Physical properties of low mass Star-Forming Galaxies at intermediate redshifts (z<1)

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Introduction

Dwarf galaxies play a key role in galaxy formation and evolution:

- They resemble the first structures that hierarchical models predict to form first in the Universe (Dekel & Silk 1986) and that are responsible for the reionization process (Bouwens et al. 2012).
- The way or epoch they form and how they evolve are still open questions of modern astrophysics:
  - Early formation model (Dekel & Silk 1986)
  - Delayed formation model (Kepner+ 1997)
  - Mass dependent scheme (Mamon+ 2012)

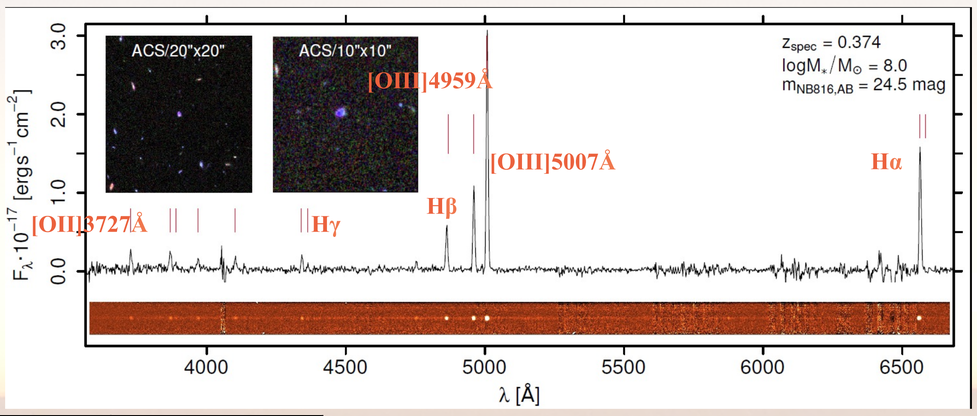
- Their study has been biased to local universe or clusters
  - Evolved stellar populations hamper accurate estimations of age
  - Evolution dominated by interactions with near neighbors.

Objective:

- Formation redshift, star formation histories and properties of low-mass dwarf star-forming galaxies at intermediate z.
- Blue Compact Dwarfs (BCDs) at intermediate z as Star-Forming Galaxies reference sample.

VIMOS spectroscopy

Deep R=580 VLT/VIMOS spectroscopy reduced using VIPGI (Scodeggio et al. 2005) and Reduceme (Cardiel 1999) at UCM and Laboratoire d'Astrophysique de Marseille (LAM).



Instrument	VIMOS (MOS)
Slits	327
Exposure	4 h
Scale	0.205”/pix

- The spectrum is characterized by a faint, blue and flat continuum and strong emission lines, revealing that the systems are dominated by an undergoing star formation burst.

The Sample

We selected the sample on the CDFS field. Photometry (40 bands, from UV to far-IR) and preliminary photometric redshifts and stellar masses were obtained from RAINBOW database (Pérez-González+ 2008). Morphology fom Griffith+ (2012). Main selection was done by stellar Mass. We consider two different galaxy samples selected from the SUBARU-NB816 image:

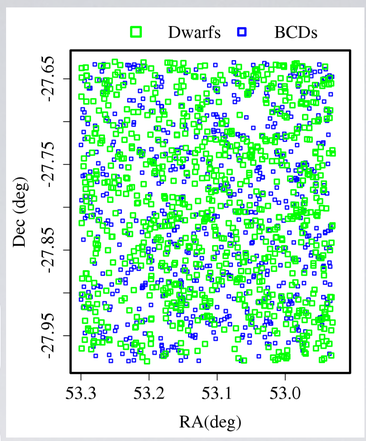
Sample 1: **675 Dwarfs** ⇦ $M_* < 10^8 M_\odot$

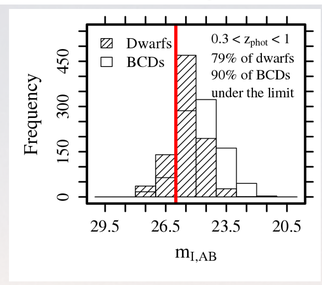
Sample 2: **900 BCDs** Tracers of dwarfs at intermediate z.

