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DI ASTRONOMIA

Sieging HELM's deep: PRIMA unveils the far-infrared properties of highly extincted low-mass galaxies

Laura Bisigello - INAF-OAPD

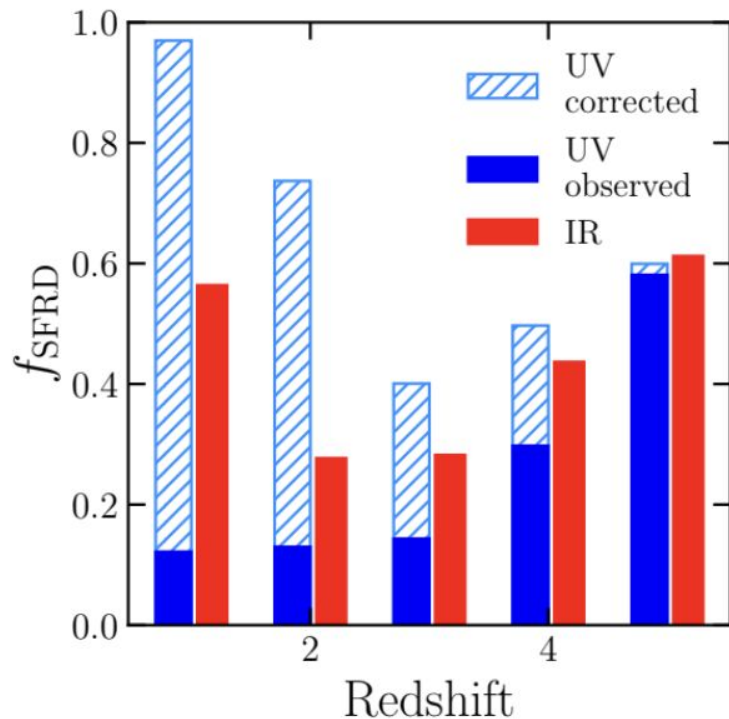
• Carlotta Gruppioni, Giulia Rodighiero, Giovanni Gandolfi, James M., S. Donnellan, Seb Oliver, Stephen M. Wilkins, L. Y. Aaron Yung

PNRR
Missione 4 • Componente 2
Investimento 3.1

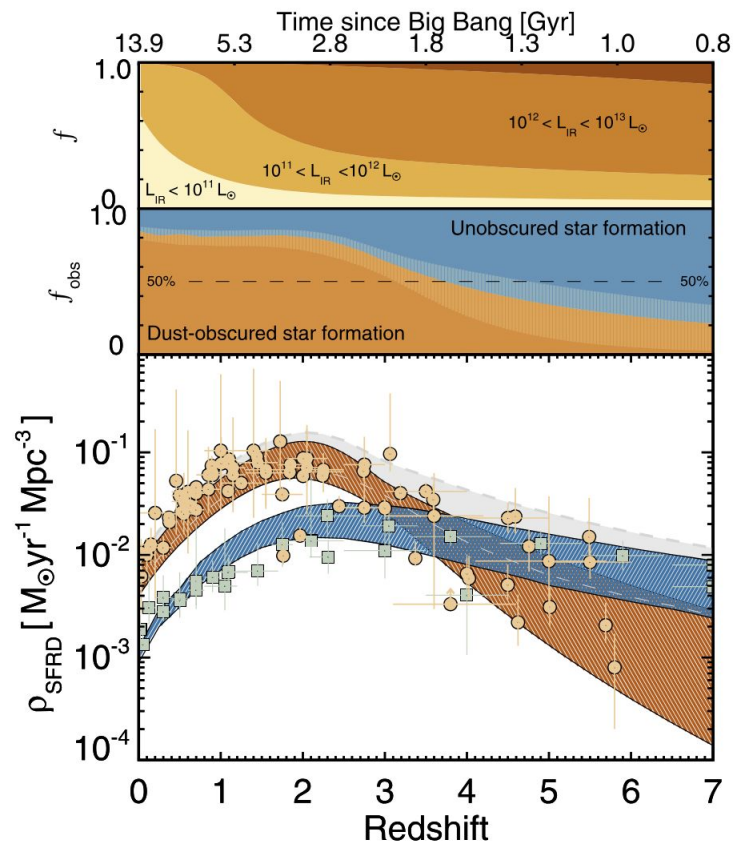
STILES – IR0000034
CUP C33C22000640006

Dusty galaxies

Traina et al. in prep.

