



# WIRC (Widefield InfraRed Camera)

Presented at Palomar Jamboree

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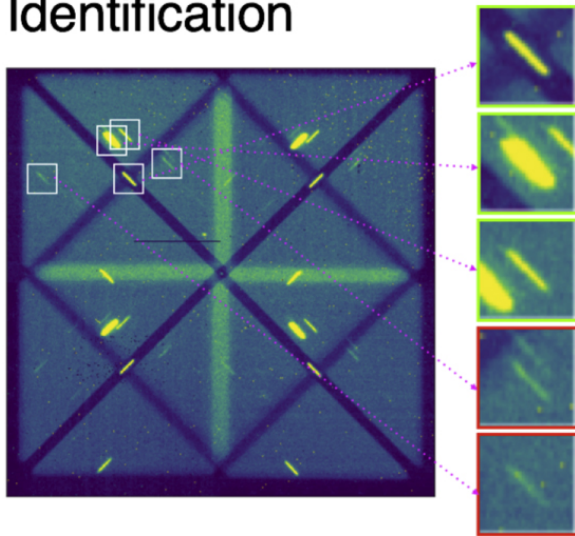
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# What is WIRC?

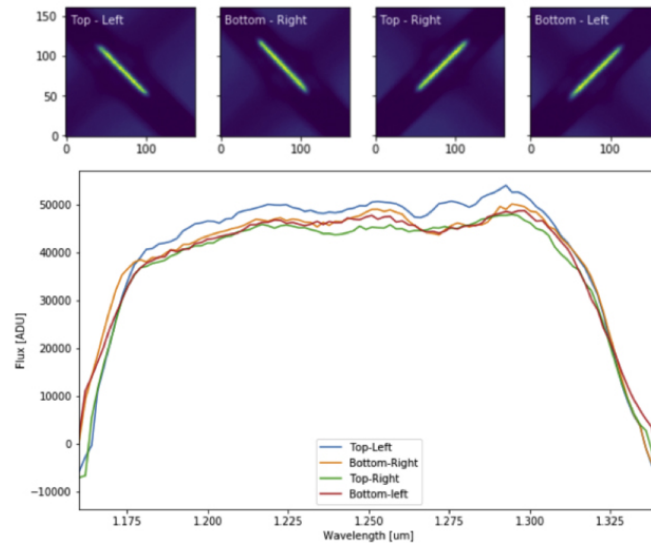
- WIRC is a wide field, infrared, imaging camera operated at the prime focus of the 200-inch.
- A variety of narrow filters are available, as well as  $J$ ,  $H$ ,  $K_s$
- Three modes: imaging, spectroscopic and spectropolarimetry
- **Imaging & Spectroscopy:**
  - Regular CCD imaging, or add low-resolution ( $R \sim 100$ )  $J$  &  $H$  grism
  - “Sampling up the ramp” readout is possible (not easy)
- **Spectropolarimetry: more in the next talk!**

# Spectropolarimetry, 2

Calibrated Data and Automatic Source Identification

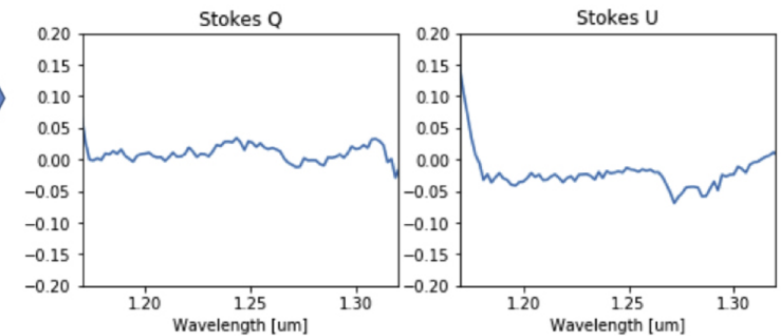


Four spectra per source via Optimal Extraction



Polarized Spectra

$$q(\lambda) = \frac{Q_+ - Q_-}{Q_+ + Q_-}, u(\lambda) = \frac{U_+ - U_-}{U_+ + U_-}$$



