Euclid: A pure sample of UltraVISTA-selected Lyman-break galaxies at $z \simeq 7$ in COSMOS

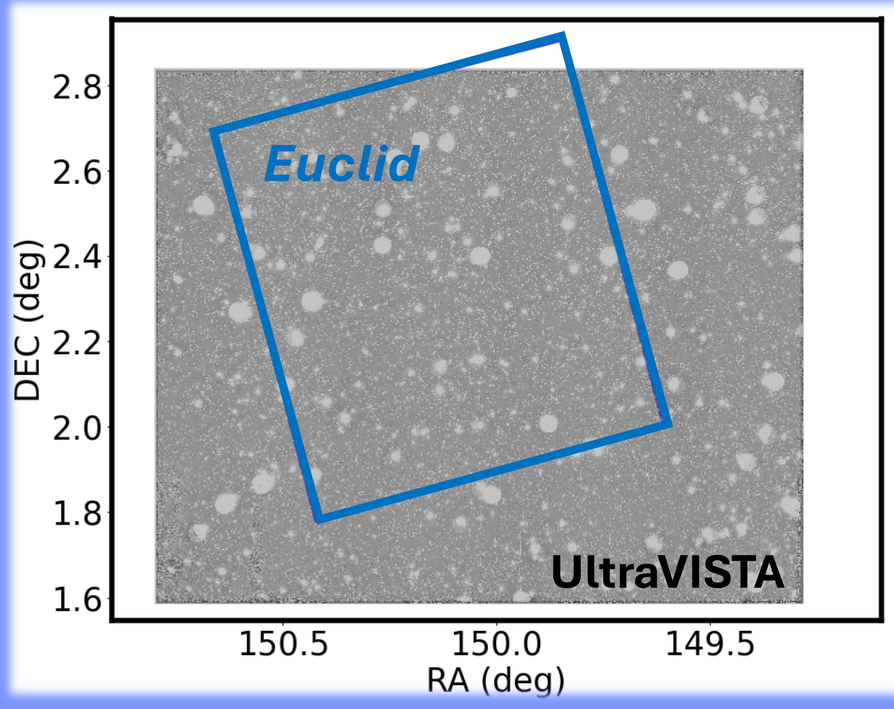
Rohan Varadaraj[1]*, Rebecca Bowler[2], Matt Jarvis[1]

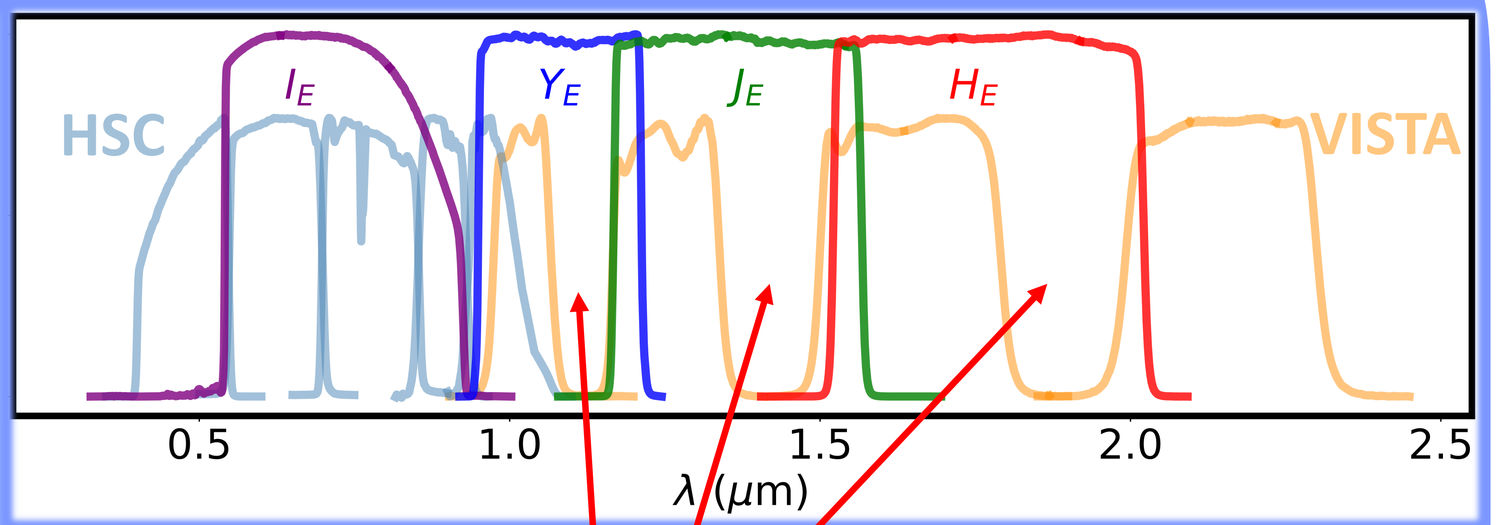
[1]Astrophysics, The Denys Wilkinson Building, University of Oxford, Keble Road, Oxford, OX1 3RH, UK
[2]Jodrell Bank Centre for Astrophysics, University of Manchester, Oxford Road, Manchester, M13 9PL, UK

