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Ministero
dell'Università
e della Ricerca



Italiadomani
PIANO NAZIONALE
DI RIPRESA E RESILIENZA



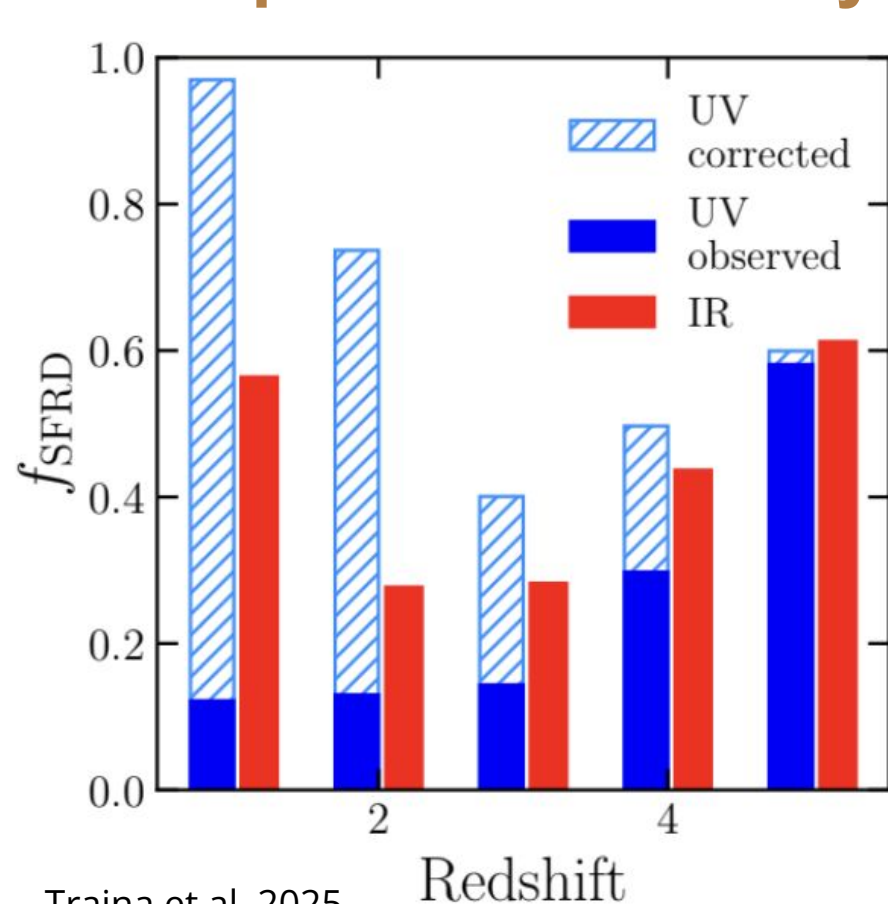
INAF
ISTITUTO NAZIONALE
DI ASTRONOMIA

Red and tiny Dusty dwarfs and little red dots as seen by ELT

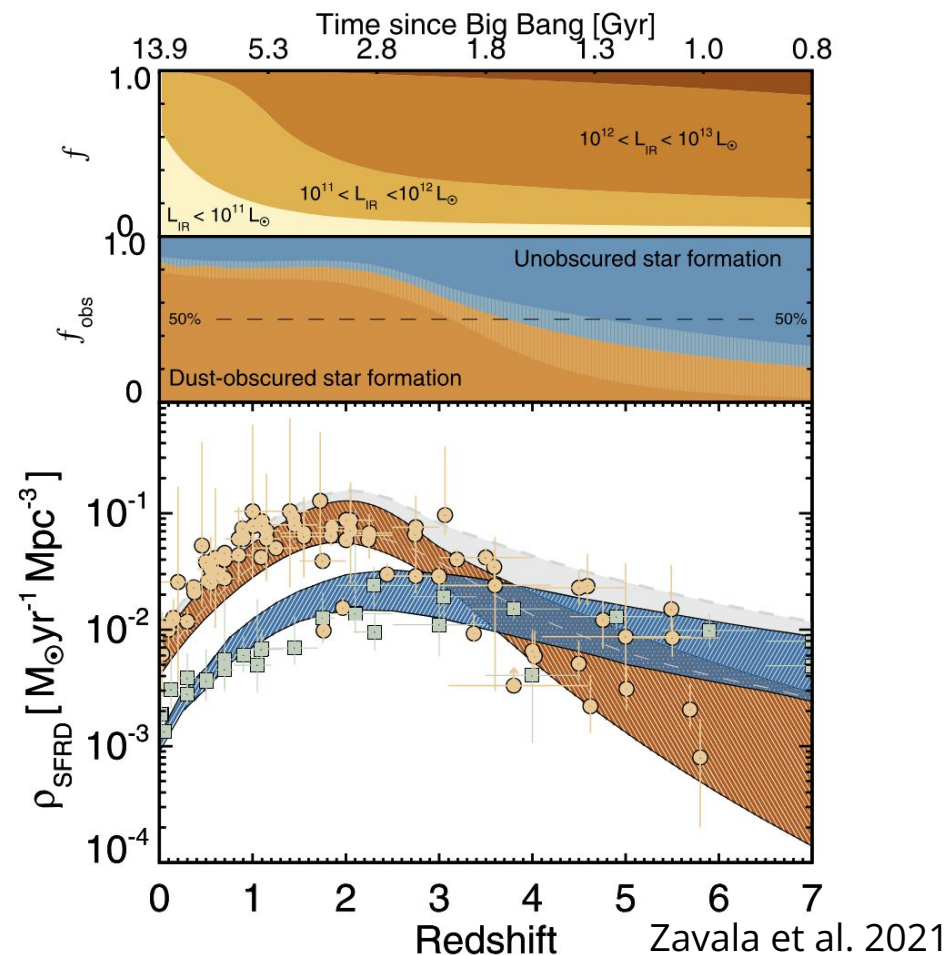
Laura Bisigello
INAF - Padova

A. Grazian, G. Rodighiero, G. Gandolfi, M. Simioni, + CEERS team + Euclid Consortium

The importance of studying dust-obscured sources



Traina et al. 2025

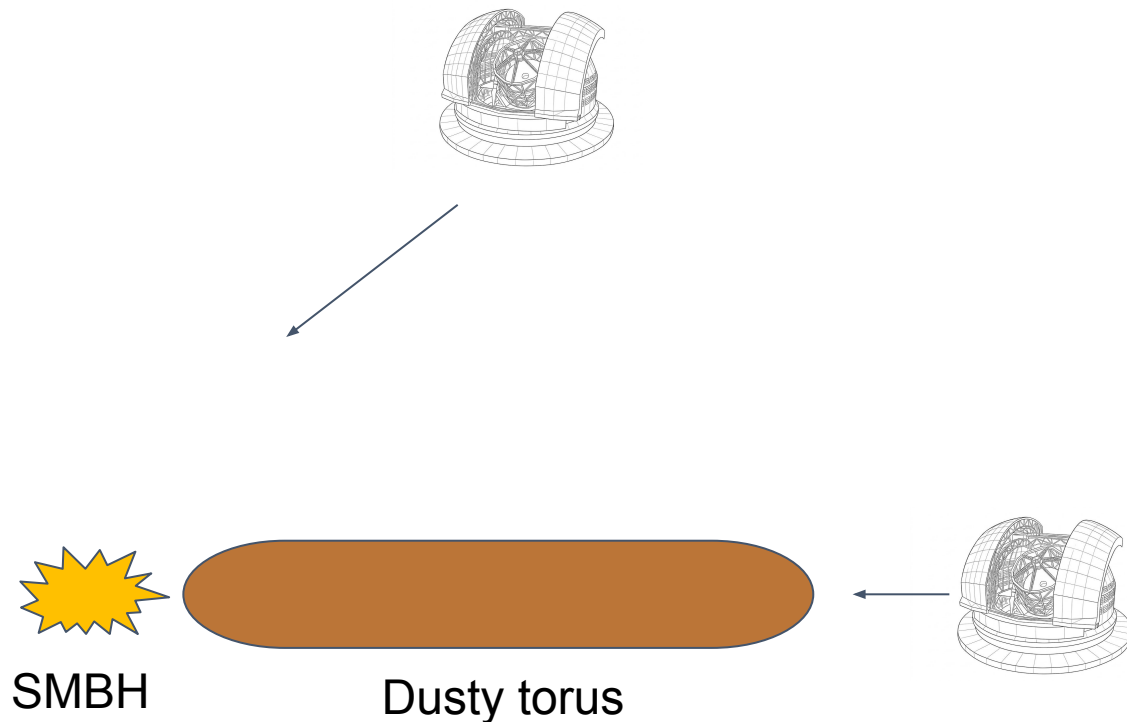


Zavala et al. 2021



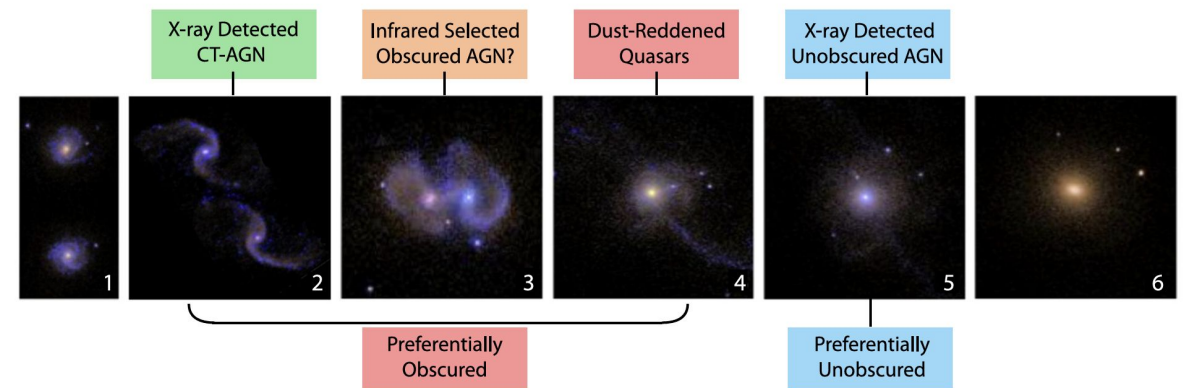
The role of AGN obscuration

Unified model (Urry & Padovani 1995)



vs.