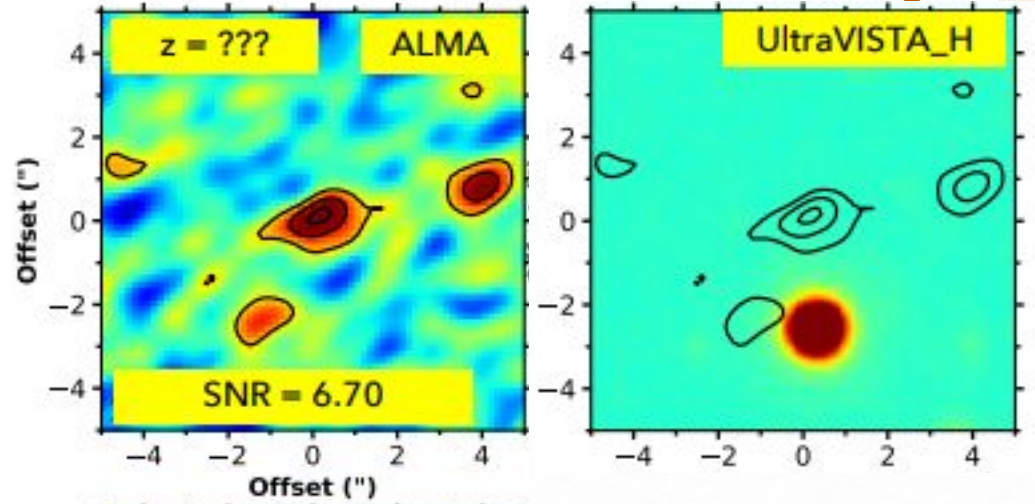


Zavala et al. 2021



Dusty galaxies

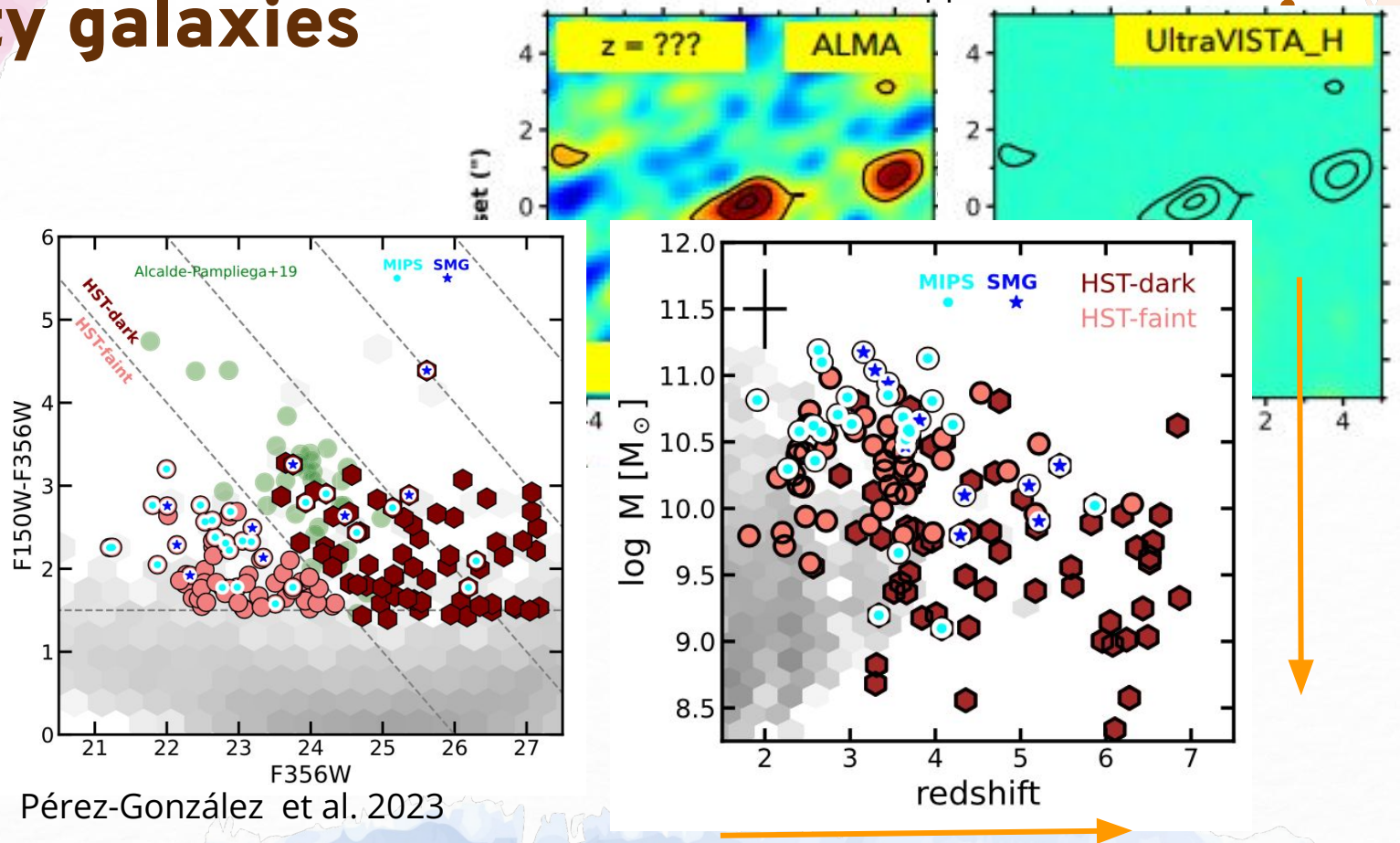
ALPINE- Gruppioni et al.2020



See also today's arxiv... 🐟

Dusty galaxies

ALPINE- Gruppioni et al.2020

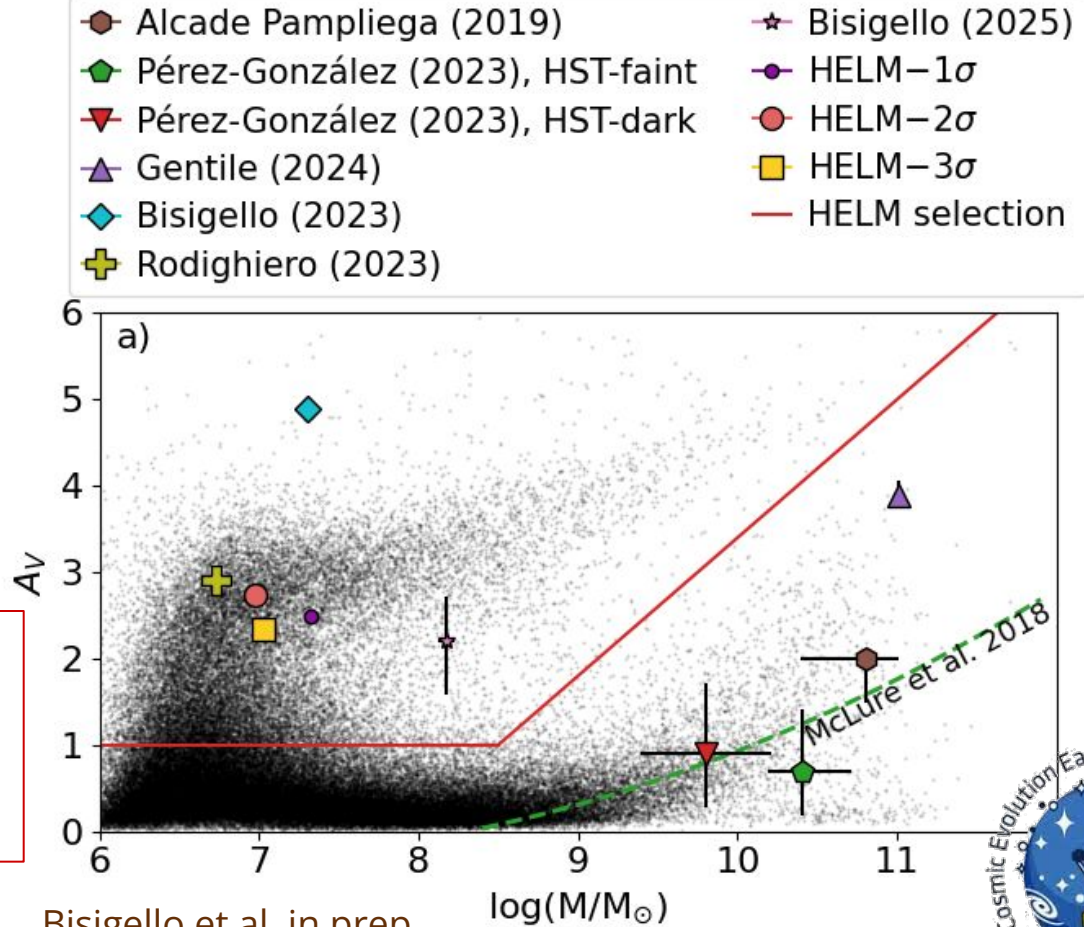


HELM

Highly Extincted low-mass galaxies

$$\log_{10}(M^*/M_{\odot}) \leq 8.5 \wedge A_V > 1$$

