

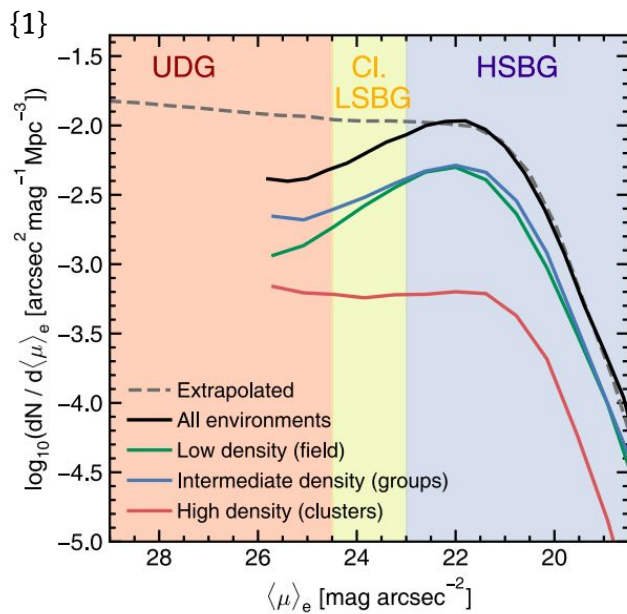
Spectroscopy fine-tuning: the last step of machine-learning approach for UDGs

Antonio
Vanzanella

Dissecting Ultra-Diffuse Galaxies in the Field.

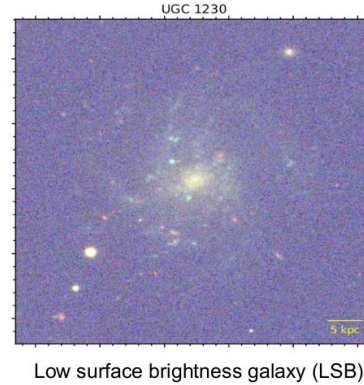
Observational Biases and Spectroscopic Determination of Physical Properties in Low Surface Brightness Systems.

A. Vanzanella¹, K. Malek^{1,2}, Junais^{3,6}, E. Bernaud², A. Gargiulo⁴, H. Thuruthipilly^{7,8}, K. Lisiecki¹, A. Pollo¹, M. Scodeggio⁴, P. M. Weilbacher³, S. Boissier², P. Franzetti⁴, G. Lorenzon¹, A. Nanni^{1,9}, C. Adami², R. Gavazzi^{2,5}, O. Ilbert², S. Pal¹, N. Principi Cavaterra¹



- $(7.5 \leq \log(M_*/M_\odot) \leq 9.5)$
- Relative new objects, just ~100 spectroscopically confirmed in the field, to date.

LSBG

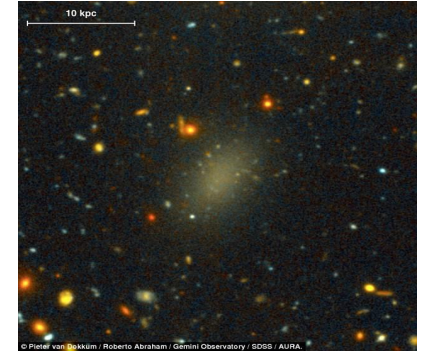


Low surface brightness galaxy (LSB)

[1]
LSBGs

galaxies with an average r-band surface brightness ($\mu_r > 23 \text{ mag arcsec}^{-2}$) below typical level of the night sky.
(Martin et al. 2019; Junais et al. 2023)

UDG



Ultra Diffuse Galaxy (UDG)
(3 times larger than the previous plot)

UDGs [2]