*rohan.varadaraj@physics.ox.ac.uk

Image credit: ESA, J.C. Cuillandre, E. Bertin, G. Anselmi

Euclid data in the COSMOS field





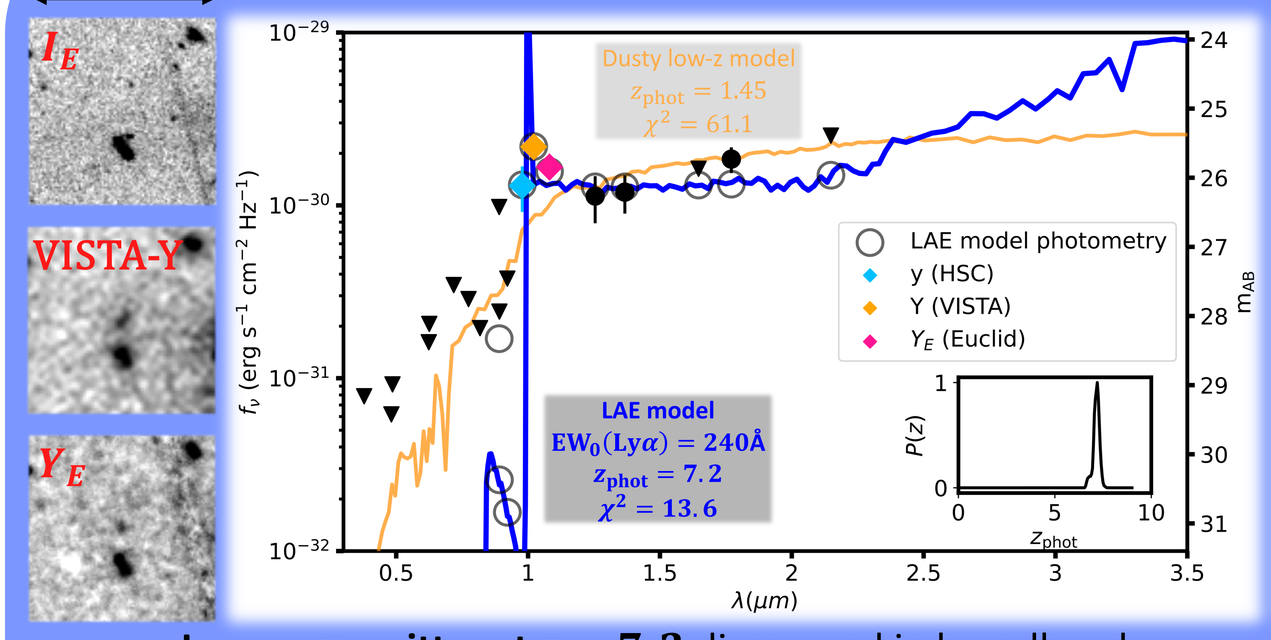
- *Euclid* Performance Verification conducted in COSMOS.
- Ideal opportunity to:
  1. Understand high-redshift selections with *Euclid*
  2. Use *Euclid* to produce a pure VISTA sample – remove interlopers
  3. **Probe mechanisms governing evolution of the most massive, luminous high-redshift galaxies.**