$$\log_{10}(M^*/M_{\odot}) > 8.5 \wedge A_V > 1.6 \times \log_{10}(M/M_{\odot}) - 12.6$$



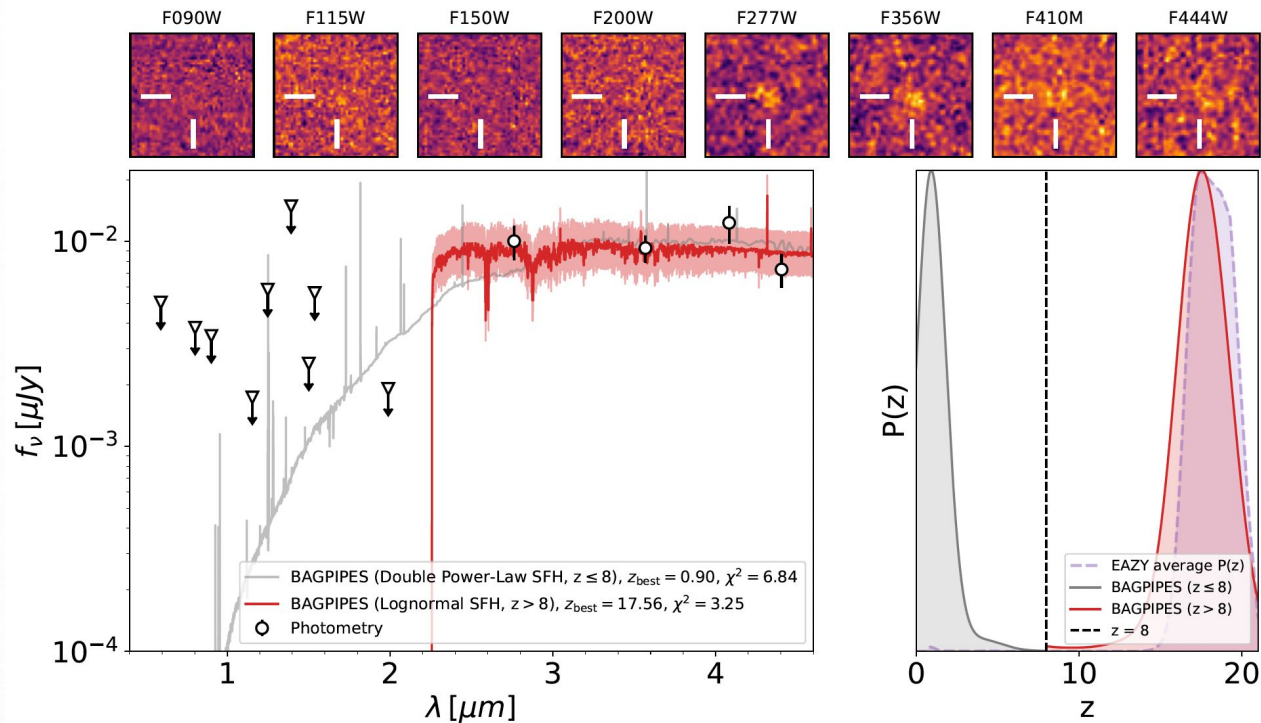
Bisigello et al. in prep.

See also Rodighiero et al. 2023, Bisigello et al. 2023, 2025, Gandolfi et al. 2025



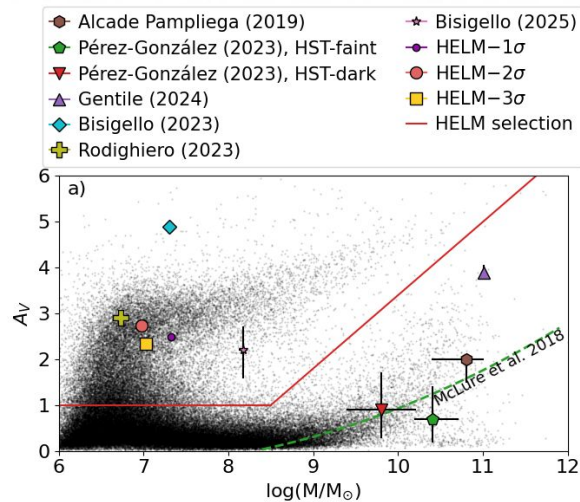
Interlopers of $z > 15$ sources

VICIADGO (U-34120)



> Giovanni Gandolfi's talk tomorrow

Gandolfi et al. subm.



Starting HELM sample

Bisigello et al. in prep.