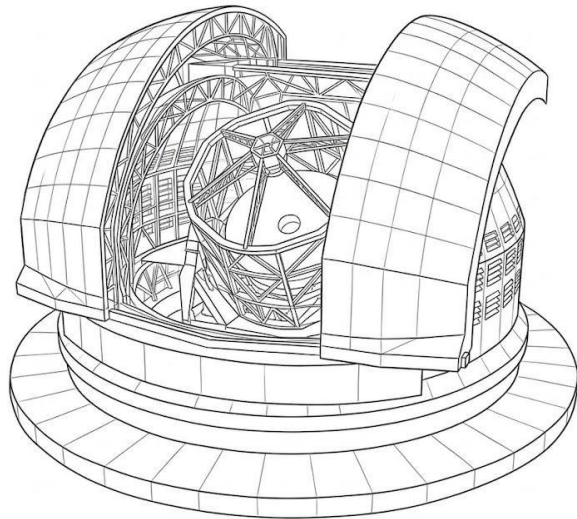
Evolutionary model (Sanders et al. 1988, Hopkins et al. 2006)



Kocevski et al. 2015



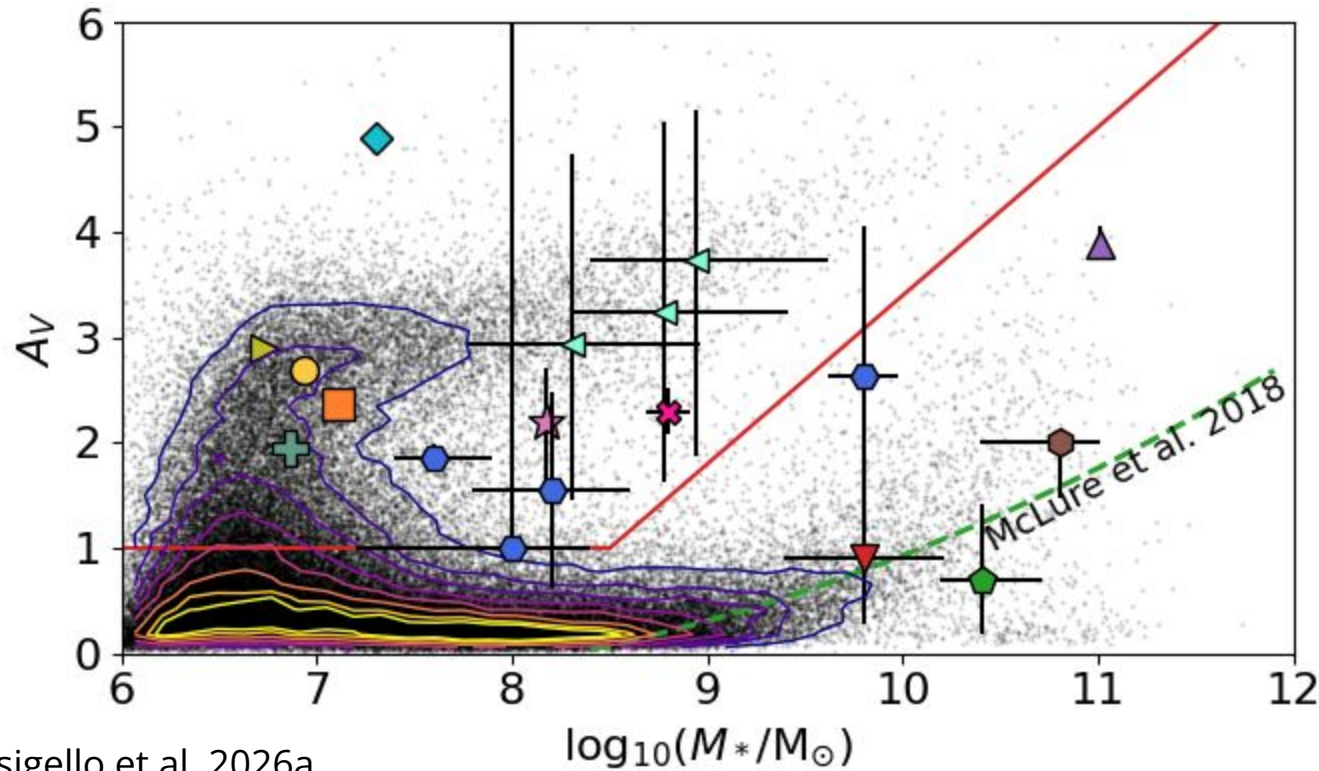
To have a comprehensive view of galaxy and AGN evolution across cosmic times is fundamental to move beyond the UV/optical



1. Highly extinguished low-mass galaxies
2. Little red dots



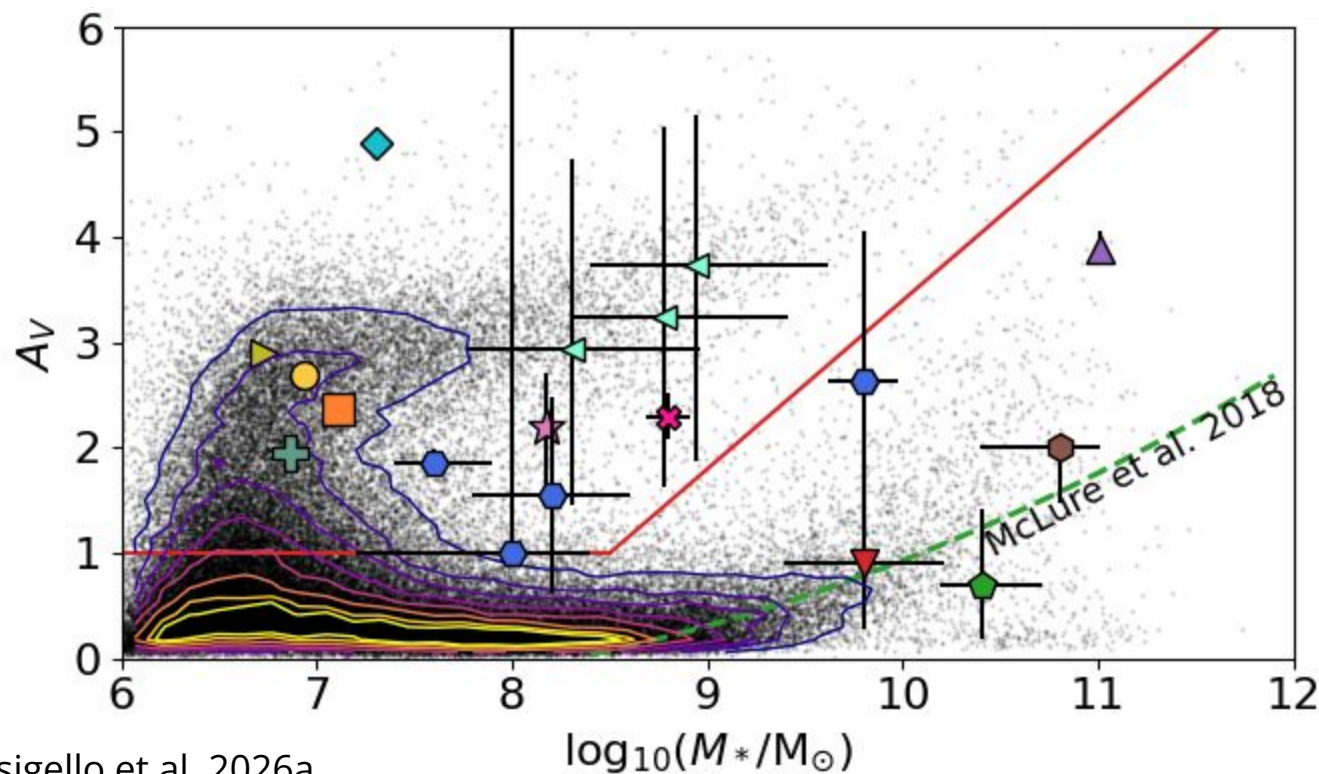
Highly extinguished low-mass galaxies (HELM)



