MOSAIC Reductions for z~2.1 Lyman Alpha Emitting Galaxies

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Project Overview

- Three data sets from KPNO and CTIO
- Narrow-band imaging selection of LAEs at z~2.1
- Evolution of the luminosity function
- Investigate age, stellar mass, dust and dark matter halo mass evolution.

Credit: S. Finkelstein

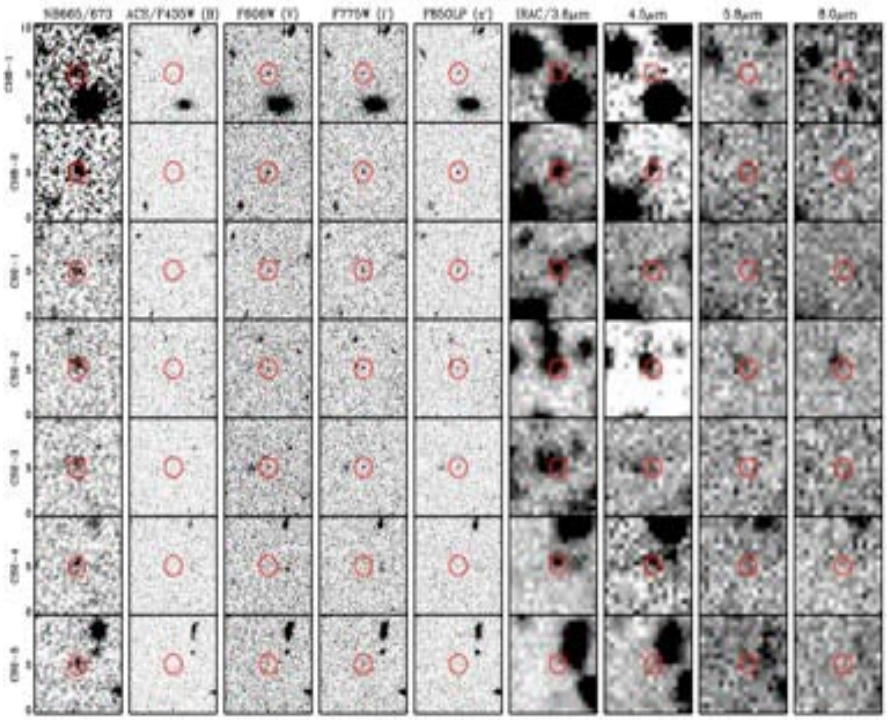
Lyman Alpha Emitters (LAEs)

- Distant galaxies that emit Lyman-alpha radiation
- Progenitors of local Universe galaxies
- Most LAEs found in $3.1 < z < 6$ (No LF evolution)
- $z \sim .3$ showed fainter and rarer LAEs

M95. Credit: NASA

Selection of z~2.1

- LAEs cannot be observed from the ground at z < 2
  - Atmospheric absorption blueward of 3500 Å
- z~2.1 is "last stop"
  - Used 3727 Å narrowband filter for Lyman alpha emission at z~2.1
- If no evolution of LF from z= 3.1 – 2.1
  - ~300 LAEs per pointing
- If LF resembles z~0.3
  - ~10 LAEs per pointing



