SUSI Update

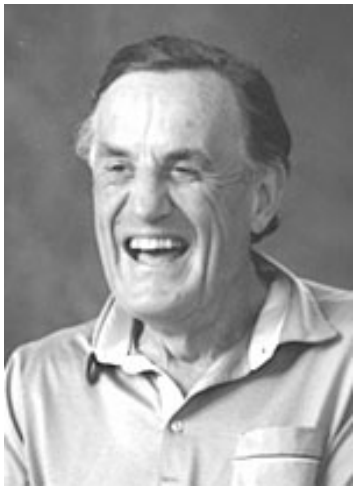
Peter Tuthill

Sydney Institute for Astronomy

University of Sydney

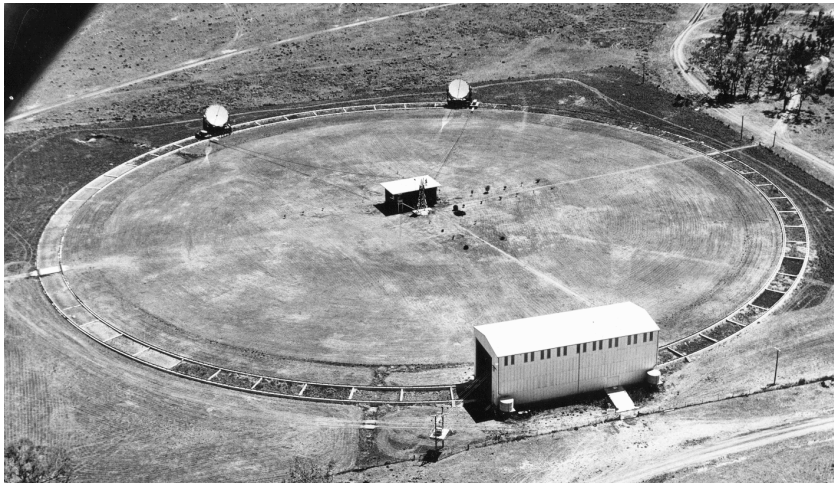
Happy 50th Birthday Optical Interferometry!

- Critical experiment in both optics and astronomy
- Established field of statistical optics, coherence
- Restarted stellar interferometry (dead for 60yrs)
- Established temperature scale for Hot stars
- Also with Richard Twiss (1920-2005)
- Roy Glauber 2005 Nobel Prize for Quantum Optics

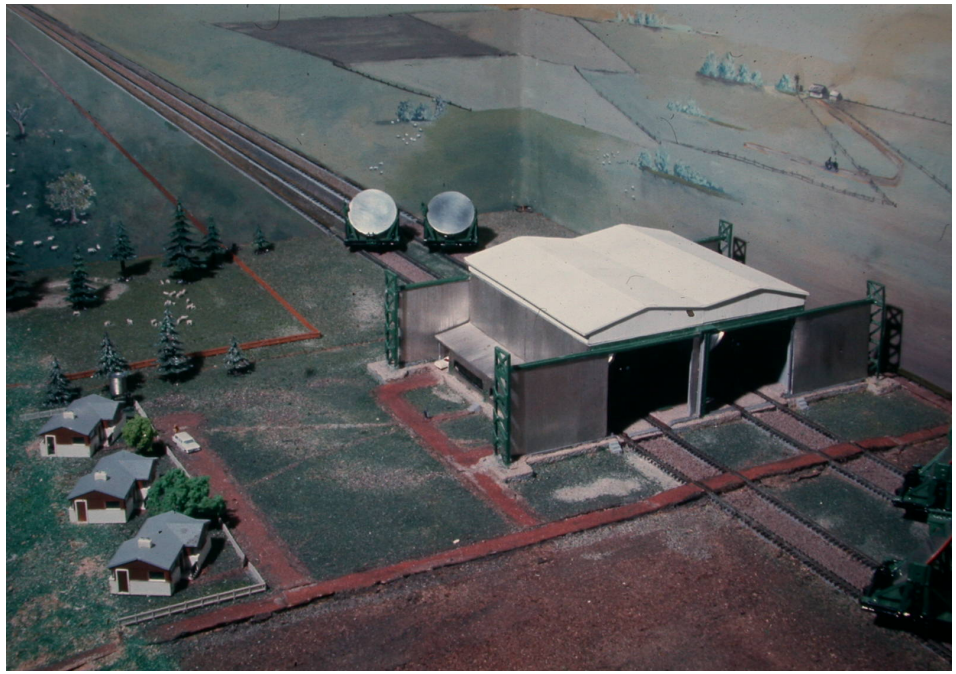


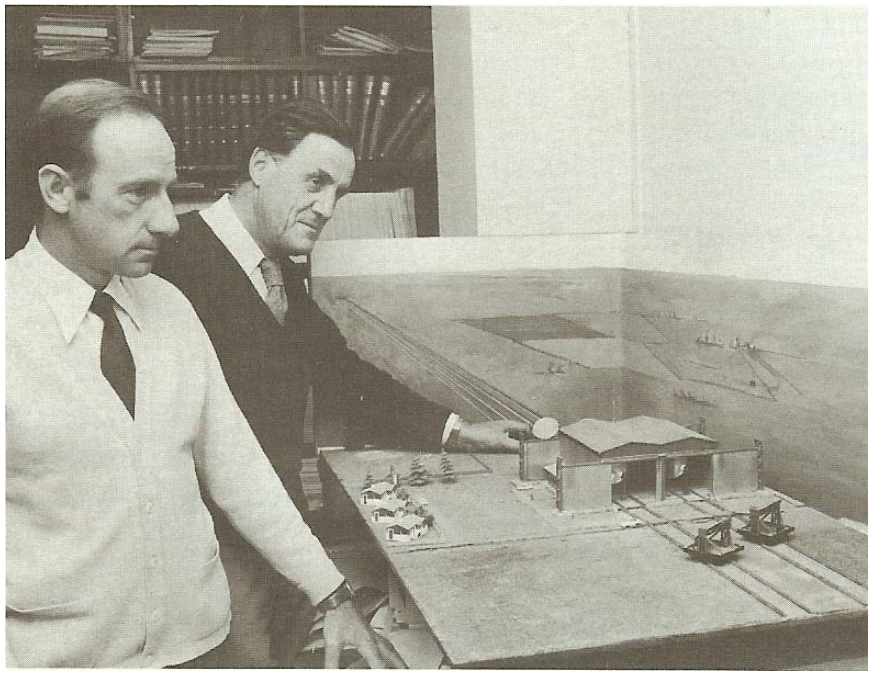
Robert Hanbury Brown (1916-2002)