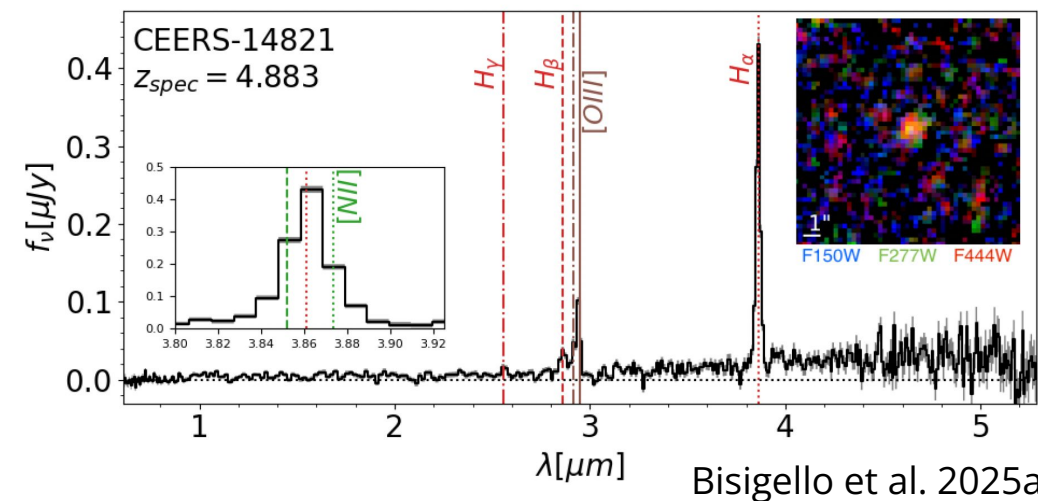
- ✱ Arrabal Haro (2023)
- ◀ Gandolfi (2025)
- ⊕ HELM-1σ
- HELM-2σ
- HELM-3σ
- HELM selection
- Castellano (2025)
- Alcade Pampliega (2019)
- ◆ Pérez-González (2023), HST-faint
- ▼ Pérez-González (2023), HST-dark
- ▲ Gentile (2024)
- ◆ Bisigello (2023)
- ▶ Rodighiero (2023)
- ★ Bisigello (2025)

Bisigello et al. 2026a
see Bisigello et al. 2023 for the original selection

Highly extinguished low-mass galaxies (HELM)



Bisigello et al. 2026a
but see Bisigello et al. 2023 for the original selection



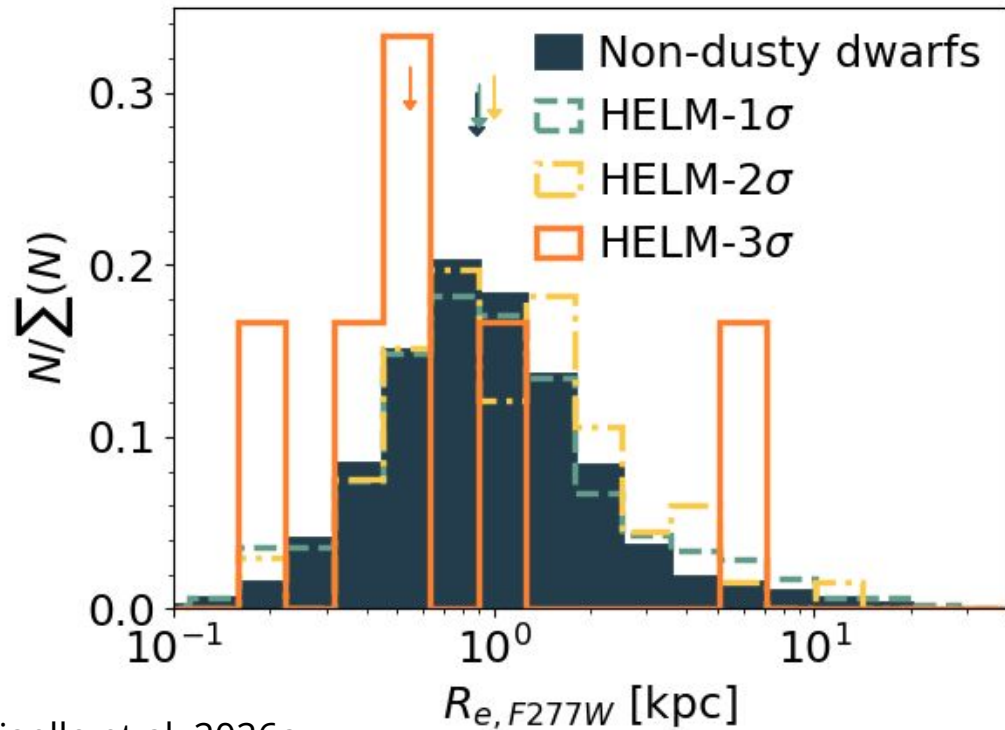
Bisigello et al. 2025a

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- ▲ Rodighiero (2023)
- ★ Bisigello (2025)



What could be the reasons for their large dust extinction?

Are they more compact?

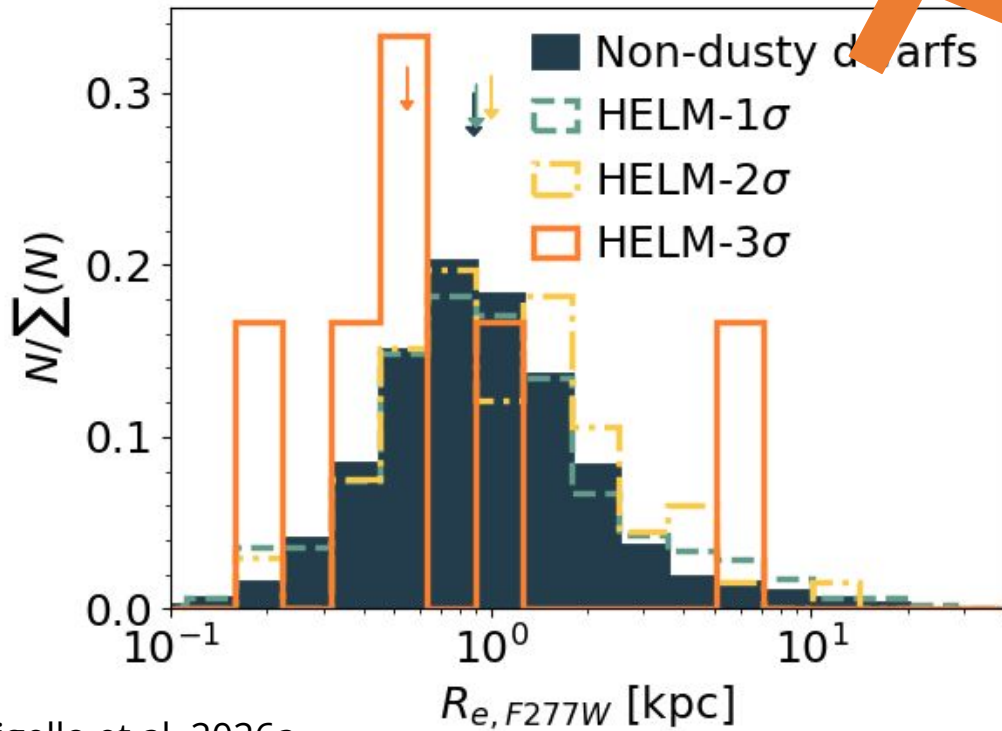


Bisigello et al. 2026a



What could be the reasons for their large dust extinction?

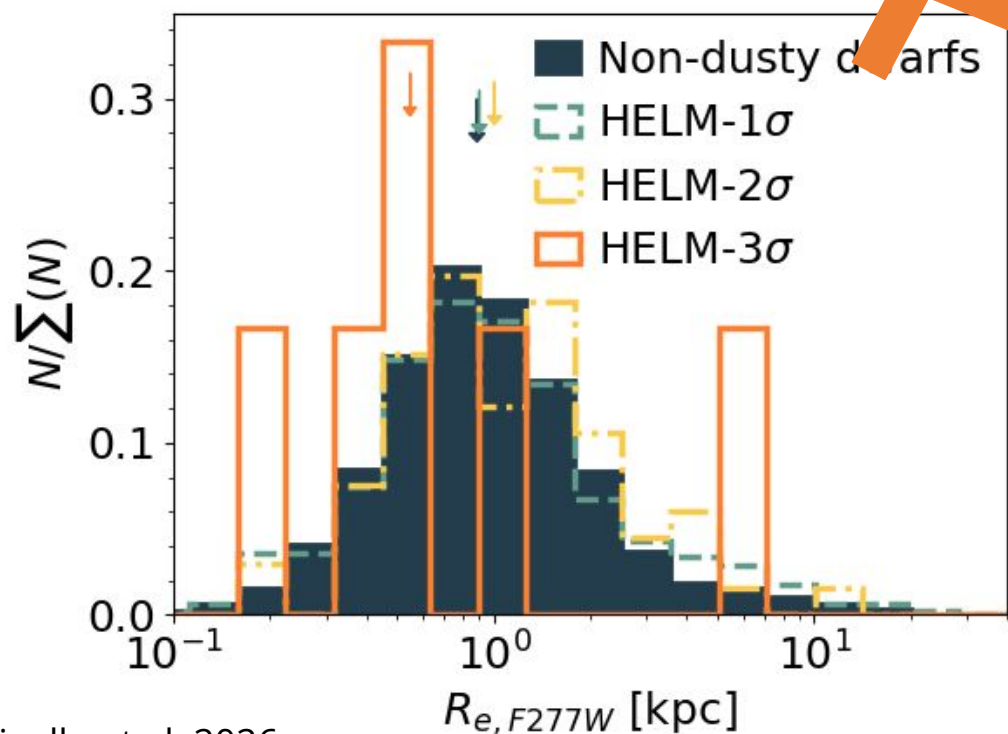
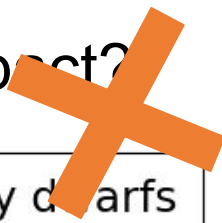
Are they more compact?