S. Finkelstein (2008)

Luminosity Function Evolution

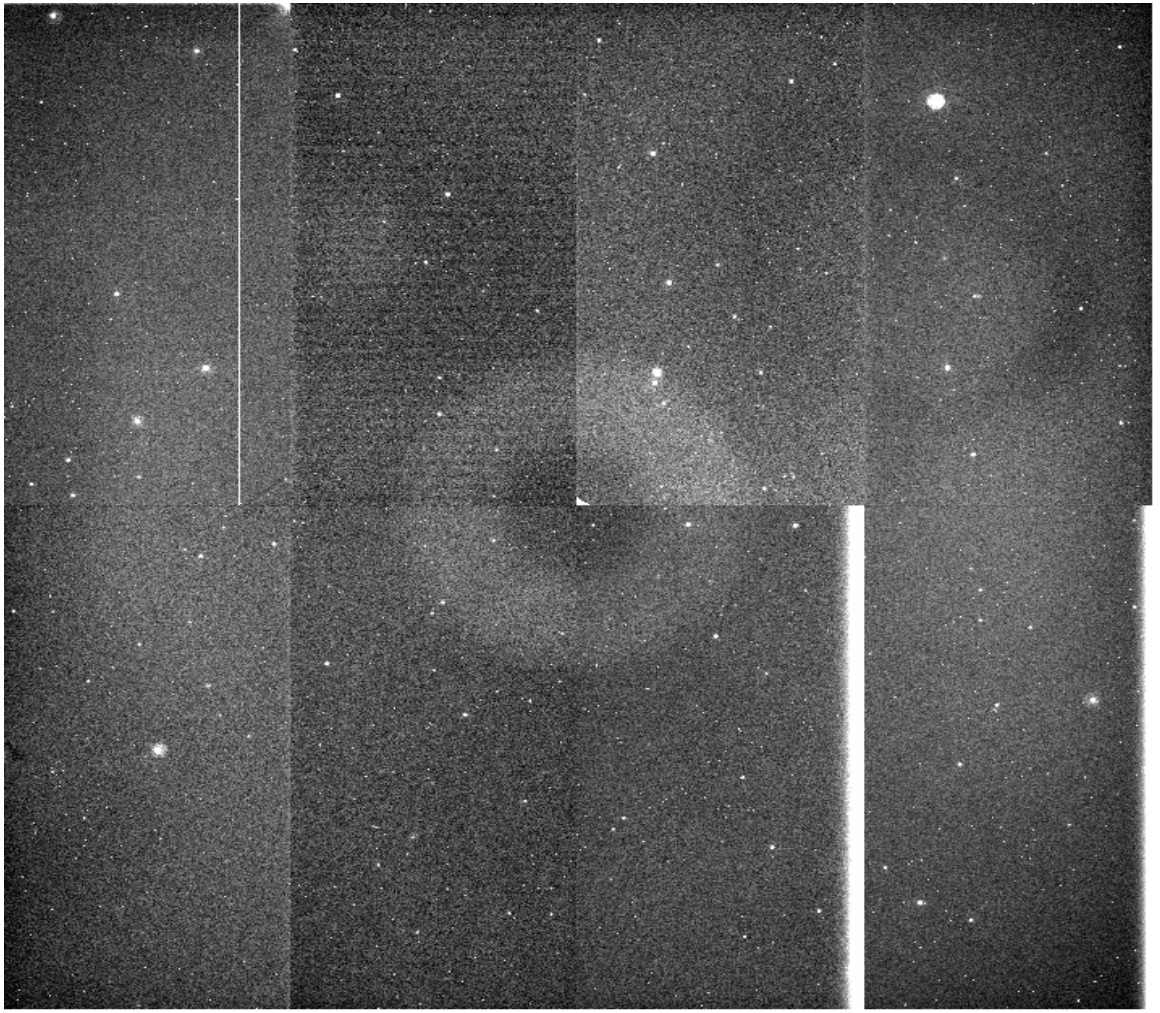
- Gronwall et al. (2007) Deharveng et al. (2008)
- z~3.1 .2 < z < .35
- Lyman Alpha Luminosity:

$L^* = 10^{42.64}\,\mathrm{erg \cdot s^{-1}}$ → $L^* = 10^{42}\,\mathrm{erg \cdot s^{-1}}$

- Characteristic Number Density:

$\Phi^* = 10^{-2.84}\,\mathrm{Mpc^{-3}}$ → $\Phi^* = 10^{-3.5}\,\mathrm{Mpc^{-3}}$