Narrabri Stellar Intensity Interferometer (1963-73)



A Model of the proposed VLSII





- Two 10 metre diameter siderostats in each arm
- 1 km long railway tracks
- Multi-spectral channel optics at focus of paraboloids

The SUSI Array

SUSI Staff:

Mike Ireland

Peter Tuthill

Gordon Robertson

William Tango

Postdoc:

Ben Warrington

Xavier Haubois

Student:

Yitping Kok

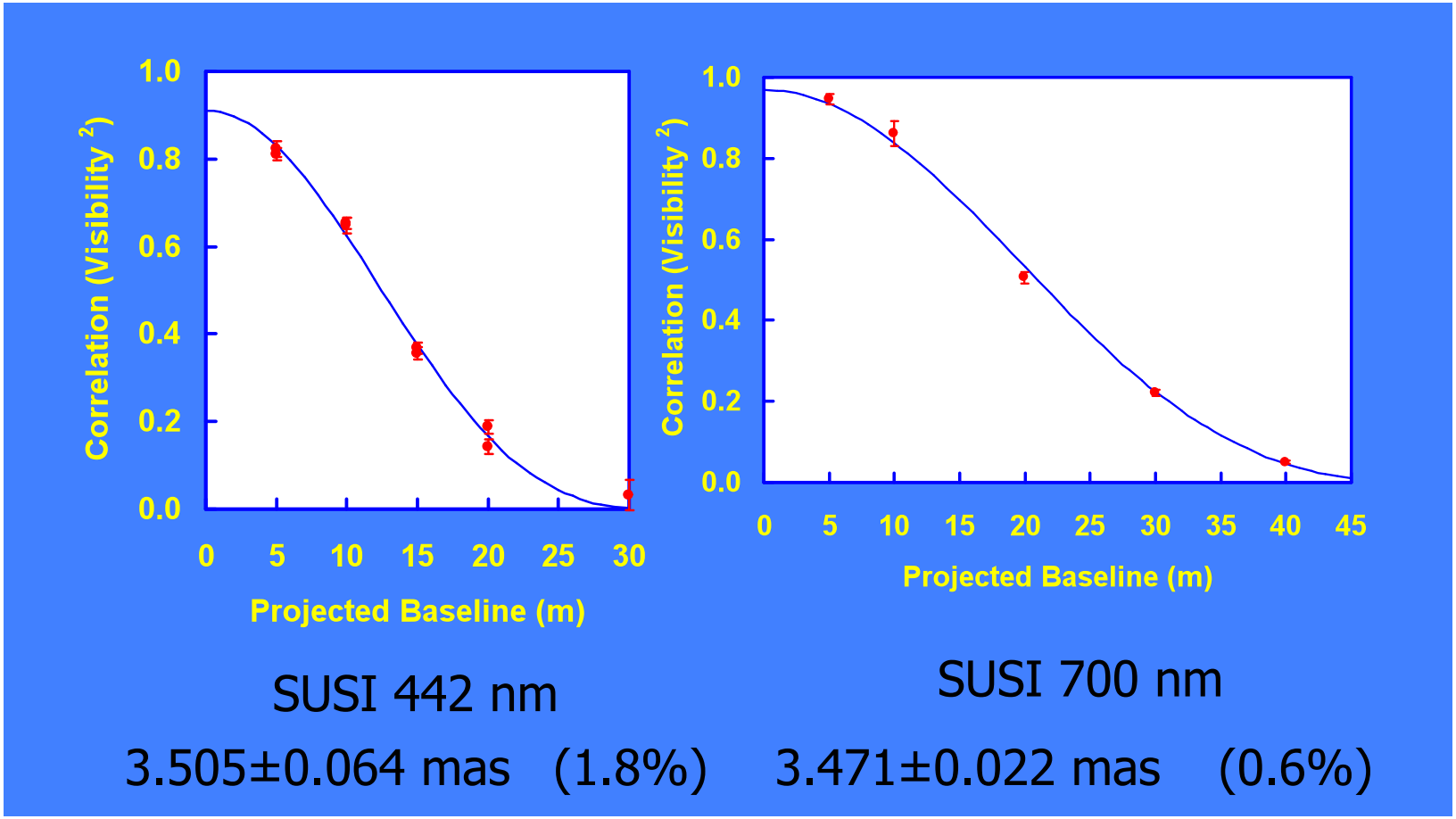
Aaron Rizzuto

PAVO Remote observing…

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…

Delta Cma (F8 Ia, B = 2.5)



SUSI 442 nm

3.505±0.064 mas (1.8%)

SUSI 700 nm

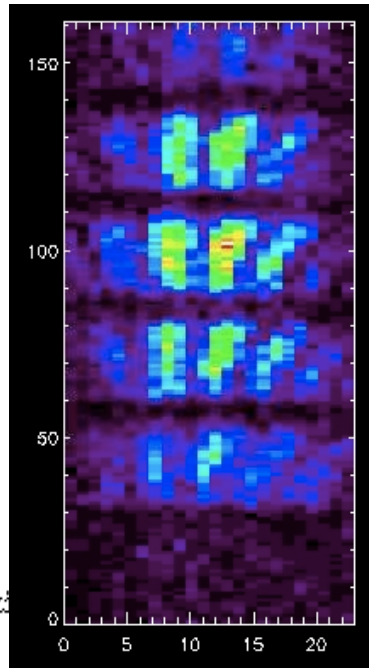
3.471±0.022 mas (0.6%)

