



Adaptive Optics for the CHARA Array

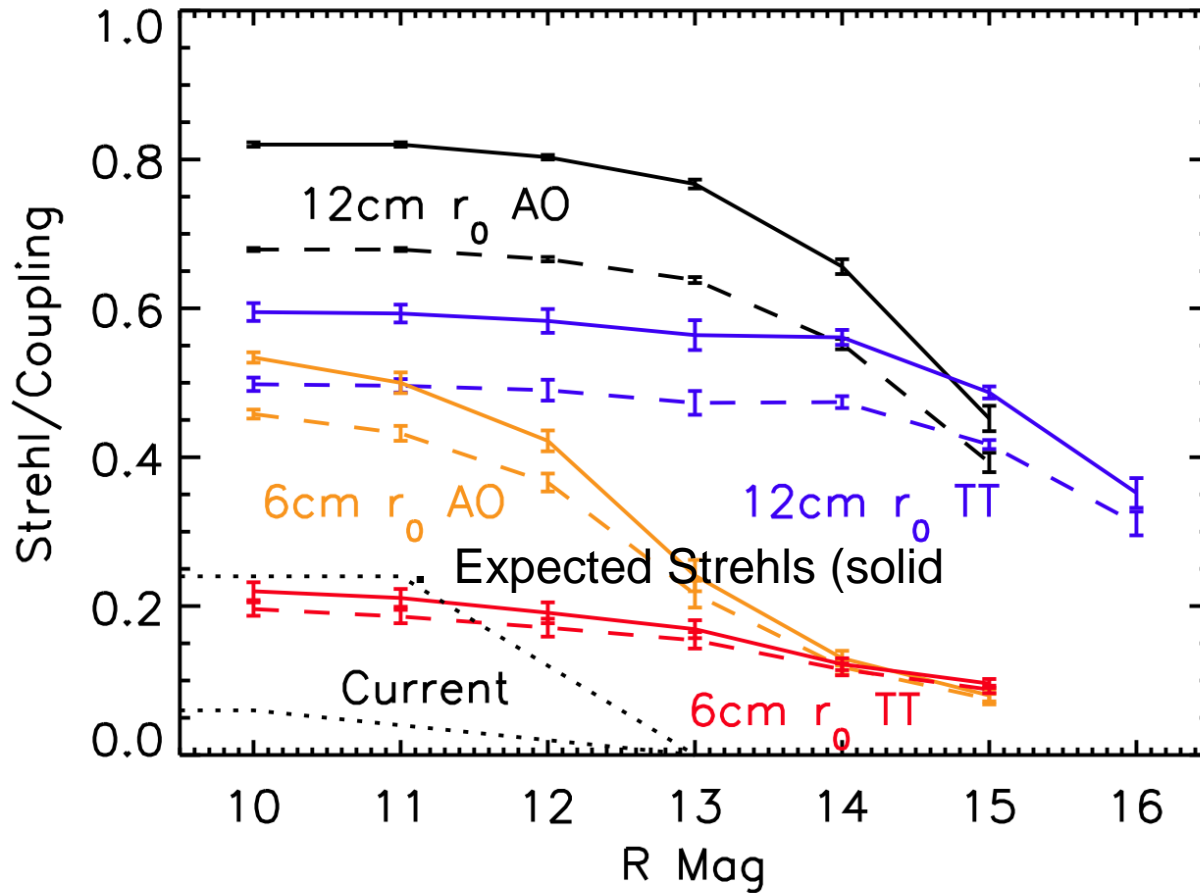
Steve Ridgway





CHARA AO History

- ATI (2007)
 - **Enabling Infrared and Visible Interferometric Imaging Science at the CHARA Array - \$673K**
- SPIE 7013, 102R (2008) – Marseille
- MRI-R2 (2009)
 - **Development of Adaptive Optics for the CHARA Array- \$1997K**
- SPIE 7734, 77340B (2010) – San Diego
- ATI (2010)
 - **Adaptive Optics for the CHARA Array - \$2300K**
- Main participants: Theo ten Brummelaar, Hal McAlister, John Monnier, Michael Ireland, Laszlo Sturmann, Chris Dainty, Chris Shelton



Expected Strehls (solid lines) and coupling to single-mode fibers (dashed lines) in H-band from our Monte-Carlo AO simulations. The “AO” curves correspond to the performance of the AO system as proposed. The “TT” curves correspond to improved tilt-only correction, as provided by just Phase I of the proposal.



