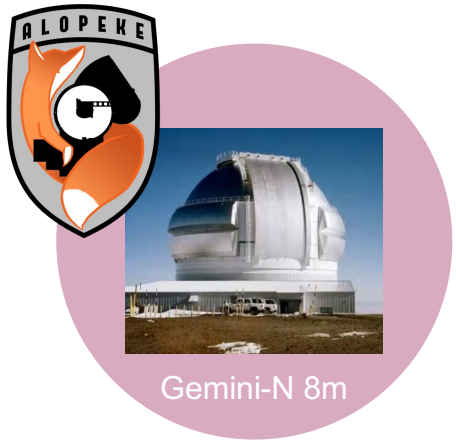
NASA Hi-Resolution Imaging Program
Speckle Imaging on Large Telescopes

WIYN 3.5m

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



Gemini-N 8m

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

Gemini-S 8m

Filters and data:

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

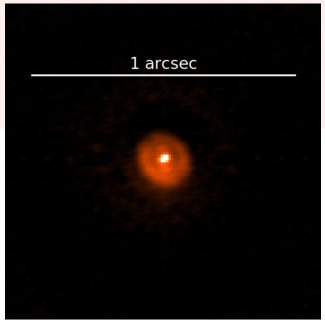
Fast ms imaging → **Diffraction-limited** → **Optical dual-channel**

Program and Instruments Funded by the NASA Exoplanet Program Office

Imaging Capabilities

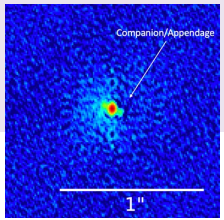
Provides the highest angular resolution of any telescope

Nova Shell



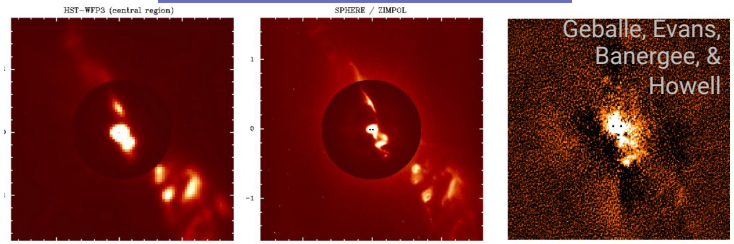
Nova V906 Car imaged at 832nm
978 days after explosion

Asteroids

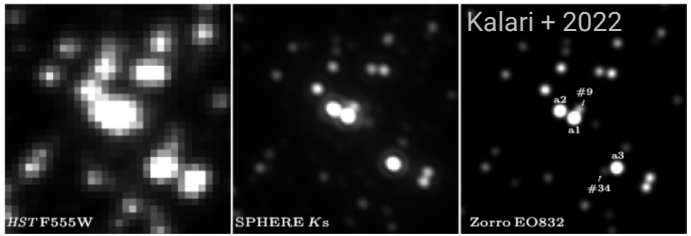


Asteroid light curves,
shapes, and binarity

Wide-Field

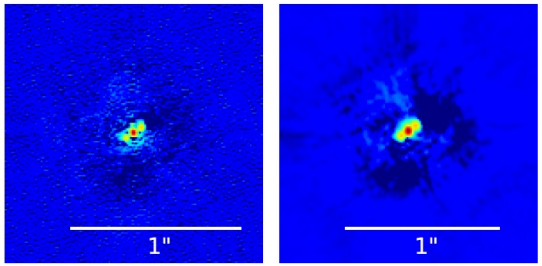


Hα imaging of central 0.5” region of R Aqr



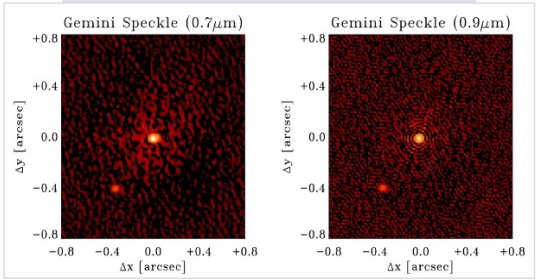
Imaging center of R136 (0.8” x 0.8”)
(Tarantula Nebula)

