The luminosity function of the Hβ emitters at z~0.87 from the OTELO survey

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ABSTRACT

A sample of **Hβ** emission line sources (ELS) at **z~0.87** is studied in order to obtain an estimation of the luminosity function (LF) of star forming galaxies at this redshift.

We draw our sample from the OSIRIS Tunable Emission Line Object (OTELO) survey. This survey uses the tunable filter of OSIRIS at the Gran Telescopio Canarias to perform a blind narrow-band observation of a selected field in the Extended Groth Strip. Its spectral resolution allows us to discriminate Hβ from [OIII], making it possible to measure emission-line fluxes at a limiting luminosity of log(LHβ)=39.07 erg s-1.

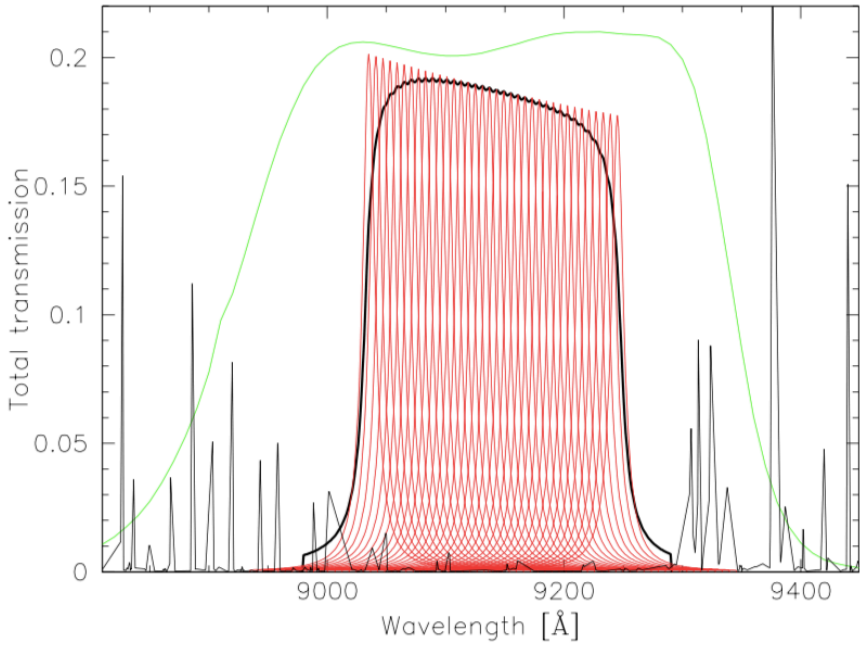
This is the first time that the faint end of the Hβ luminosity function at z~0.8 is obtained. We extend our results to the bright end by using previously published data.

CONTEXT

In this work we exploit the data from OTELO, a slitless pencil beam survey that makes use of the red tunable filter (RTF) of the OSIRIS instrument at the 10.4m GTC. It is the key project of the Guaranteed Time of OSIRIS EGS (Extended Groth Strip)

OTELO targeted a region relatively free of sky emission lines to find emission lines sources (ELSs) at different comoving volumes with redshifts up 6.5.

- Sky area of 50 arcmin^2 EGS
- Limit magnitude of 27.8 [AB] in the OTELO synthetic band
- Spectral range of 9070-9280 Å
- 11237 sources detected

