NASA Hi-Resolution Imaging Program
Speckle Imaging on Large Telescopes

WIYN 3.5m

Gemini-N 8m

Gemini-S 8m

- Full frame readout at 1MHz
  - 1024 X 1024 EMCCDs
- Dual plate scale
  - 0.01" or 0.07" / pixel

- High-resolution (20mas)
- High-contrast (~12mag)
- Wide Field – up to 56"

Filters and data:
- u, g, r, 467, 562, Hα
- i, z, 716, 832
- Provide fully reduced data

Fast ms imaging → **Diffraction-limited** → **Optical dual-channel**

Program and Instruments Funded by the NASA Exoplanet Program Office

Imaging Capabilities

Provides the highest angular resolution of any telescope

Nova Shell
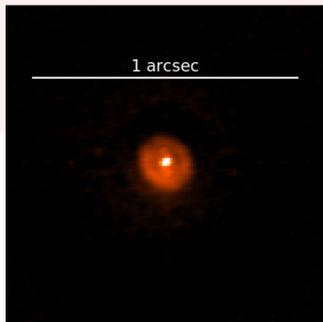
Nova V906 Car imaged at 832nm
978 days after explosion

Asteroids
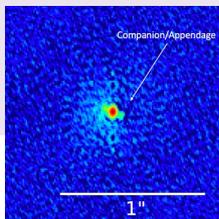
Asteroid light curves,
shapes, and binarity

Wide-Field
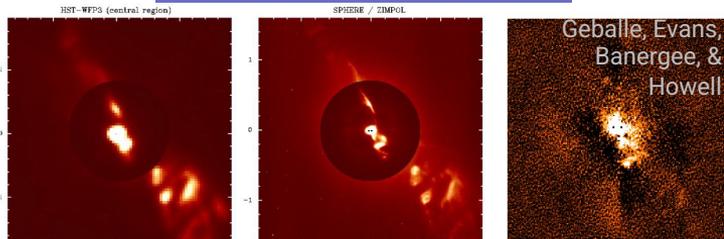
Hα imaging of central 0.5" region of R Aqr
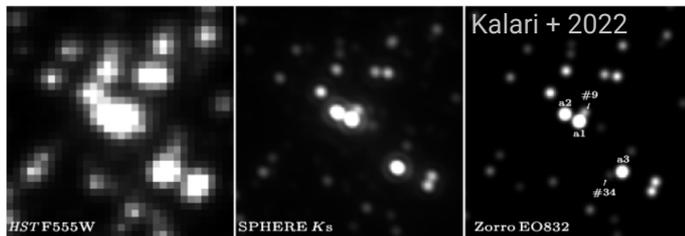
Imaging center of R136 (0.8" x 0.8")
(Tarantula Nebula)

Transient Follow-up
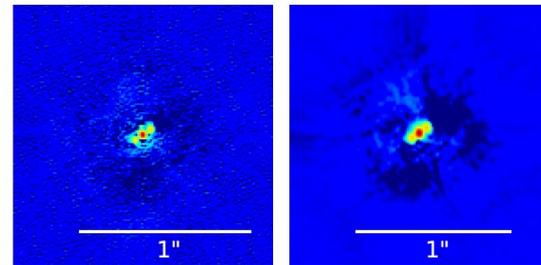
Follow-up imaging detected
lens and source:
sep = 0.058", contrast = 3.7

Binary Stars
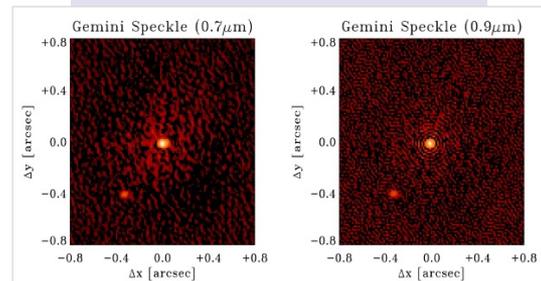
Exoplanet validation, formation, and
evolution; stellar multiplicity, orbits