Transient Follow-up



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

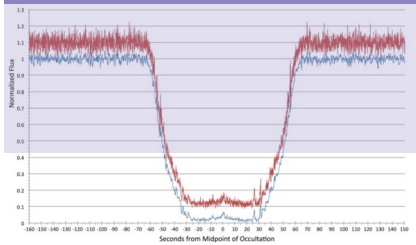
Binary Stars



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

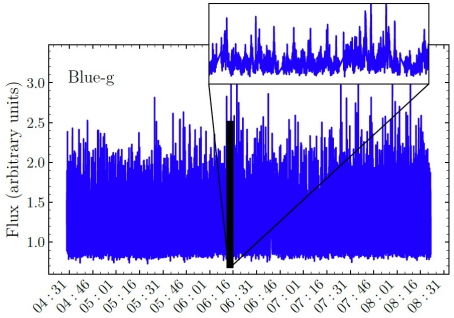
Time Domain Capabilities

Occultations



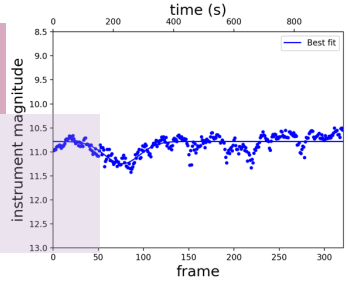
Pluto occultation 2018

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



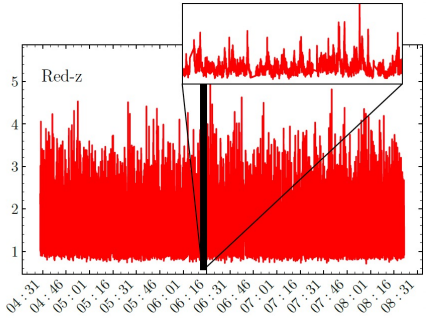
Variable Stars

Faint cataclysmic variable NZ Boo showing 4min eclipse



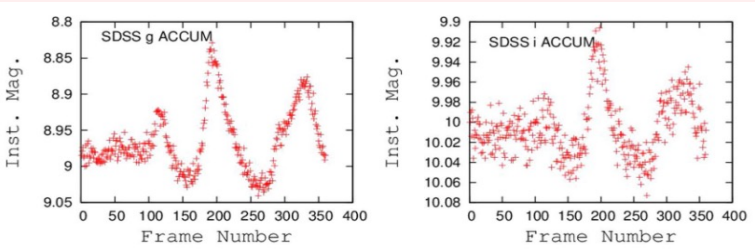
BH X-ray Binaries

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

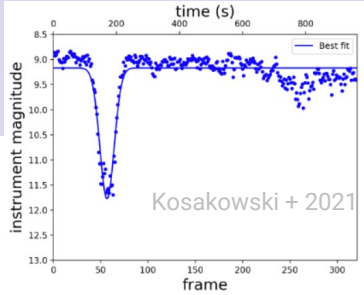


White Dwarf Pulsations

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

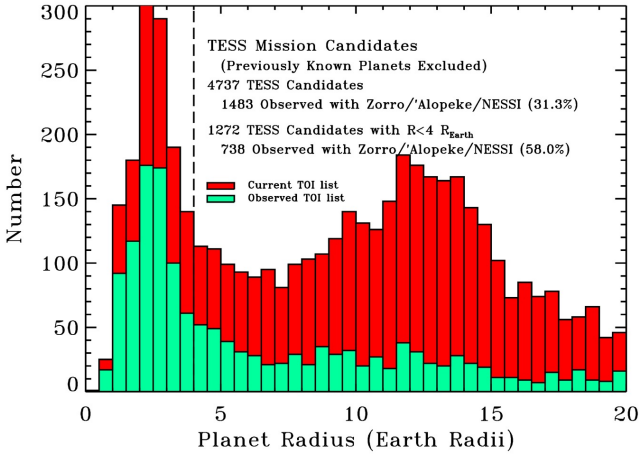


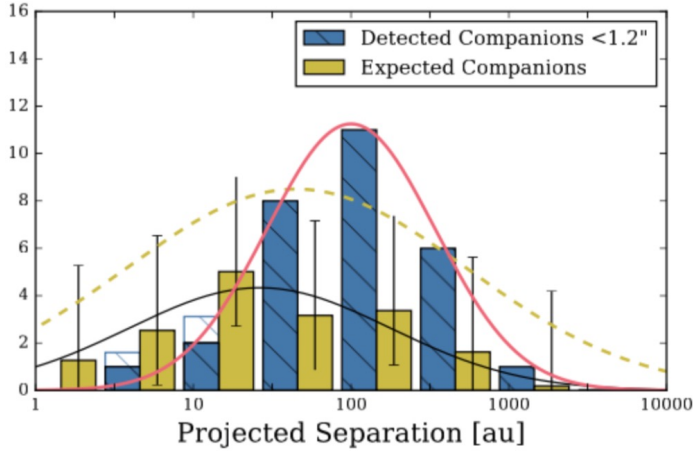
Degenerate Eclipsing Binaries