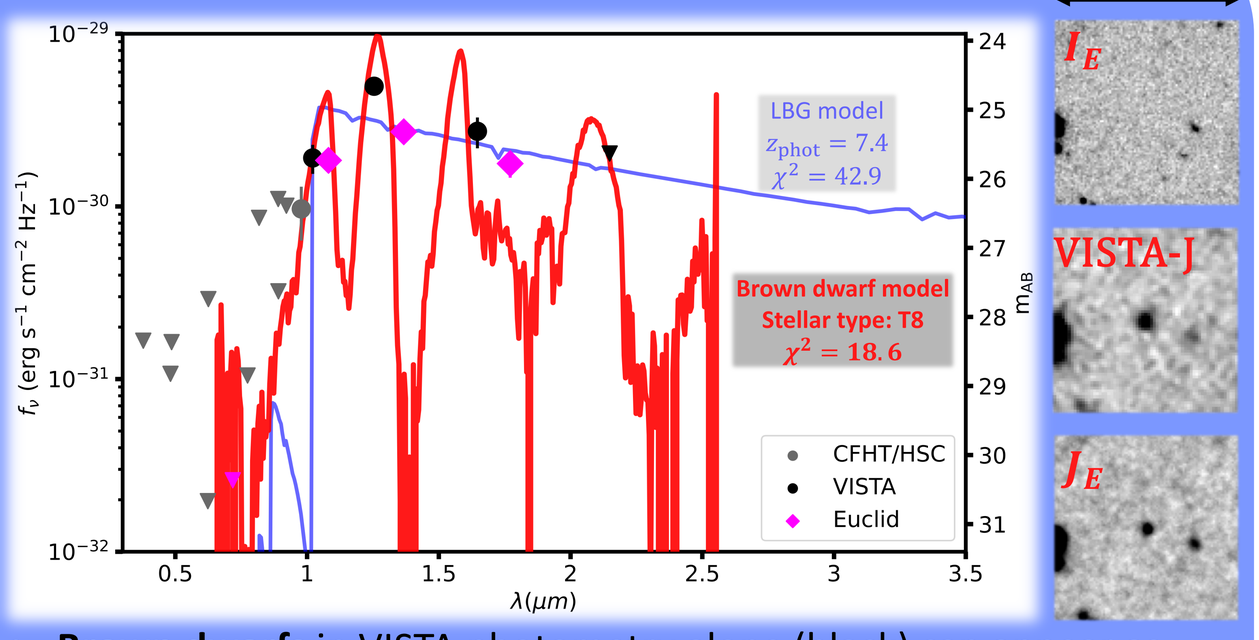
- ***Euclid* NIR filters cover atmospheric transmission windows inaccessible from the ground. Crucial for removing brown dwarf interlopers.**

- **Depths:** *Euclid* $Y_E J_E H_E$ imaging 0.2-0.6 mag deeper than UltraVISTA DR6. VIS I_E is 0.3-1.0 mag deeper than HSC-R, I, Z.
- **Rich NIR coverage:** XMM-LSS and CDFS will also be imaged by *Euclid* – overlaps with VISTA VIDEO survey.
- **Outlook:** *Euclid* + VISTA will provide pure Lyman-break galaxy (LBG) samples over 10 square degrees.