68-95% of the
 $P(M^*, A_v)$

95-99.7% of the
 $P(M^*, A_v)$

>99.7% of the
 $P(M^*, A_v)$

	HELM-1 σ	HELM-2 σ	HELM-3 σ
Initial HELM selection ^a	3955	203	19
Brown-dwarf ^b	3	0	0
$\chi^2(A_v < 1) < \chi^2(A_v \text{ free})$	1326	28	1
$z > 8.5^c$	3	1	0
Spectroscopic data ^d	2	0	1
Final HELM sample	2621	174	17

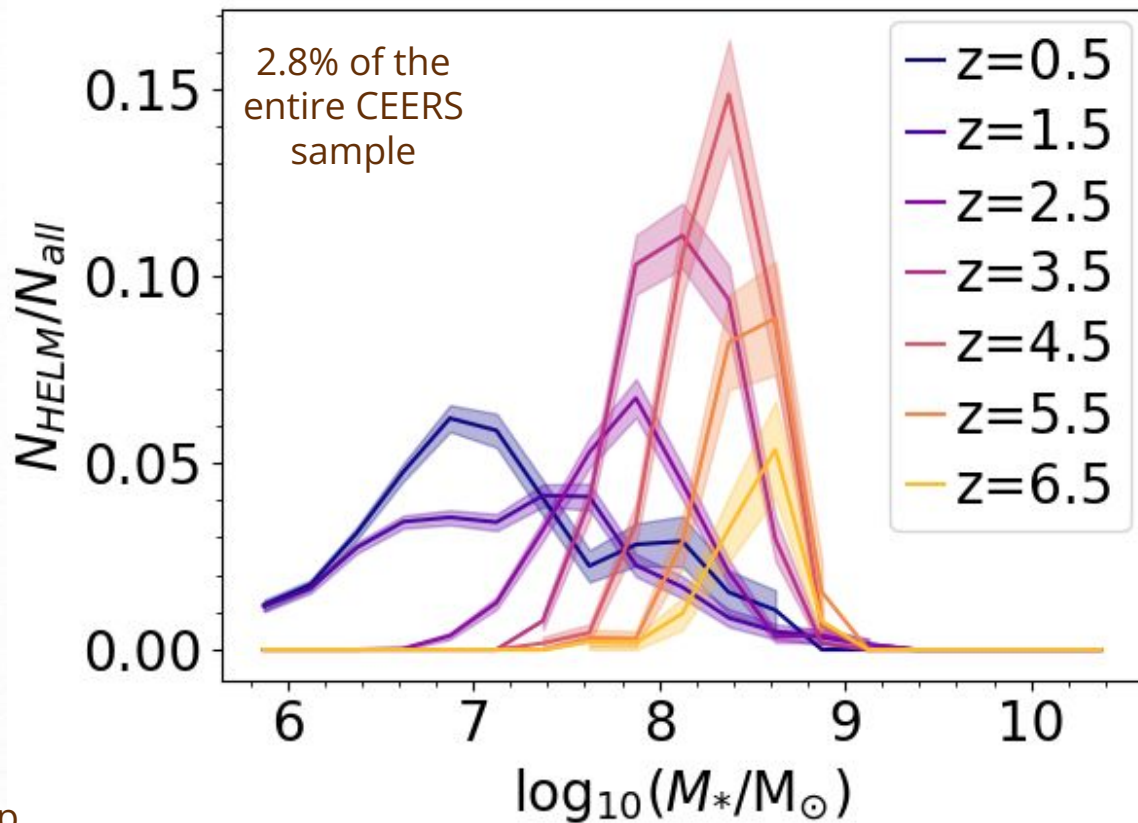
b) Holwerda et al. (2024)

c) Finkelstein et al. (2024)

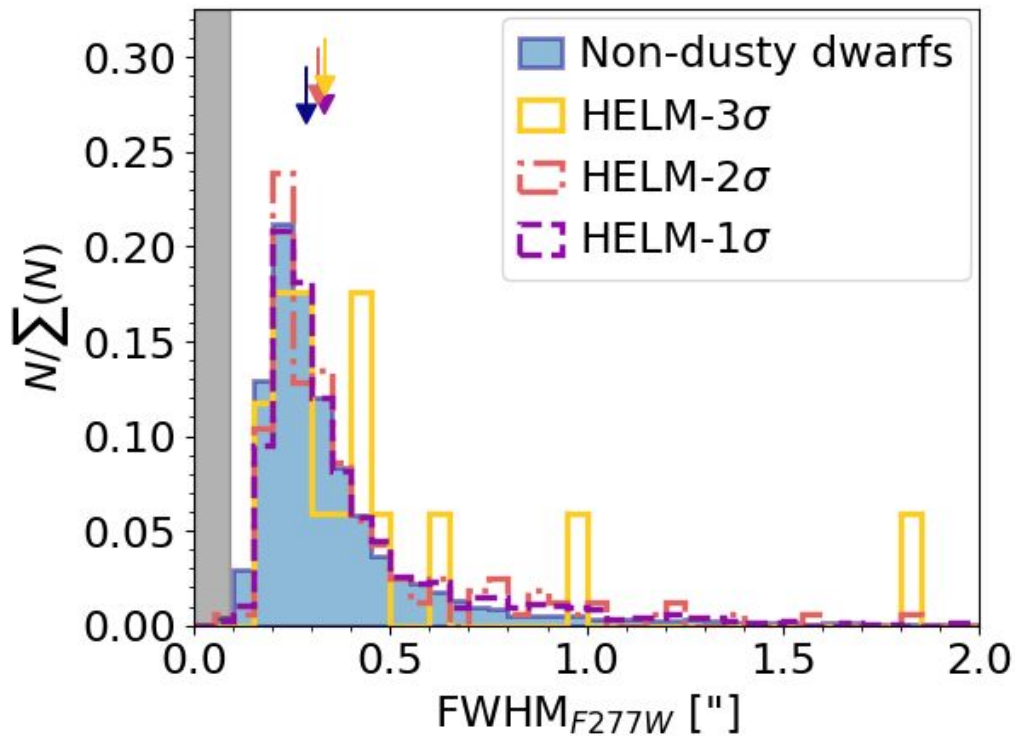
Finkelstein et al. (2025)



