WIRC+Spec, WIRC+Pol (Wide-field InfraRed Camera)

Presented at JPL Colloquium
September 19, 2019
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What is WIRC?

- WIRC is an infrared wide field imaging camera operated at the prime focus of the 200-inch
- It has a ~2Kx2K CCD with an ~8.7x8.7 arc min field of view
- Two filter wheels, each with 7 slots.
  - FW1: Open, polarization grating, Br-gamma, Diffuser, Fe II, H-cont, Grism
  - FW2: K-cont, CO (0-2), H2, Open, Ks, H, J
- Current science being performed: brown dwarf spectropolarimetry, transiting exoplanet spectroscopy, transit-timing variation measurements

WIRC – Key Characteristics

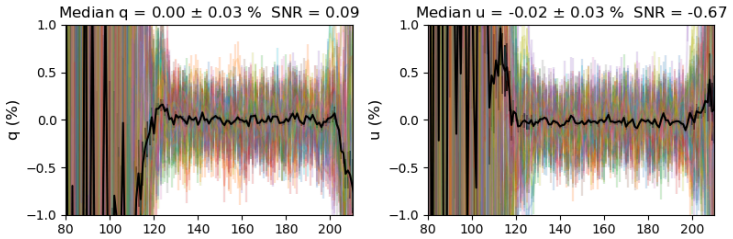
- Detector – 2Kx2K Hawaii-II (HgCdTe)
- Pixel Scale - 0.25”/px
- Field of View - 8.7x8.7 arcmin
- Read noise – 12e-,
- Gain – 1.2 e-/ADU
- Detector linear to 0.5% at 22K ADU, to 1% at 30K ADU, full well at 50K ADU
- Minimum exposure time – 0.92s
- Filter Wheel includes Diffuser for photometry:
  - 500 ppm/30 min bin for J = 14 mag star (with diffuser)

What are WIRC+Spec and WIRC+Pol?

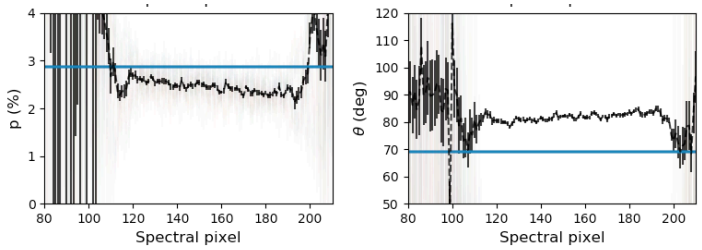
- WIRC+Spec
  - Grism-based slitless spectroscopy
  - J, H and K Bands
  - Resolving Power R~100 (seeing limited)
  - Current Science Programs: Transit and Secondary Eclipse Spectroscopy
  - Sensitivity (work in progress)
- WIRC+Pol
  - Polarization grating-based spectropolarimetry
  - 4.3x4.3 arc min FOV
  - J and H-bands
  - Resolving Power R~100 (seeing limited)
  - Current Science Programs: Brown Dwarf Atmospheric Characterization, Keppler Dippers, YSOs, Asteroid Polarized Phase Functions

WIRC+Pol: New Half-wave plate Upgrade (Better systematics)

