The MOTH II Experiment: Probing the Solar Atmosphere at Multiple Heights

S. Jefferies[1], N. Murphy[2], B. Fleck[3], S. McIntosh[4], T. Straus[5], C. Giebink[1], W. Giebink[1], L. Heida[1], W. Rodgers[6], J. Sasian[7]

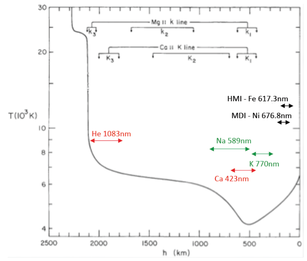
[1]Univ. of Hawaii, [2]JPL, 3ESA, [4]HAO, [5]INAF/OAC, [6]Eddy Company, [7]Univ. of Arizona

Science

Science Targets:

- Heating mechanisms of chromosphere/corona
- Properties of solar turbulence
- Solar sub-surface structure and dynamics
- Magnetic field evolution, reconstruction and extrapolation
- Detection and characterization of magneto-acoustic gravity waves

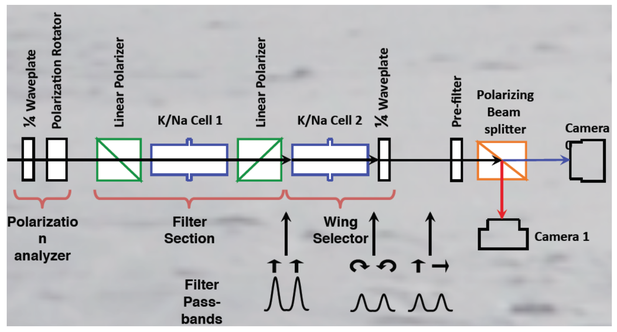
- MOTH II is comprised of four instruments, each with a different MOF (K, Na, Ca & He) [Ca channel not implemented yet]



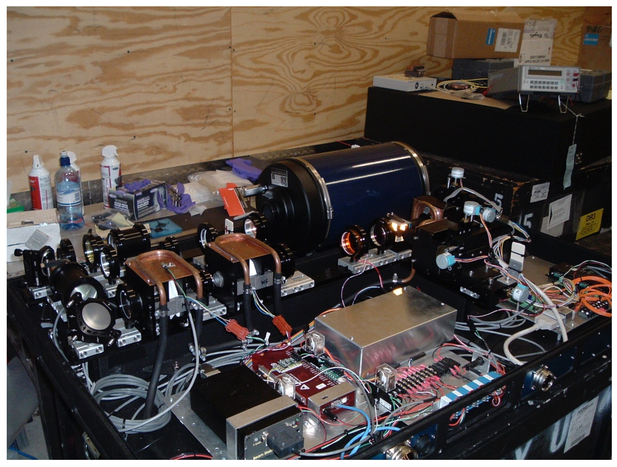
Aperture	20 cm
Field-of-view	30 arc seconds
Spectral lines	769 nm (K) 589 nm (Na), 1083 nm (He) 422 nm (Ca)
Diameter of Solar Disk	950 pixels (i.e. ~ 4 arc sec resolution)
FWHM of instrument PSF	2 pixels (i.e. Nyquist sampling)
Maximum image cadence	1 Hz
Image stabilization	Instrument Box: Tip/tilt correction at 400 Hz Tracking platform: Slow guiding at 0.5 Hz
MOF bandpass	~ 50 mÅ
LOS magnetic field sensitivity	< 5 Gauss in 5 seconds