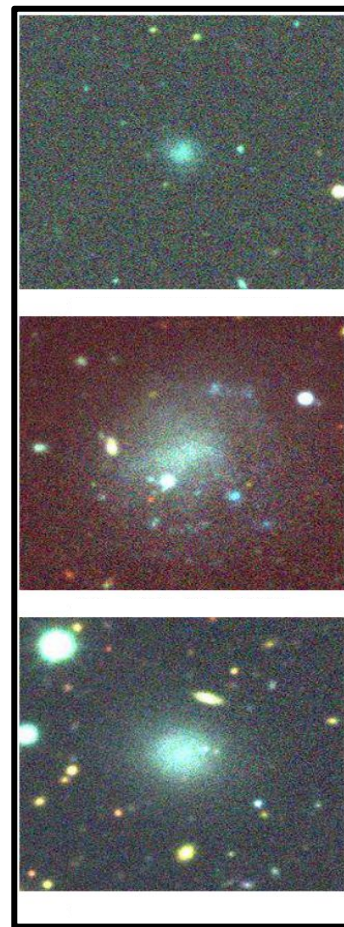
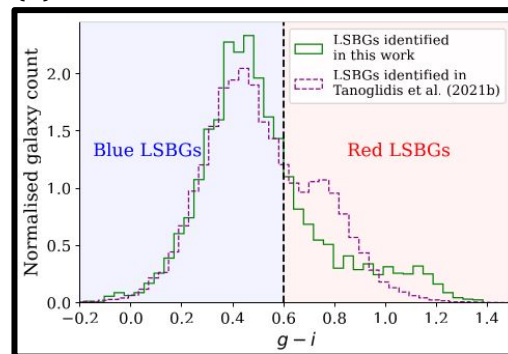
subclass of LSBGs presenting extended half-light radii $r_{1/2} > 1.5 \text{ kpc}$ and a central surface brightness $\mu_0 > 24 \text{ mag arcsec}^{-2}$ in the g-band. (van Dokkum et al. 2015)

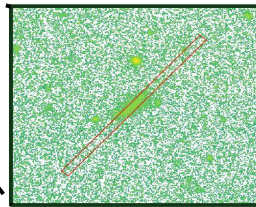
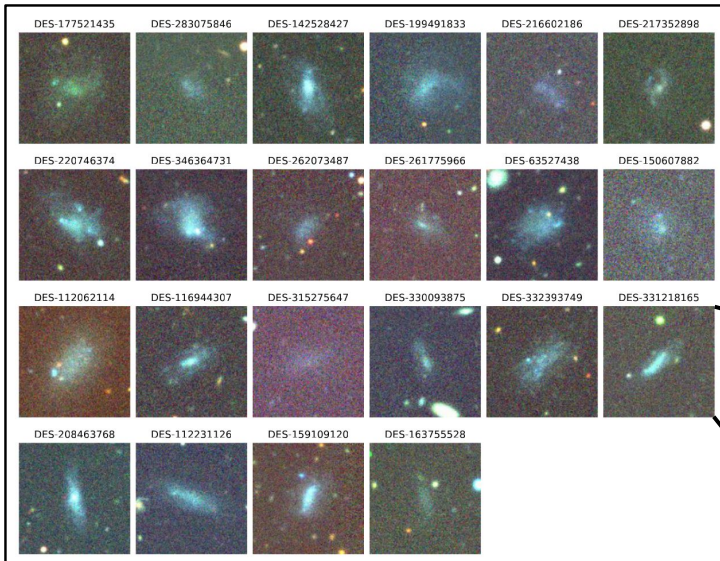
UDGs candidates confirmation

- **Candidates**(~27,000 LSBGs including UDGs) selection from catalog built using a Machine Learning pipeline on Dark Energy Survey (DES) samples.
- LSST era : on $18,000 \text{ deg}^2$, ~100k LSBGs estimated.
- Spectroscopy follow-up to: confirm the nature of candidates, estimate the physical properties and using it as prior for ML algorithms LSST dedicated.



{1}





- Proposal **accepted** for 22 UDG candidates, **observed** 14.
- Large Binocular Telescope Observatory(LBT)/The Multi-Object Double Spectrographs(MODS).
- Mostly Blue UDGs in the field.
- Relative new objects, just ~40 spectroscopically confirmed in the field, to date.