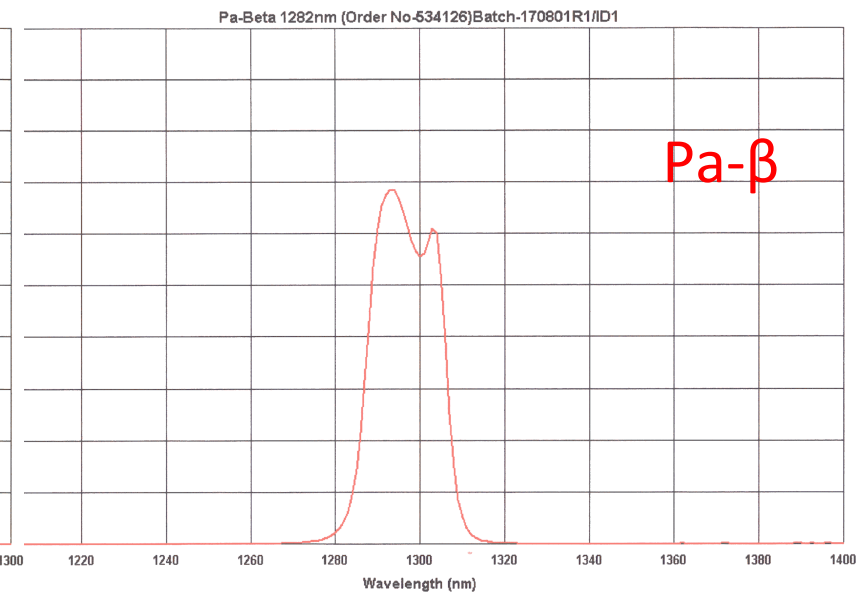
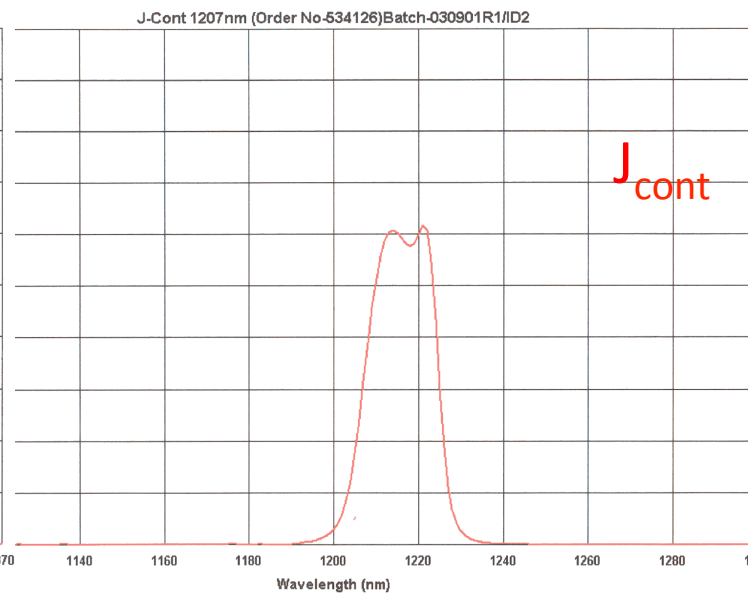
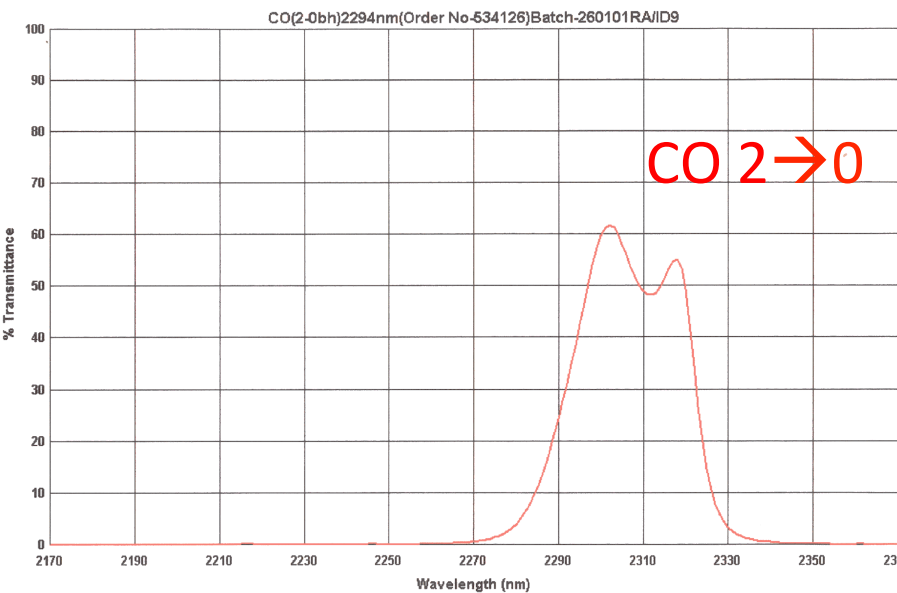
