The Sydney University Stellar Interferometer
Prof Peter Tuthill Sydney Institute for Astronomy
Mike Ireland, Yitping Kok, Andrew Jacob, Gordon Robertson, William Tango, Ben Warrington
In Memoriam: John Davis 1932 - 2010
$f = 40$ m lens

PAVO front-end optics

PAVO back-end optics and camera
Optical path length compensator
35m focal length achromats
PAVO: Precision Astronomical Visible Observations

- “Twin” instruments at SUSI and CHARA
- PAVO uses ~1000 pixels, splitting the pupil into 16 parts (CHARA) or 4 parts (SUSI), with 30 wavelengths and spatial modulation.
PAVO@SUSI Mask and Tip/tilt
SUSI regularly operates under full remote control (in fact is rarely driven from site). Once set up a queue-scheduler mostly takes care of the work.
PAVO Remote observing…
PAVO@SUSI: Multiplicity Survey of bright Sco-Cen

› Preliminary Sco-Cen survey for companions.
› Several companions, that were not in major catalogs (kappa Cen, ups Sco)
› A major part of the research effort for Aaron Rizzuto

7ms of raw Fomalhaut data.
• Pulsating K-giant, a “hybrid bright giant” that is UV-bright and has a wind that is both cool and hot (coronal). Precision diameter required for asteroseismology collaboration with Tim Bedding/Graham Harper
• UD Diameter 9.08±0.07 compared with Cohen’s 8.98+/-0.1 mas LD estimation. Double checking wavelength scale calibration before publication…
The outback is not always a desert ...
MUSCA: A Project for Finding Tatooine ….
Searching for companions astrometrically

› Side-to-side wobble, not back and forth wobble.

› Unlike radial velocity: gives inclination and a unique mass.

Mutterspaugh (2005)
1. PAVO tracks the phase for star 1. The “red table” measures the phase for star 1 and star 2.

2. Only the difference in optical path between two closely-spaced beams affects the astrometric measurement.

3. Corrections to the delay can be applied in post-processing (photon-counting).
› Astrometric signature of Jupiter at 10pc is 100µas.

› Fundamental limits for 1 hour observing are:
  - 2.6µas from photon-noise (S/N of 1 per scan)
  - 3µas from anisoplanatism (1” binary).

› Practical limits will likely be $10^{-5}$ fractional precision: 10µas for a 1” binary or 75µas for α Cen.

› Competitor (VLTI-PRIMA) will mostly focus on wider binaries.

› 50-100 targets