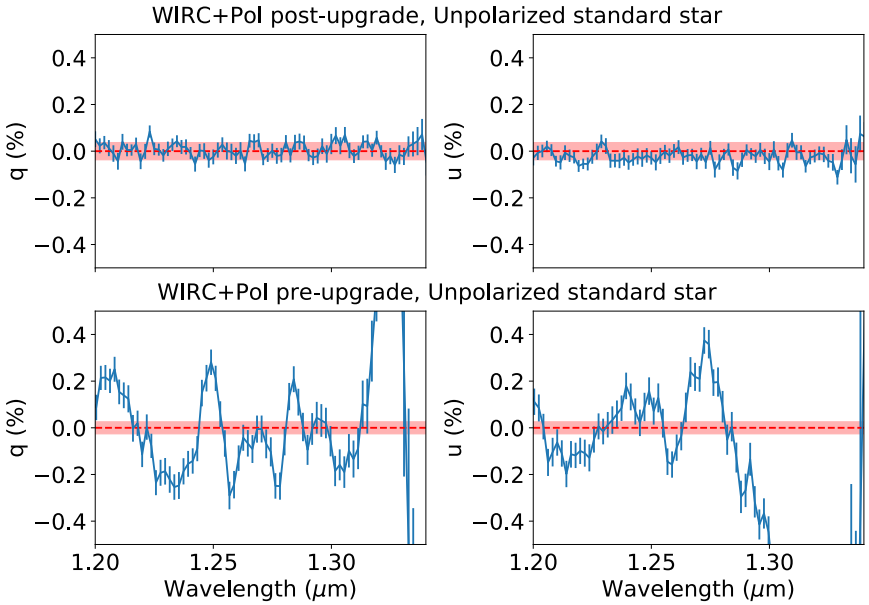
- Unpolarized Standard:
  - <0.03% instrumental polarization



- Polarized Standard:
  - Not 100% efficiency
  - Instrument Model in progress.



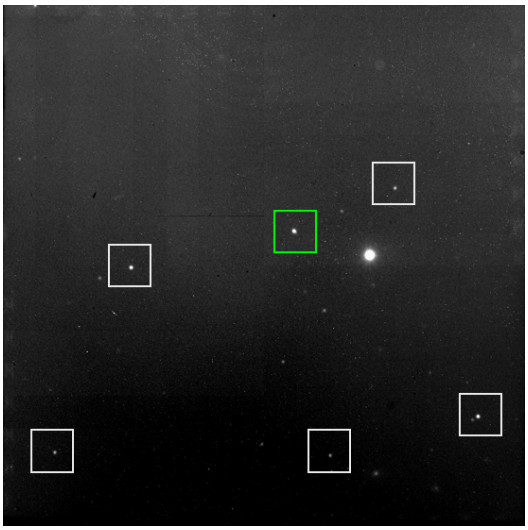
Pre Vs. Post Upgrade



WIRC+Spec and WIRC+Pol – Things you might need to know about observing and data reduction

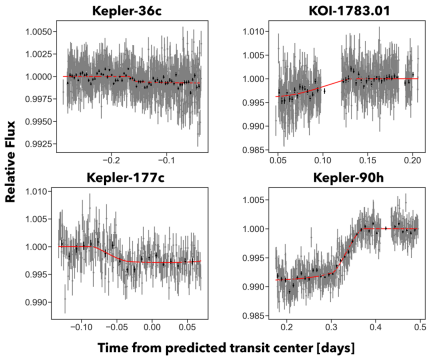
- Good documentation available at WIRC's website: http://www.astro.caltech.edu/palomar/observer/200inchResources/wircspecs.html
- Observing procedures available on internal wiki (contact us): http://www.astro.caltech.edu/wiki-wircpol/doku.php?id=start
- WIRC+Pol Instrument paper (Tinyanont et al. 2019): http://adsabs.harvard.edu/abs/2019PASP..131b5001T
- Exposure times are typically set dynamically for observations to bring you to ~20K ADU on your target's PSF maximum
- Python data reduction pipeline in active development for all exoplanet/BD observing modes
- Photometry mode data reduction is most mature
- If you have questions, please talk to us!