Bisigello et al. 2026a

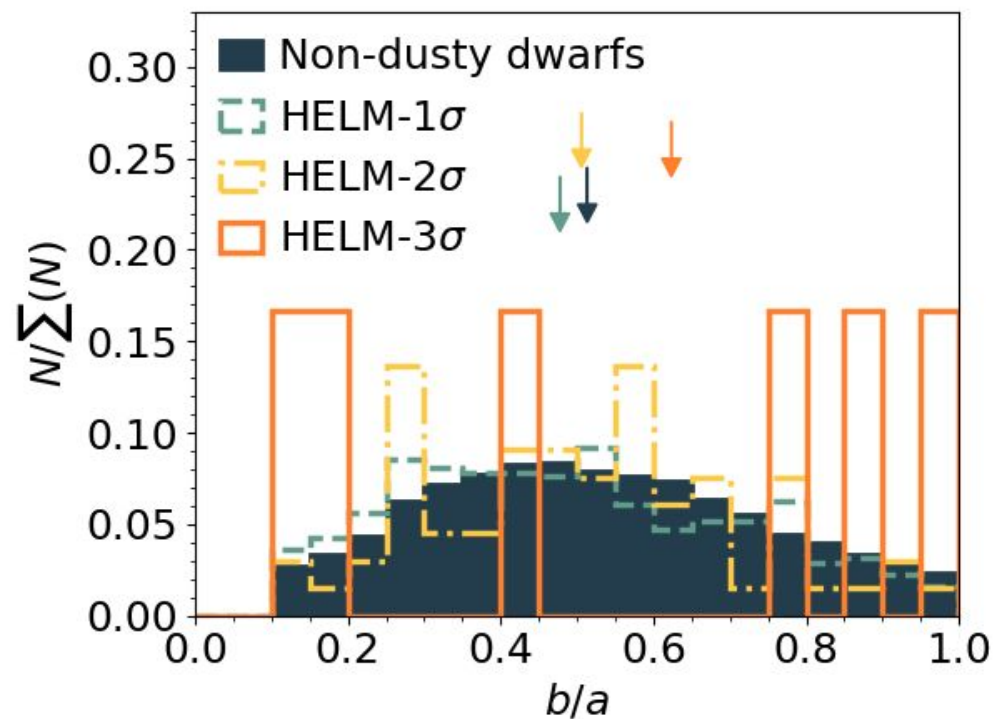
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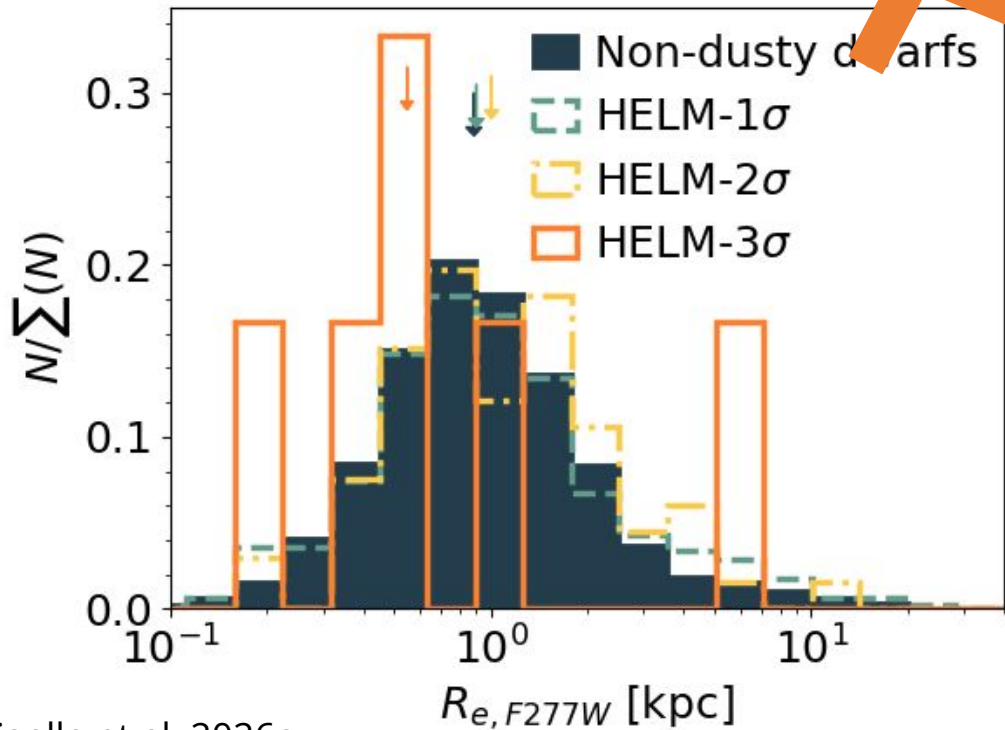
Are they edge-on?





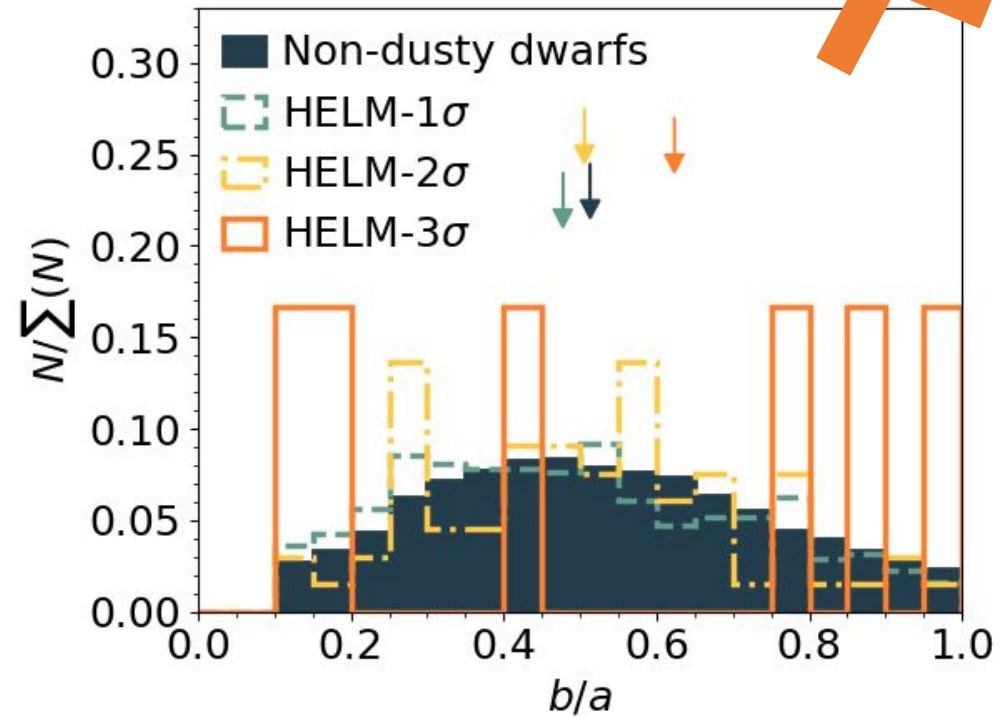
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Bisigello et al. 2026a

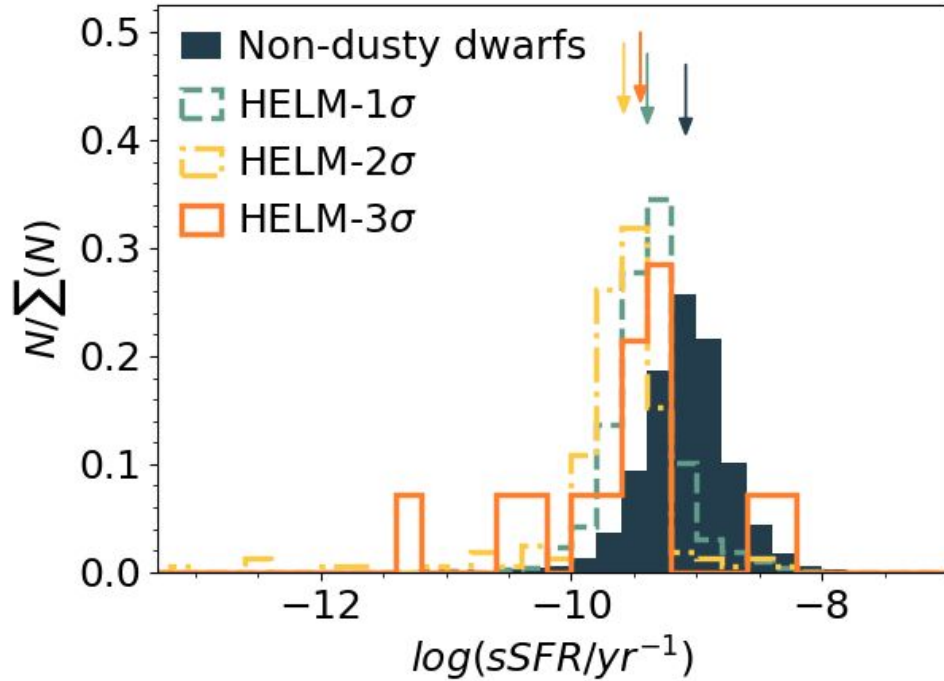
Are they edge-on?