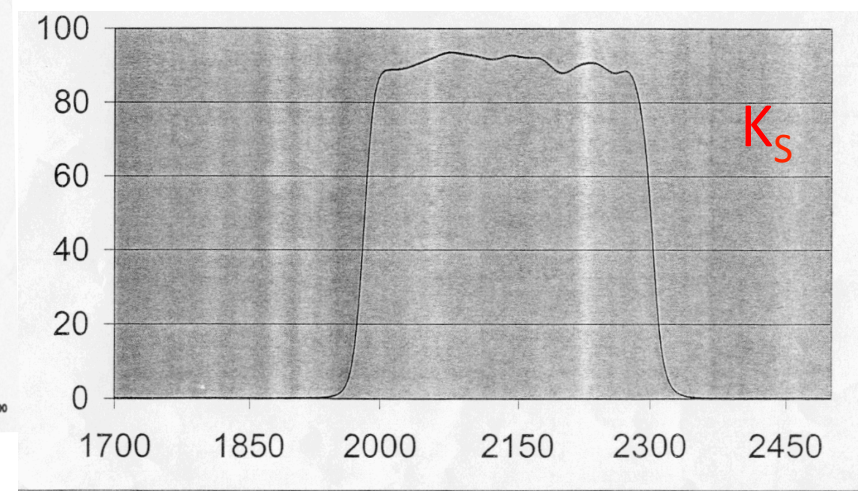
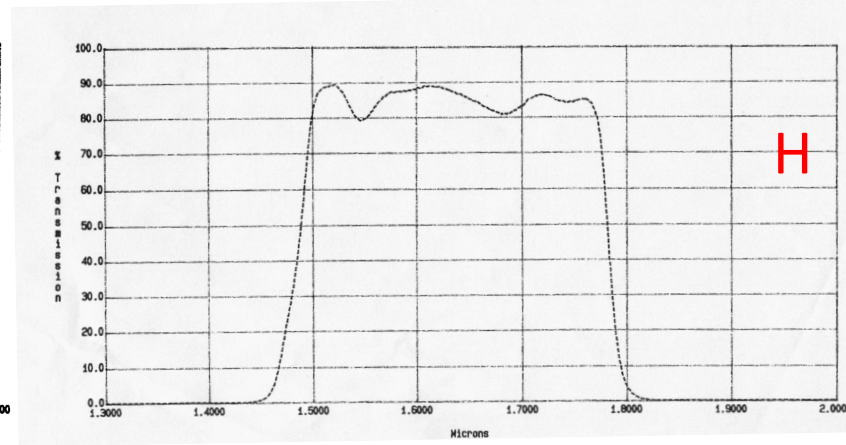
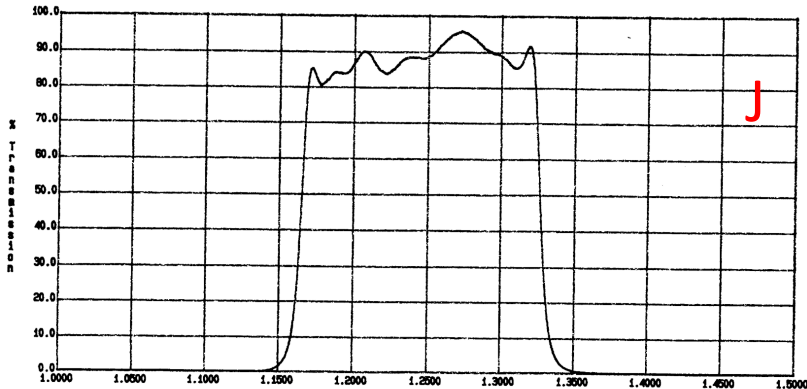
Tinyanont et al. 2018