$M_{B,0} > -18.5$; $(B-V)_{B,0} < 0.6$;
$\mu_{eff,B,0} < 23$ mag arcsec^{-2}

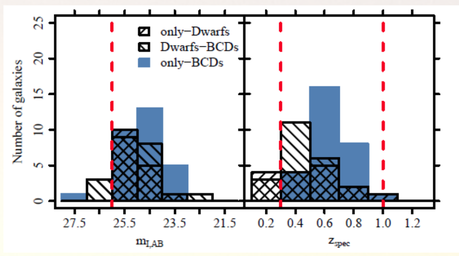
$0.3 < z_{phot} < 1$

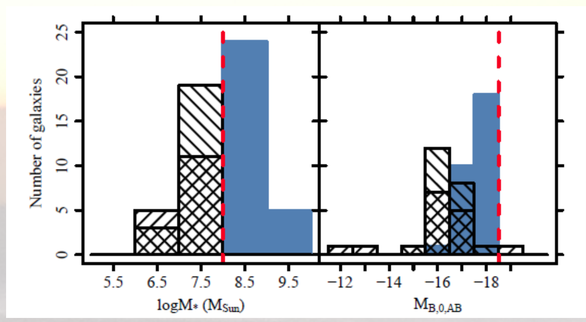
$m_{I,AB} < 26$

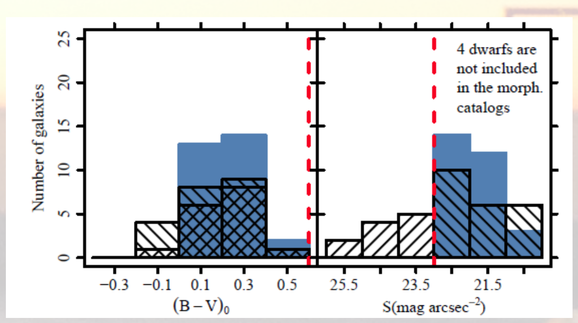




- z_{spec}-based properties of the sample of objects confirmed spectroscopically in VIMOS/VLT survey. Stellar masses were obtained using the Pacifici et al. (2012) approach:
  - 62 $M < 10^8 M_\odot$ dwarfs and
  - 32 BCDs

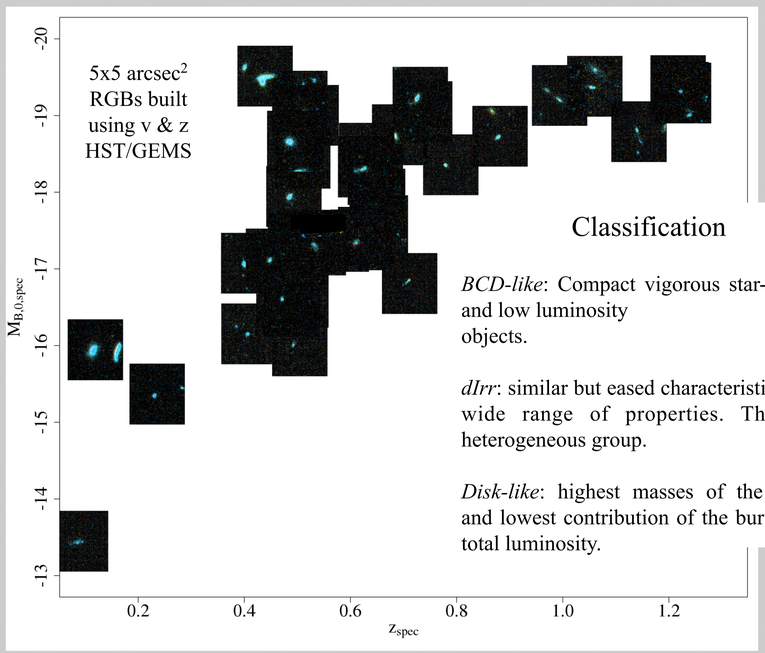






- For more information about stellar masses and Star Formation Histories see Rodríguez-Muñoz talk