{1}

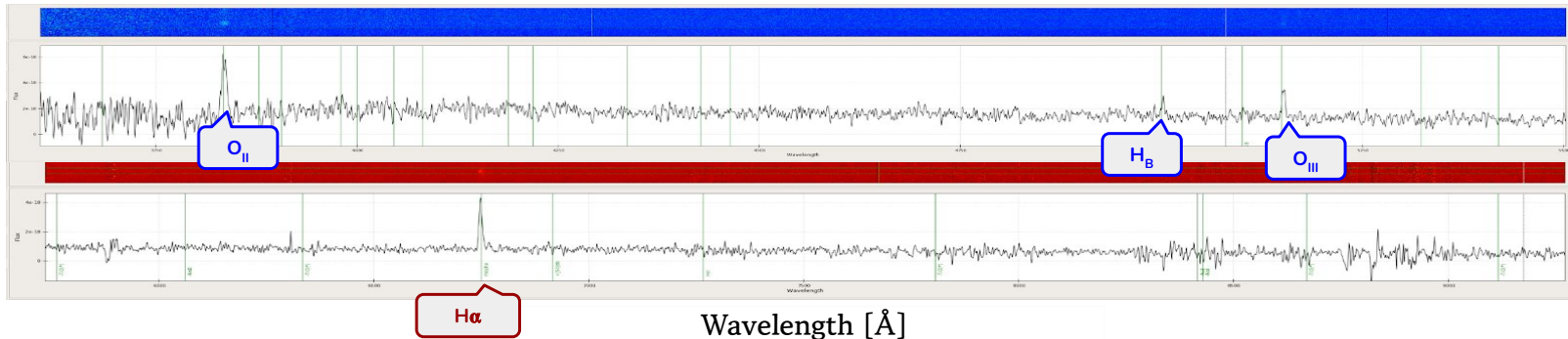
Flux [$\text{erg cm}^{-2} \text{s}^{-1} \text{\AA}^{-1}$]/ 10^{-17}

