HSC-UKIRT Survey
Data Products and Science Projects Examples

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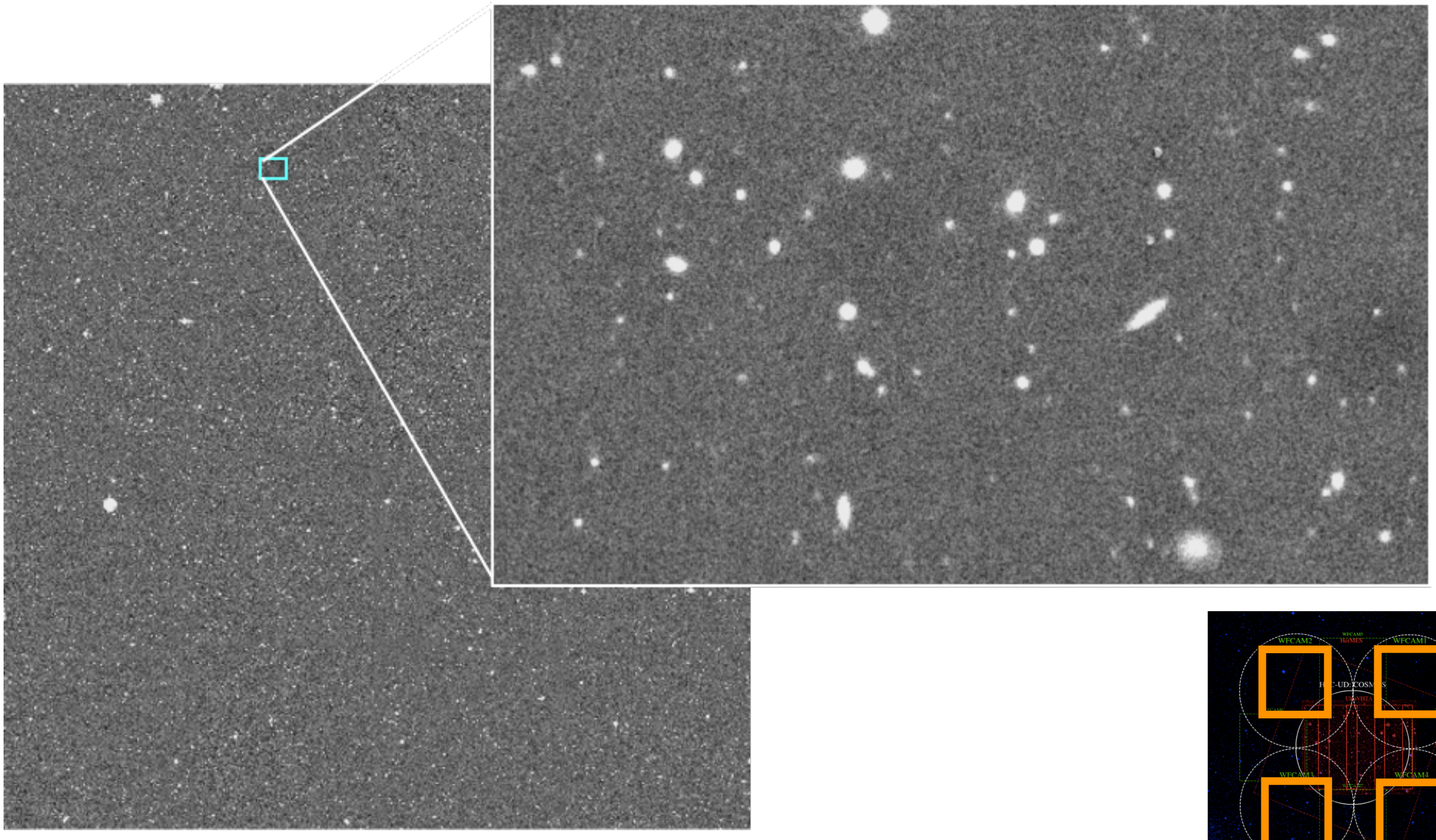
Data Processing Summary

- Imaging processing: CASUTOOL
  - ➤ CASU (Cambridge Astronomy Survey Unit): produces 10 min filled mosaic images covering 0.75 deg^2 (from 10s WFCAM exposures).
  - ➤ We produce the final mosaic images using CASUTOOLS.
    - Advantages: Full use of the confidence map, better handling of edges, better modeling of background (compared to e.g., SWARP)
- Catalog:
  - ➤ Zeropoint: determined using 2MASS and/or UKIDSS LAS
  - ➤ Sextractor catalogs: ready for preliminary science inspection (including flags of cross-talks). Data quality tests ongoing.