Time Domain Capabilities

Occultations
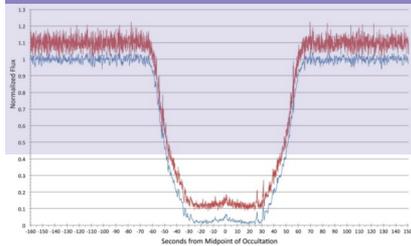
Pluto occultation 2018

High speed and accurate timing:
0.001s min. exp time
70nsec internal precision

Blue-g

Red-z
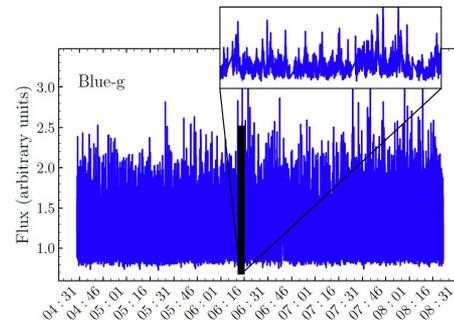
Variable Stars

Faint cataclysmic variable NZ Boo showing 4min eclipse
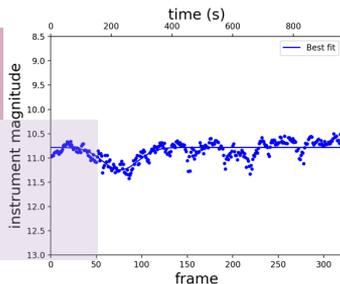
BH X-ray Binaries

4-hr simultaneous 30 sec sampled light curve (Tetarenko, A.+ 2021)
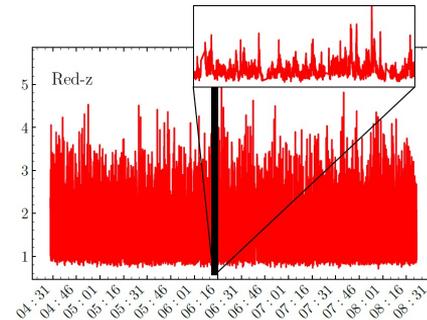
White Dwarf Pulsations

Simultaneous g + i light curves: 20min, 0.5s exposures

SDSS g ACCUM

SDSS i ACCUM
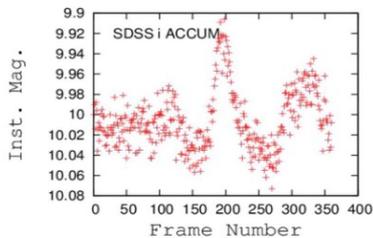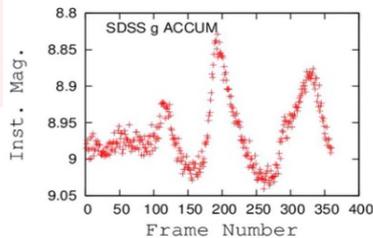
Degenerate Eclipsing Binaries

Kosakowski + 2021
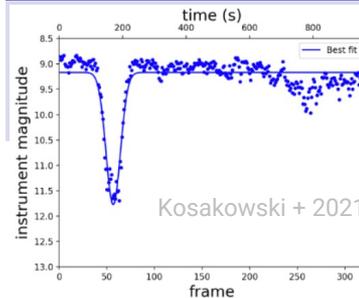
Eclipsing Double WD ZTFJ0220+2141 R = 19, 3.5hr, 10s exposures

