Unveiling the nature of a representative sample of Extreme Emission Lines Galaxies at intermediate redshift

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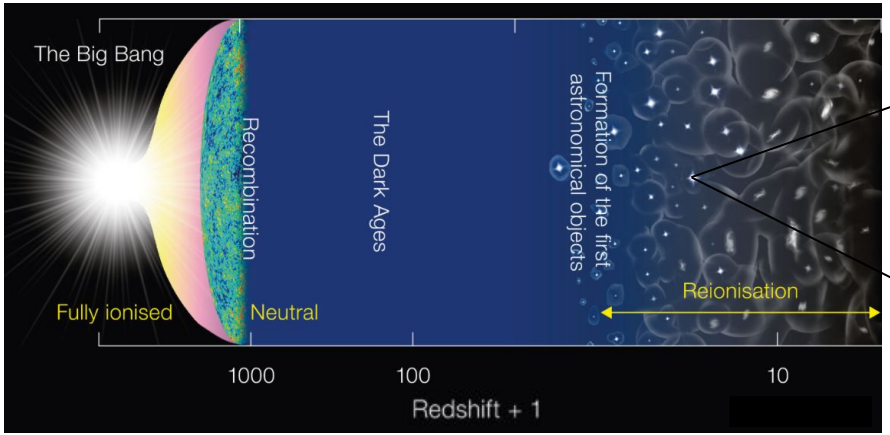
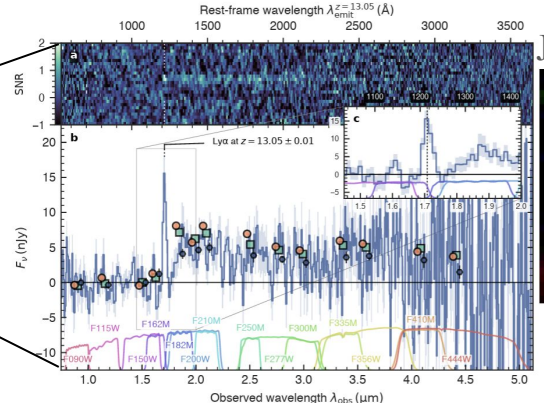
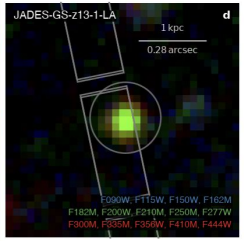
Introduction: Extreme Emission Lines Galaxies



European Southern Observatory (ESO). *Diagram of the history of the Universe.*: https://www.eso.org/public/images/eso1620a/



Joris Witstok+25



Extreme Emission Lines Galaxies

Stellar mass: **Low** (< 10^9 $M_\odot$)

Equivalent width: **High** (> 100Å)

Extreme emission lines: **[OII]λ3727,Hα , [OIII]λ5007**

Specific star formation rate: **High** (< 1-100 Gyr^{-1})