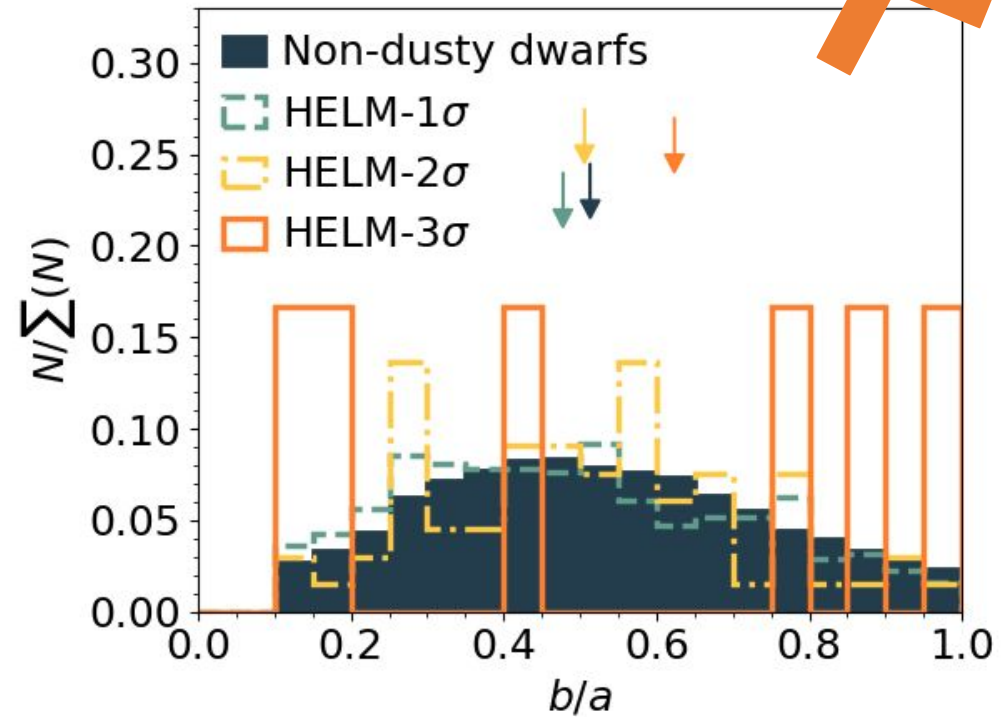


What could be the reasons for their large dust extinction?

Are they starburst?



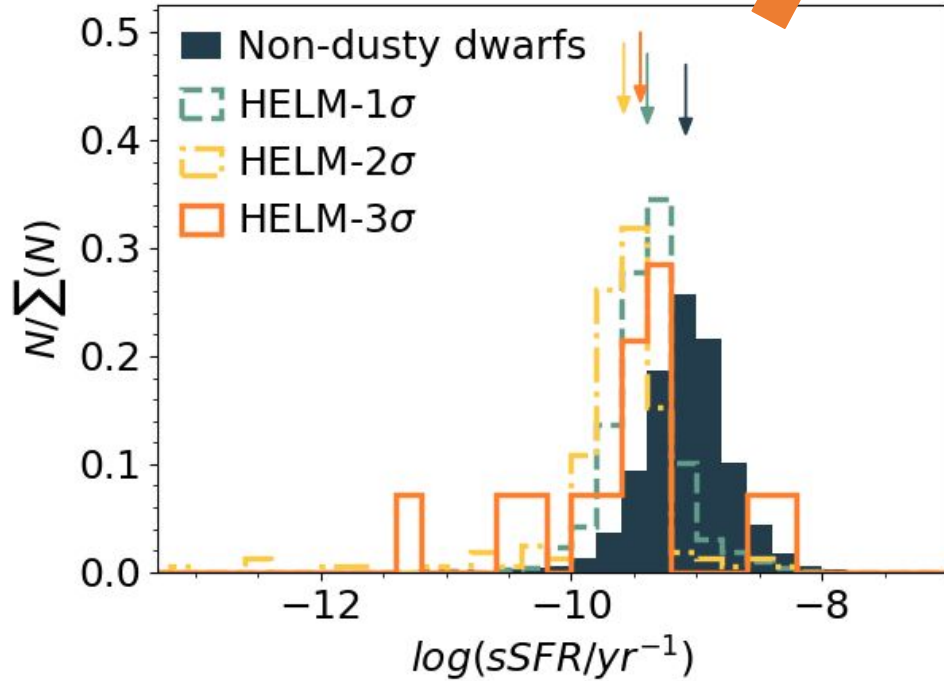
Are they edge-on?



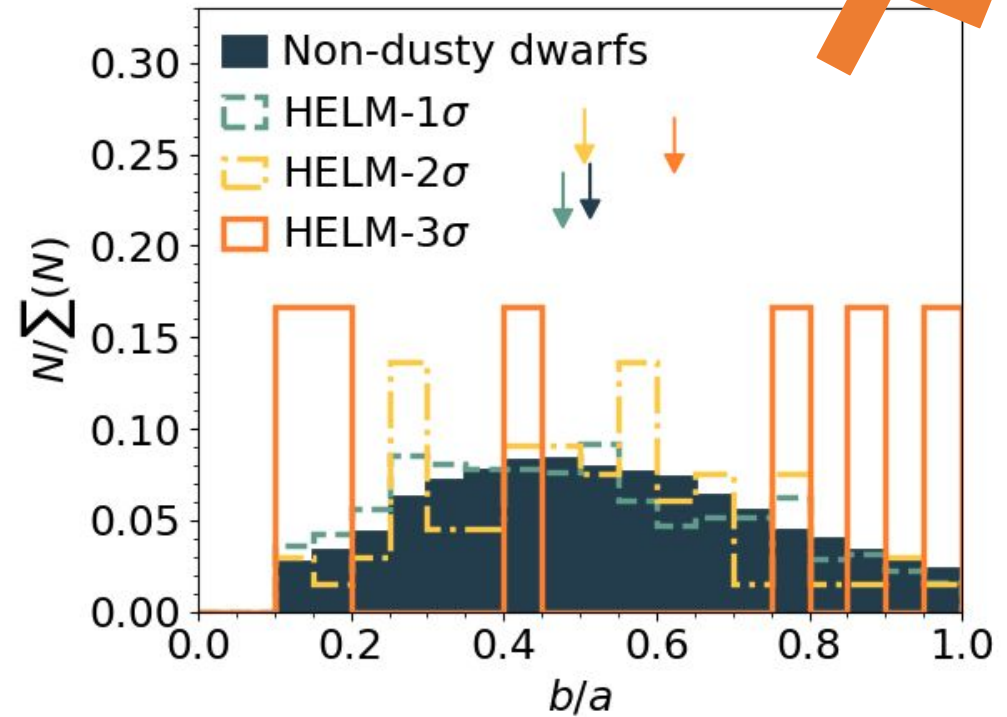
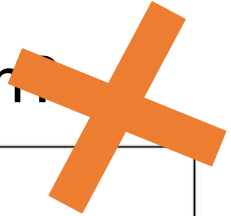


What could be the reasons for their large dust extinction?

Are they starburst?



Are they edge-on?

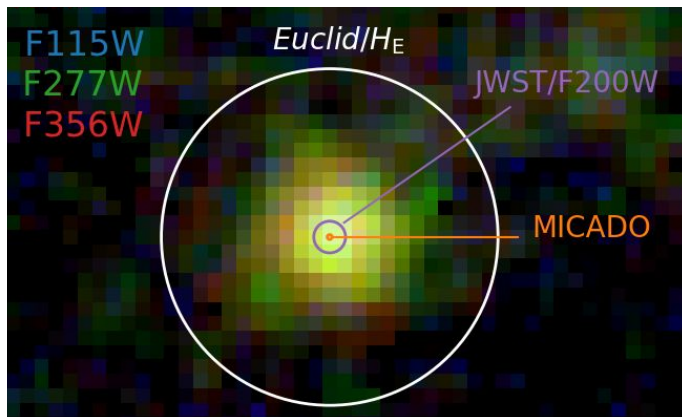




What could be the reasons for their large dust extinction?