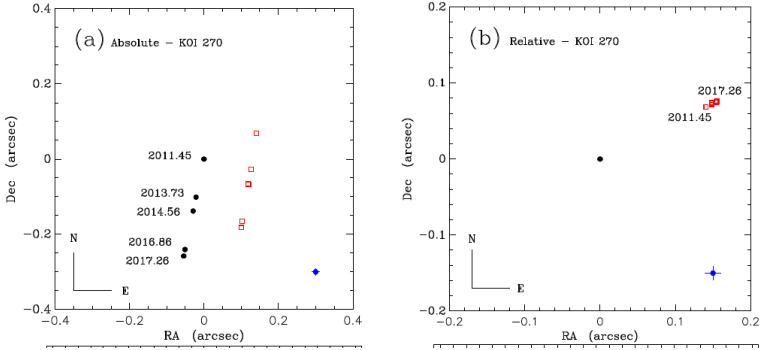
Eclipsing Double WD
ZTFJ0220+2141
R = 19, 3.5hr,
10s exposures

NASA Hi-Resolution Imaging Program: Emphasis on Exoplanets

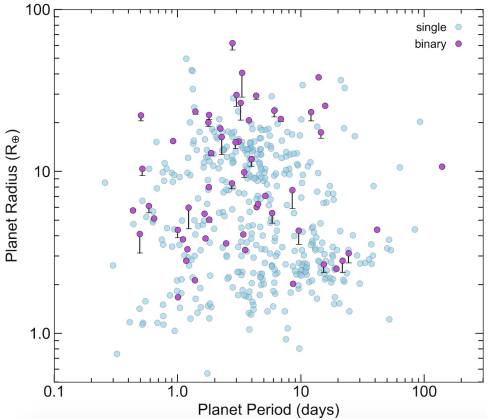




Binary stars
which host exoplanets
have wider orbits.
Howell+, Lester+ 2022

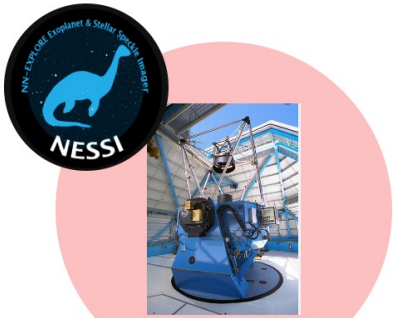


Highlight bias
Against small planet
detection
in binary systems
Lester+ 2021



Perform absolute and relative +/- 1 mas astrometry (Colten+ 2021)

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



Available to the Community, Two ways

Propose thru NOIRLAB

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

Contact Information

Few target pilot programs, Time critical, JWST observation, etc.

Contact Instrument PI:
Steve B. Howell, NASA Ames
steve.b.howell@nasa.gov

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