NASA Hi-Resolution Imaging Program: Emphasis on Exoplanets
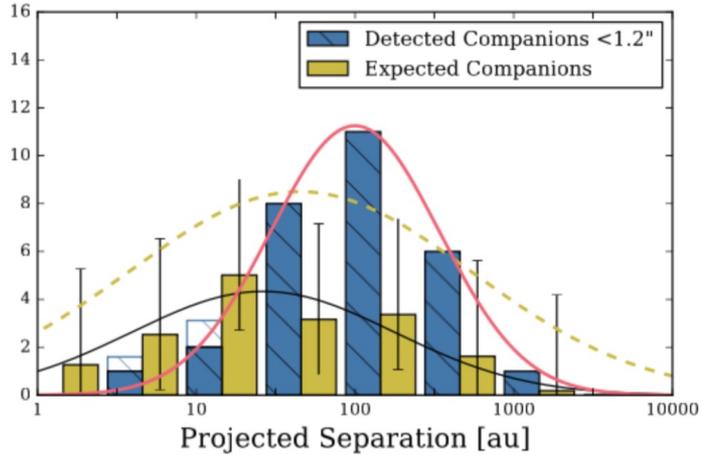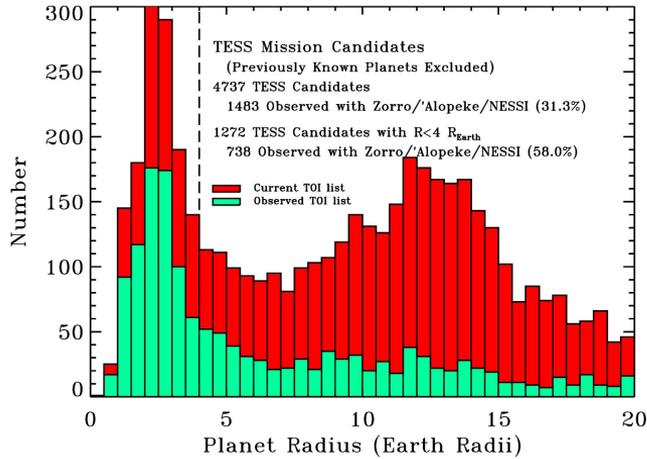
Binary stars
which host exoplanets
have wider orbits.
Howell+, Lester+ 2022
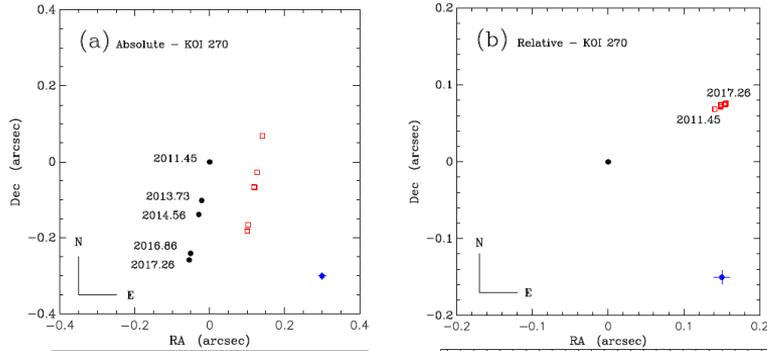
Highlight bias
Against small planet
detection
in binary systems
Lester+ 2021
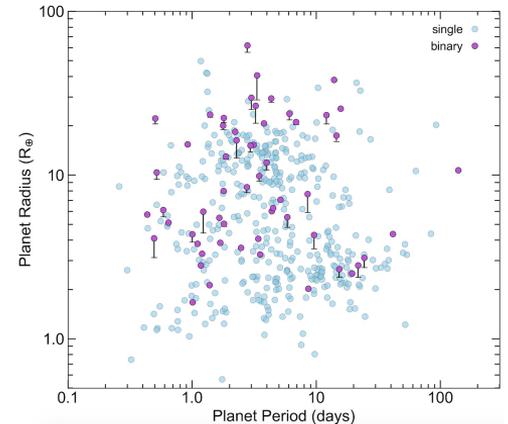
Perform absolute and relative +/- 1 mas astrometry (Colten+ 2021)

NASA Hi-Resolution Imaging Program - Speckle Imaging on Large Telescopes

WIYN 3.5m

Gemini-N 8m

Gemini-S 8m

Available to the Community

Propose thru NOIRLAB

- https://www.wiyn.org/Instruments/wiynnessi.html
- https://www.gemini.edu/instrumentation/alopeke-zorro

All raw and reduced data are publicly available with no exclusive use period at NASA Exoplanet Archive

Contact Information

Instrument PI:
Steve B. Howell, NASA Ames
    steve.b.howell@nasa.gov
Exoplanet Archive:
David Ciardi, NexScI
    ciardi@ipac.caltech.edu