Van Der Wel+11

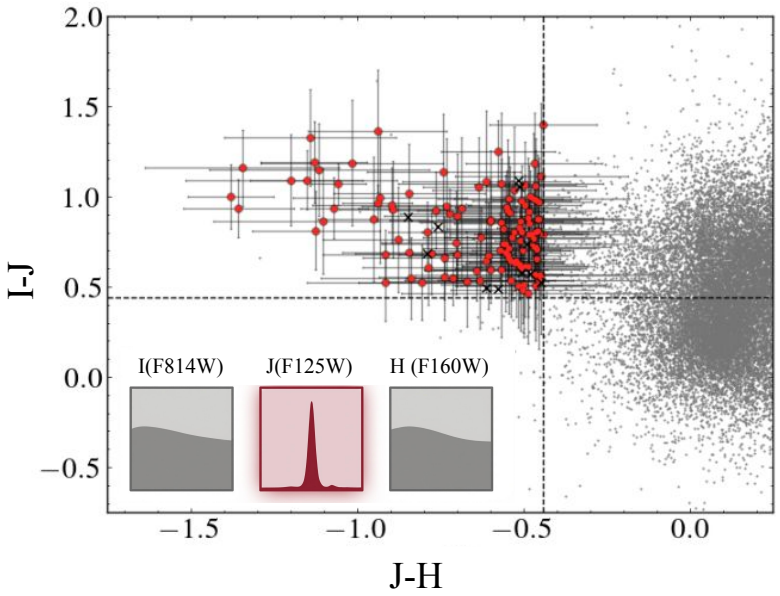
Data and sample selection

Data

Grogin+11,Koekemoer+11

- **Survey**: **C**osmic **A**ssembly **N**ear-IR **D**eep **E**xtragalactic **L**egacy **S**urvey (**CANDELS**).
- **Field**: **E**xtended **G**roth **S**trip (**EGS**)
- **Instruments**: **WFC3**: **W**ide **F**ield **C**amera and **ACS: A**dvanced **C**amera for **S**urveys.
- **Data**: only sources with S/N>3 in F814W, F125W and F160W bands are included.

The EELG sample selection

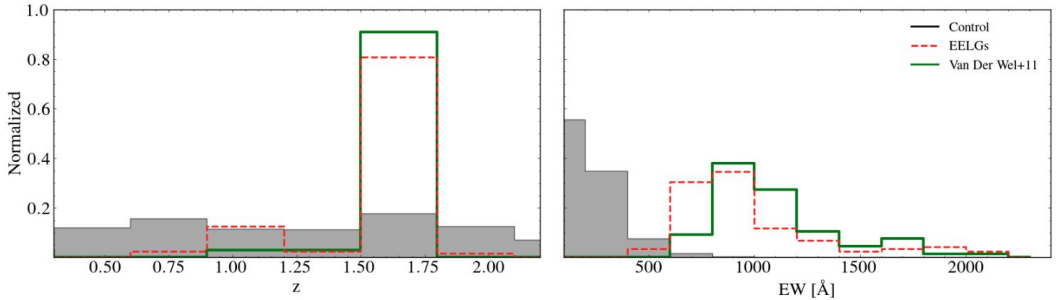


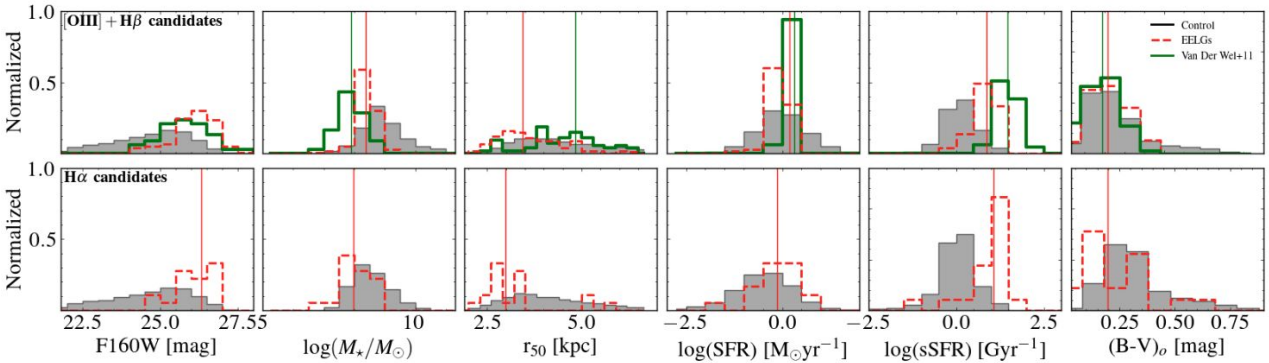
120 candidates

Hβ+[OIII] emitters (z=1.40-1.81): 102 sources

H*α* emitters (z = 0.70-1.10) : 18 sources

The properties of extreme emission-line galaxies





EELGs vs control sample

Fainter in the F160W filter (~1 mag)
Much larger equivalent widths (>900 Å)
Less massive (<0.5 dex)
More compact (<1 kpc smaller)
Higher SFR (>0.2 dex) **and sSFR** (>0.8 dex)
Bluer colours (<0.1 mag)

Hβ+[OIII] vs Van Der Wel+11

Results are consistent with Van der Wel+11 using the same selection criteria.