UKIRT Image Reduction Using the CASU Pipeline



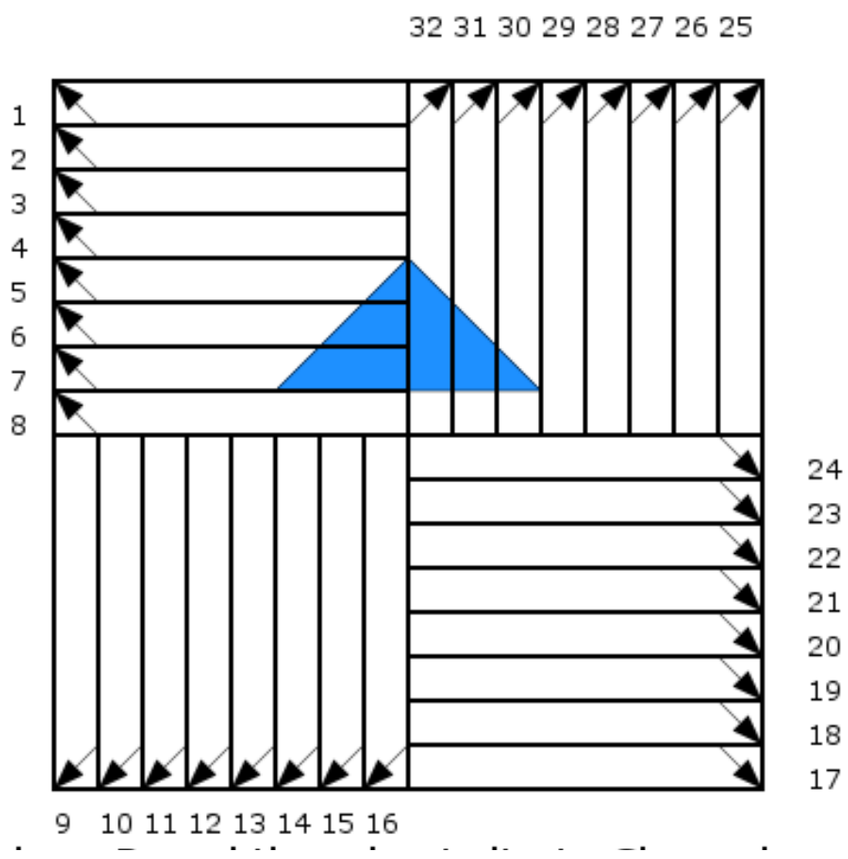
- (Individual 10min exposure is available upon request).

