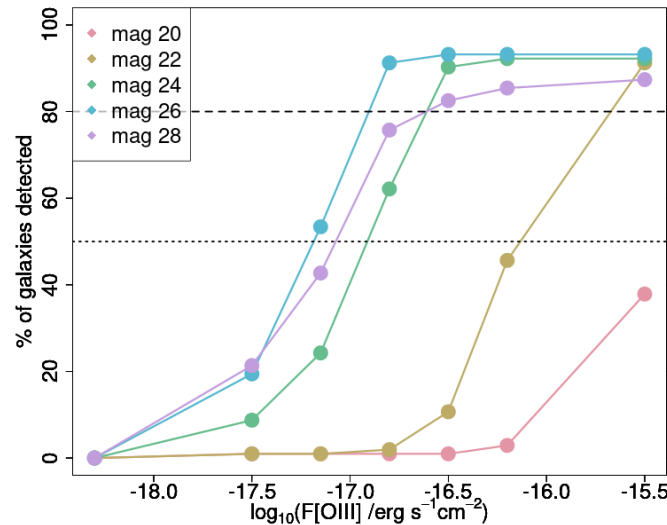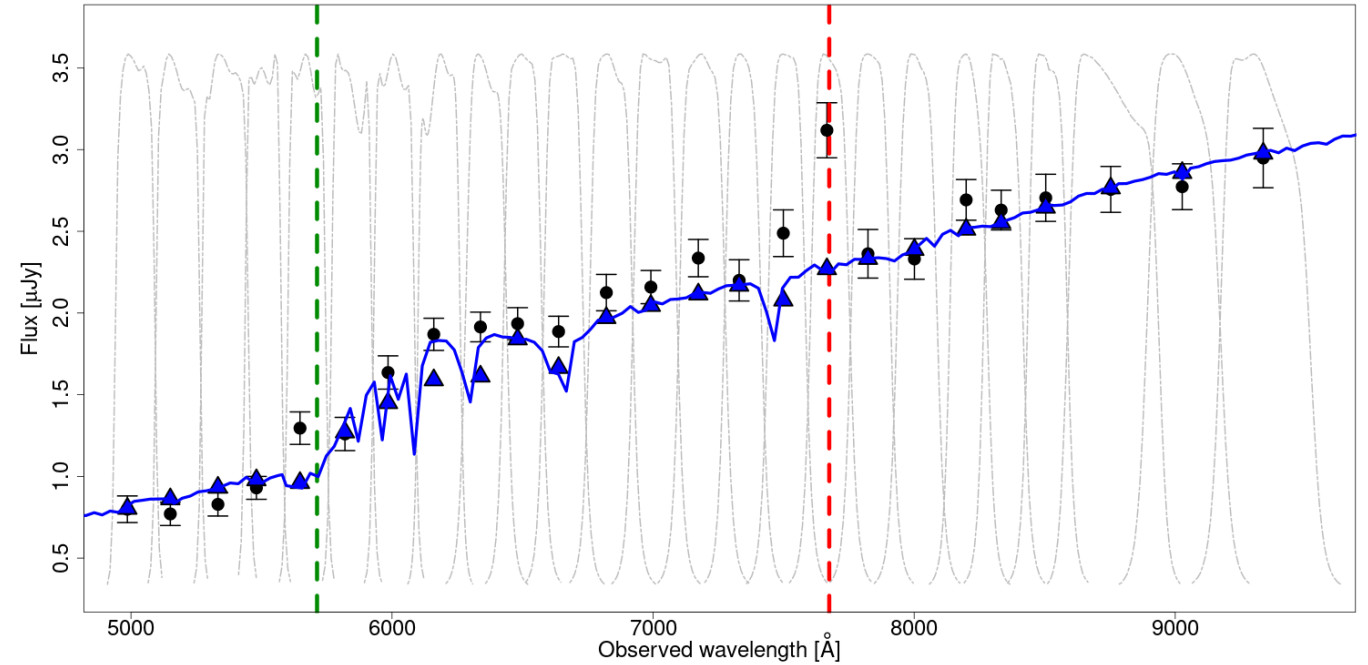

Madau & Dickinson (2014)

Whitaker et al. (2012)

Bournaud et al. (2011)