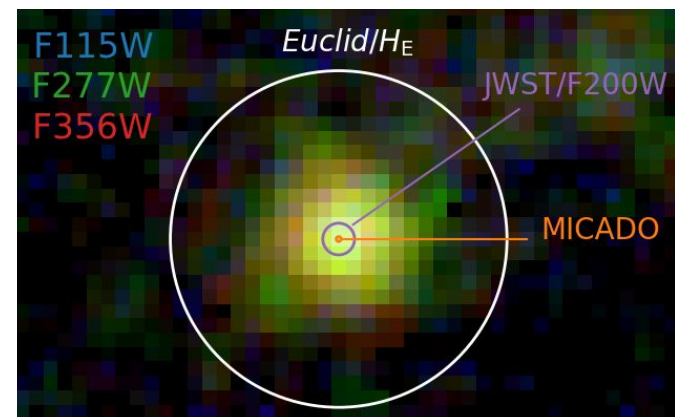
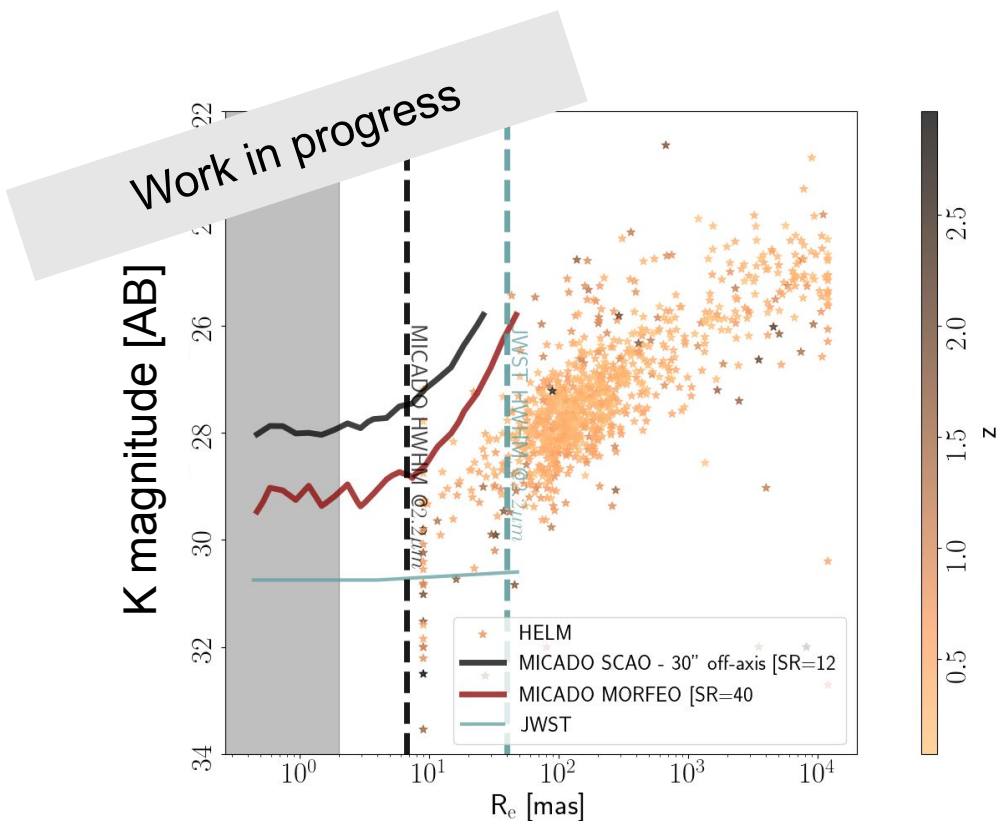
- ✗ Are they more compact
- ✗ Are they edge-on galaxies?
- ✗ Could they be starburst?

- ? Are they prolate systems?
- ? Are they tidal dwarfs?



We need to spatially resolve them!

ELT contribution



Assumptions:

- S/N=5 on $r=2.5\text{px}$ aperture
- Gaussian profile

Next steps:

- Different light profiles
- Gain S/N over resolution

Thanks to Matteo Simioni



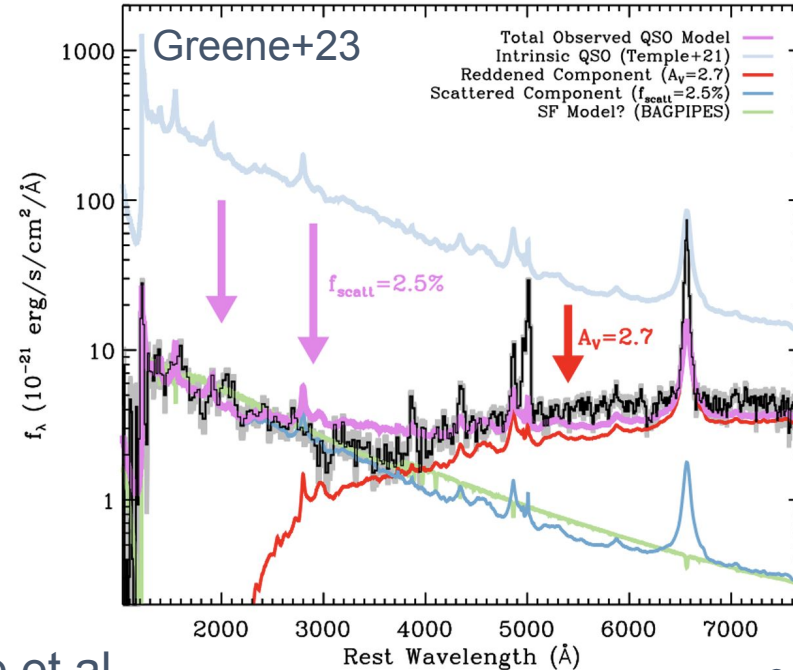
Little red dots

Observational constraints:

- Broad hydrogen lines
- Strong Balmer breaks
- X-ray undetected
- No variability
- Radio undetected
- Rare at $z < 4$

References: Greene et al. 2023, Matthee et al. 2023, Harikane et al. 2023; Barro et al. 2024, Maiolino et al. 2024b; de Graaff et al. 2025, Naidu et al. 2025, Kocevski et al. 2025, and at least 100+

We need low- z candidates!



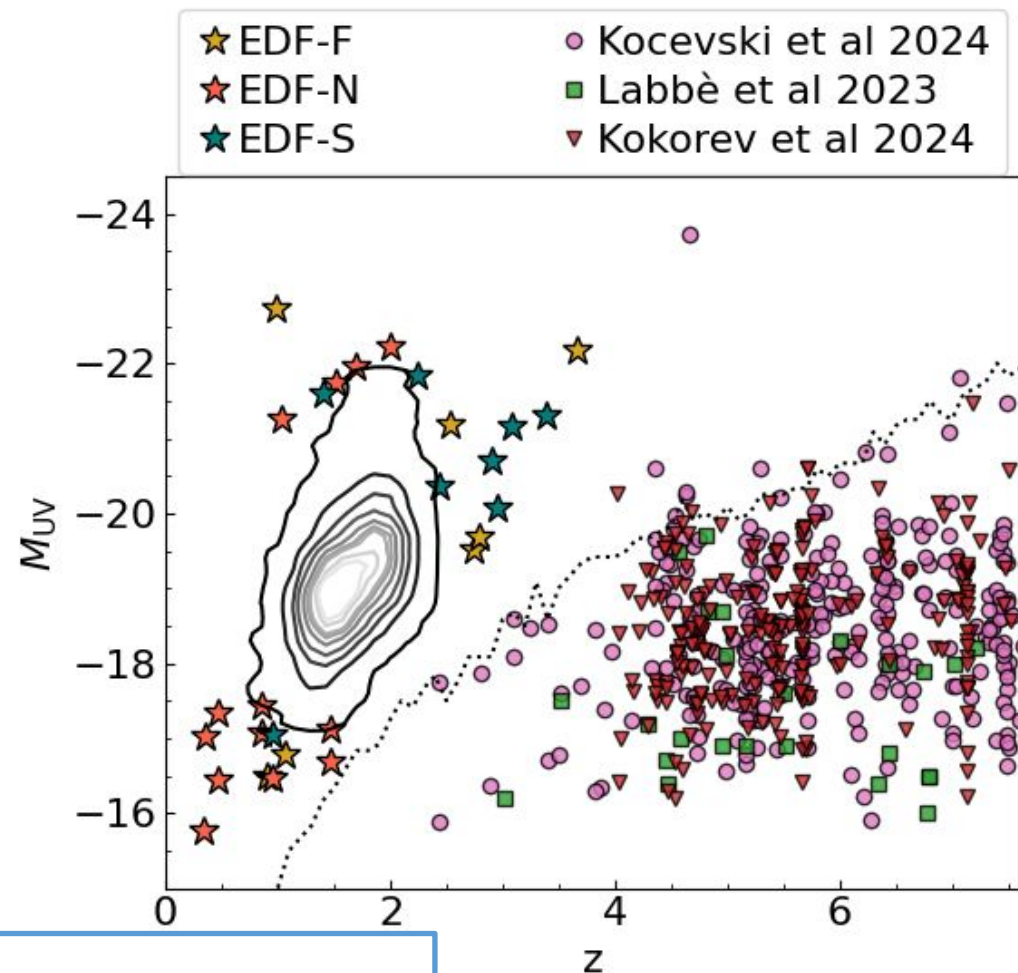
AGN BH*
SUPER-MASSIVE STARS
MASSIVE GALAXIES

Euclid Q1 LRD candidates

1. Removal of artifacts with flagging
2. $S/N > 3$ in at least 4 filters
3. "v-shape"*:
$$\begin{cases} \beta_{\text{opt}} > 0 \\ \beta_{\text{UV}} < -0.37 \\ \beta_{\text{UV}} > -2.8 \end{cases}$$
4. Compact ($\mu_{\text{max}} - m_{\text{star}} < -2.6$)
5. Removal of emission line galaxies
6. Final visual inspection

EC: Bisigello et al. 2026

Final sample of 3341 LRD candidates



EC: Bisigello et al. 2026b



CAVEATS:

- Euclid LRDs may not be as compact as JWST ones.
- Blending issues in IRAC

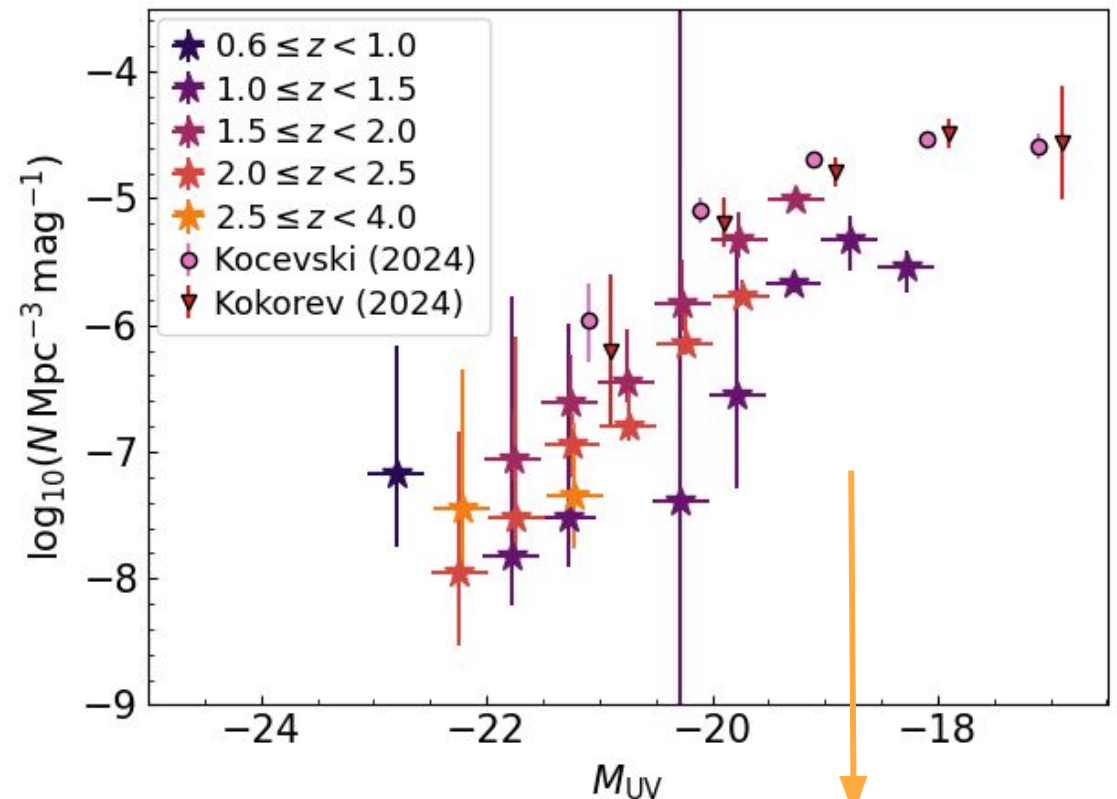
CONCLUSIONS:

- Evolution of LRDs may be less strong at $z < 4$ than seen by JWST
- Large sample of $z < 4$ LRD candidates to follow-up around the sky. Expecting to have even more with future Euclid DRs.

NEXT STEPS:

- Simulating LRDs to verify if ELT could observe their host galaxy

EC: Bisigello et al. 2026b



No evident drop in density at $z < 4$!



Conclusions

HELM:

- rare population of galaxies with A_v larger than expected given their stellar mass
- their nature is still totally unclear

LRDs:

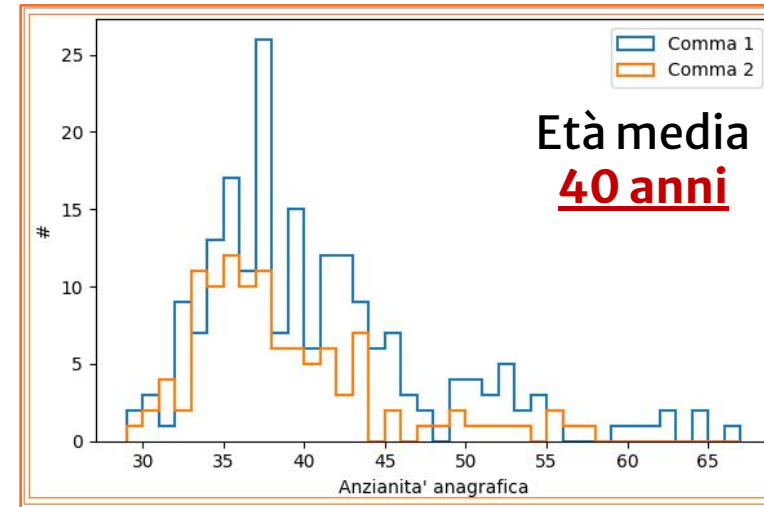
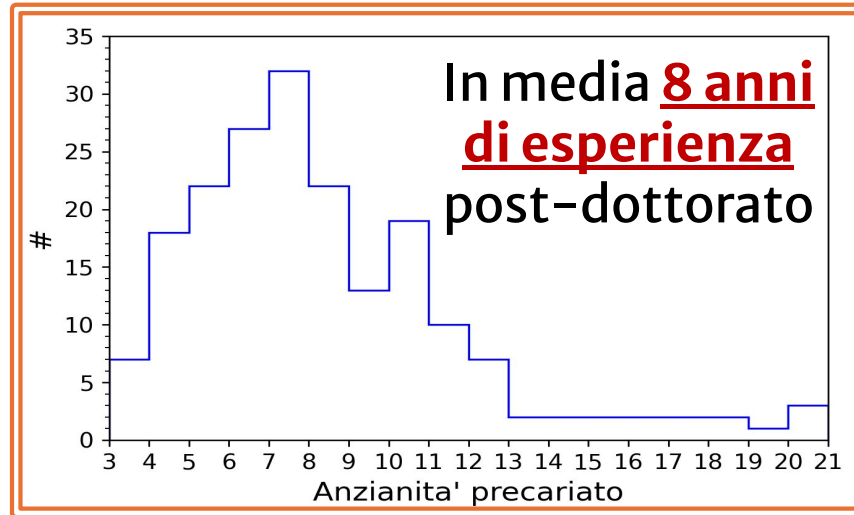
- their evolution at $z < 4$ may be less strong than objects with JWST.
- Euclid can give thousands of candidates

ELT will be fundamental to improve on our understanding of these red and tiny sources.



La situazione del personale precario in INAF è **CRITICA**

1.200 Tempo Indeterminato Vs **650** precari: più di 1 precario ogni 2 persone di ruolo. Tra questi ~300 potrebbero essere assunti a tempo indeterminato con la legge Madia (che scade a fine 2026)



Più di 100 precari altamente qualificati e con esperienza decennale rischiano l'esodo da INAF

L'impatto sui progetti nazionali e internazionali in cui INAF è coinvolto sarebbe dirompente.

Per sostenere la rete stabilizzandi firmate qui!





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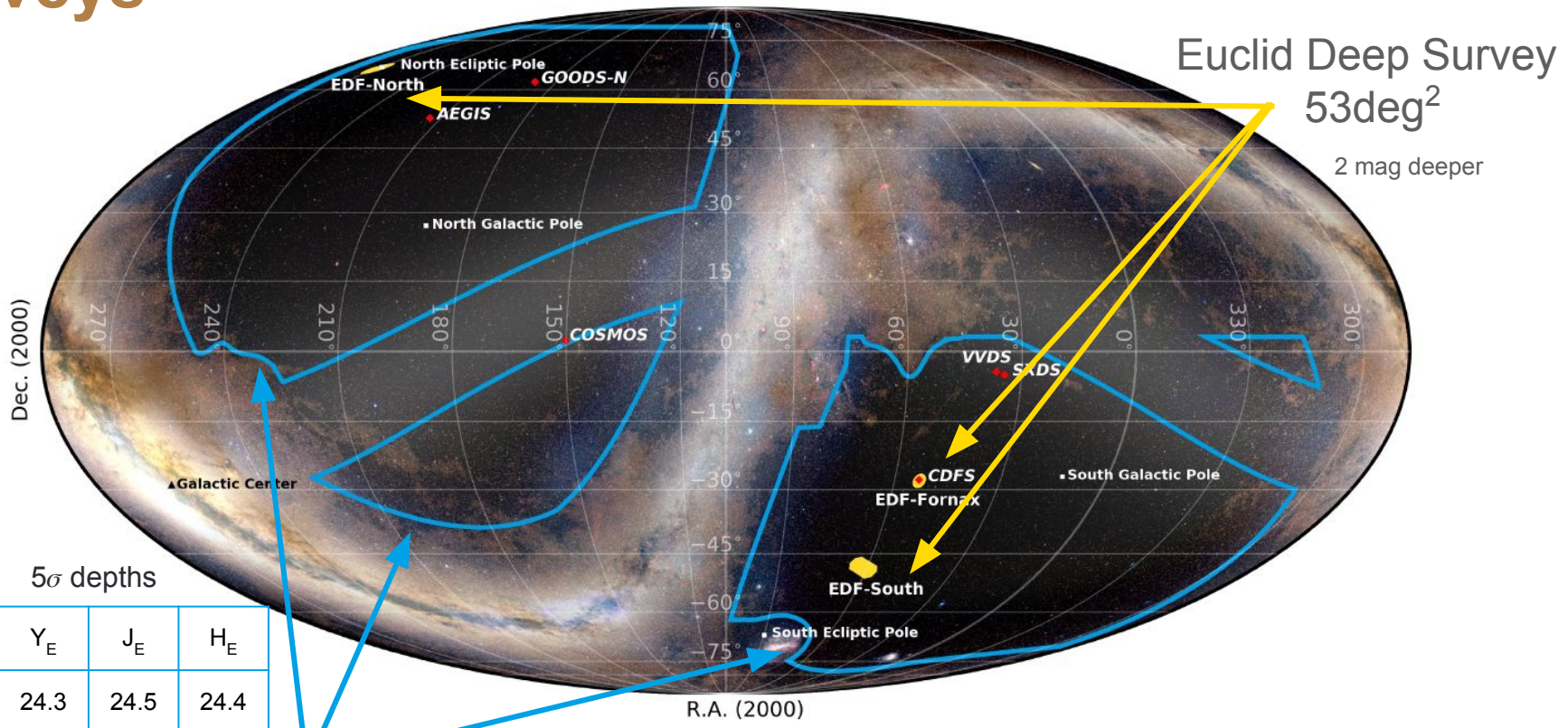
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Euclid Surveys