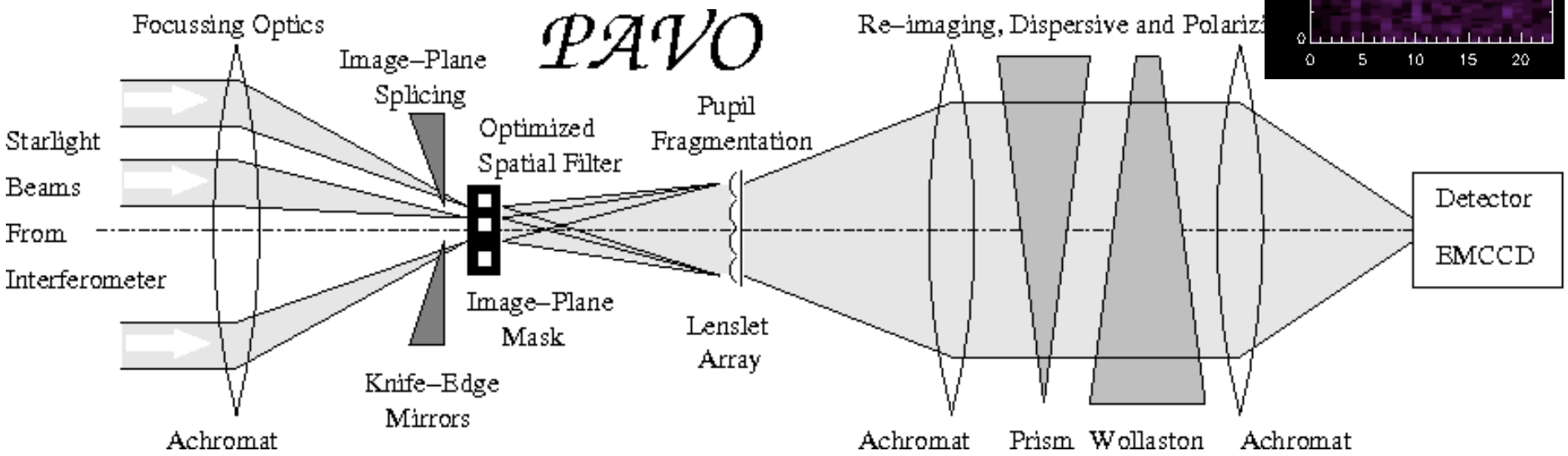
$\mathcal{F}$ = (1.38±0.07) × 10^{15} Wm^{-2}

T_e = 6100±80 K

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 wavelength channels.





A PAVO@SUSI Binary Survey

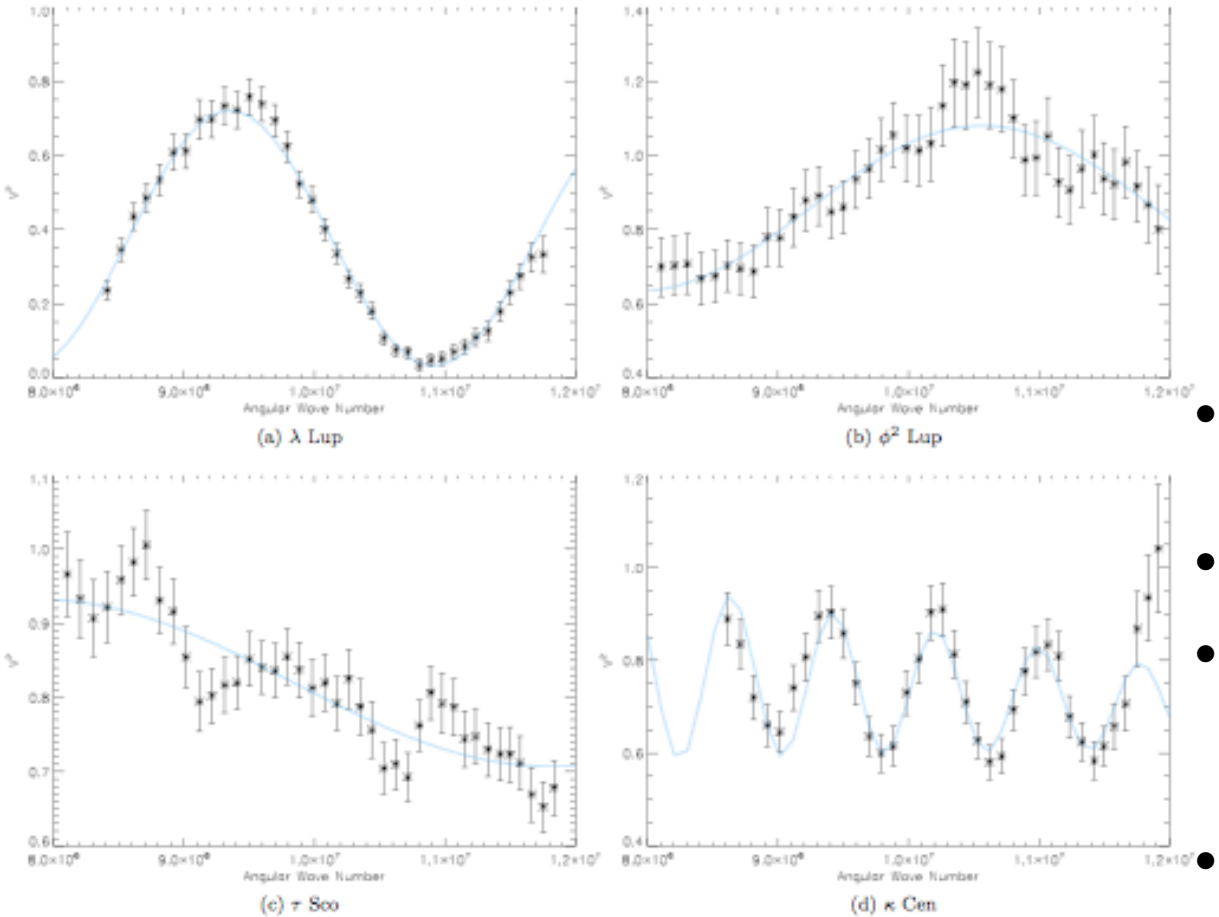
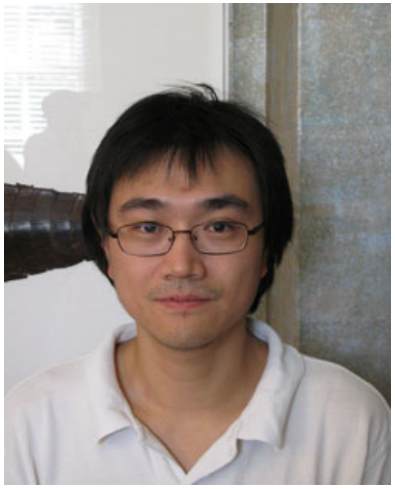


Figure 3. Examples illustrating the typical characteristics of the survey data and the closeness of the binary fits. Figure 3d displays the wide companion against which we calibrated for de-focus. The other three visibility profiles are new detections of companions to the stars τ-Sco and ϕ^2-Cen and . In these figures, the horizontal axis is the angular wavenumber.