Methodologies

- SHARDS survey (Pérez-González+13)

  - 25 mediumband filters (FWHM ~ 170 Å)

  - OSIRIS@ GTC 200 hours

  - GOODS-N field

- Selection of galaxies presenting excess flux at the wavelength of the [OIII] line

  - SED fitting to derive accurate continuum

  - 0.4<z<0.8

- 50% completeness ~ 10^-17.25 erg/s/cm²/Å

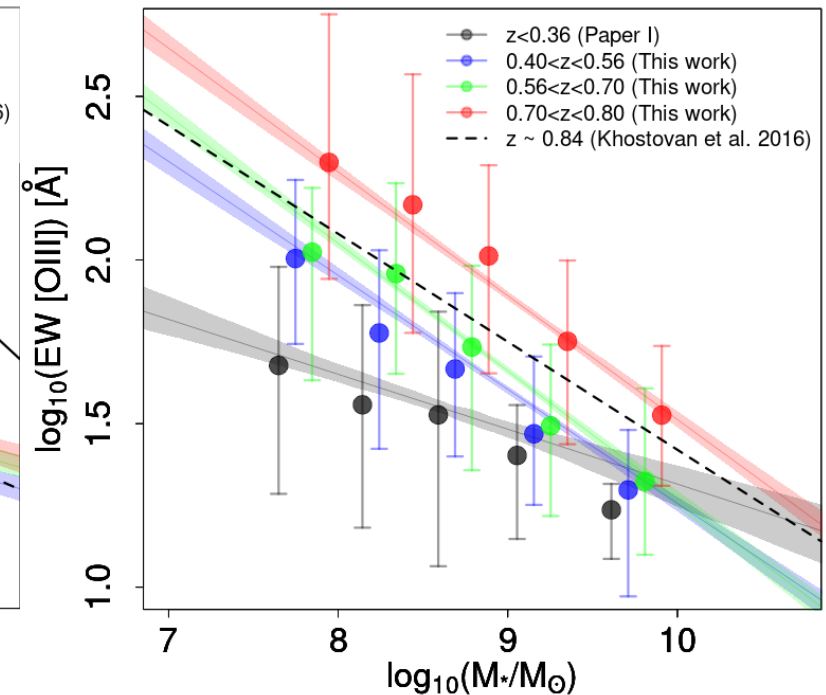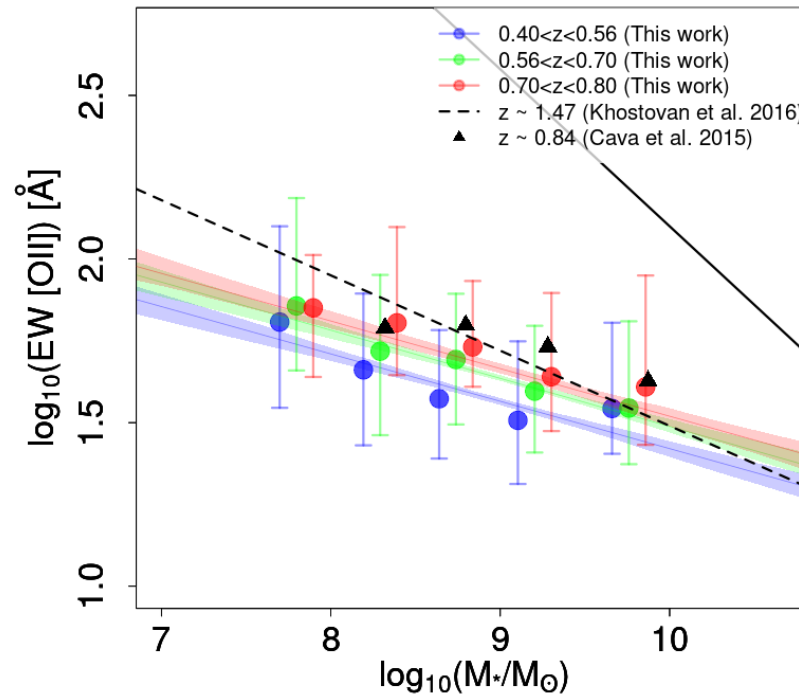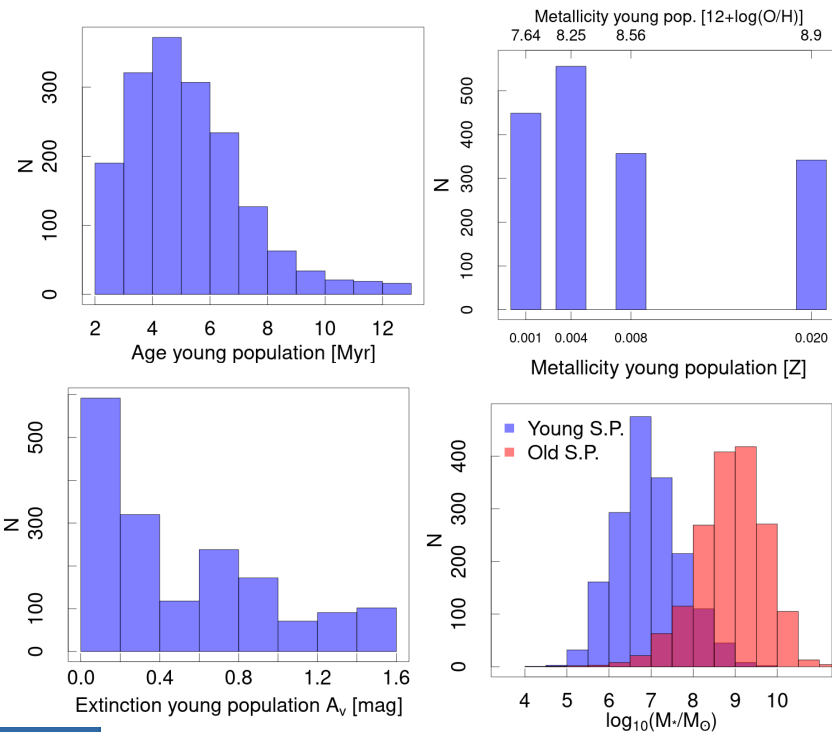- Calibration of EW measurements with longslit spectra