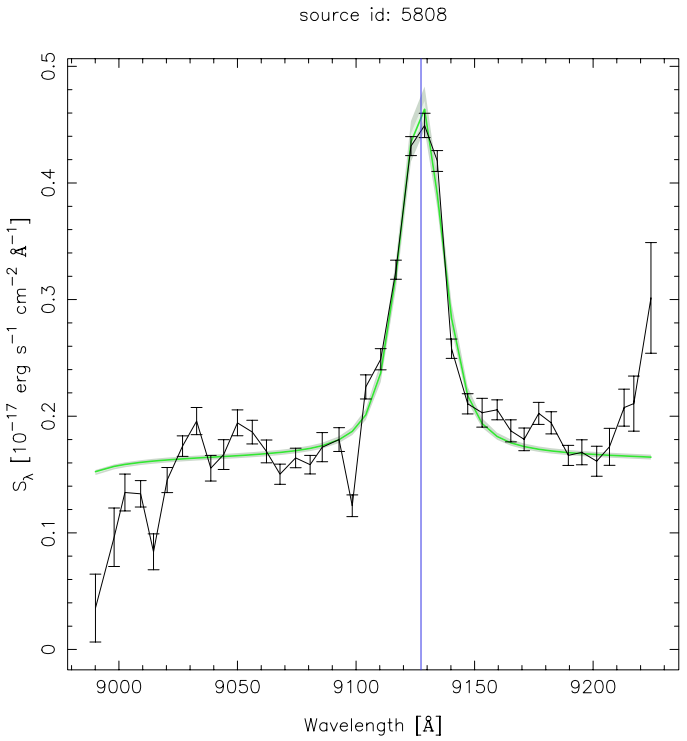


Scanning of the spectral range of interest along the full field of view of the instrument produces pseudospectra of resolution of R~700.

All this makes OTELO the deepest emission line survey to date

METHODOLOGY

- Sample selection:
  - Automatic classification algorithm running over the pseudospectra
  - Filter based on photo-z from the OTELO catalogue
  - Final selection on visual inspection by the team.
  - 47 Hβ emitters obtained
- Exclusion of bright AGNs by infrared selection criterion (Donley+12)
- Flux obtention from the pseudo-spectra, using an inverse deconvolution process after masking spurious points in the spectra when present. The line flux limit detected by OTELO is $5.5 \times 10^{-19} \mathrm{erg/s/cm^2}$



The redshift for Hβ emitters in our sample ranges in $0.855 \leq z \leq 0.904$

RESULTS

➤ Using our sample of Hβ star forming galaxies we obtain the luminosity function of Hβ emitters, LF(Hβ), at $\langle z \rangle = 0.87$

➤ The estimation of the LF takes into account completeness and cosmic variance corrections.

➤ The Hβ sample luminosity range is $39.07 < \log L(\mathrm{H}\beta)[\mathrm{erg\ s^{-1}}] < 41.3$

➤ We built an extended LF by joining to our sample the data from Comparat et al.(2016) covering a full brightness range of $39.07 < \log L(\mathrm{H}\beta)[\mathrm{erg\ s^{-1}}] < 42.7$.

➤ For the construction of the LF we adopted the formalism described by the Schechter function, defined as:

$$\Phi[\log L(\mathrm{H}\beta)]\ \mathrm{d}\log L = \phi(L)\mathrm{d}L,$$

where $\phi(L)\mathrm{d}L \equiv \phi^*(L/L^*)^{\alpha}\exp(-L/L^*)\mathrm{d}(L/L^*).$