Instrument specifications

Instrument Design



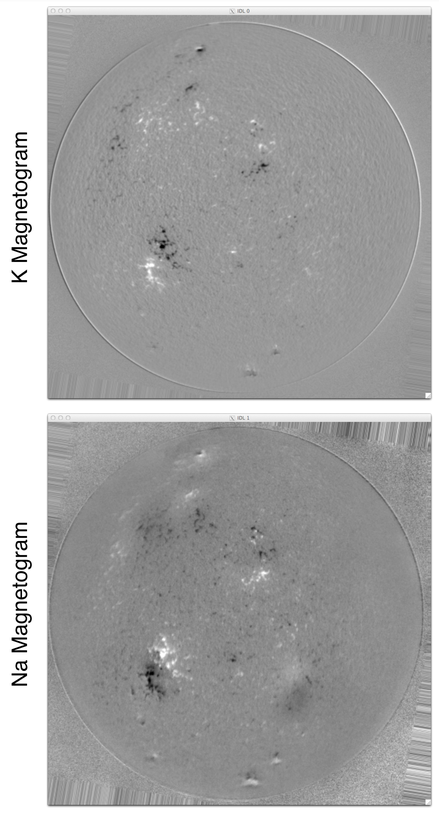
Schematic of a magneto-optical filter

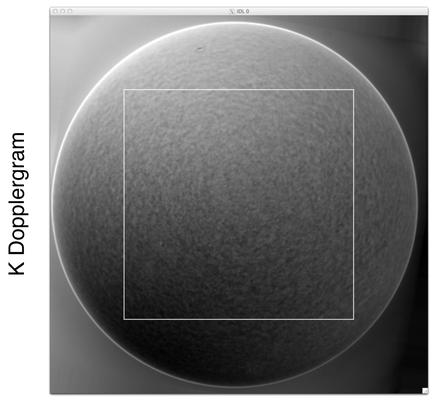


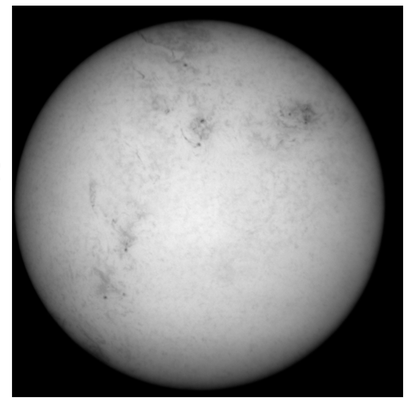
MOTH II setup in laboratory

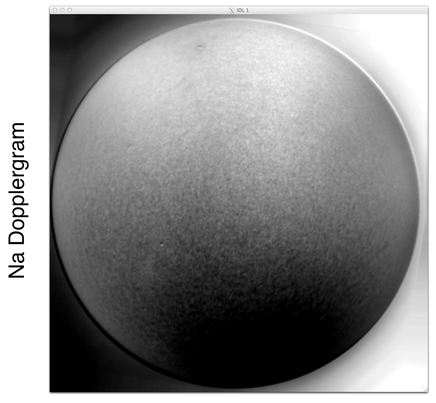
Future:

- Move to 2kx2k cameras (2 arcsec resolution)
- Routine observations from Haleakala
- Extended campaigns at South Pole







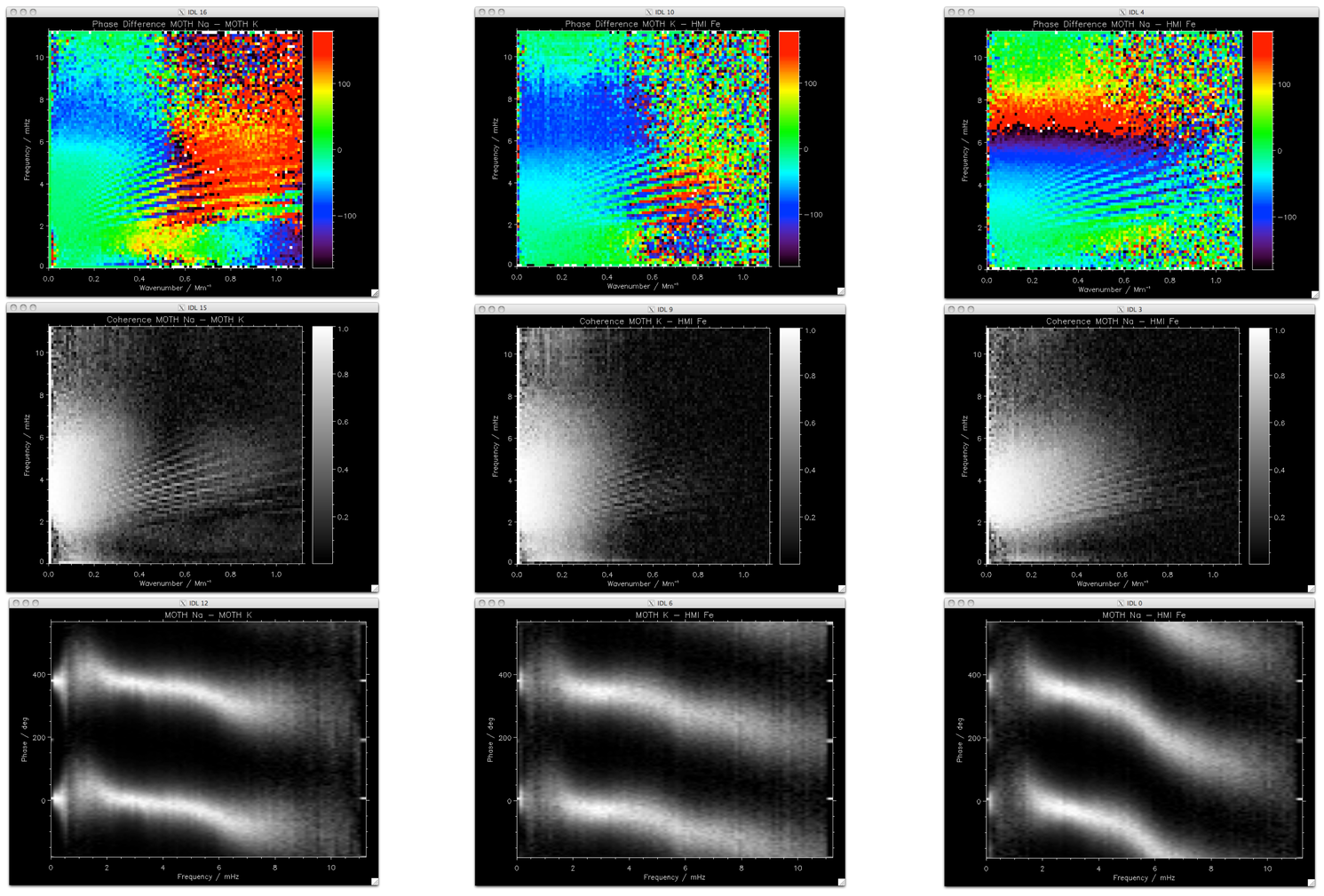


First test run at Mees Solar Observatory on 2 Nov 2012 18:36 UT - 20:42 UT.

Left: Raw Dopplergrams and magnetograms in Na D and K

Top: Intensitygram in He 10830

Below: k-ω phase and coherence spectra and 1D phase diagrams between
left: MOTH Na - Moth K (Δz ~ 200 km)
middle: MOTH K - HMI Fe (Δz ~ 300 km)
right: MOTH Na - HMI Fe (Δz ~ 500 km)



MOTH Na - MOTH K | MOTH K - HMI Fe | MOTH Na - HMI Fe