Adaptive Optics at the German Solar Telescopes

Thomas Berkefeld, Dirk Soltau
Kiepenheuer-Institut für Sonnenphysik, Freiburg, Germany
The German Solar Telescopes
Observatorio del Teide, Tenerife, Spain

VTT (70cm)

GREGOR (150cm)
under construction
Adaptive Optics Projects

- AO at the VTT: KAOS January/July 2002
- MCAO at the VTT: MultiCAOS soon
- AO for GREGOR Q4 2004
- MCAO for GREGOR money!
Basics of the VTT AO KAOS

- 70 cm telescope aperture
- diffraction limited (0.17" @ 500nm) for seeing better than 0.9"
- ca 25 corrected mirror eigenmodes
- control loop frequency 950 Hz
- 8 CPU Sun Workstation as control computer
KAOS Wavefront Sensor

- FFT crosscorrelating Shack Hartmann
- 36 subapertures (10cm/subaperture)
- 24x24 pixels/subapertures, 12" FOV
KAOS Deformable Mirror

- bimorph mirror
- 35 electrodes
- 50 mm clear aperture
- 900 Hz resonance frequency
KAOS running since January 2002

uncorrected

corrected
Mercury transit as seen by KAOS
May 7, 2003
Mercury transit as seen by KAOS
May 7, 2003
Granulation with KAOS
MultiCAOS at the VTT

- corrected FOV 10" -> 30"
- correction of the differential TipTilt
- extension of KAOS
- testbed for the MCAO at GREGOR
MultiCAOS Wavefront Sensor

- additional wide field sensor (30" FOV)
- 7 subapertures (23cm)
MultiCAOS additional Deformable Mirror

- OKO membrane mirror
- 37 electrodes
- curved mean surface
- small stroke
Test of MultiCAOS at the Prime Focus of the VTT
Test of MultiCAOS at the Prime Focus of the VTT

-> Next Step: Lock on the Sun!
Basics of the GREGOR and its AO (First Step)

- 150 cm telescope aperture
- scaled-up KAOS
- diffraction limited (0.08"@500nm) for seeing better than 0.7"
- 52 corrected Karhunen-Loeve modes
- control loop frequency 1 kHz
Basics of the GREGOR AO (First Step)

78 subaperture SH sensor (15cm/subaperture)  

68 actuator bimorph mirror (50mm pupil)
Second Steps for the GREGOR AO
(what we would like
but presently have no money for)

- High order AO (150 deg. of freedom)
at M5 (saves 5 mirrors)
or at M12 again

- MCAO: 60" corrected FOV, uses spare bimorph DM and spare
WFS camera for correcting tropopause turbulence r0 > 50cm