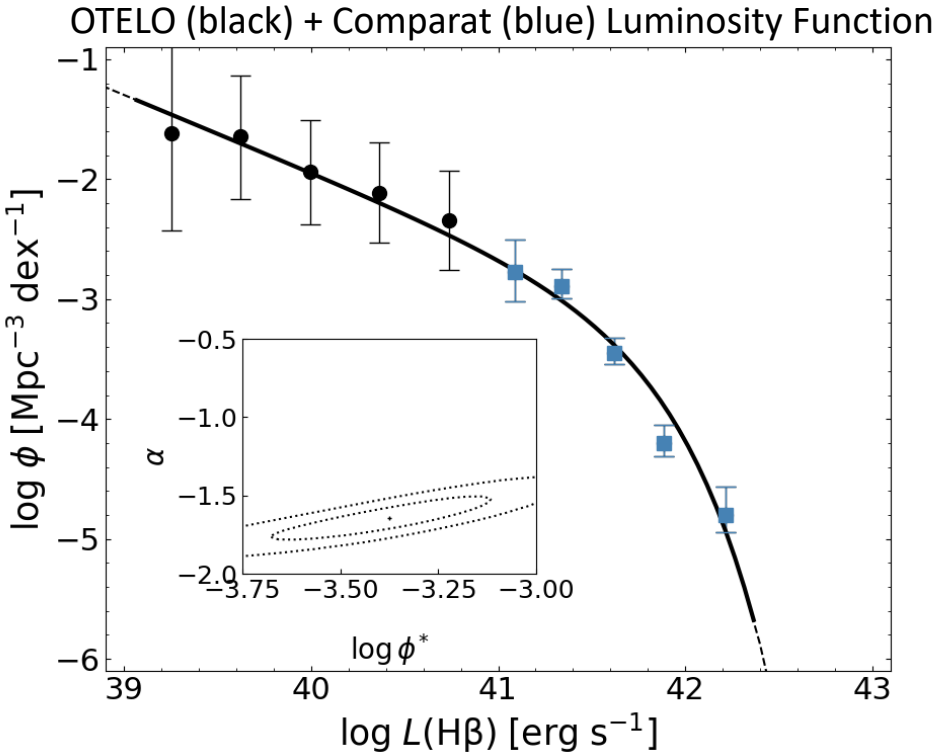
RESULTS

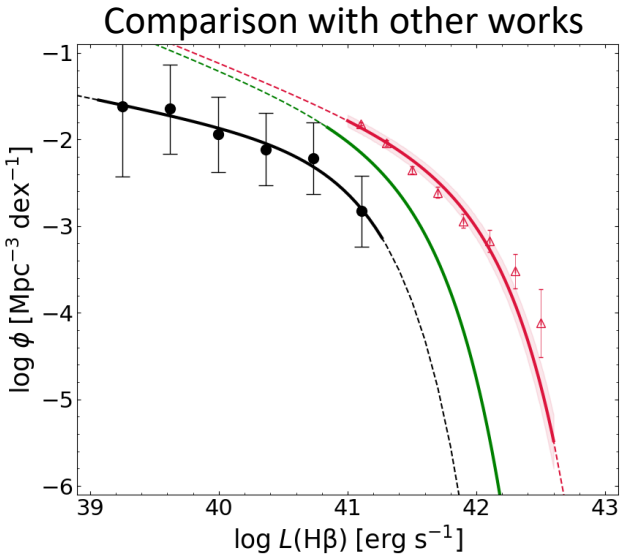
The luminosity function obtained is

$$\phi(L)\mathrm{d}L \equiv \phi^*(L/L^*)^{\alpha}\exp(-L/L^*)\mathrm{d}(L/L^*)$$

Where:

$$log(\Phi) = -3.37$$
$$\alpha = -1.64$$
$$logL^* = 41.66$$





This figure shows the LF from the Otelo Hβ sample (in black) next to Hβ+[OIII] LF by Khostovan et al.(2015) in red, and the fit for the Hβ luminosity derived from the Hα sample (Hα/Hβ =2.86) at z~0.8 from Sobral et al.(2015) in green.

CONCLUSIONS AND WORK IN PROGRESS

- The obtention of the luminosity function of emission line galaxies is a key element to study their evolution in a cosmological context.
- Comparing with previous works, our LF extends the faint end almost 1 dex, reaching observed Hβ luminosities as low as log L(erg s^{-1}) = 39.07.
- The most important result is the estimation the exponential slope (alpha) of the luminosity function with an unprecedented robustness, since it is the faint end of the function what contributes the most to its characterization.

——— WORK IN PROGRESS:

- Characterization of the Beta emitters in terms of
  - Morphology
  - Stellar Mass
  - Star formation rate
- Comparison with the population of the Hα emitters at z~0.4 from the OTELO survey