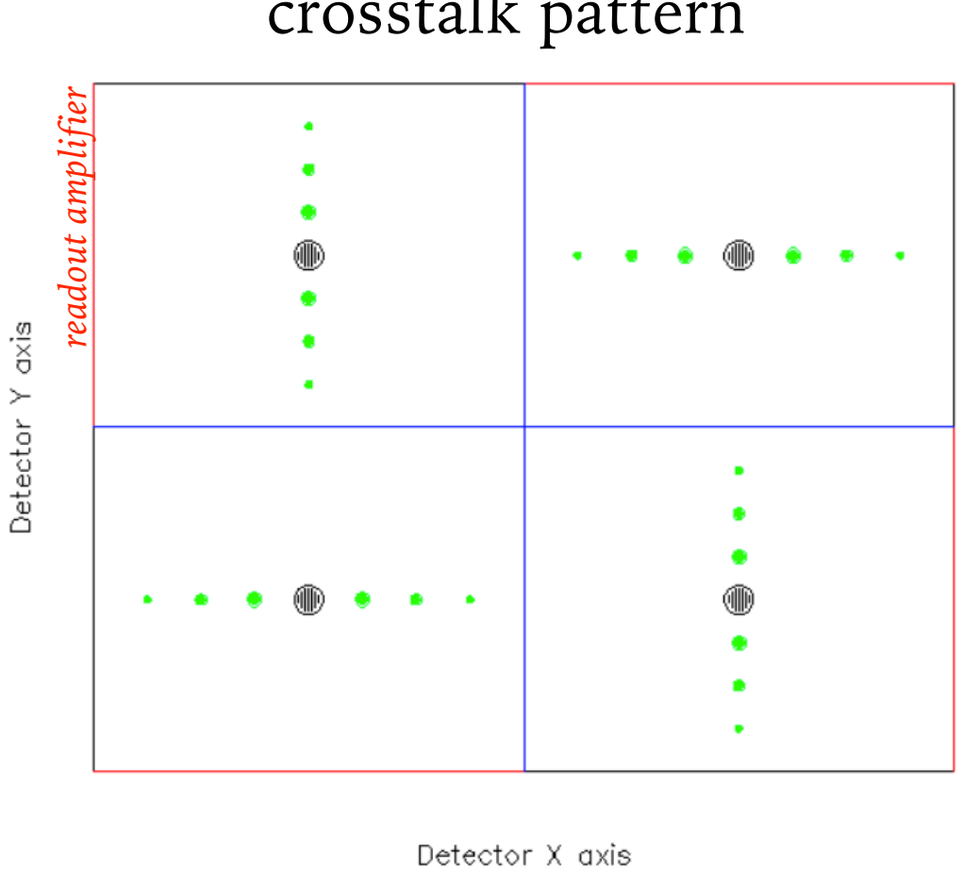
UKIRT NIR Source Catalogs

- Catalog: Sextractor-based catalogs for J/H/K-bands in each WFCAM tile.
- Columns:
  - ➤ Basic information (ID, ra, dec, x, y , …)
  - ➤ AUTO, Aperture(2”,3”) magnitudes, fluxes
  - ➤ Flags (Crosstalk flag)

Treatment of Crosstalk: Crosstalk Flags

- In UKIRT/WFCAM, IR arrays are each divided into 4 electronically isolated quadrants, each of which is subdivided into 8 channels (all read out simultaneously).
- In our UKIRT survey, crosstalk appears ±(128x2) *N pixels away.
- CASU pipeline removes crosstalk (~90%, but not entirely).





Treatment of Crosstalk: Crosstalk Flags (or Masks?)

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- In our UKIRT survey, crosstalk appears ±(128x2) *N pixels away.
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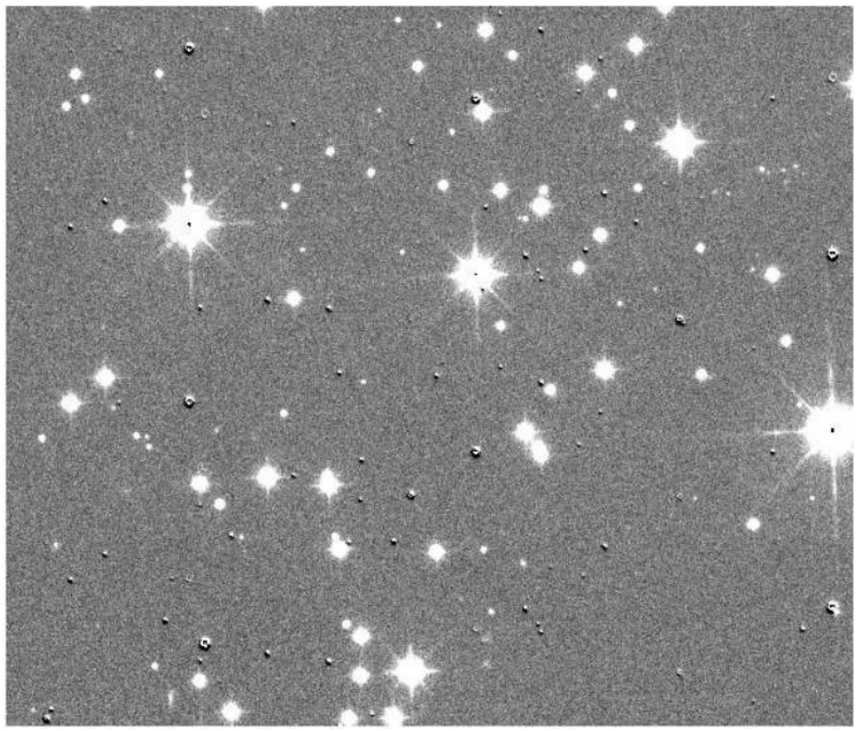
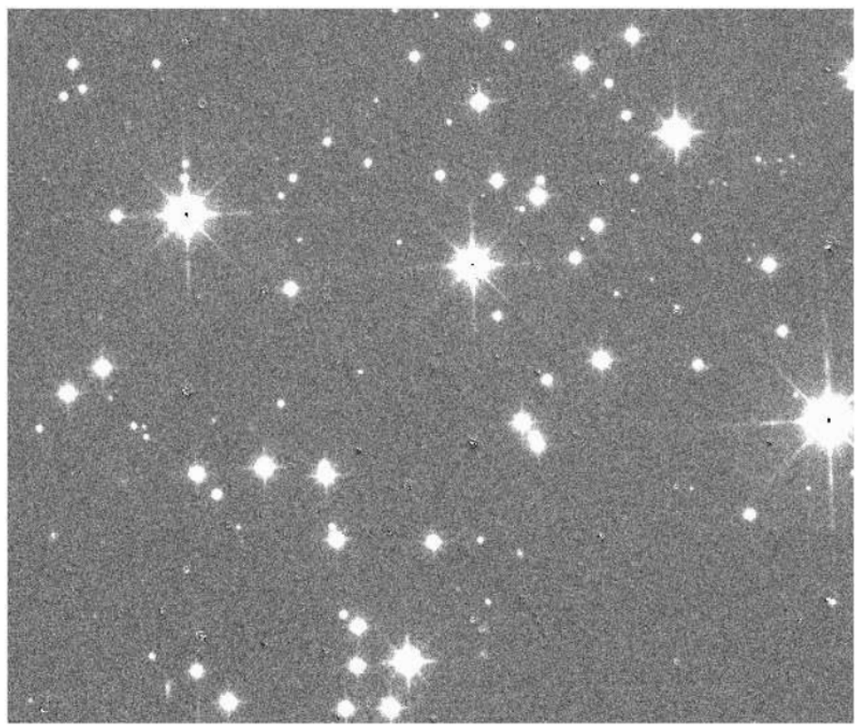
before crosstalk removal