Results

- SED fitting with Starburst99 models
  - Two single stellar populations
- Low metallicities, low E(B-V), young ages, low masses

- ## EW of [OIII] and [OII] variation
  - Linear anticorrelation with mass
  - Consistent with trends in higher-mass galaxies
  - Shallower slope in the [OII] relation and in the [OIII] low redshift sample
  - Increase of the normalization of the relation with higher redshift

Results

- ## Star formation main sequence (SFR vs Stellar mass relation)
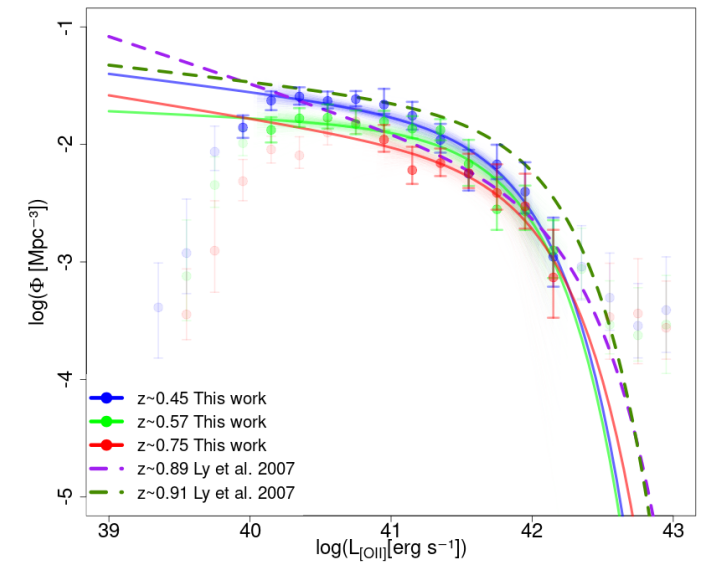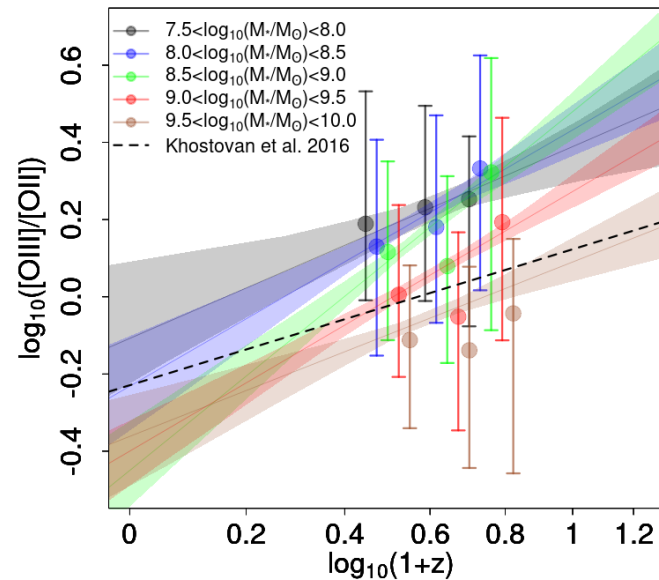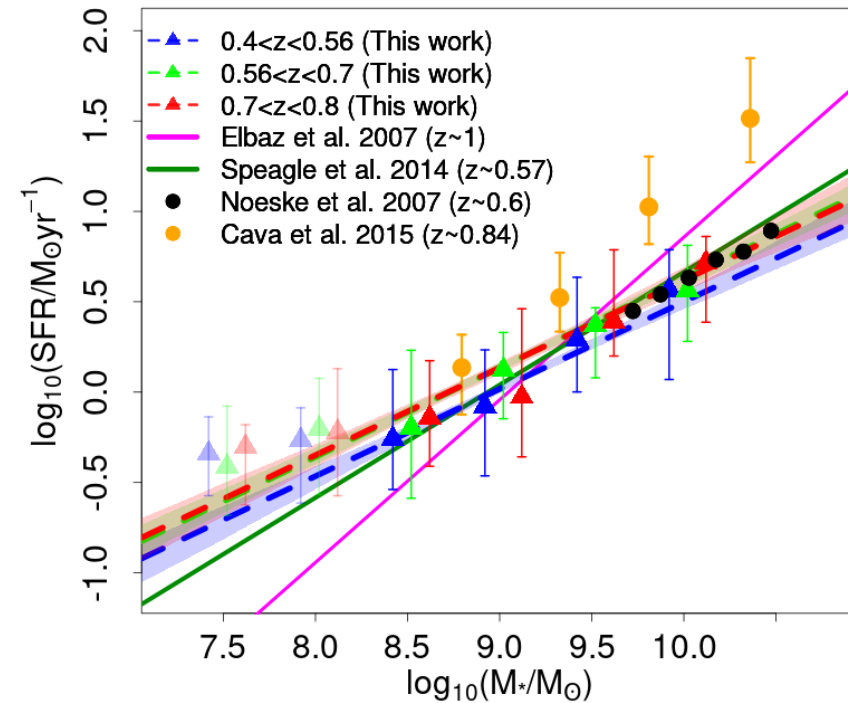
  - SFR derived from [OII] flux

  - Lower extinction than Cava+15

  - Little evolution with redshift

  - Consistent with higher mass studies of Speagle+14 and Noeske+07, flatter than Elbaz+07 (z~1)

- ## Higher [OIII]/[OII] ratios at higher masses and higher redshifts

  - Lower metallicities, higher ionization states

- ## Luminosity function

  - Constraining low-mass slope and L*

  - Little evolution with redshift

  - Consistent with literature for [OIII]

  - Affected by cosmic variance

Impact

- Multiband surveys are an excellent tool to detect and analyze complete surveys of emission-line galaxies over a wide redshift range

- Low-mass ELGs at intermediate redshift follow the same relations (in SFR, EW) as their higher-mass counterparts

Prospects for the future

- Morphological analysis of inter-z host component of star-forming galaxies

  – Masking H-alpha emitting regions

  – Performed in Lumbreras-Calle+19b for low-z sample

    • Discovery of a population of small, spheroidal-like galaxies hosting star formation events

  – Spectra analysis (García del Valle et al. *in prep*)

- Extension to wider area surveys

  – J-PAS (56 filters, starting soon!)

  – J-PLUS (12 filters, 2000 deg²)

  – Discovery of extreme events, separation of close emission lines

J-PAS filters

JPCAM focal plane