Stuck at the crossroads: where to now in interferometry implementation?

David Buscher
Chris Haniff
WHERE ARE WE NOW?
Interferometric science has made great strides in the last decade.
Technical progress has not been as good

• Limiting magnitude
  – 2003 (IOTA) K=7
  – 2013 (VLTI/CHARA) K~9

• Imaging/number of telescopes
  – 2003 (NPOI) N=6
  – 2013 (CHARA/NPOI) N=6

• Max baseline
  – 2003 (CHARA) B=330m
  – 2013 (CHARA) B=330m
Science output is stagnating
Where will we be in 2023?
We are becalmed
New science will come from new technical capabilities

- Better imaging (not astrometry)
- Fainter targets
- Longer baselines
- Higher dynamic range
- …
WHERE WILL TECHNICAL IMPROVEMENTS COME FROM?
Imaging needs more telescopes

- Number of u-v points
- Baseline bootstrapping
- Use parallel combiners for large N
Imaging needs movable telescopes
To go faint we need to be able to drive the active systems

- Limiting factor is fringe acquisition/tracking
- Good seeing (spatial/temporal) is a must
- Infrastructure must preserve the coherent photons
We can go fainter now
Bigger telescopes need more photons to drive the AO

![Graph showing the relationship between variance and Zernike radial order. The y-axis represents variance on a logarithmic scale ranging from $10^{-3}$ to $10^0$, and the x-axis represents Zernike radial order from 1 to 9.]
Laser guide stars can help
Cost per telescope becomes a limiting factor

- Telescope + enclosure + foundation costs scale as $\sim D^2 - D^3$
- Lightweight telescopes?
- Wind loading $\Rightarrow$ enclosure & foundation costs will then dominate
Longer baselines require only a suitable site
A vision for a mid-scale array

- R-L band operation, spectrally-dispersed
- 10-15 movable telescopes
- 1.5-2m diameter
- Low-order NGS AO
- eAPD spatially-filtered fringe tracker, H~14-15
- Max baseline ~500m
- Good seeing
Inter-continental collaboration will be needed

- Cost ~ $100M
- US decadal will come too late
  - NSF Mid-scale
  - Private funds
- ESO will be overrunning on E-ELT
  - Institutional funds?
  - Go direct to EU?
- Chinese involvement?
Using a developed site will make significant savings