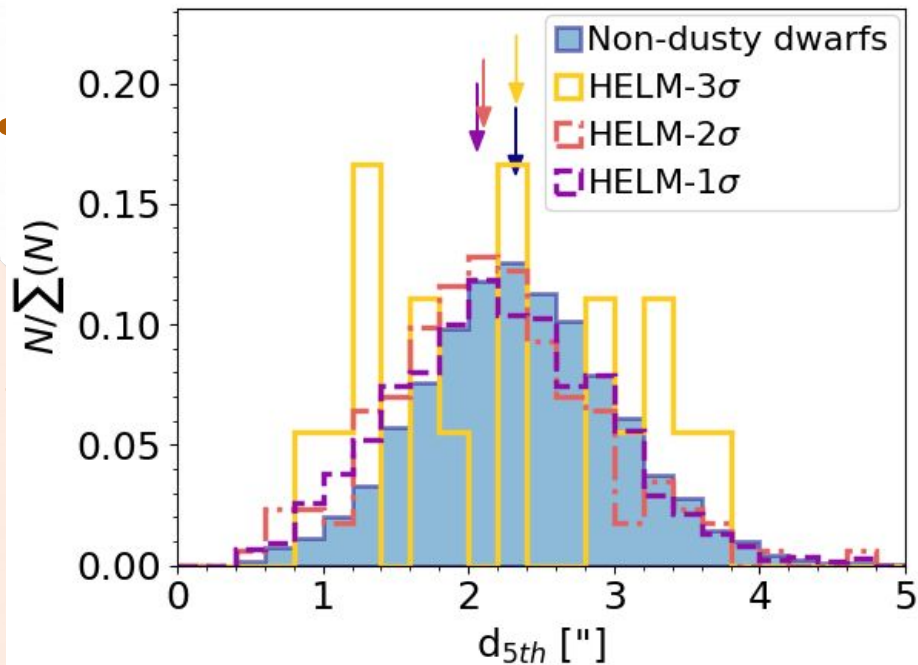
The HELM samples



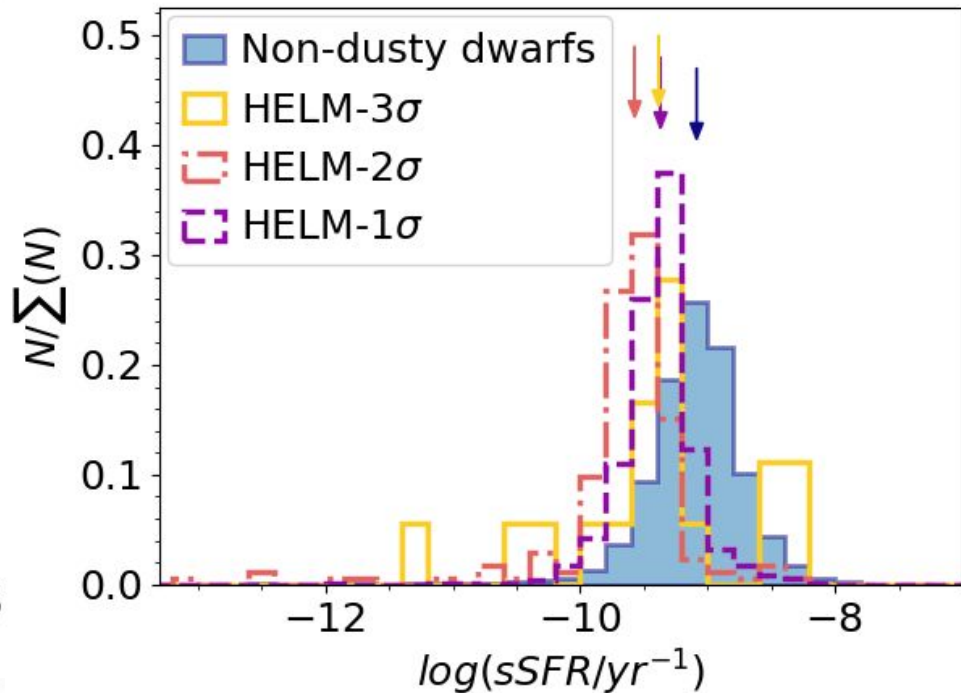
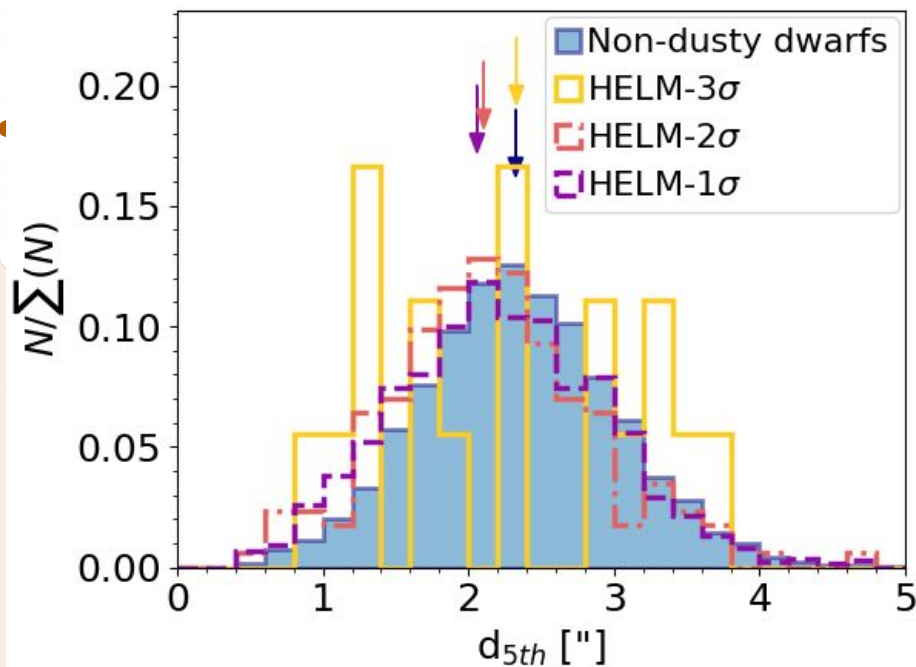
Are HELM sources simply more compact?