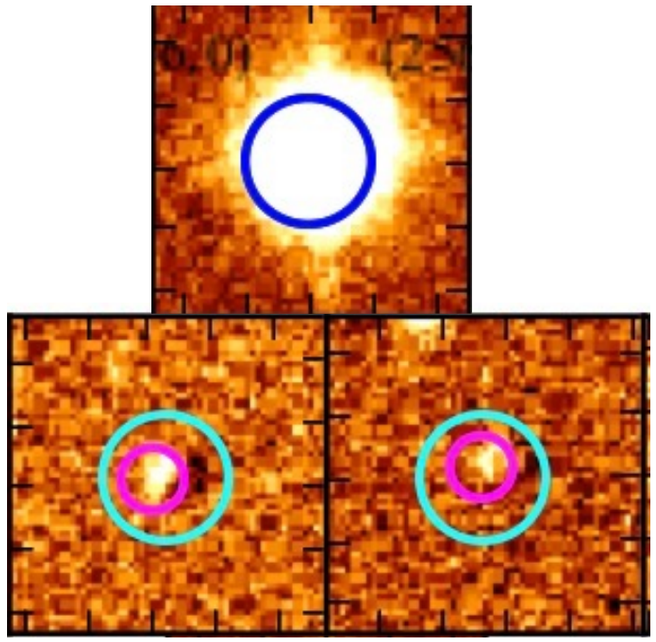


after removal



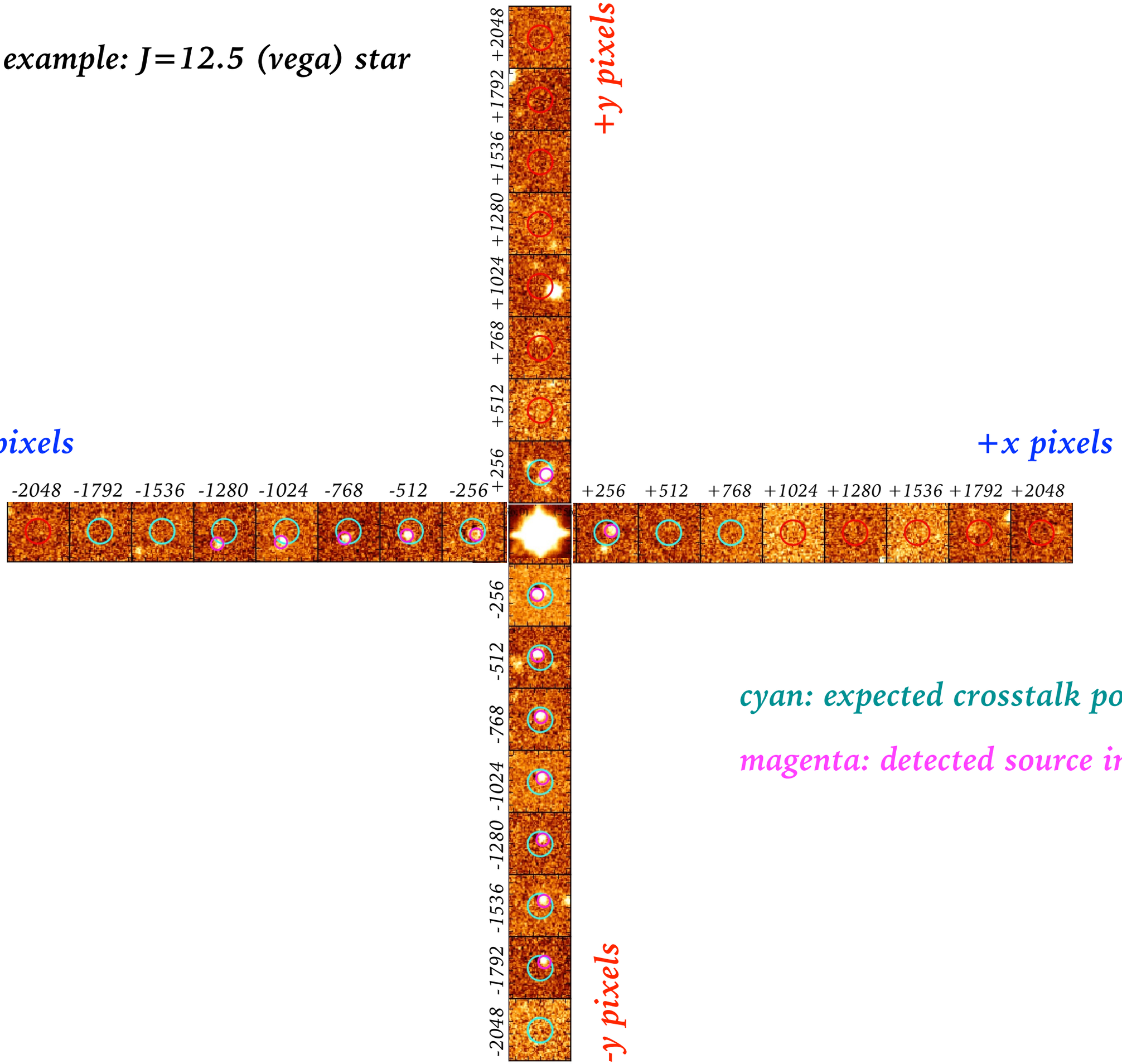
Erwin et al. (2006)