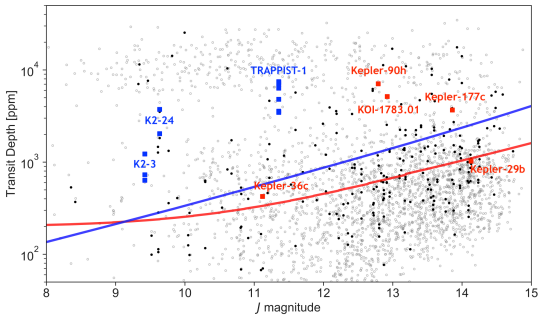
WIRC Diffuser – Sample Data



- J band photometry data (with diffuser) on the left; target star in green, comparison stars in white
- Basically take this picture 100s of times throughout the night, perform photometry, and detrend to build up light curve

WIRC – Shreyas science project

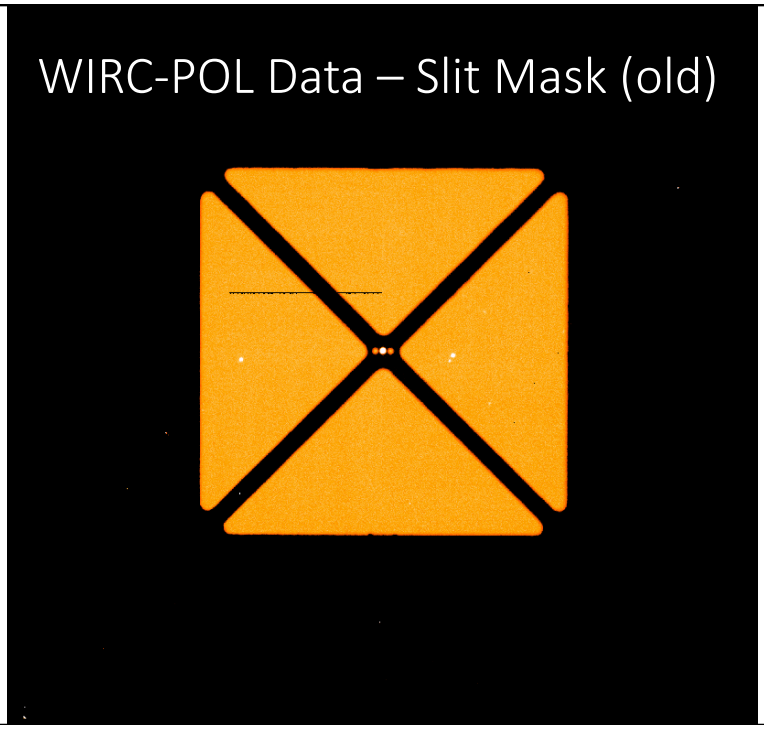




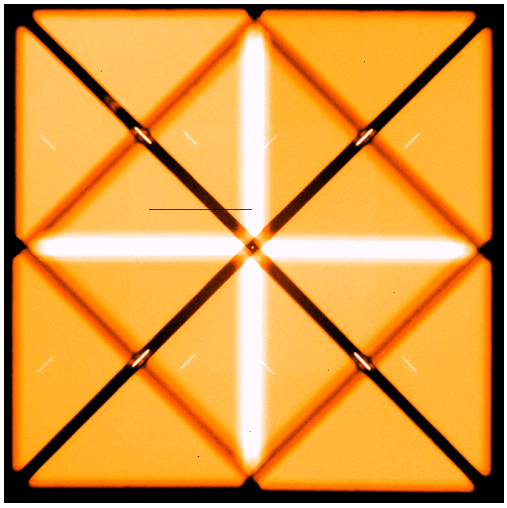
Better photometric precision than Spitzer for stars fainter than J ~ 9.5

- We have used WIRC to measure transit timing variations in five systems, achieving a better photometric precision than Spitzer for stars fainter than J ~ 9.5 (Vissapragada et al. in prep.)