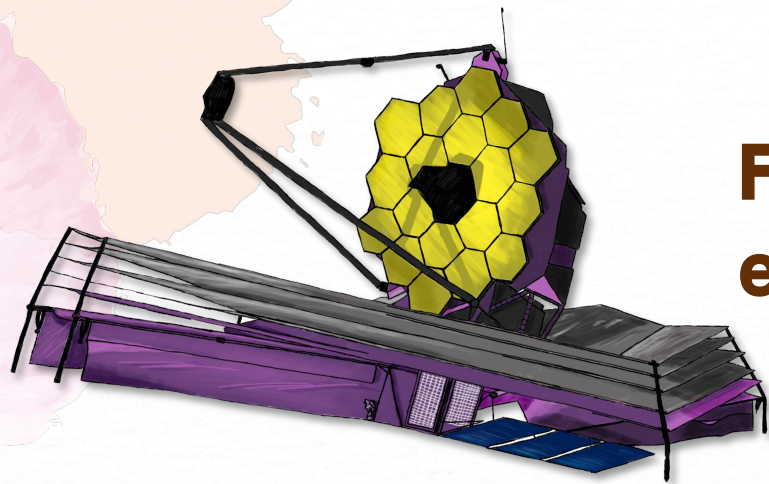


Linked to environment



Linked to environment...but

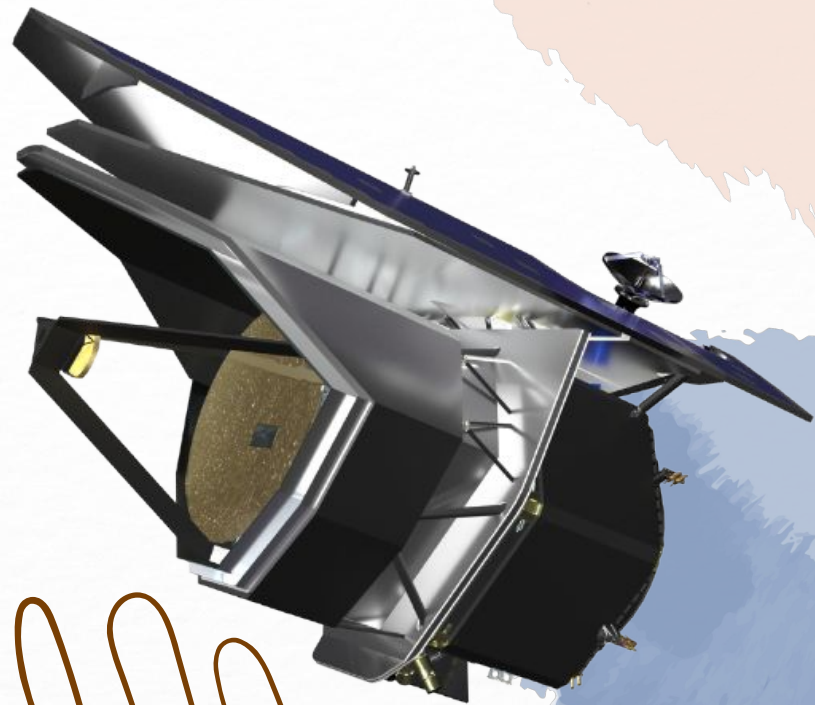




**From dust
extinction**

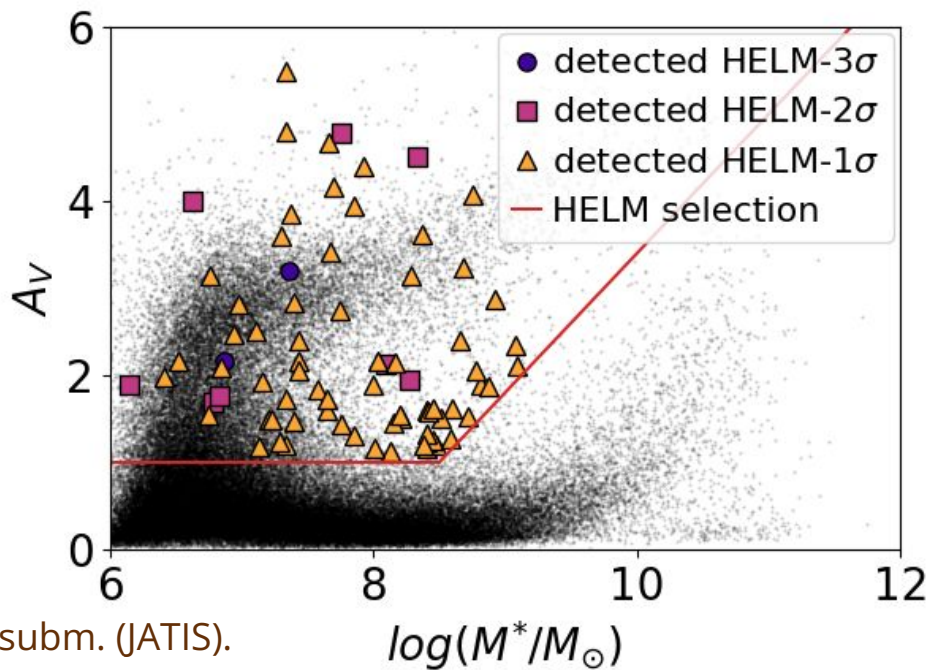


to dust mass



PRIMA's expectation