spectroscopic redshift = 0.0289

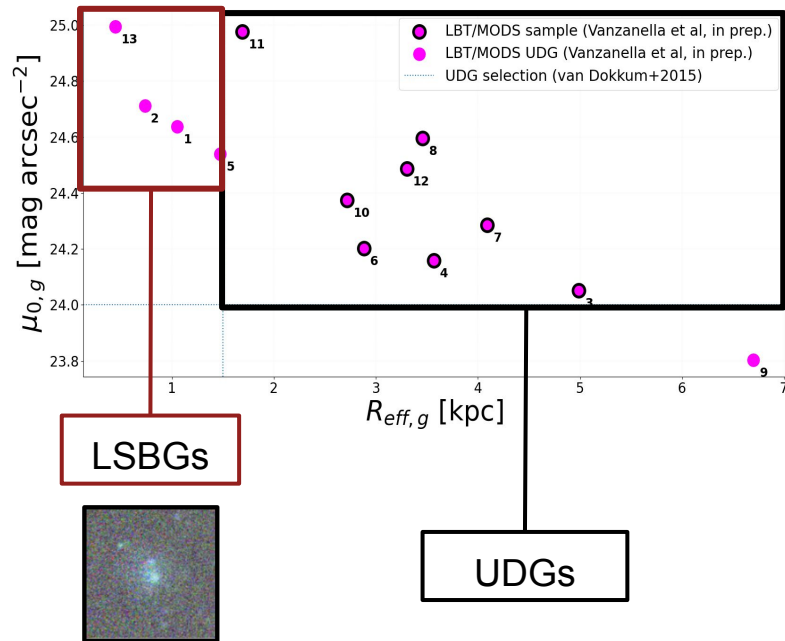
confirm. : LSB/UDG

SFR : 0.0027

C.S.BRIGHTNESS : 24.610

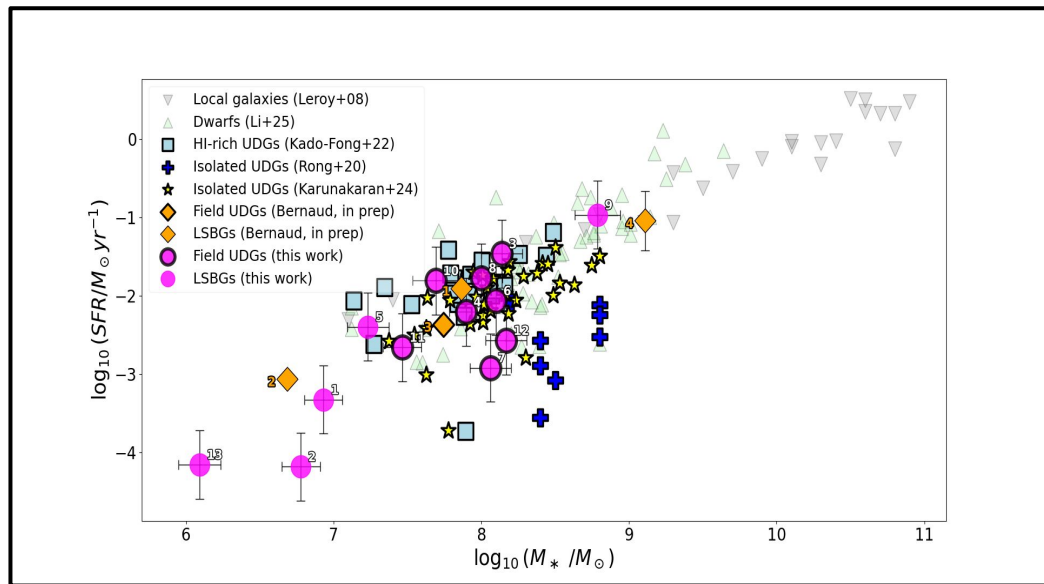


UDGs space



UDGs in the main sequence

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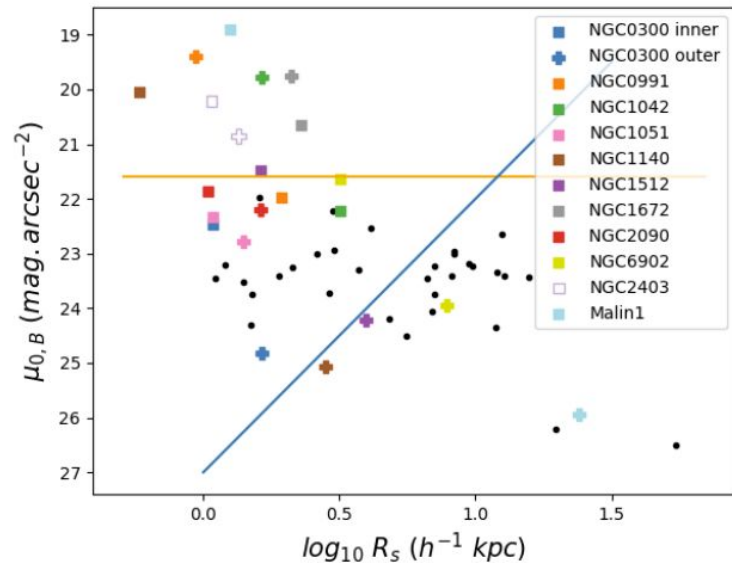
Hundreds many other applications

- *From DES to KiDS: Domain adaptation for cross-survey detections of low-surface-brightness galaxies.* Hareesh Thuruthipilly, Krzysztof Lisiecki, Junais, Katarzyna Małek, Agnieszka Pollo, ...
- *DES to HSC: Detecting low-surface-brightness galaxies in the Abell 194 cluster using transfer learning.* H. Thuruthipilly, Junais, J. Koda, A. Pollo, M. Yagi, ...

Thank you

Back Up

Giant LSBG



"Characterizing the outer disk of eXtended-UV galaxies in the optical domain with deep surveys".
Bernaud et al. 2025.

- Classification of the sample adapted from Sprayberry et al.(1995); Hagen et al. (2016).
- The squares symbols represent the value of the disk fit for the inner part of the galaxies and the cross symbols for the extended UV region.
- The blue line distinguishes the Low Surface Brightness galaxies (LSB) from the Giant LSB (GLSB) galaxies.
- The orange line, the Freeman (1970) value ($21.65 \text{ mag. arcsec}^{-2}$), separates the high surface brightness (HSB) galaxies from the LSB galaxies.
- In order to compare with the data of Sprayberry et al. (1995); Hagen et al. (2016); McGaugh & Bothun (1994) (black dots) calculated with $H_0 = 100 \text{ h km s}^{-1} \text{ Mpc}^{-1}$ we corrected the Scale Length with h^{-1} .