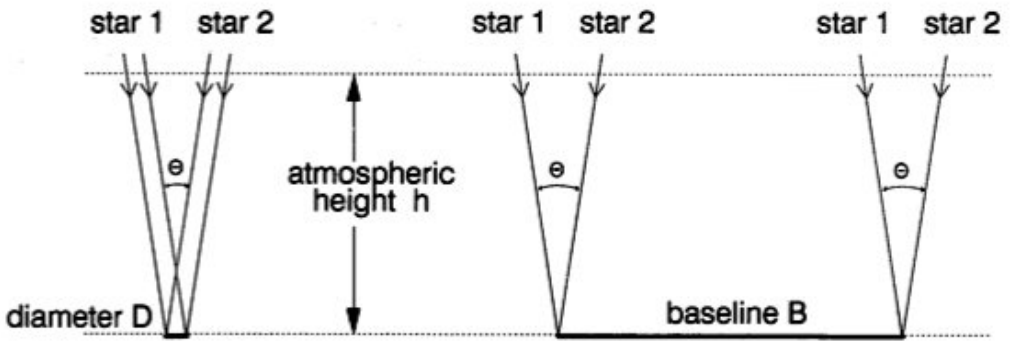
Aaron Rizzuto

- Survey of 58 stars in Sco-Cen for Binarity
- 26 binaries detected
- B stars brighter than 5th mag, binary range 7-130mas, ΔM up to 4.
- Survey complete in 6 half-nights!
- Paper (almost) submitted

MUSCA: A Project for Finding Tatooine ….

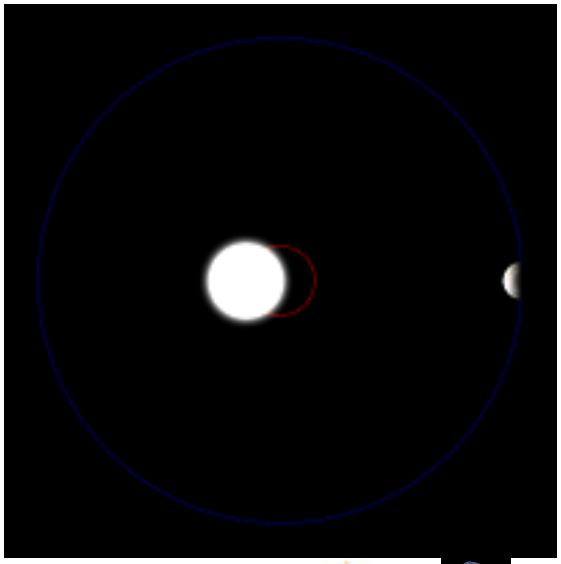


Yitping Kok

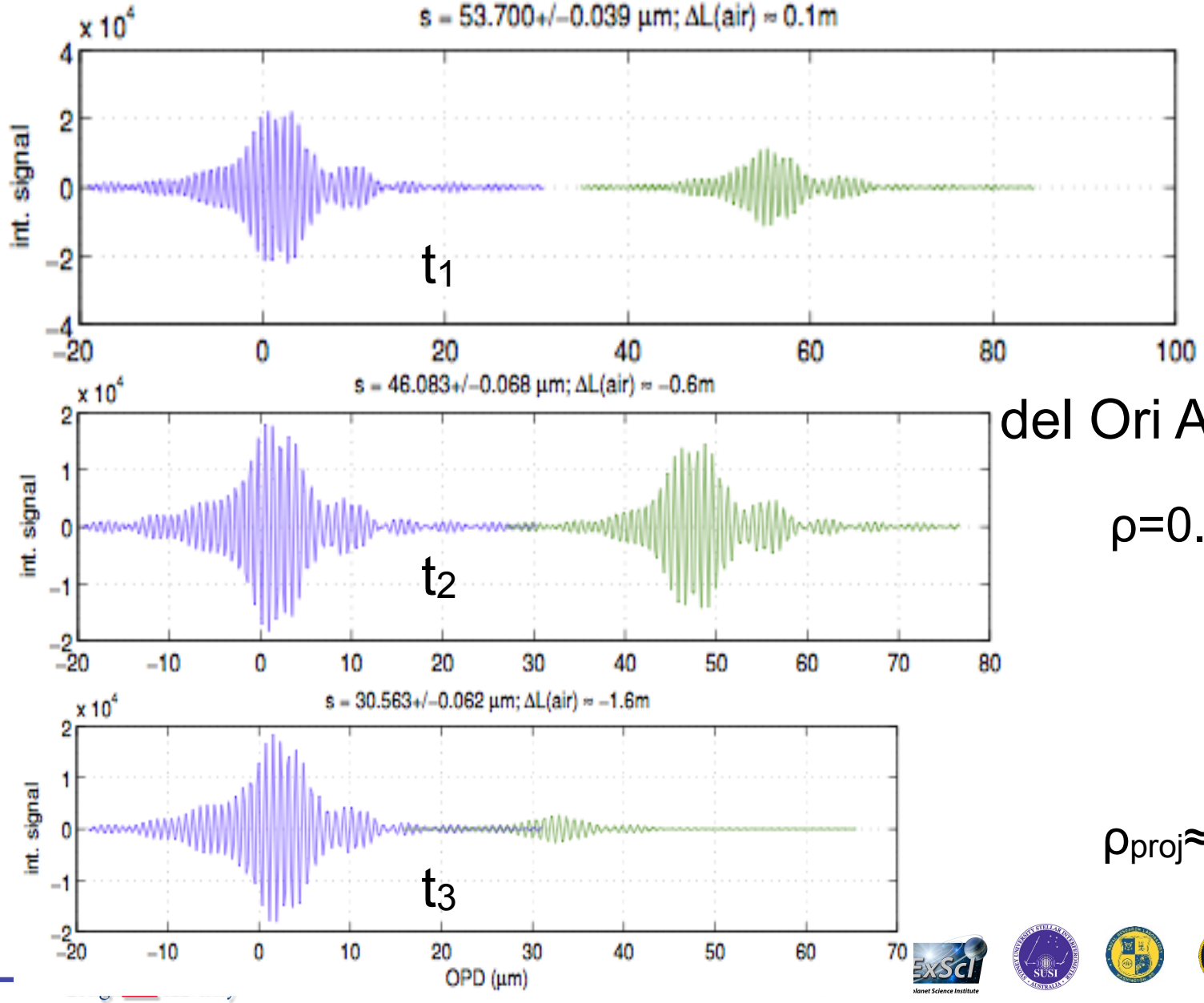


Traditional Narrow-Angle Regime
Θh >> D
error independent of D
error weakly dependent on Θ

