Overview of CHARA AO
Planning and Concepts

Steve Ridgway
Mar 17, 2009
CHARA Collaboration Year-Five Science Review

M2 (fast tilt)
M3
M4

Space for optics

In vertical plane

<-----------------------------On-telescope ----------------->

Catseye on moving cart for adjustable delay

Beam diameter 125 mm

M5
M6
M7

Beam combination

Compressor

IR

Vis

Tilt detection

Beam diameter 19 mm

Optical Layout
Current AO Expert Contacts

• University of Galway
  – Chris Dainty, Derek Cobourn, Alexander Goncharov, Nicholas Devaney

• ALPAO
  – Frédéric Rooms
Raw Visibility

Cumulative Probability

Visibility

2006
2005
2004
AO Concept 1

Beam diameter 125 mm

Beam diameter 19 mm

Catseye on moving cart for adjustable delay

Compressor

Beam combination

IR

Vis

Slow WFS

Beam combination

WFS

DFM
AO Concept 2

M1

M2 (fast tilt)

M3

M4

Beam diameter 125 mm

Beam diameter 19 mm

Catseye on moving cart for adjustable delay

Compressor

IR

Vis

Fast WFS

Beam combination

Beam combination

On-telescope
AO Concept 3

Beam diameter 125 mm

Beam diameter 19 mm

WFS

On-telescope

Catseye on moving cart for adjustable delay

Compressor

DFM

IR

Vis

Slow WFS

Beam combination

Beam combination
AO Concept 4

Beam diameter 125 mm

Beam diameter 19 mm

Catseye on moving cart for adjustable delay

Compressor

IR

Vis

WFS

Beam combination

On-telescope

DFM
ALPAO Performance - K band

Star V=7.1

$T_{wfs} = 0.8\%$ (Expected >2.5%, or 80%)

(=> >1 mag, or 5 mag)
ALPAO Performance - H band

Star V=7.1

$T_{\text{wfs}} = 0.8\%$ (Expected $>2.5\%$, or 80%)

(=> $>1$ mag, or 5 mag)
ALPAO Performance - J band

Star V=7.1

\[ T_{\text{wfs}} = 0.8\% \text{ (Expected } >2.5\%, \text{ or } 80\%) \]

\( \Rightarrow \text{ >1 mag, or 5 mag} \)
## CHARA Performance Summary - no AO

<table>
<thead>
<tr>
<th>Mode</th>
<th>Telescopes</th>
<th>Band</th>
<th>Typical limit</th>
<th>Best performance</th>
<th>At Spectral Resolution R=</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquisition</td>
<td>2</td>
<td>V-R</td>
<td>10.0</td>
<td>12.0</td>
<td>Broad band</td>
</tr>
<tr>
<td>Tilt tracking</td>
<td>2</td>
<td>V-R</td>
<td>10.0</td>
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<tr>
<td>FLUOR (standard)</td>
<td>2</td>
<td>K band</td>
<td>4.5</td>
<td>6.0</td>
<td>Broad band</td>
</tr>
<tr>
<td>FLUOR (grism)</td>
<td>2</td>
<td>K Band</td>
<td>??</td>
<td>??</td>
<td>100</td>
</tr>
<tr>
<td>CLASSIC</td>
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<td>7.0</td>
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</tr>
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<td>8.5</td>
<td>Broad band</td>
</tr>
<tr>
<td>PAVO</td>
<td>3</td>
<td>R-I</td>
<td>6.5</td>
<td>8.2</td>
<td>50</td>
</tr>
<tr>
<td>VEGA</td>
<td>2</td>
<td>1 band, 150nm 480-820</td>
<td>6.5</td>
<td>7.2</td>
<td>1700</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2 bands, 30 &amp; 45nm 480-820</td>
<td>5.5</td>
<td>5.8</td>
<td>5000</td>
</tr>
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<tr>
<td>MIRC</td>
<td>4</td>
<td>J-H</td>
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<td>10.0</td>
<td>12 -&gt; (14.5)</td>
<td>Broad band</td>
</tr>
<tr>
<td>FLUOR (standard)</td>
<td>2</td>
<td>K band</td>
<td>4.5 -&gt; 6</td>
<td>6 -&gt; 7</td>
<td>Broad band</td>
</tr>
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Funding Opportunities

• Keck Foundation
  – Any time
  – Any amount

• Air Force Support for University AO
  – August every year, up to $1M, average $235K.
  – For research equipment

• NSF ATI
  – November 1, 2009, up to $2M
  – In 1995-99, success rate 30%, avg award $331K

• NSF MRI
  – January 2010, NSF-wide, up to $2M ($4M)
  – Requires cost sharing (30%)!
  – In 2007, success rate 29%, avg award $402K