Status Update: Magdalena Ridge Observatory Interferometer

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On behalf of the NMT and Cambridge Teams
Magdalena Ridge Observatory

- Federally funded 2000-2011
- EIS completed in 2003
- Two facilities at MRO
  - Fast-tracking 2.4m
  - NIR/Optical 10-element interferometer
- 2.4m scope started full operations Aug, 2008
- 75% NASA/DoD funded

- MROI is 10 1.4m movable afocal telescopes in equilateral Y configuration
- Optical and near-IR operation
- Baselines from 7.8 to 340m
- Minimized reflections
- Design optimized for imaging mission
MROI Key Science Mission

- **AGN:**
  - Verification of the unified model
  - Determination of nature of nuclear/extra-nuclear starbursts
  - $H = 14$ gives >100 targets.

- **Star and planet formation:**
  - Protostellar accretion, imaging of dust disks, disk clearing as evidence for planet formation
  - Emission line imaging of jets, outflows and magnetically channeled accretion.
  - Detection of sub-stellar companions.

- **Stellar accretion and mass loss:**
  - Convection, mass loss and mass transfer in single and multi-star systems
  - Bipolarity and collimation of circumstellar material, wind and shock geometries.
  - Pulsations in Cepheids, Miras, RV Tauris, etc.
Requirements Flowdown

- Telescope diameter of 1.4 m
  - H magnitude = 14 for group delay tracking limit
- Spatial scales of 0.3 to 30 mas
  - Baselines from 7.8 to 340 m (for 0.6-2.4 microns)
- Moderate-to-high spectral resolutions
  - Separate fringe tracking and science cameras
- High throughput to achieve sensitivity limit
  - Fifteen reflections from primary to detectors
  - Optimized coatings for 0.6-2.4 microns
- Large number of telescopes
  - Optimized for model-independent imaging
Walk through the Optical Path

1.4m Unit Telescope and enclosure

Beam Transport Lines
Enhanced silver, 30 deg incidence in air

Vacuum Delay Lines
"Cat's-Eye" retro-reflecting telescope carried on moving cart in vacuum

Beam Turning Area
Enhanced silver, 30 deg incidence in vacuum

Beam Combining Area
15 deg incidence, dichroic mirrors for selective reflection of different wavelengths

10cm beam dia
2 mirrors comprising Mersene 6.66 x Beam reducing telescope

Exit Vacuum Window
Vacuum Delay Line

15mm exit beam

These outputs to switchyard and beam Combiner

Visible
J Band
H Band
K Band

Alignment Laser for back propagating alignment beam

Metal Film Mirror

Beam Combining Facility

Low Noise Detector
Beam Combiner
Unit Telescopes

- Designed/built by AMOS
  - 1.4m aperture
  - afocal alt-alt design
  - polarization preserving
  - 62 nm rms wavefront
  - UT1 expecting to ship later this year
  - UT2-3 ordered

02/29/2012 CHARA Science Meeting 6
UT Enclosures

- Designed by EIE
- Builder selected
- Houses and transports UTs
- Allows close-packed configuration to 30 deg elevation without vignetting for 6 hour tracks
Foundations and Beam Transport

- Designed M3 and built by MRO
- Supports 3 UTs per beamline with 0.5 mbarr vacuum from UT to BCA
- Install for piers for inner array began 2010
- Houses all components of automated alignment system
Automated Alignment System

Designed and built by MRO

End-to-end alignment of tilt and shear enclosed in a "Magical Optical Box"

Custom quad cells and beam injection via fibers
Beam Combining Facilities

- Thermal & vibrational stability
- Supports full array
- Single-pass DL section 190 m long
Delay Lines

- Designed/built Cambridge
- Innovative approach
- Inductive pick-up & wireless communications
- DL1 install to about 100m
Science Instrument - SIRCUS

- MRO conceptual design
- J, H, K with R~30 and 300; studying higher R
- One design: 4-way image plane combination with fast-switching to combine 6 beams in ~100 sec

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Performance:
SNR per spectral channel in 100 sec at R~30 with 0.7” seeing and RN=5e-
Scientific Schedule for MROI

- Technical Phase – Key observations that quickly demonstrate technical competencies
- Science Phase – Scientific observations that produce transformational changes to understanding of astrophysical phenomena
- Open Time Phase – Release of facility to broader community through public funding
Funding Issues

- No more earmarks*
- Currently operating on university funds
- No anticipation of state educational bond this year
- Pursuing other avenues
- Expect to know more by SPIE

* Earmarks may return in 2013
New Website
Thank you for your attention!

- **PI:** Van Romero
- **Deputy PI:** R. Cervantes
- **Prog. Director:** I. Payne
- **System Architects:** C. Haniff, D. Buscher
- **Proj. Scientist:** M. Creech-Eakman
- **Proj. Manager:** R. Selina


- **Cam. Team:** R. Boysen, J. Coyne, M. Fisher, B. Seneta, D. Sun, D. Wilson, J. Young