Very-Narrow-Angle Regime
Θh << B
error decreases with increasing B
error linearly dependent on Θ



projected separations



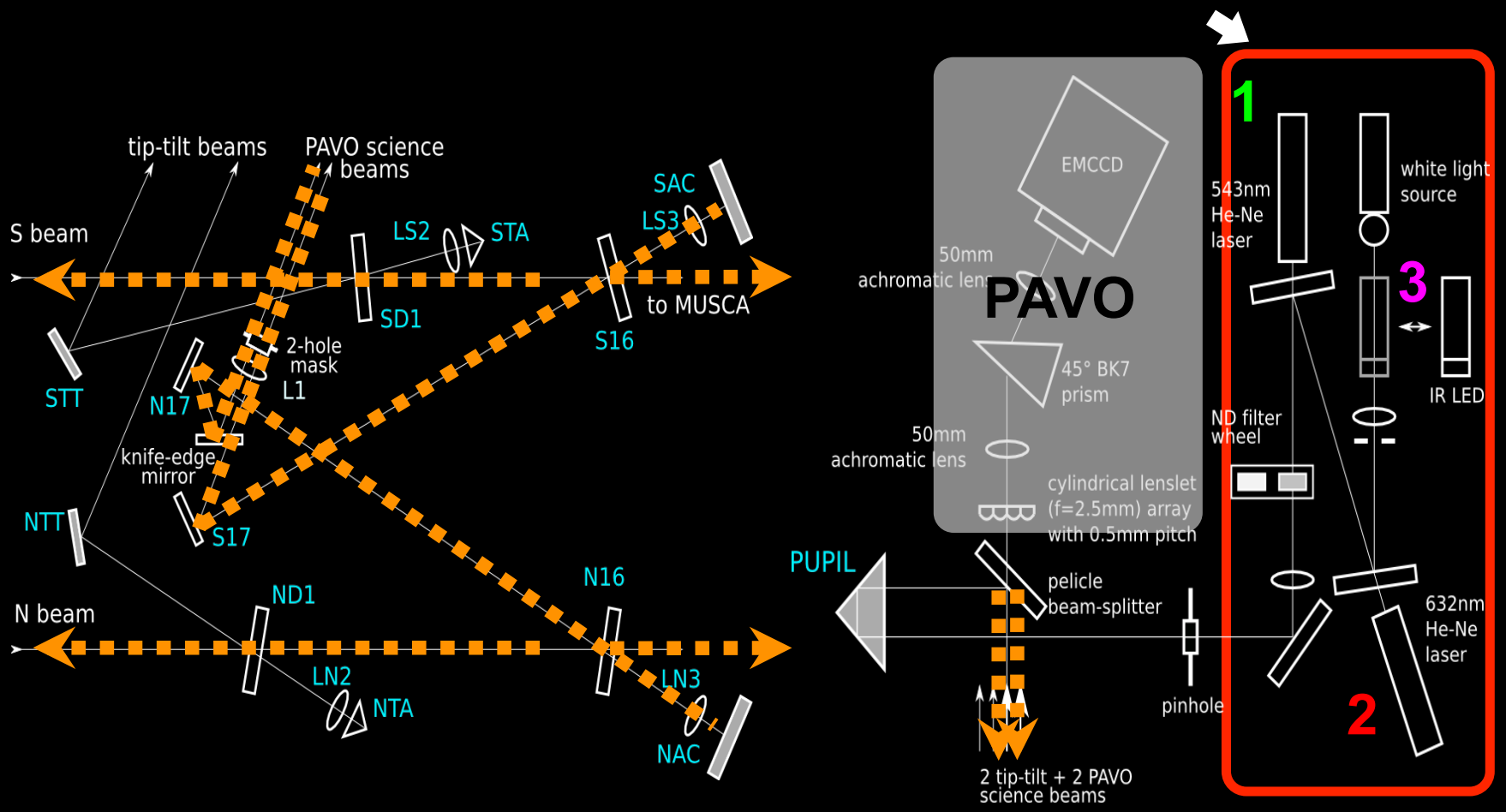
del Ori Aa, del Ori Ab

ρ=0.3”, θ=133°

ρ_{proj}≈0.11-0.18”