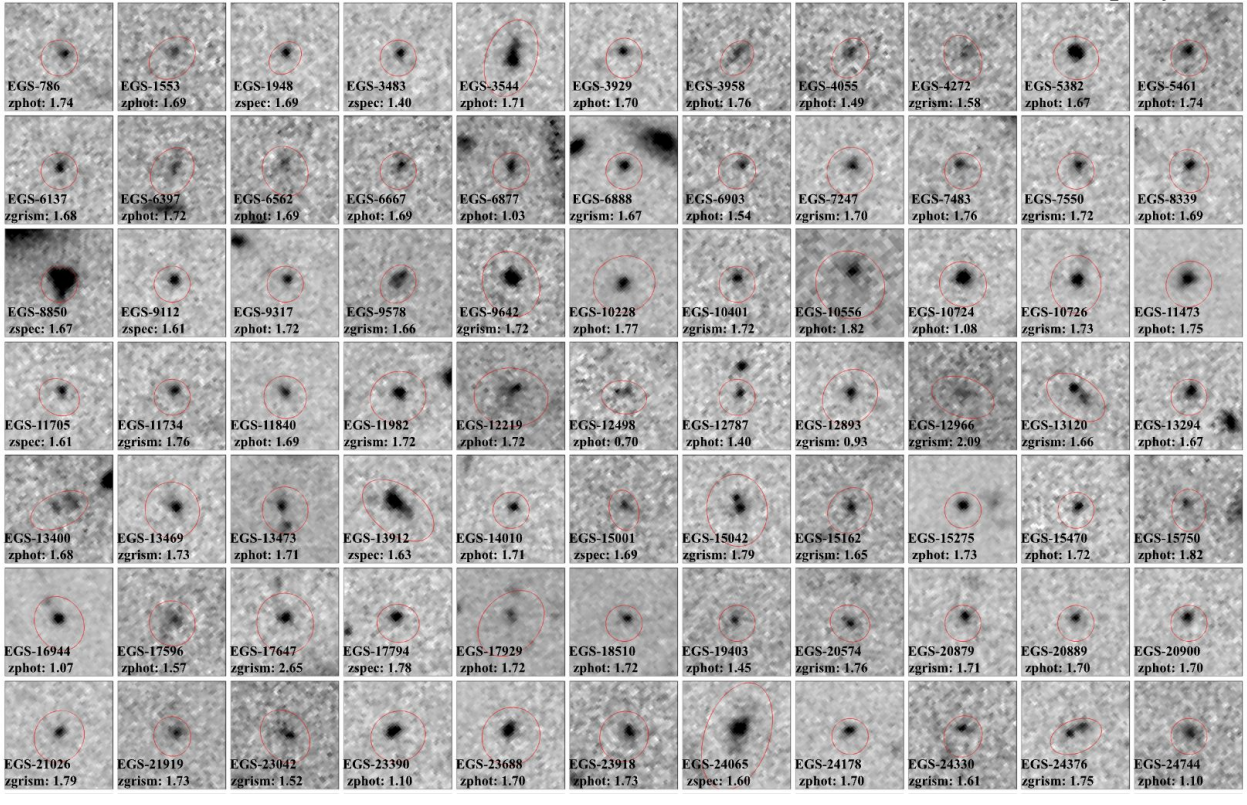
Differences are most evident in mass, size, and sSFR, but overall consistency remains.

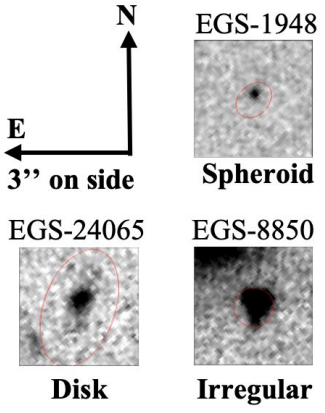
Hβ+[OIII] vs Hα

Both samples are broadly similar, showing only modest differences in mass, size, and SFR.