J=14 (vega)



$x = -256$ $x = +256$

An example: J=12.5 (vega) star



cyan: expected crosstalk position

magenta: detected source in the catalog

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  - ➤ AUTO, Aperture(2”,3”) magnitudes, fluxes
  - ➤ Flags (Crosstalk flag):
    - ➤ FLAG_CXTALK=1 if an object is at the expected cxtalk position of a nearby bright star. Need to be cautious!
    - ➤ Essential for projects searching for rare objects

Other Catalogs

- U/HSC/WFCAM catalog (via private communication):
  - ➤ catalog-based position matching
  - ➤ Including U-band, NIR (UKIDSS, VIDEO, our WFCAM data)

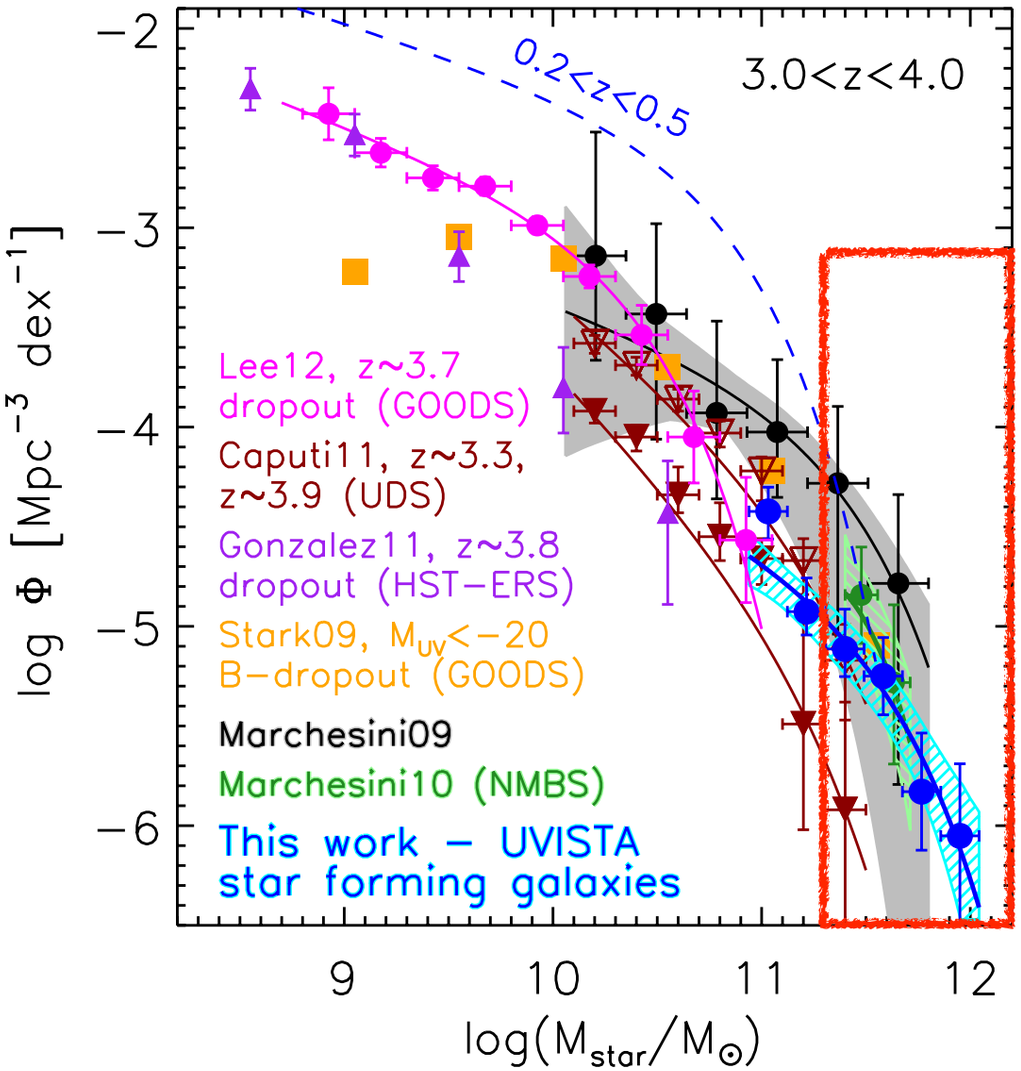
- Photometric redshift and stellar mass
  - ➤ HSC-only: available photo-z and stellar mass from multiple groups (query using the HSC interface).
  - ➤ U/HSC/WFCAM: Preliminary catalogs. Under test.