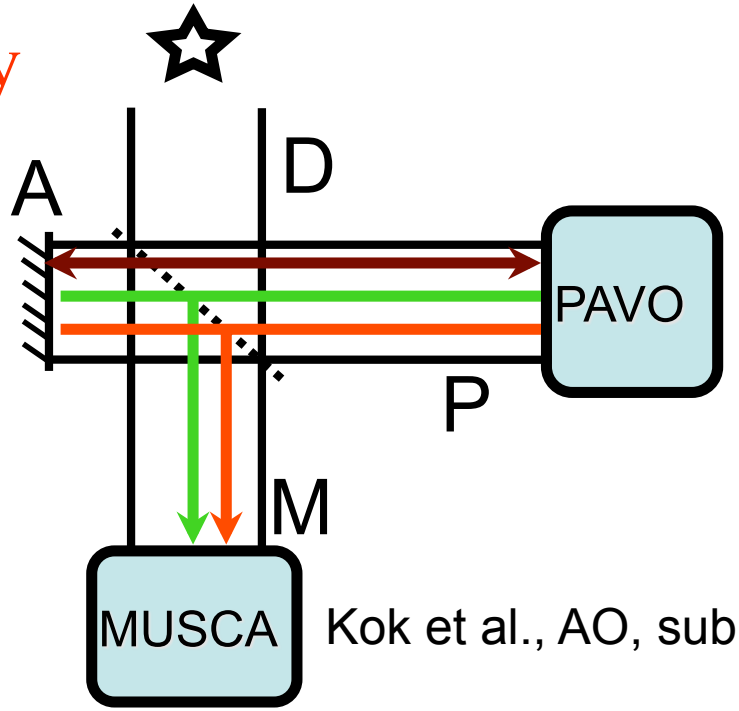
n_2-m_1

Metrology systems



Dual-Laser Metrology

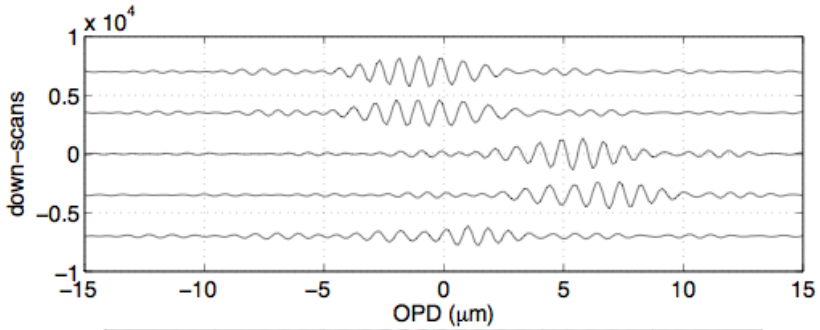
- IR LED metrology
  - $w = 2OPD_P + 2OPD_A$
- Single laser (SL) metrology
  - $x = OPD_D + 2OPD_A + OPD_{M,0}$
- Dual laser (DL) metrology
  - $d = \Delta OPD_M$