Morphology



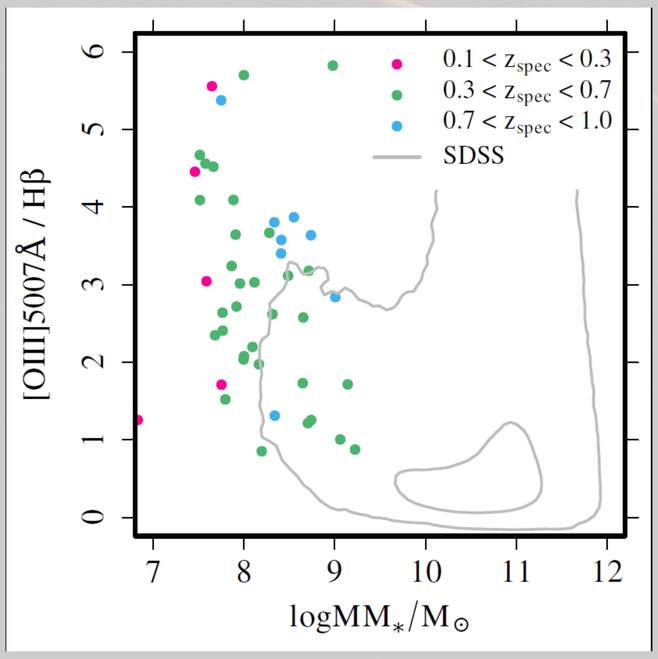
Classification

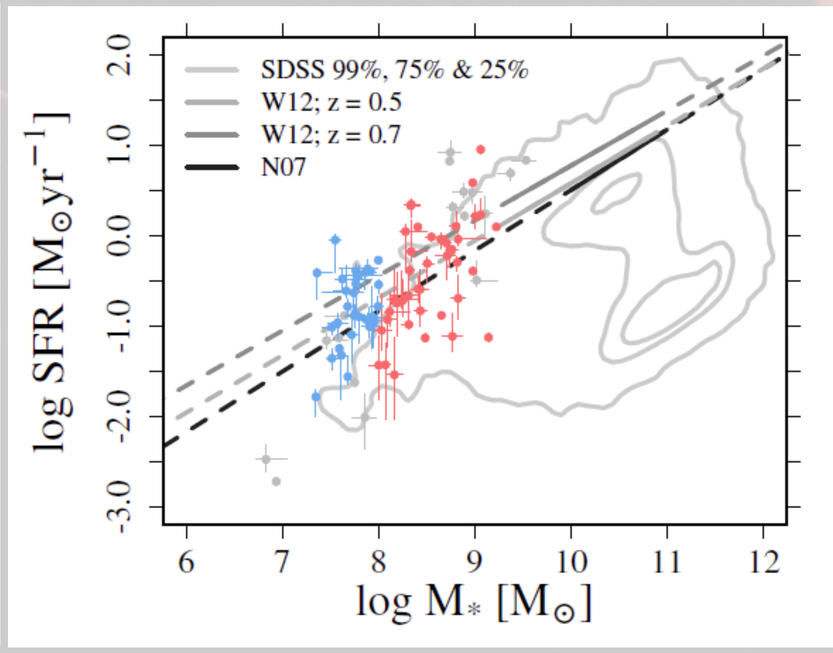
BCD-like: Compact vigorous star-forming and low luminosity objects.

dIrr: similar but eased characteristics and a wide range of properties. The most heterogeneous group.

Disk-like: highest masses of the sample and lowest contribution of the burst to the total luminosity.

Physical Properties





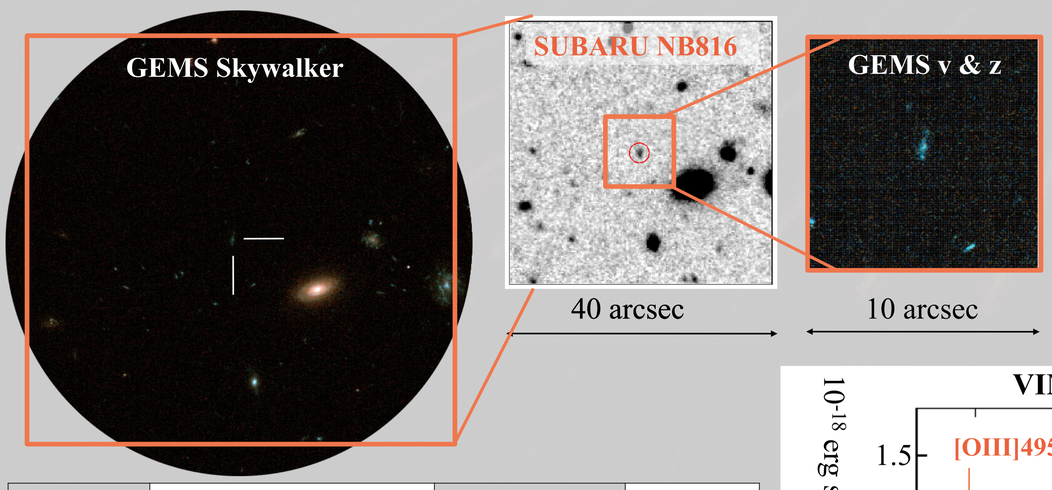
Conclusions

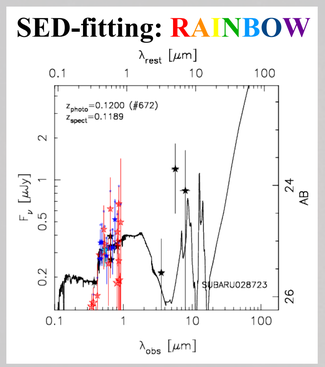
- a) Unique sample of extremely low-mass star-forming galaxies at intermediate z. Our sample extends the available data range to extremely low stellar masses (<10^8 $M_\odot$).
- b) SFRs and Stellar Masses are consistent with the SF main-squence over 2 dex range. More massive objects show higher SFRs than low-mass objects, following the SF main sequence.
- c) Distant Dwarfs and BCDs follow the overall star-forming sequence in the excitation-luminosity diagram, populating the high excitation, low metallicity and high strength region.
- d) LowMass SFGs (M<1e8) present short SFHs that form
  - 90% of mass in the 0.8 – 2.3 Gyr period prior to the obs
  - 50% of in the 0.4 – 0.6 Gyr period
  - “Late” epoch of formation
    - Confirms SLOAN results
    - Compatible with Downsizing

  See Rodríguez-Muñoz talk
- e) Key science-case for the future E-ELT/MOSAIC Spectrograph

MOSAIC

Example of Dwarf candidate to low metallicity





Type	Irr	Z_{spec}	0.1189
m_{NB816}	25.11+/-0.05	$(B-V)_0$	0.06
$R_{eff,GEMS}$	0.9+/-0.1 kpc	$M_{B,0}$	-13.5
$S_{eff,B,0}$	25.3+/-0.1mag arcsec^{-2}	$\log M_*$ [$M_\odot$]	6.8+/-0.3