WIRC-POL Data – Slit Mask (old)

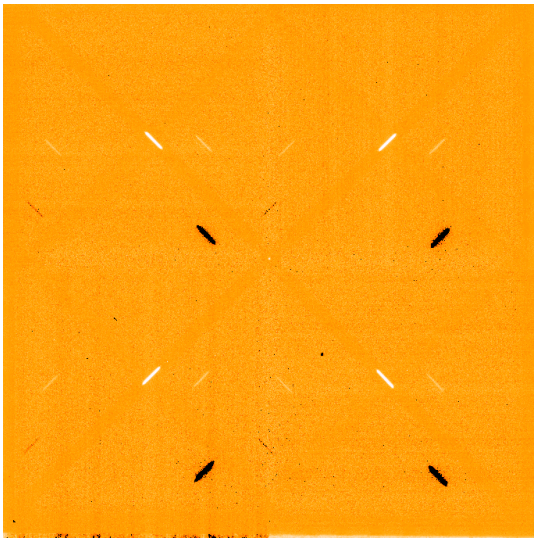


WIRC+Pol – Sample Data – Raw Data



- Raw data looks intense. Most of it is background.
- J-band data

WIRC+Pol – Sample Data - Background Subtracted



- One target in central slit, two reference targets in the field
- (Dark regions are background-nods)

WIRC+Pol: New Half-wave plate Upgrade (Better systematics)

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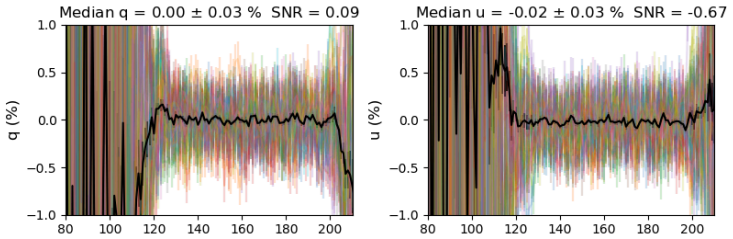

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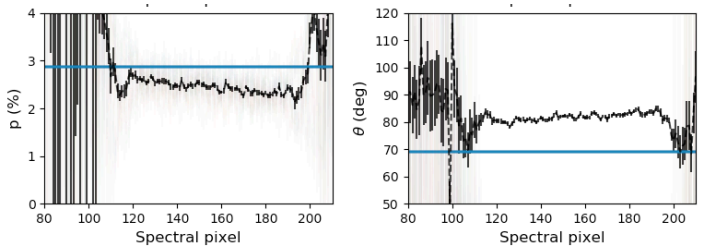
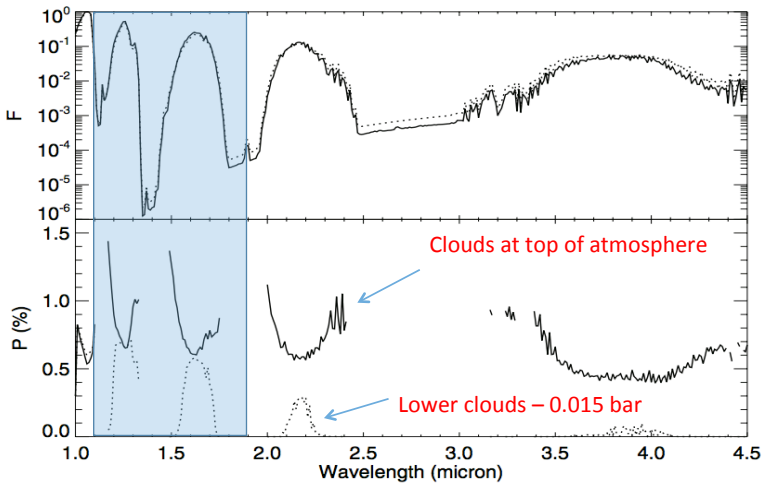


My Science - Polarimetry as a diagnostic of Brown Dwarf Cloud Properties



de Kok et al 2011

Main Contacts

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  - Gautam Vasisht
- Caltech
  - Kaew Tinyanont
  - Shreyas Vissapragada
  - Ricky Nilsson
  - Dimitri Mawet
  - Heather Knutson