Sensitivity Improvements Expected

Table 1. Sensitivity Improvements (magnitudes) using Adaptive Optics at CHARA
(value in parenthesis shows Phase I only "Static Correction + Tip-tilt" upgrade)

| | R band (tracking) | J band | H band | K band |
|-------------------------------------|-------------------|----------------|----------------|----------------|
| "poor" seeing ($r_0=7.0$ cm) | +2.7 (+2.7) | +3.5 (+2.1) | +1.8 (+1.1) | +1.1 (+0.7) |
| "excellent" seeing ($r_0=12.0$ cm) | +4.7 (+4.7) | +2.9 (+1.9) | +1.5 (+1.0) | +0.9 (+0.6) |



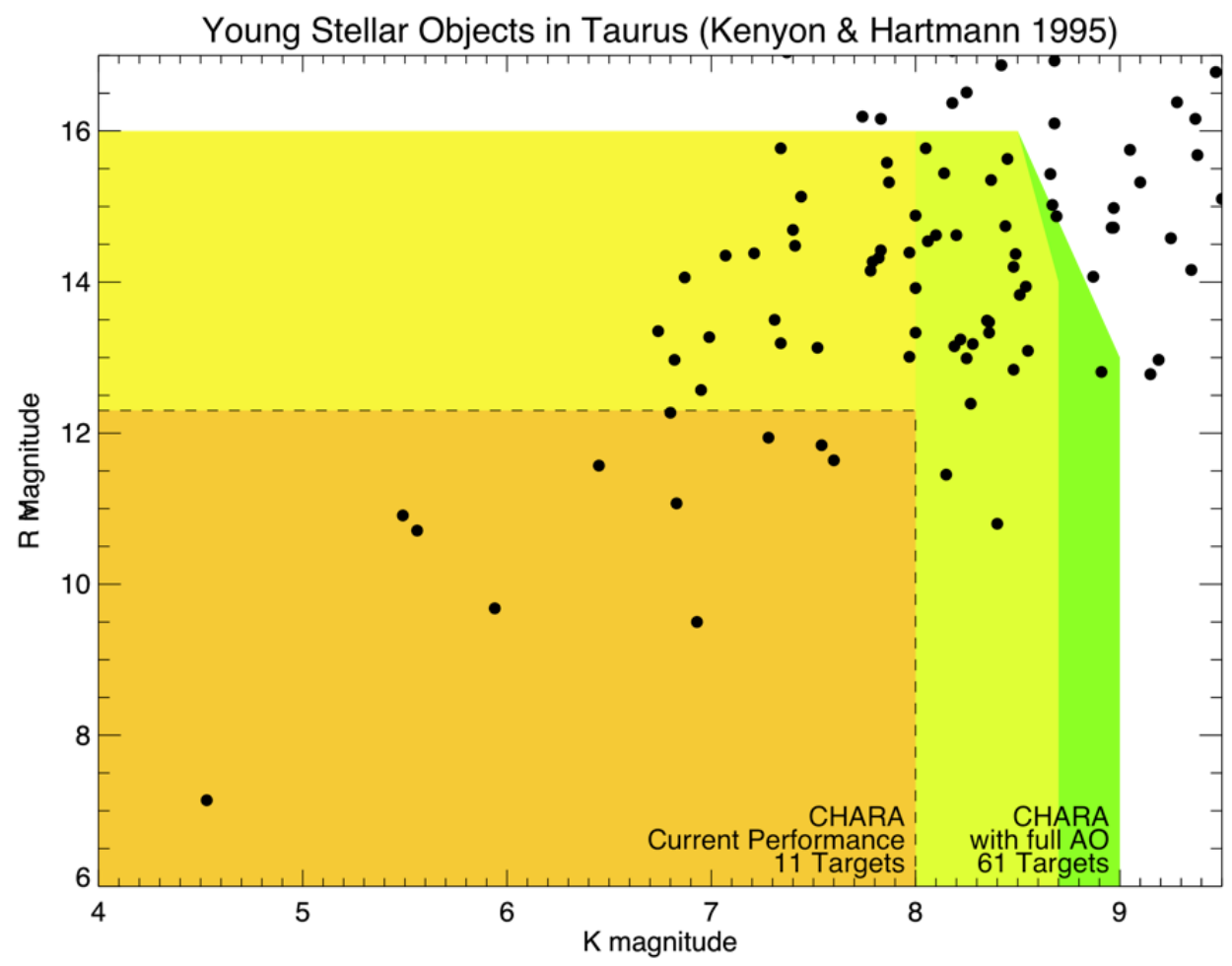
Enabled Science

- Key project
 - Revealing the nature of T Tauri disks
 - New discovery areas
 - AGN
 - Microquasars