Raw Image



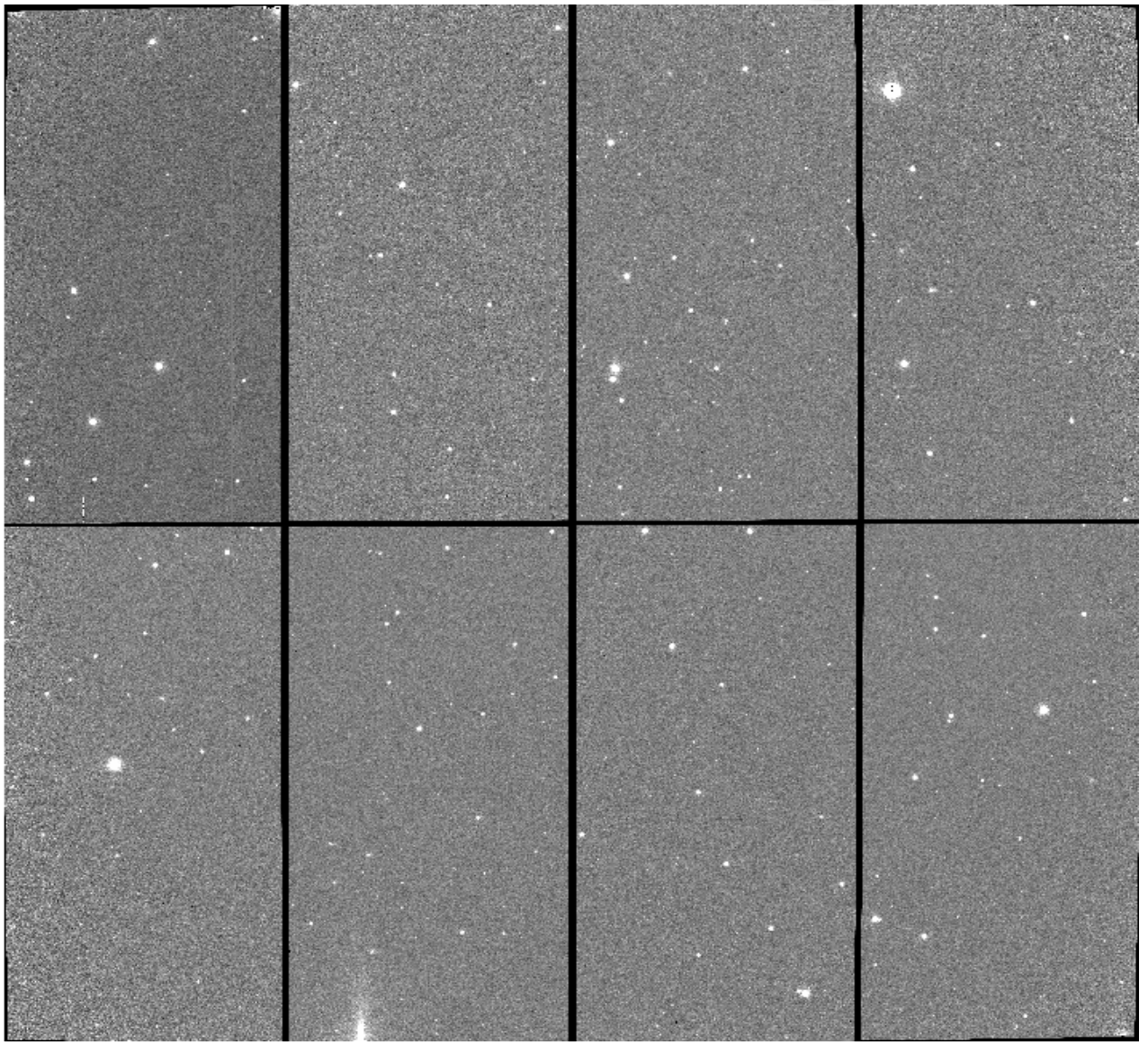
Basic Reductions

- Crosstalk, overscan, trim correction
  - Zeros →Combine
  - Flats → Normalize →Combine
  - Objects
- Cosmic Ray Rejection
  - Crgrow (residuals)
- WCS fitting
  - Inconsistencies with catalogs (mscimage)

Reductions cont.