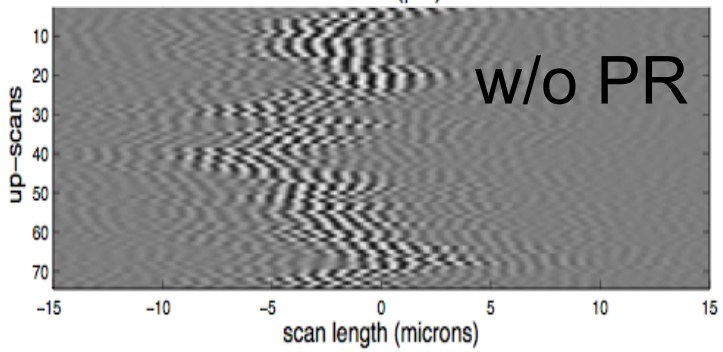


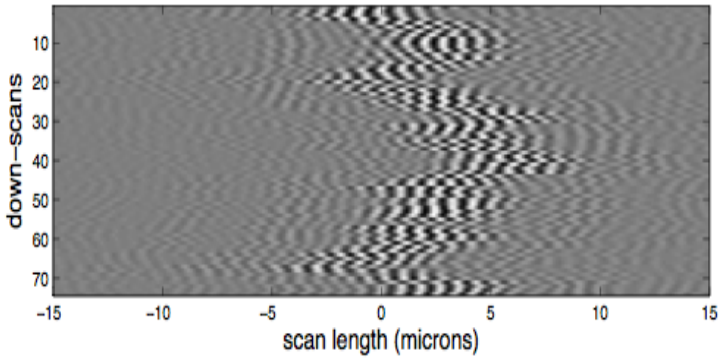
Kok et al., AO, submitted

Phase-referencing

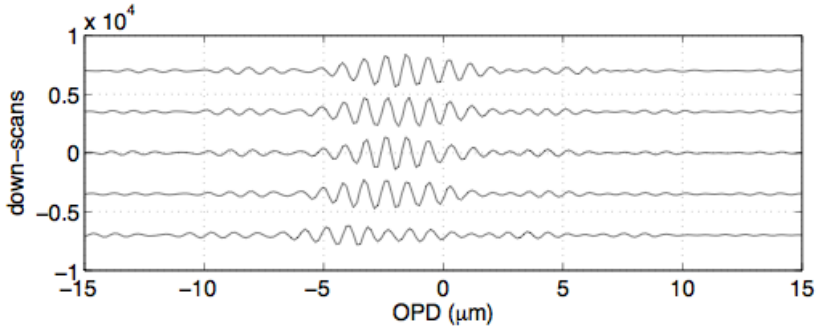
random fringe motion

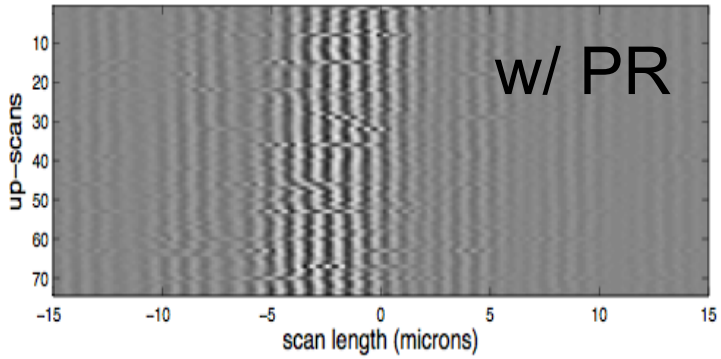


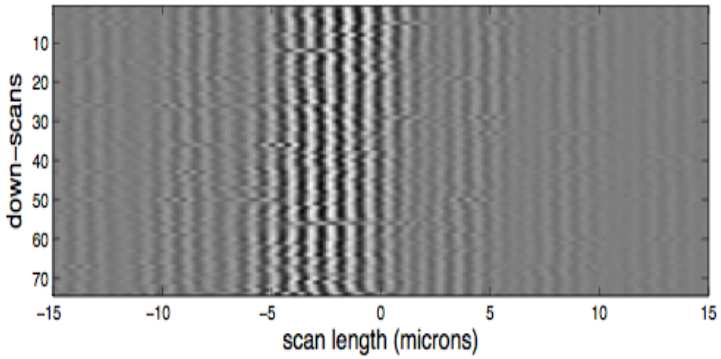




stabilized fringes

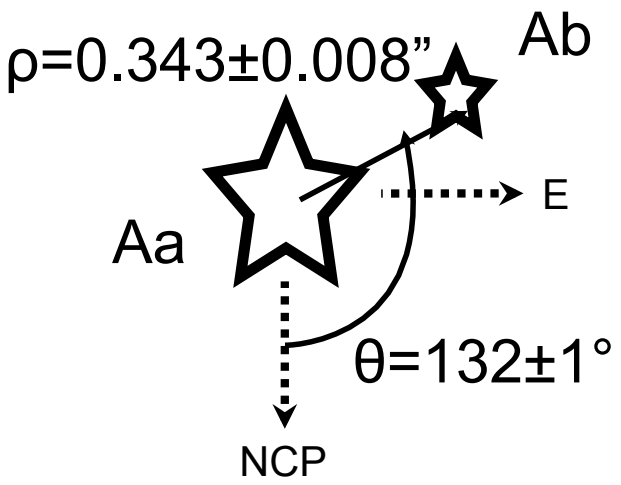


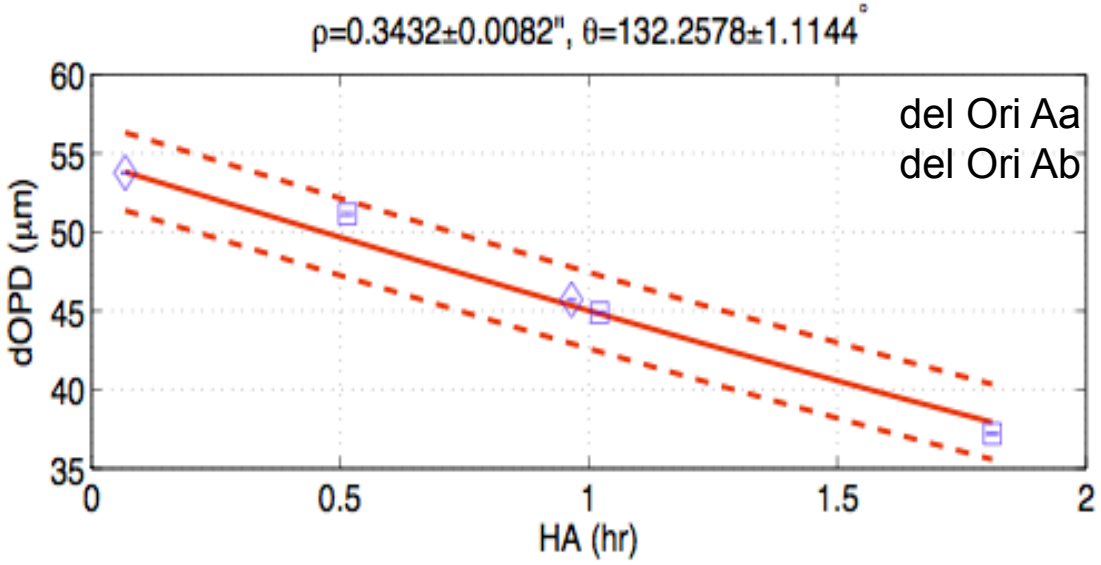


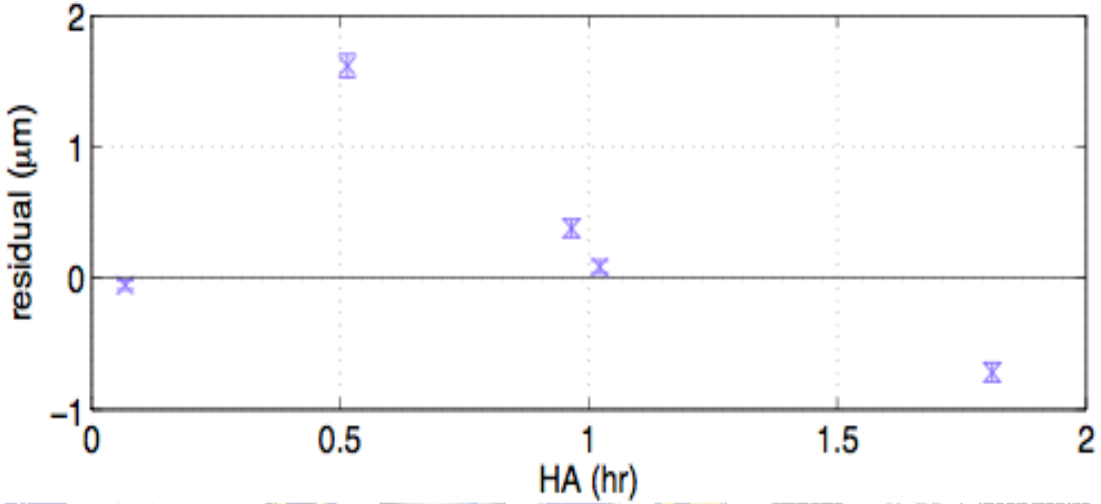


Kok et al., AO, submitted

position angle







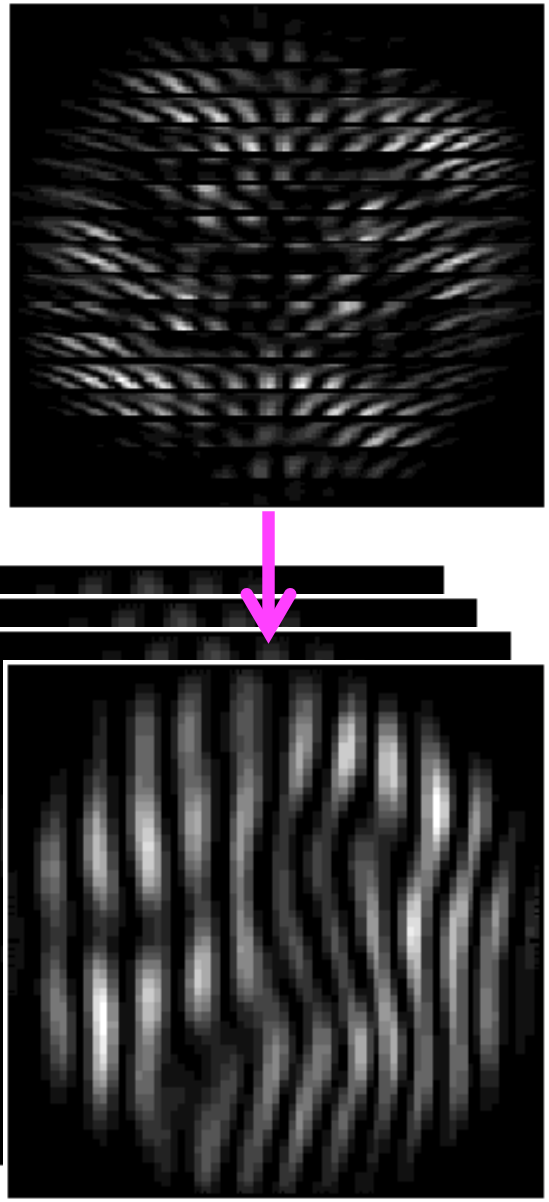
- 2 nights of data
- Preliminary astrometry
- Needs refinement