Euclid Collaboration et al. (2024)

SED fitting with HSC + VISTA + *Euclid*





- **<u>Lyman-α emitter at $z = 7.2$</u>** discovered in broadband photometry: excess VISTA-Y flux relative to HSC-y and Y_E.
- Ability to find extreme galaxies during Epoch of Reionization demonstrated in just one *Euclid* pointing.

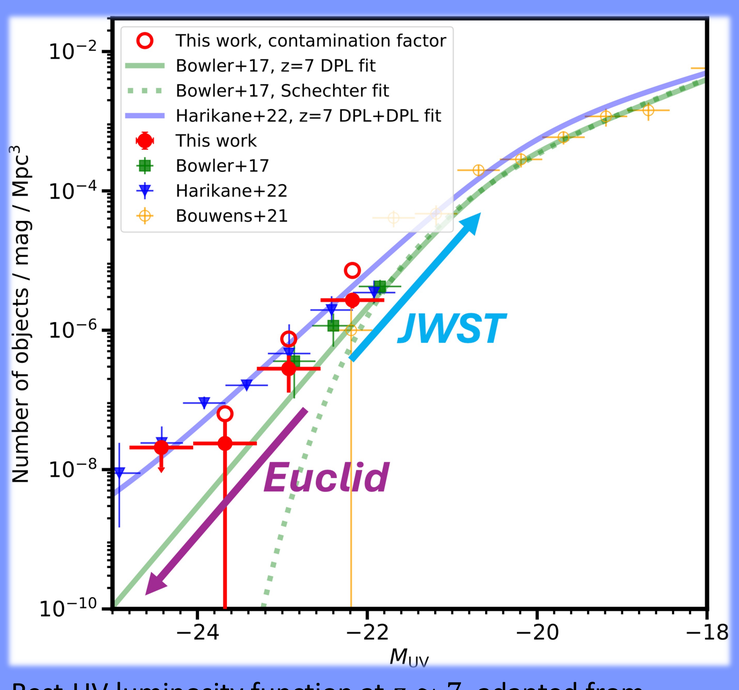
- **<u>Brown dwarfs</u>** in VISTA photometry alone (black) can appear as a LBG with blue rest-UV continuum.
- Inclusion of *Euclid* (pink) significantly prefers brown dwarf solution – molecular absorption bands are revealed.

Unveiling the evolution of the brightest LBGs

- Bright-end ($L > L^*$, $M_{\rm UV} \lesssim -23$) of the rest-UV luminosity function (LF) at $z \simeq 7$ **still uncertain**: affected by brown dwarf contamination and limited LBG samples.
- LF at $M_{\rm UV} \lesssim -22$ **difficult to constrain with *JWST*** – not enough area.
- Samples from *Euclid* Deep Fields (EDFs) will probe the ultra-bright end (demonstrated by ERO fields, Weaver et al. 2024) but will **still suffer from BD contamination** – no ancillary NIR data.

- By combining VISTA+*Euclid,* brown dwarf interlopers will be eliminated:
  1. with complementary NIR photometry
  2. by looking for unresolved sources in *Euclid* imaging.

- **Pristine measure of bright-end** of rest-UV LF at $z > 6$: pinpoint onset of mass quenching/dust obscuration in the most luminous, massive galaxies at high-redshift.
- Use contamination factors to **inform LFs determined from the EDFs**, covering 50 deg^2.



Rest-UV luminosity function at $z \simeq 7$, adapted from Varadaraj et al. (2023). The slope of the bright end probes mechanisms driving the evolution of luminous LBGs, such as dust obsuration and mass quenching.

References

Euclid Collaboration et al., 2024, arXiv e-prints, p. arXiv:2405.13491
Varadaraj R. G., Bowler R. A. A., Jarvis M. J., Adams N. J., Häußler B., 2023, MNRAS, 524, 4586
Weaver J. R., et al., 2024, arXiv e-prints, p. arXiv:2405.13505