SUSI Update

Michael Ireland… plus:
Peter Tuthill, Gordon Robertson, Bill Tango, Theo ten Brummelaar, Yitping Kok (PhD Student), Aaron Rizzuto (honours student), David Prabhakhar (Undergrad), Anthony Cheetham (Undergrad), Cedric Laliberte (Canadian Undergrad) and a couple of ring-ins.
In Memory of John Davis

Passed away on Jan 15, 2010, age 77… having given much of his life to developing long baseline optical interferometry.
Main Changes since 2009

1. PAVO@SUSI works routinely. Baselines up to 80m in use. 160m should work.
2. Longitudinal dispersion corrector (the “glass” or the LDC) upgraded and working.
3. Remote observing fully commissioned… except from GSU.
PAVO@SUSI: Fringes and tip/tilt with small beams.
PAVO@SUSI Mask and Tip/tilt
PAVO@SUSI Back-End
SUSI ROCS Observations
PAVO@SUSI Observations

• ~60 nights with some on-sky data, max half night, but often testing one or two things after sunset. No full night’s observing yet (or planned).

7ms of raw Fomalhaut data. Obviously plenty of S/N…
Preliminary Science 1: Alpha TrA

- 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…
Preliminary Science 2: Sco-Cen

- Preliminary Sco-Cen survey on a 15m baseline for companions.
- No new companions, but 2 that were not in major catalogs (kappa Cen, ups Sco)
- The major effort for 2010 (Rizzuto thesis)
The (funded) Micro-arcsecond University of Sydney Companion Astronomy (MUSCA) Instrument
Searching for companions astrometrically

- Side-to-side wobble, not back and forth wobble.
- Unlike radial velocity: gives inclination and a unique mass.

Mutterspaugh (2005)
Very Narrow Angle Astrometry with SUSI

1. PAVO tracks the phase for star 1. MUSCA 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).
SUSI Planet Search

- 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
MUSCA Concept

Optics concept, 4th mag, 50ms simulation with 543nm laser and reconstructed fringe.
Expected Progress in 2010

1. Routine operation from outside Australia.
2. The first PAVO@SUSI papers.
3. MUSCA commissioned, but operating within a limite FOV (no alpha Cen) until 2011

Questions now???