Observable YSO's



LESIA



Observatoire de la CÔTE d'AZUR



The Layout

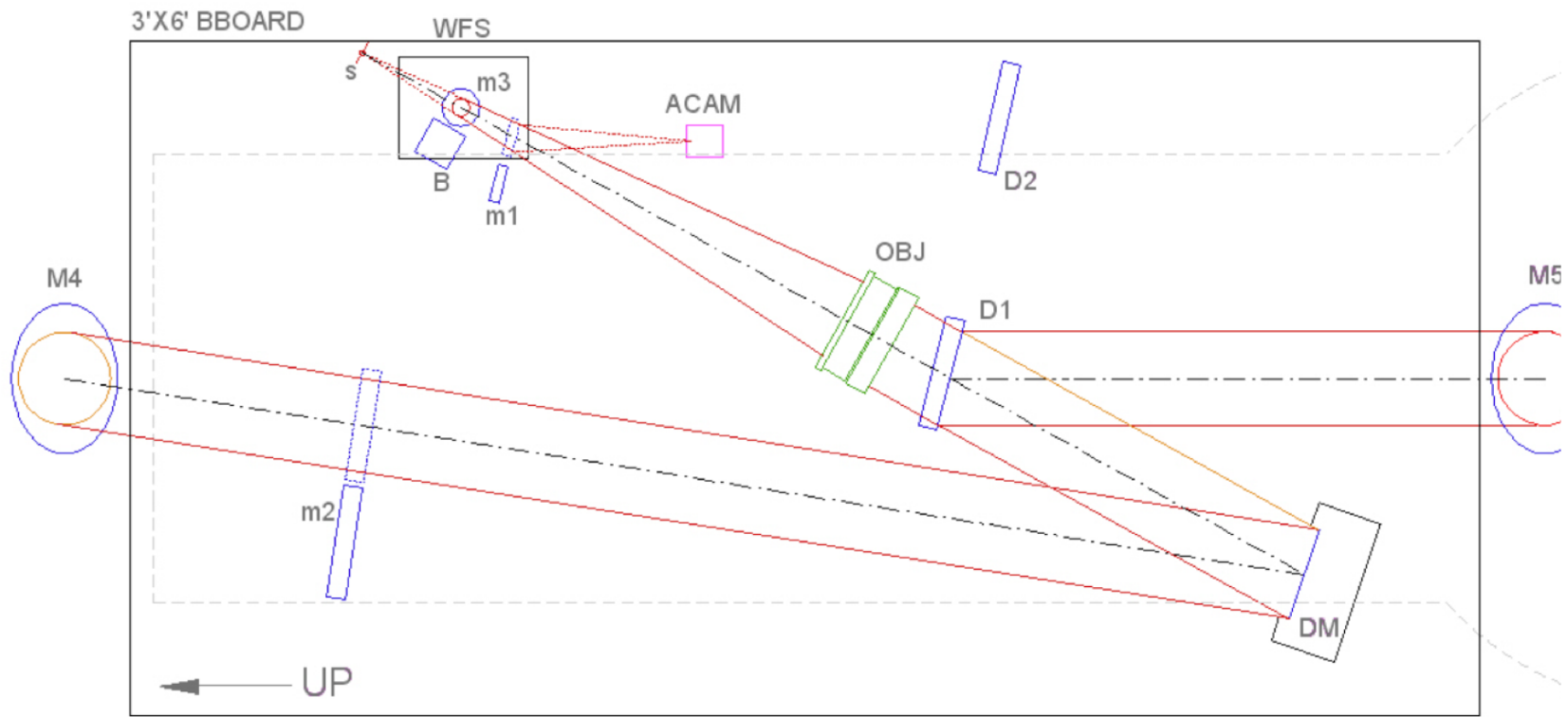


Fig 7. The *Big Beam* layout (rotated by 90 degrees), with the components between the existing M4 and M5 telescope mirrors on the side of the telescope mount. In this position the instrument will be fixed with respect to gravity, and is easily accessed. It will be enclosed except for remotely actuated entrance and exit apertures.