Morphological types

Huertas-Company+15





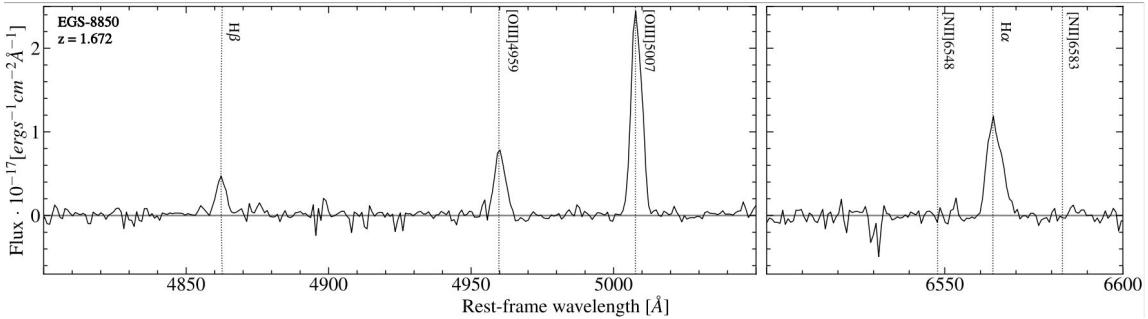
N = 119 Spheroid
N = 3 Disk
N = 1 Irregular

Black and white footprint (3" on side) from Rainbow database taken with WFC/F125W

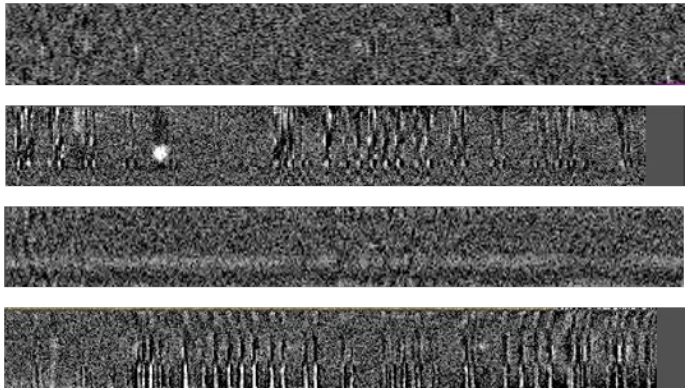
https://arcoirix.cab.inta-csic.es/Rainbow_navigator_public

Spectra confirm EELGs nature

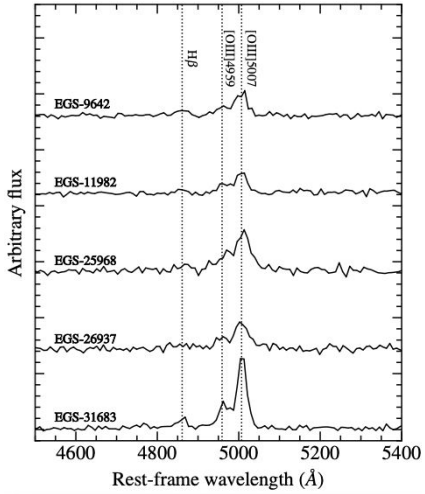
Spectra spectroscopy courtesy of Tang+18,+22 using MOSFIRE@Keck



Optical MOS spectroscopy with OSIRIS@GTC



Spectra from 3D-HST Survey



Initial sample: 120 candidates

- Hβ+[OIII] emitters (z=1.40-1.81): 102 sources
- Hα emitters (z = 0.70-1.10): 18 sources

Final sample: 122 candidates

- [OII]3727 (z = 2.64): 1 sources
- Hβ+[OIII] emitters (z = 1.40 - 1.82): 105 sources
- Hα emitters (z = 0.70 - 1.10) : 16 sources

We confirm the nature of 31 candidates:

- [OII]3727 (z=2.64): 1 sources
- Hβ+[OIII] emitters (z = 1.40 - 1.79): 31 sources
- Hα emitters (z=0.93) : 1 sources