Milestones

- ✓ Hardware design and installation
- ✓ On-sky fringes (1st light: 2011)
- ✓ Self phase-referencing
- ✓ Dual star phase-referencing
- ▸ High-precision narrow-angle astrometry
- • Routine observations

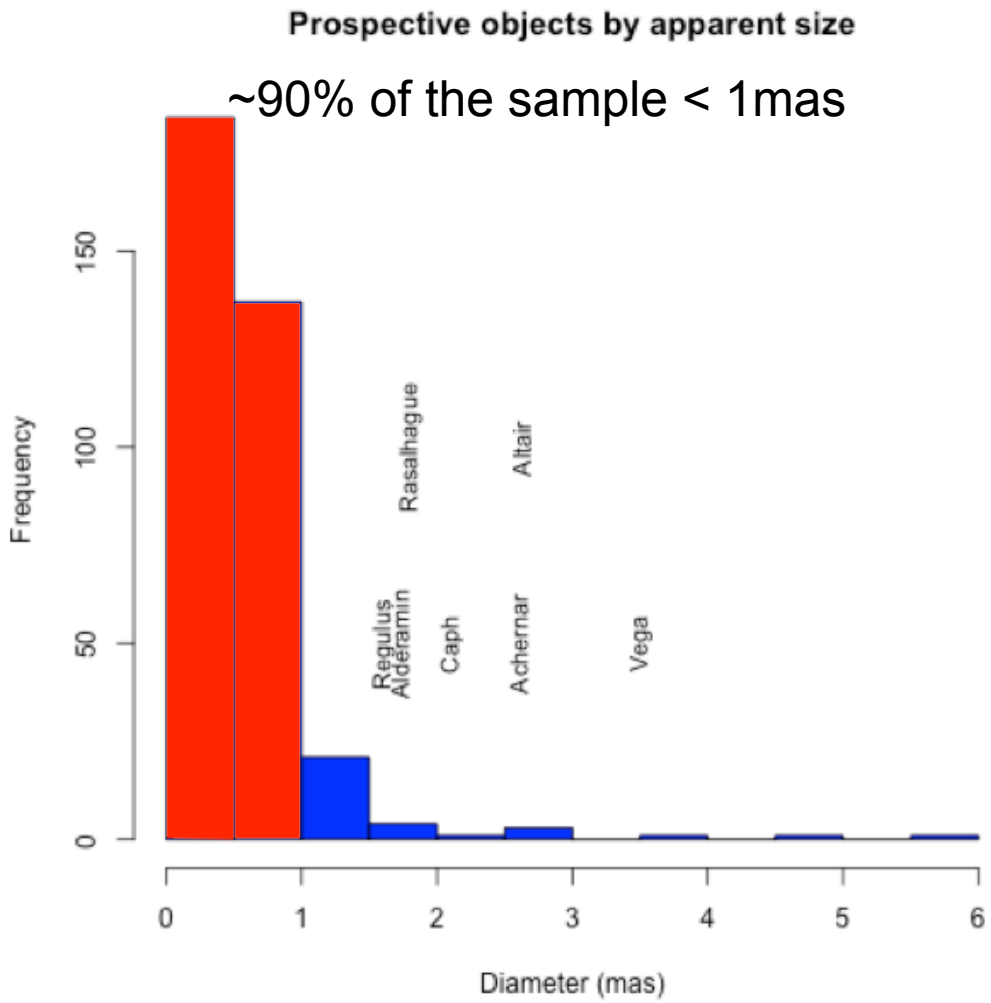
PAVO@CHARA update

Integral Field Unit
CHARA: 16 lenslets

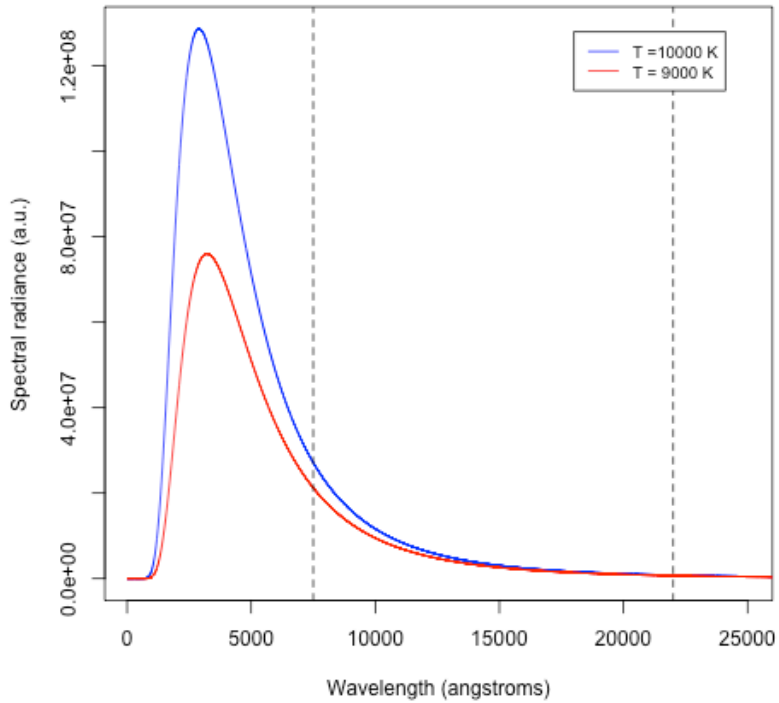


Vicente Maestro

Observing fast rotators with PAVO@CHARA



Black body spectral radiance (T_{eff} ~ 10000 K vs 9000 K)
Brightness contrast for surface temperature change a factor of >2 more than K



Observing fast rotators with PAVO@CHARA

Name	a (mas)	b (mas)	PA_p (°)
β Ser	0.73±0.02	0.61±0.02	-25±8
109 Vir	0.69±0.03	0.53±0.02	18±3
α Del	0.55±0.02	0.42±0.01	-21±5
ι Cyg	0.92±0.04	0.65±0.01	12±2