Personnel

- CHARA staff
- U Michigan Subcontract
 - Wavefront sensor
- Chris Shelton subcontract
 - Systems Engineer
- Design review board
 - R. Dekany, B. Ellerbroek, B. Oppenheimer



Project cost and Phasing

A less expensive Phase I program, one that includes the detector systems only, is an option for funding at a lower level should the funding not be available for the complete system. This would provide all the benefits of improved tip-tilt performance, as well as wave front diagnosis, providing a substantial fraction of the science, as well as enabling the complete Phase II system for an alternative funding stream or for a future time.

- Full project ~ \$2.3M
 - hardware \$1.1M
- Phase I only (tip-tilt correction) – costs less

A Technical Issue - dichroics

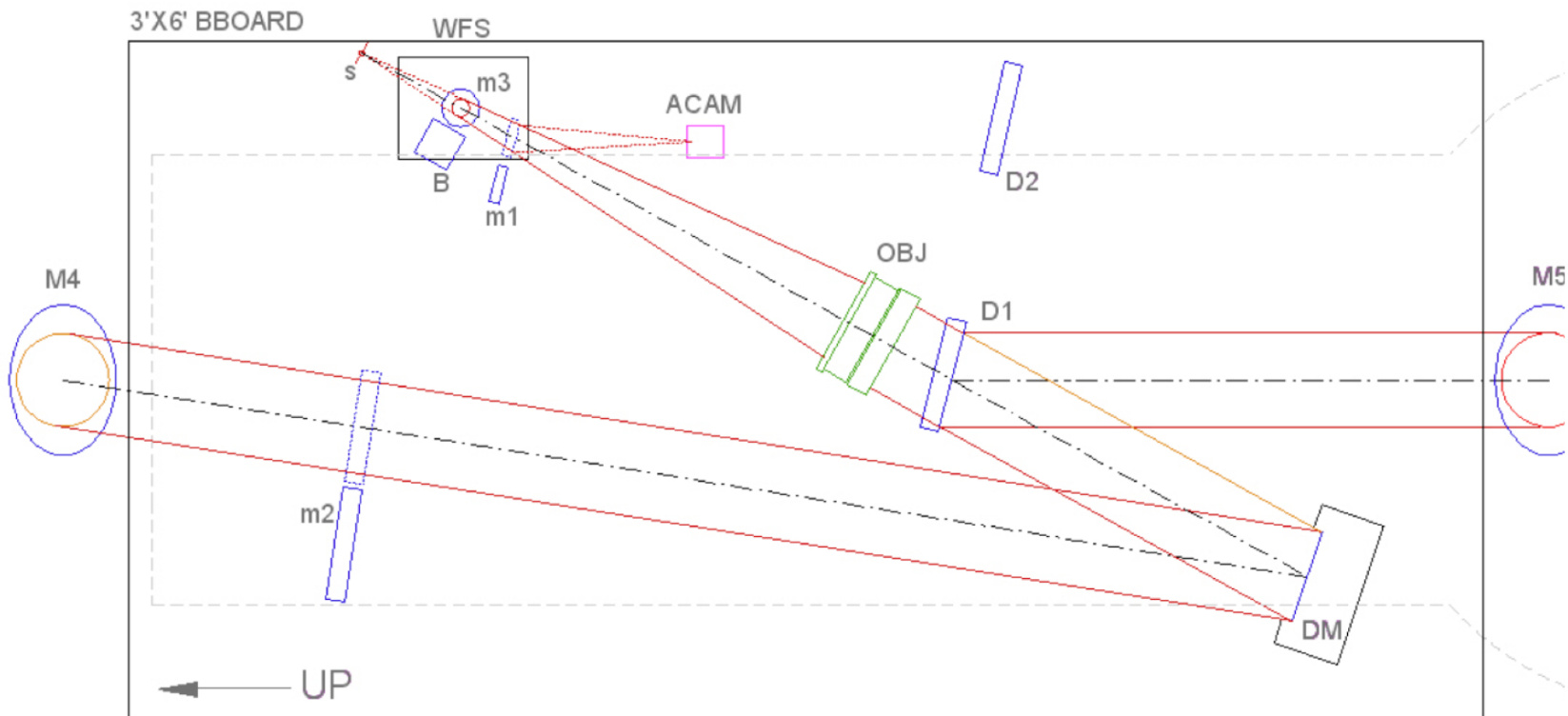


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