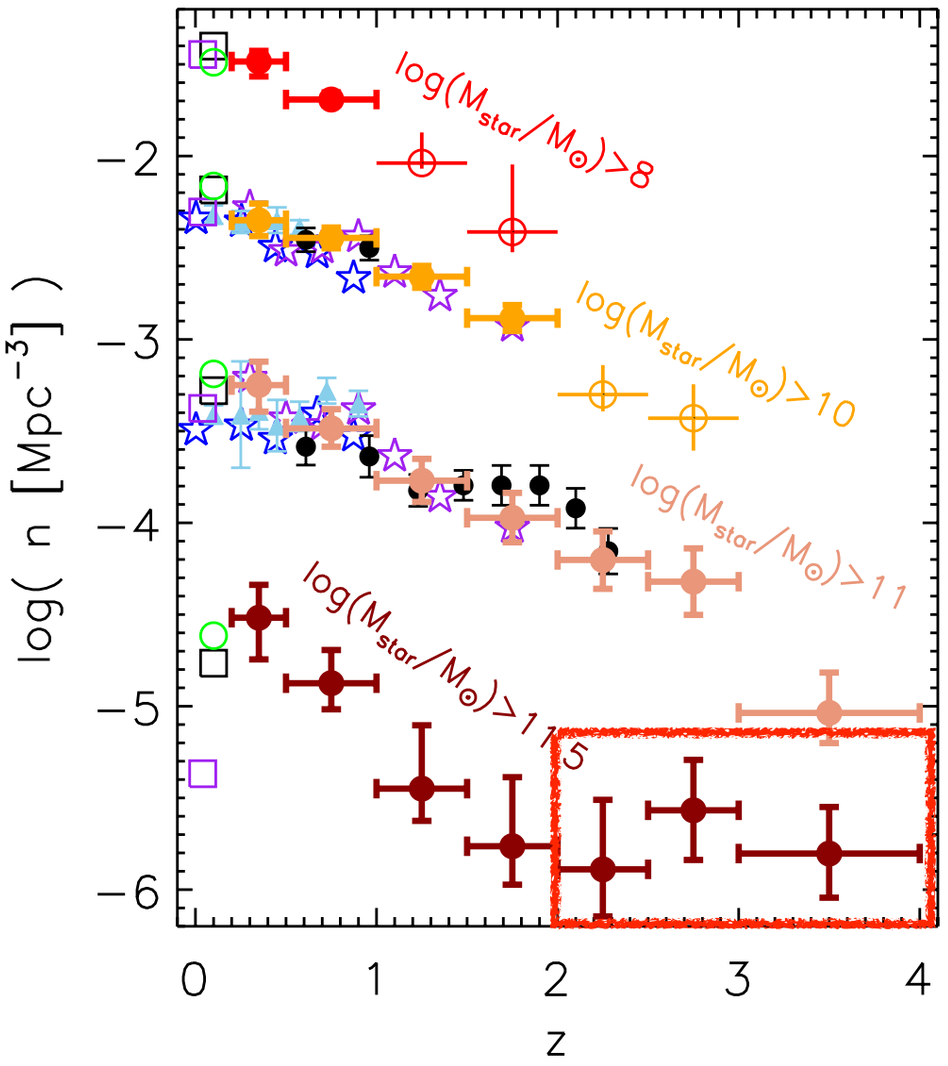
Science Projects with HSC Deep Fields

- Massive galaxies at z=2-4:
  - stellar mass function
  - spectroscopic followup of massive galaxies
- Near-IR counterparts for high-redshift LAEs and LBGs