- Clobber bad pixel masks
  - Replace bad pixels with sky values
- Mscimage
  - Resampled 8-extension object/bpm frames into single images with simple WCS
- Mscimatch
  - Match intensity scales for reconstructed mosaic image

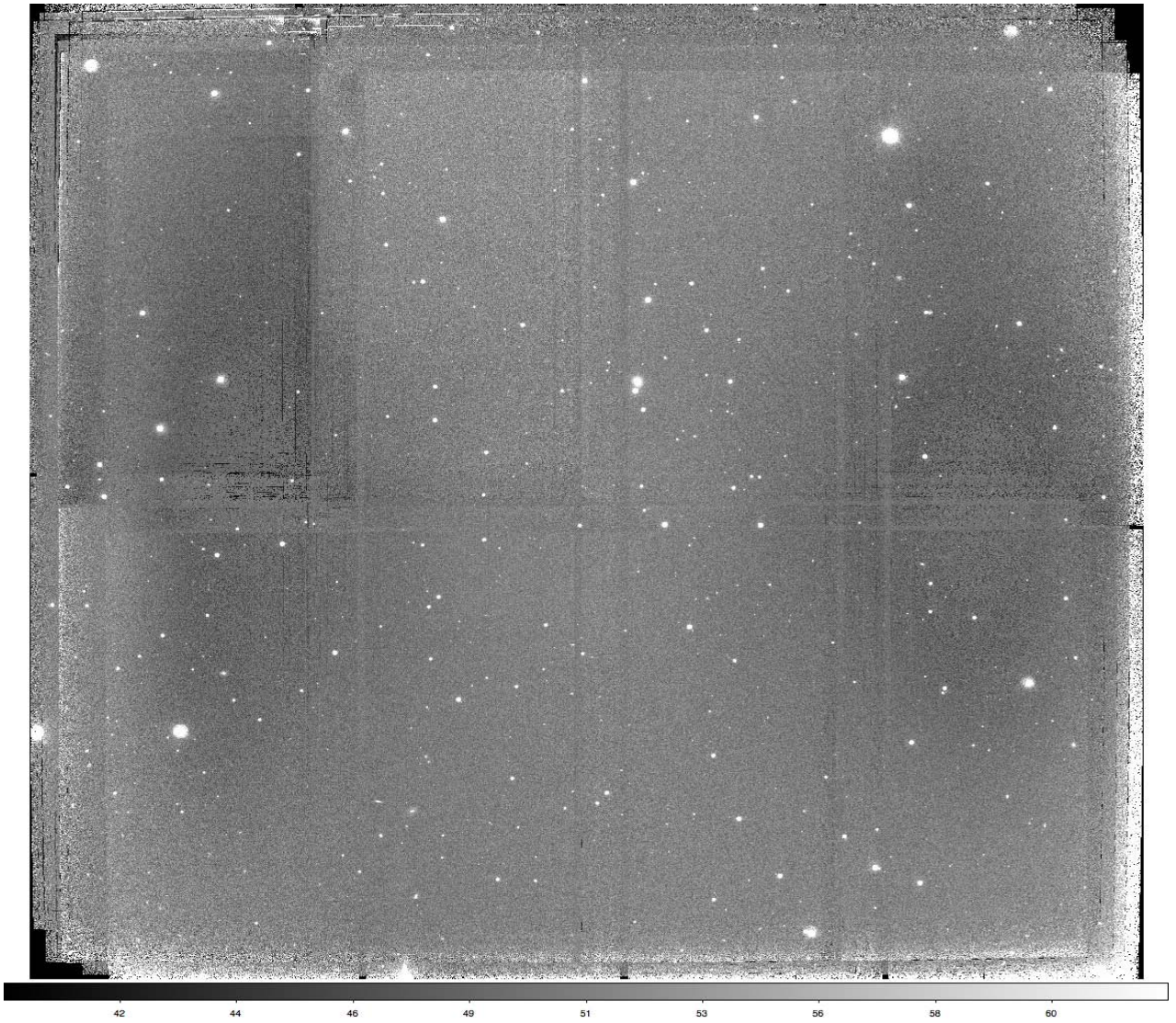
Post-Mscimage



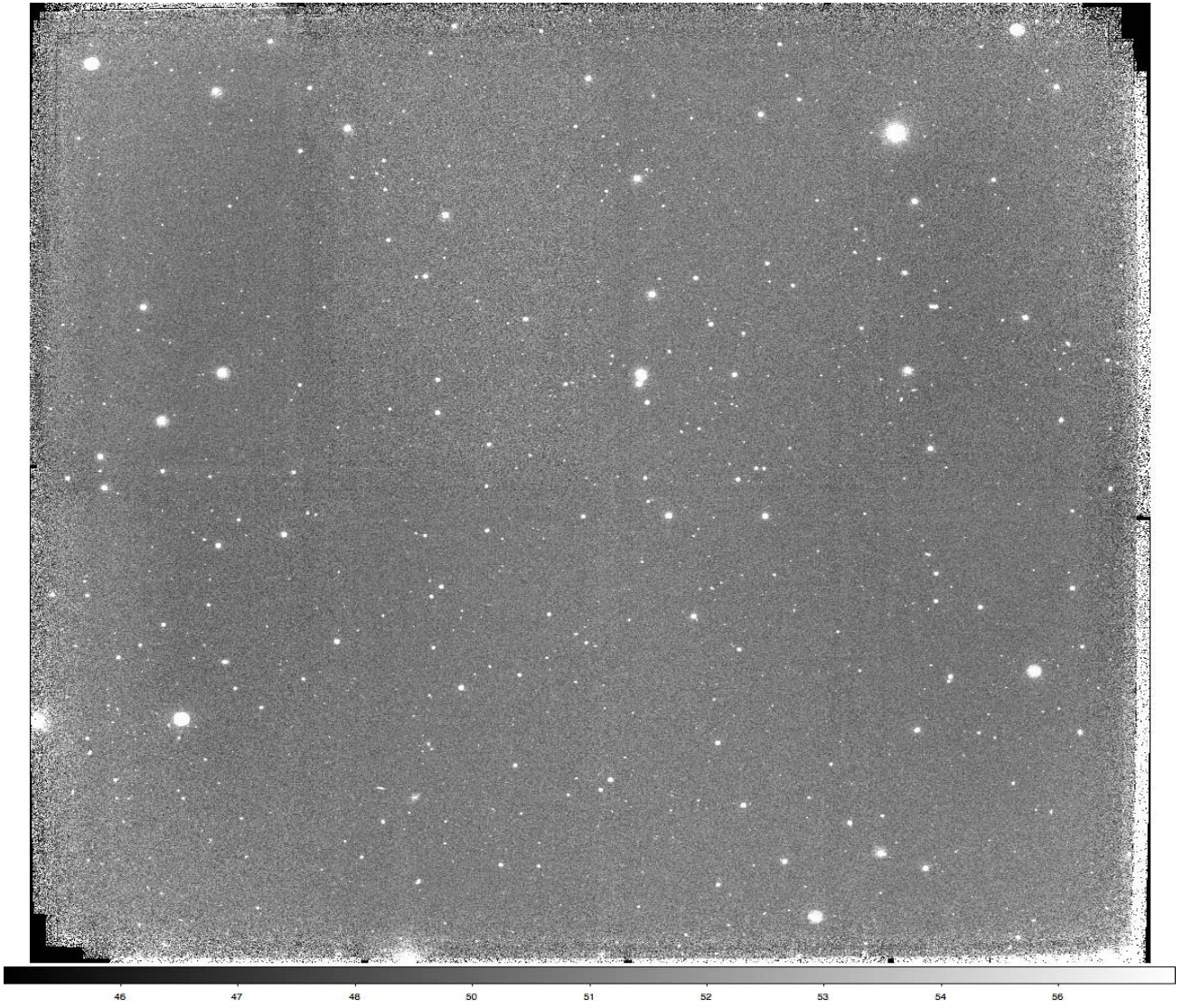
Stacking

- Mscstack
  - Combines multiple reconstructed mosaic images using WCS
  - Excludes chip gaps
  - Increases effective depth of field (makes LAE detection easier)
- Data from 2009 fully stacked (best seeing)
  - If 2007 and 2008 sets give good stack, possibly combine with 2009

Bad Stack



Good Stack



Post Stacking

- Fit stellar population models
  - Compare to $3 < z < 6$ samples
  - Study how age, dust content, stellar masses evolve with redshift
- Follow up NIR spectroscopy
  - Measure metallicity via N2, O3N2, or R23 indices
  - Study mass-metallicity relation evolution with redshift

Thank you!

Questions?