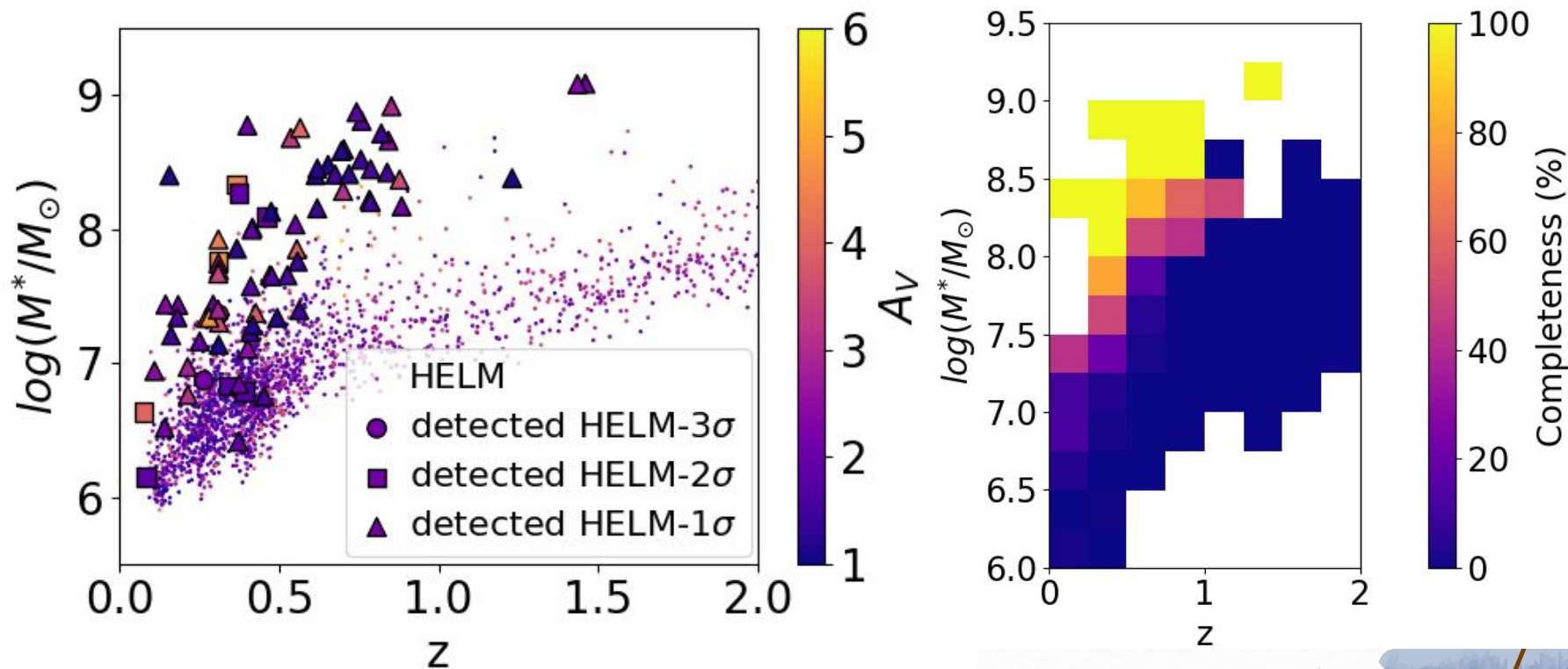
filter	PHI1	PHI2	PPI1	PPI2	PPI3	PPI4
$\lambda[\mu m]$	24-45	45-84	96	126	172	235
5σ depth [μJy]	92-156	172-292	110	197	144	229



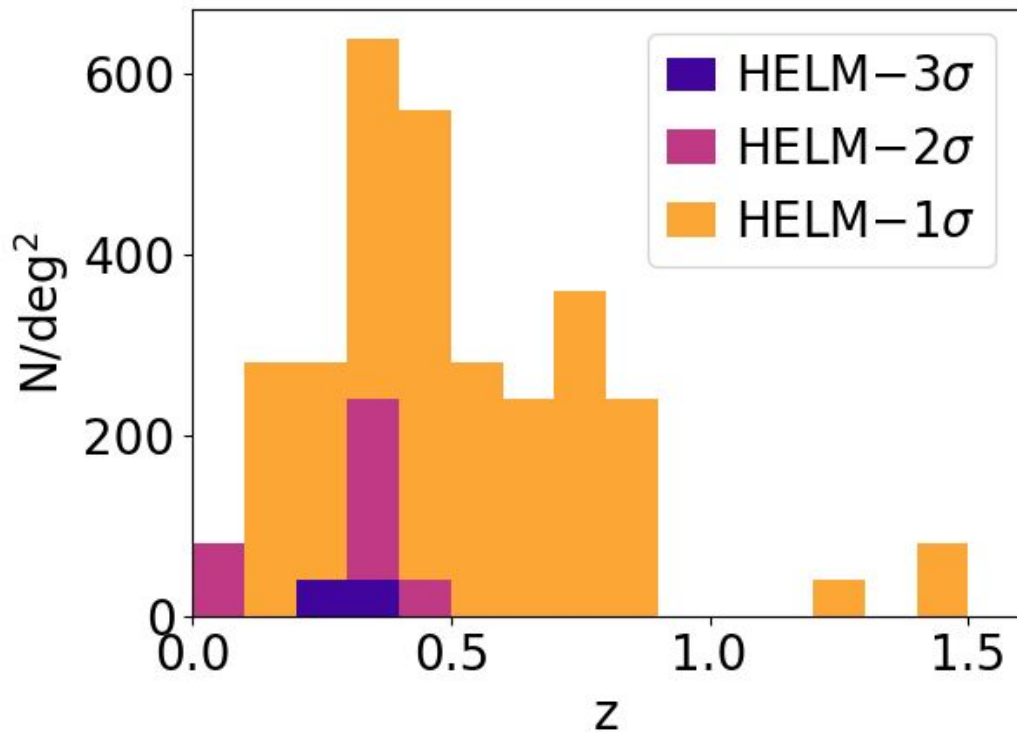
2/17 (12%) HELM-3 σ
 8/174 (4%) HELM-2 σ
 67/2623 (2%) HELM-1 σ