The very massive end of the stellar mass function at z>2 remains uncertain

Muzzin et al. (2013)

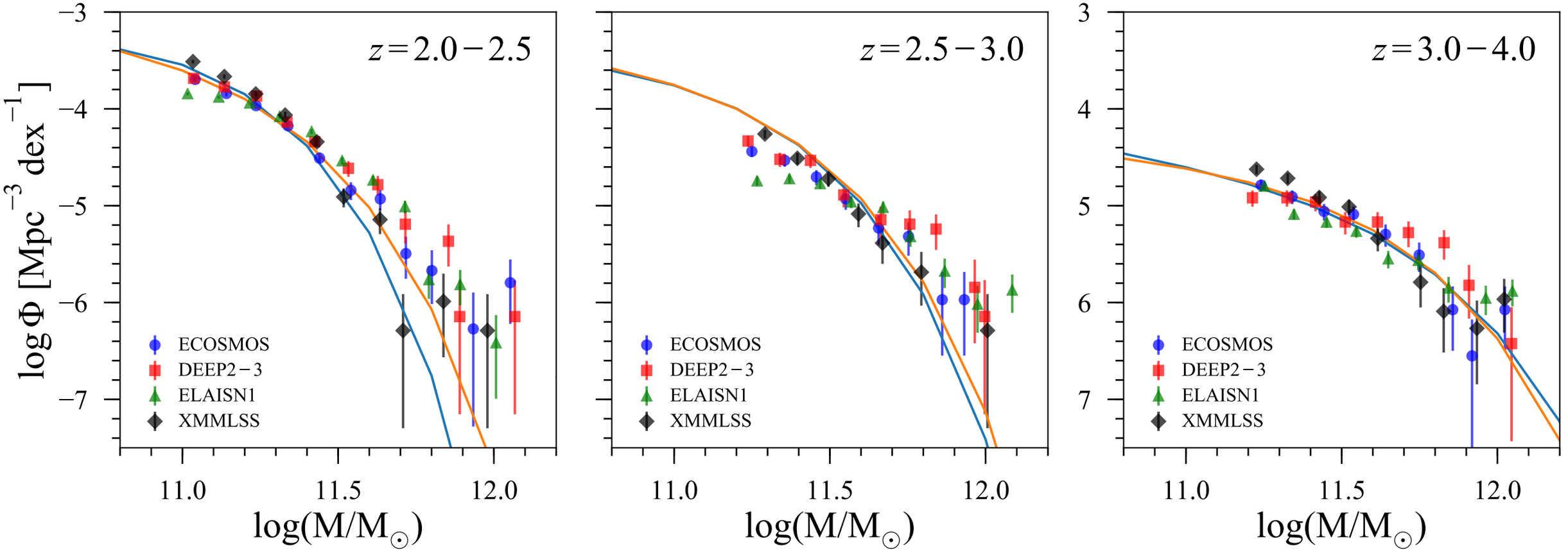


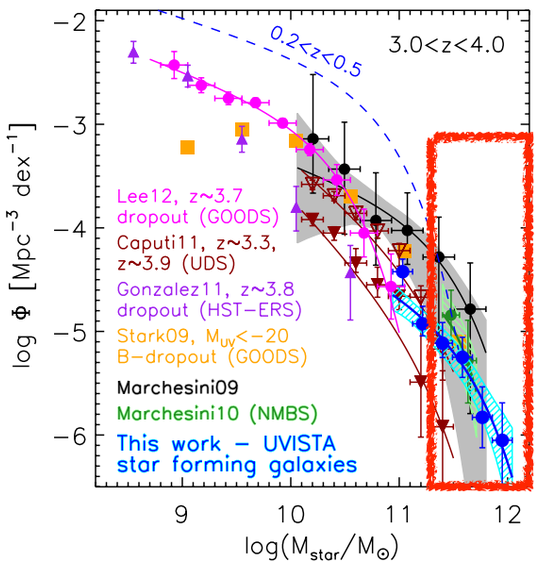


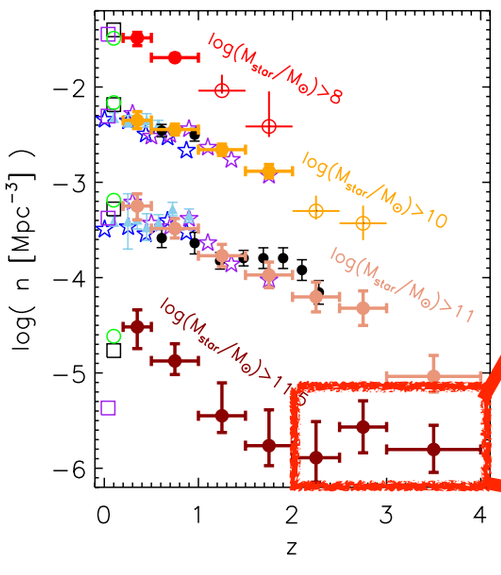
The Massive End of the Stellar Mass function at 2<z<4