- WIRC+Pol has automated data reduction pipeline to extract polarized spectra for every source identified in image!
- Pipeline also works for WIRC+Spec

# WIRC – Key Characteristics

- Detector: 2048 × 2048 CCD, Pixel Scale:  $\sim 0''.25$
- Field of View:
  - WIRC & WIRC+Spec:  $8'.7 \times 8'.7$
  - WIRC+Pol:  $4'.3 \times 4'.3$
- Read noise: 12 e-
- Linearity: between 3,000 ADU and 36,000 ADU.
- (Theoretical) Sensitivity for 1 hr:
  - J: 22 mag @ S/N = 5
  - $K_s$ : 20.6 mag @ S/N = 5
  - We saw a bit less, see later slides

# WIRC – Selected Filter Transmissions



# WIRC – Backgrounds

Filter	Time of Year	ADU/s/arcsec <sup>2</sup>	Magnitude
J	May	992	15.3
J	November	1840	14.6
H	May	5120	13.9
H	September	4320	13.8
K <sub>s</sub>	May	12000	12.4
K <sub>s</sub>	November	8000	12.8

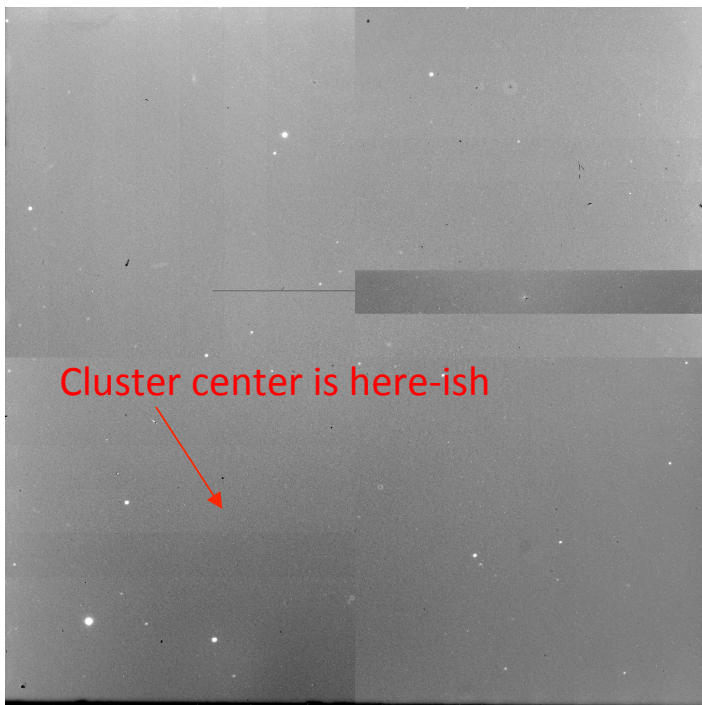
# WIRC – Things you might need to know about observing and data reduction

- Specs available at Palomar instrumentation site:

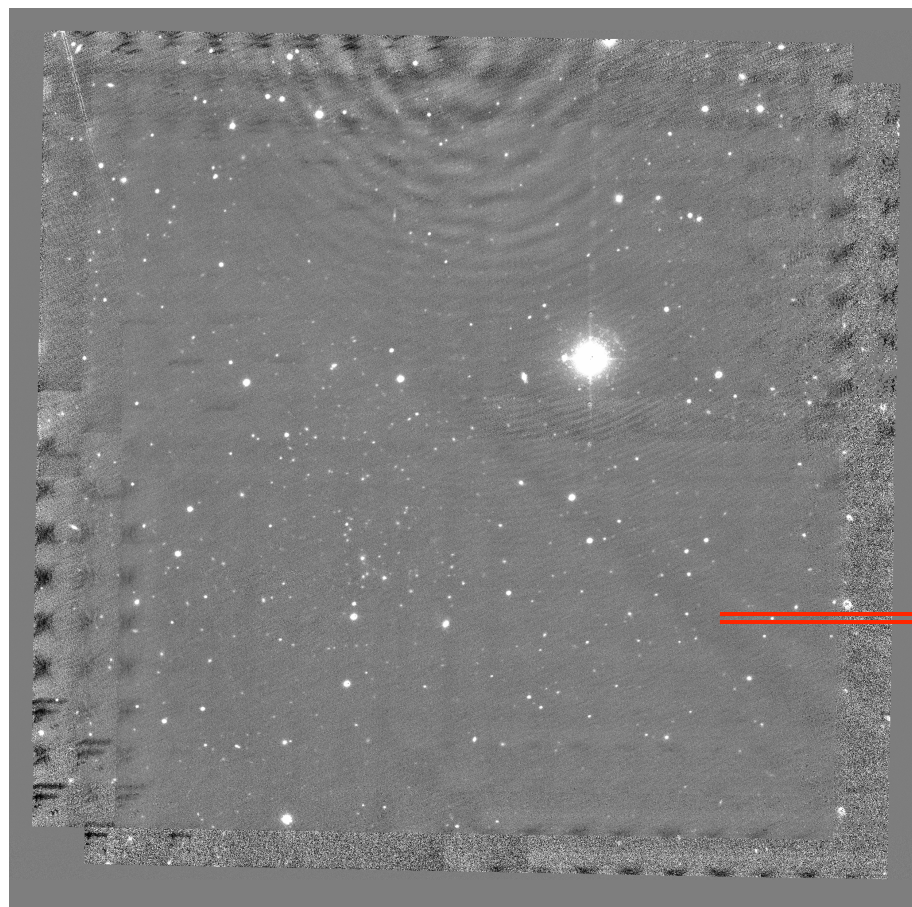
<http://www.astro.caltech.edu/palomar/observer/200inchResources/wircspecs.html>