1000h integration
on 1deg²

PRIMA's expectation

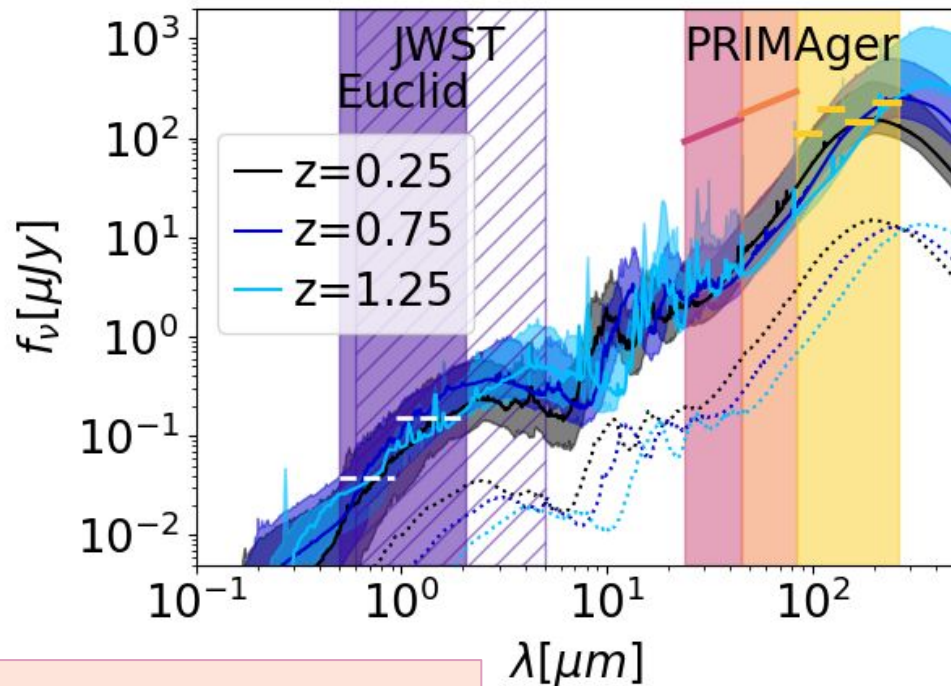
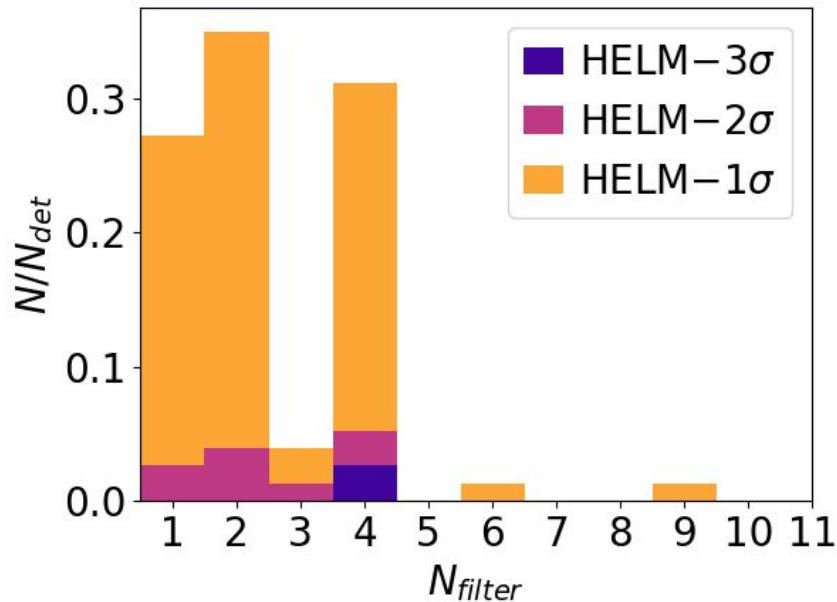


PRIMA's expectation



Over 1 deg²
 3×10^4 HELM sources
 ~ 100 $z > 1$

More than just a detection

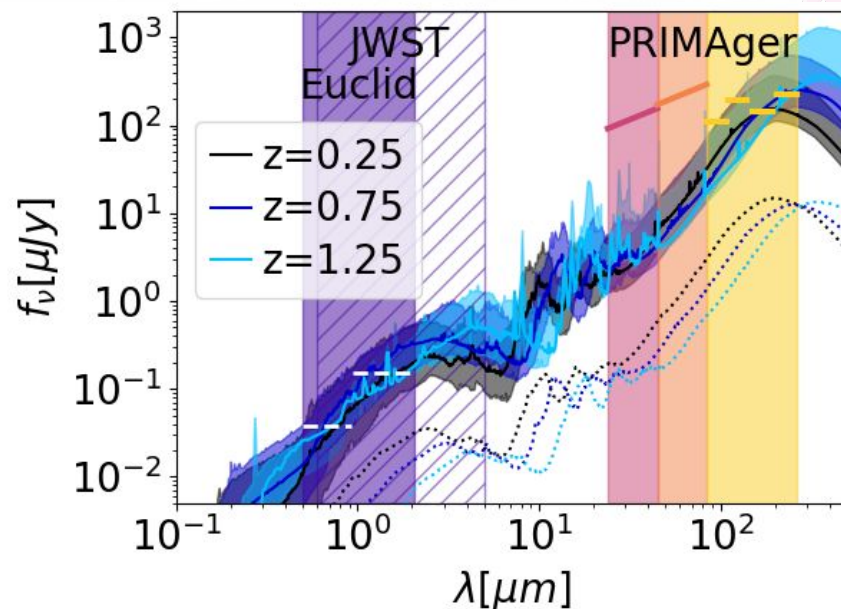


A lot to learn from
stacking!



Summary

- There is a new interesting population of highly extincted low-mass galaxies (HELM, Bisigello et al. 2023, 2025, in prep., Rodighiero et al. 2023, Gandolfi et al. 2025)
- PRIMA will be able to detect the dust continuum of a small fraction of them
- Observations on 1deg2 will allow to detect 3×10^4 sources with PRIMAgger
- Synergies with optical-NIR surveys will be fundamental for selecting HELM sources or stacking!





Stacked photometry