Summary and Future work

- We identified **122 EELG candidates**, with **1 showing [OII]λ3727 (z = 2.64), 105 showing Hβ+[OIII] (z = 1.40 - 1.82)** and **16 showing Hα (z = 0.70 - 1.10)** and emission lines in the **J-band**.
- **Compared to the control sample**, EELGs are fainter, less massive, more compact galaxies with much larger equivalent widths, higher SFR and sSFR, and bluer colours.
- Once **the method is validated**, comparison with the full van der Wel+11 sample shows compatible results.
- We confirm **the nature of 33 candidates**: 1 [O II] λ3727 emitter **(z=2.64)**, 31 [O III]+Hβ emitters **(z= 1.40 - 1.79)** and 1 Hα emitter **(z=0.93)** .
- We analyzed their **morphology**, finding that almost all exhibit a **spheroid**, 3 **disk** and 1 **irregular** structure.
- **[O III]+Hβ and Hα** emitters are **broadly similar**, with only modest differences in mass, size, and SFR.
- **Future work: Complete the analysis** of the observations and **compare them with EELG samples** at different redshifts, including **a research stay in Marseille** in February to learn and use the CIGALE code to analyse the data and derive the physical properties of the galaxies.

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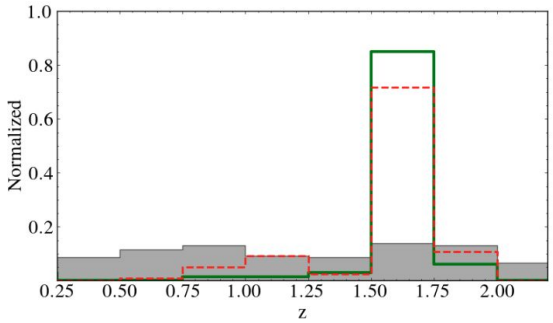
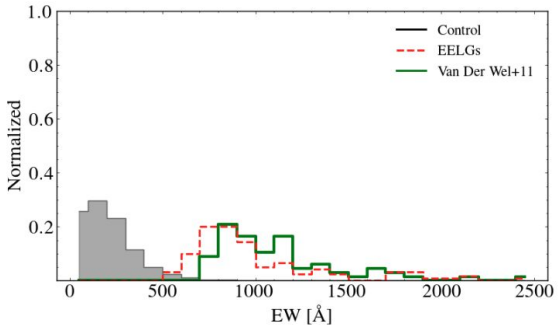
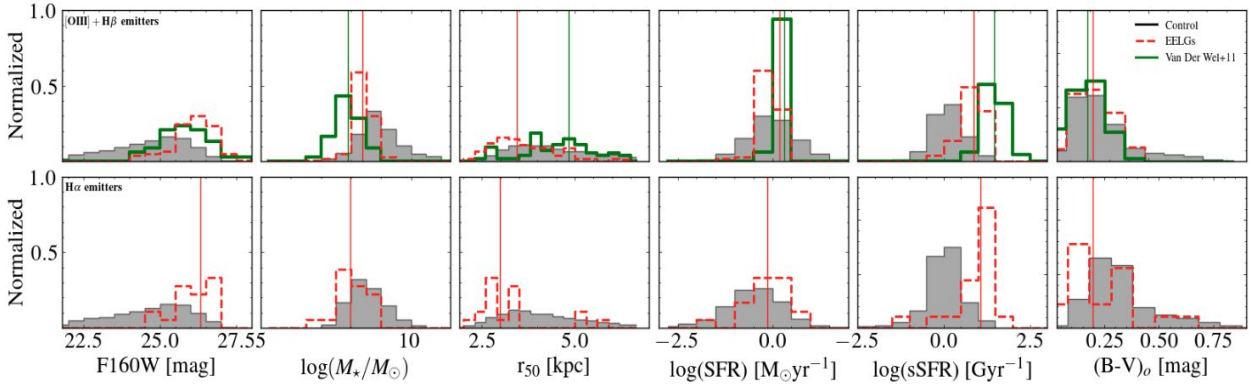
The properties of extreme emission-line galaxies







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Bluer colours (<0.1 mag)

EELGs vs Van Der Wel+11

Results are consistent with Van der Wel+11 using the same selection criteria.
Fainter in the F160W filter (~0.6 mag)
Much larger equivalent widths (~120 Å)
Less massive (~0.5 dex lower)
More compact (~1 kpc smaller)
Lower SFR (~0.1 dex) **and sSFR** (~0.6 dex)
Redder colours (~0.2 mag)