- Imaging data can be reduced using standard CCD routines
- Fringes appear, possibly worse in longer exposures
- There is a bad CCD channel, 3% of detector unusable
- *n.b.* WIRC manual on website is severely out-of-date; use as a rough guide only

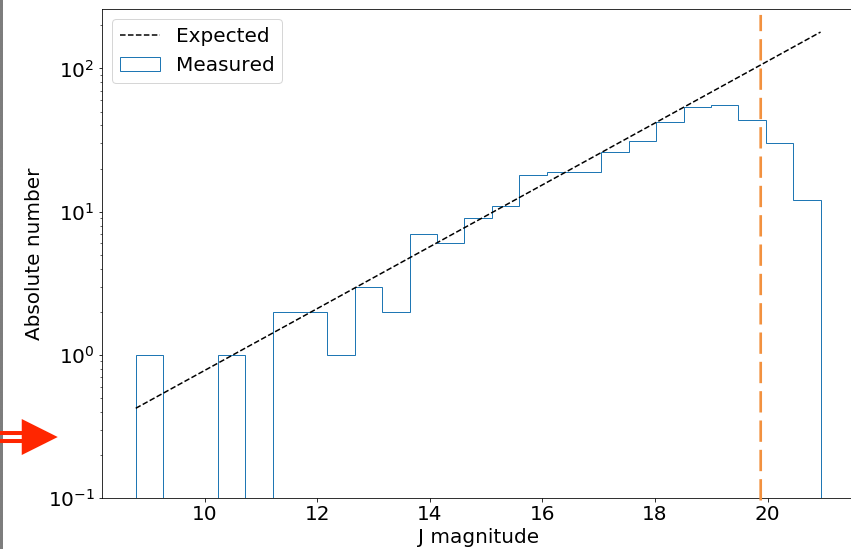
# WIRC – Sample Data



30 sec J-band



J-band coadd, ~1hr integration

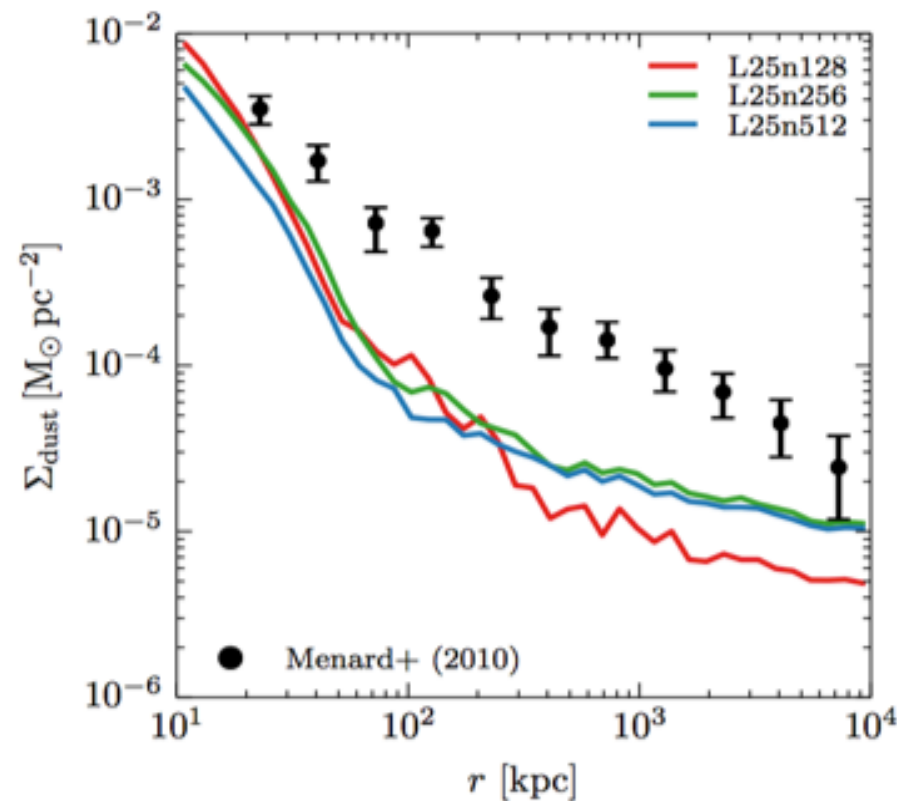


50% completeness = 20 mag

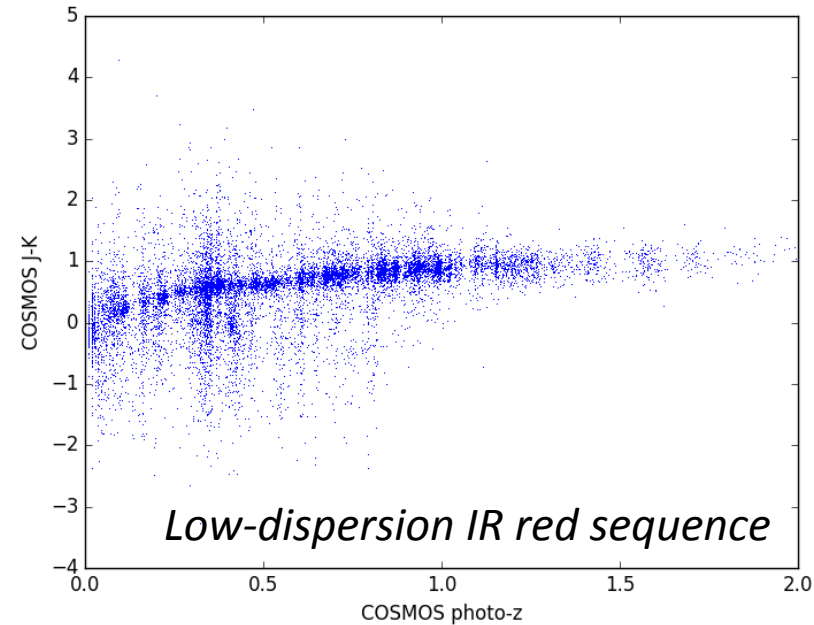
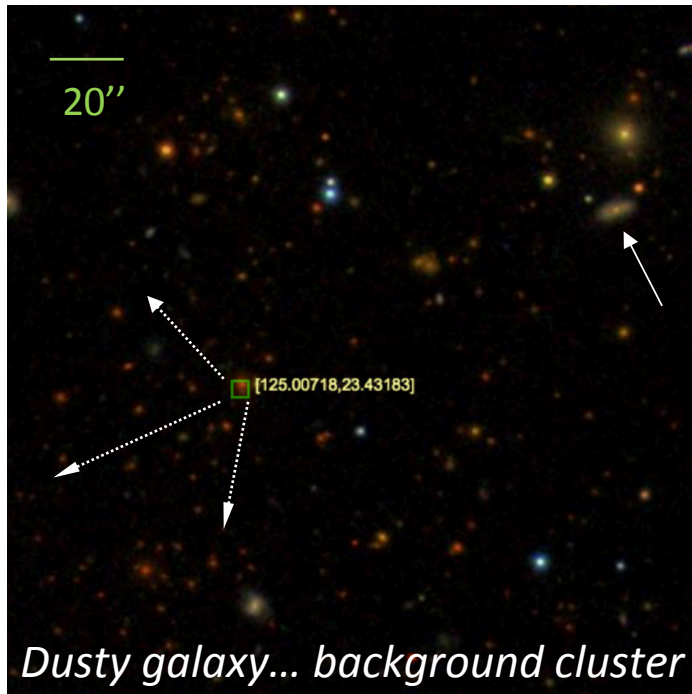
# Science Project: Circumgalactic Dust Halos

- Ménard et al. measured extinction behind galaxies with quasars, found anomalous reddening
- Do star-forming galaxies have extended dust halos? Probably!
- What is implication for galaxy formation and cosmology?

*Dust halos measured with quasars*



# Circumgalactic Dust Halos: WIRC edition



- We repeat measurement with massive clusters behind star-forming galaxies
- WIRC: constrained by smaller FOV/small program...
- But have small dispersion in cluster red sequence, and longer “lever arm” of IR photometry

# Ménard et al. 2010: Differential Extinction