5 σ depths

I _E	Y _E	J _E	H _E
26.2	24.3	24.5	24.4

Euclid Wide Survey
~14700deg²

EC: Mellier et al. 2024

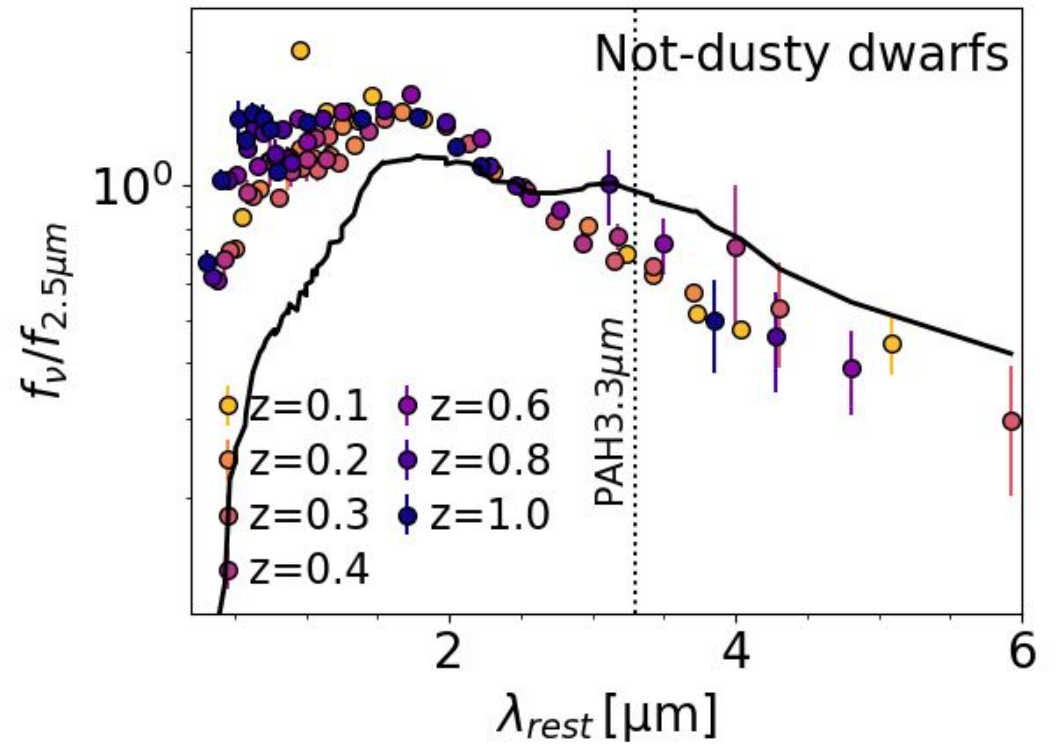
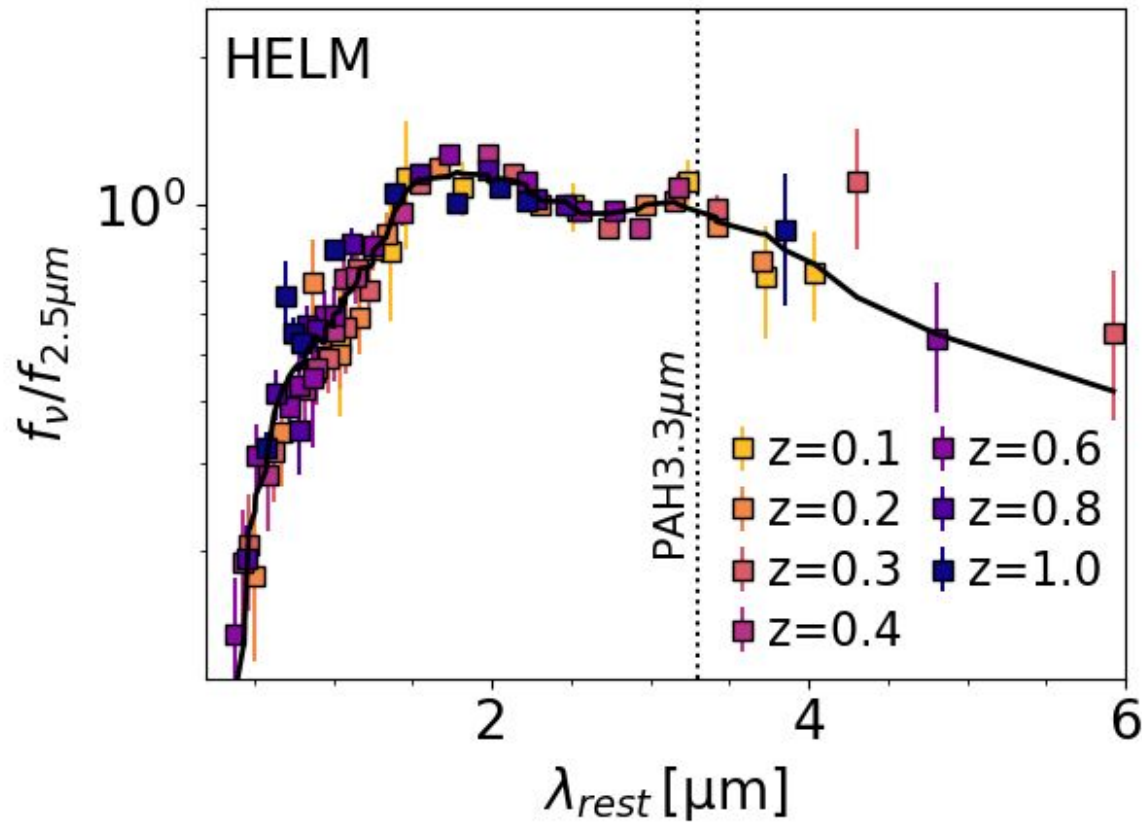
Euclid Deep Survey
53deg²
2 mag deeper

**Euclid Q1:
63deg² at Wide depth**





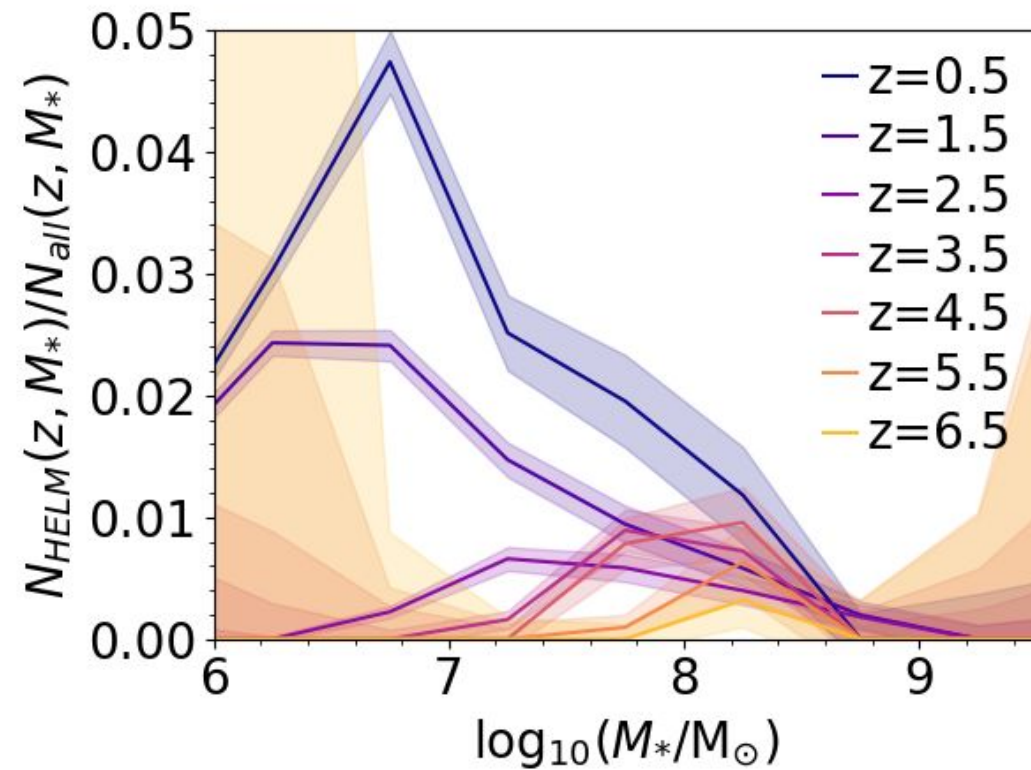
Stack photometry



Bisigello et al. 2026a



A rare but intriguing population



Bisigello et al. 2026a



LRDs w/ Euclid