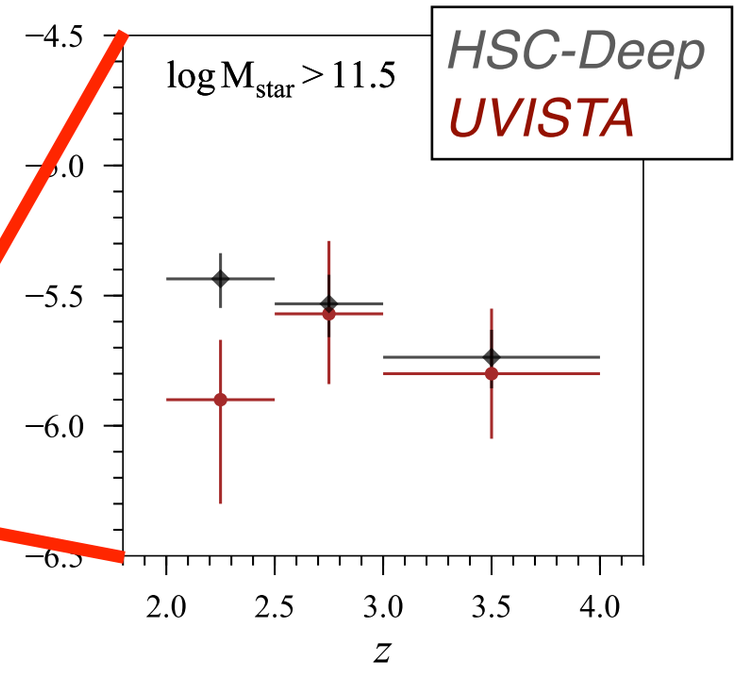
Preliminary

Over total area ~16 deg²: ECOSMOS (3.1), ELAISN1(7), XMMLSS (3.3), DEEP2-3 (2.3)



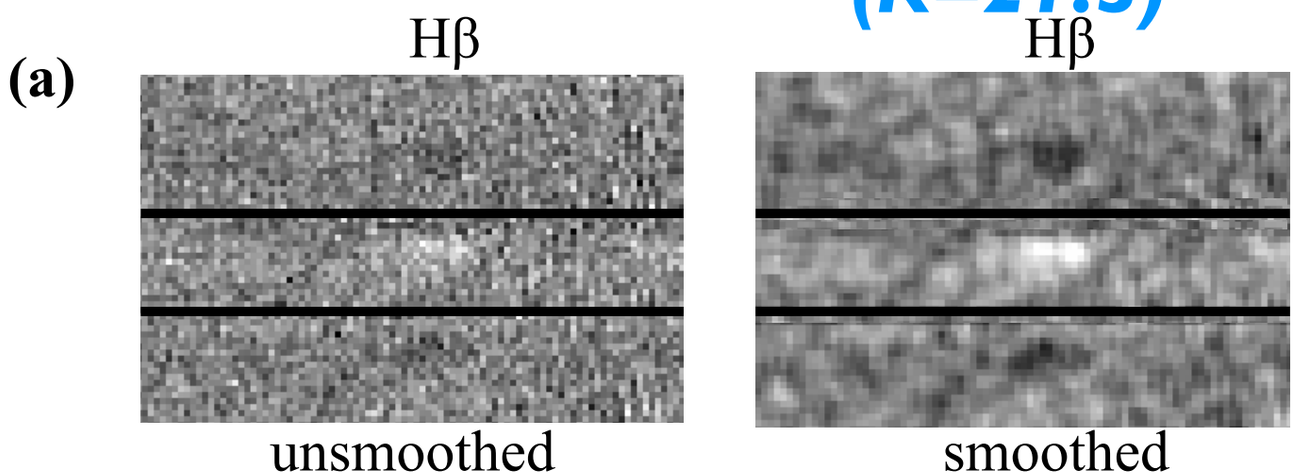






NIR Spectroscopic Follow-ups of Massive Galaxies at z~3

A massive log(Mstar)~11.7 galaxy found at z=3.75 (K=21.3)



Science Projects with HSC Deep Fields

- Near-IR counterparts for high-redshift LAEs and LBGs
  - No individual detections (stacking?)
  - collaboration with other groups: e.g., SILVERRUSH (LAEs), GOLDRUSH (LBGs)