

Polarization measurements in the solar atmosphere

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COST ACTION ON POLARIZATION
1ST WG MEETING
WARSAW 7-9 MAY 2012



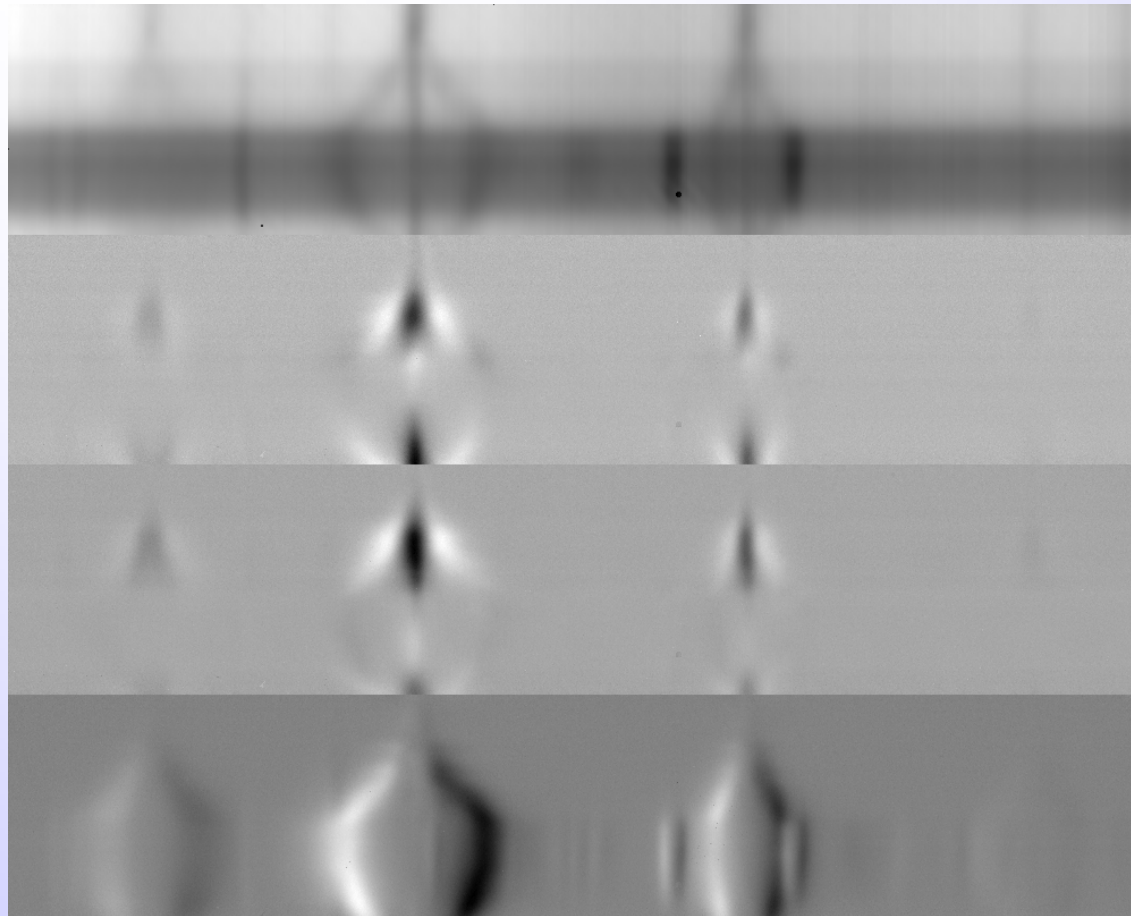
SOLAR SPECTROPOLARIMETRY

- Powerful technique to probe the solar atmosphere



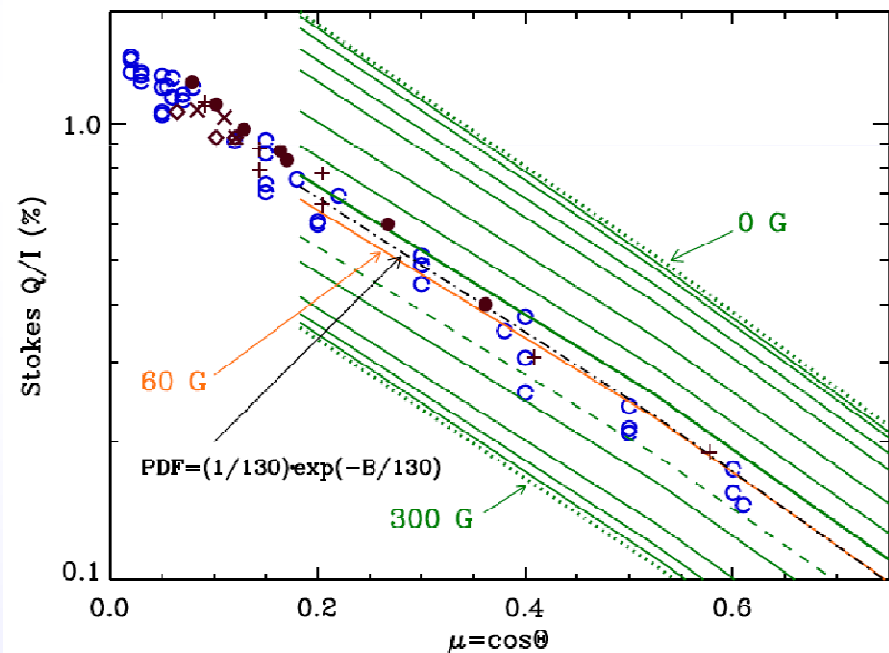
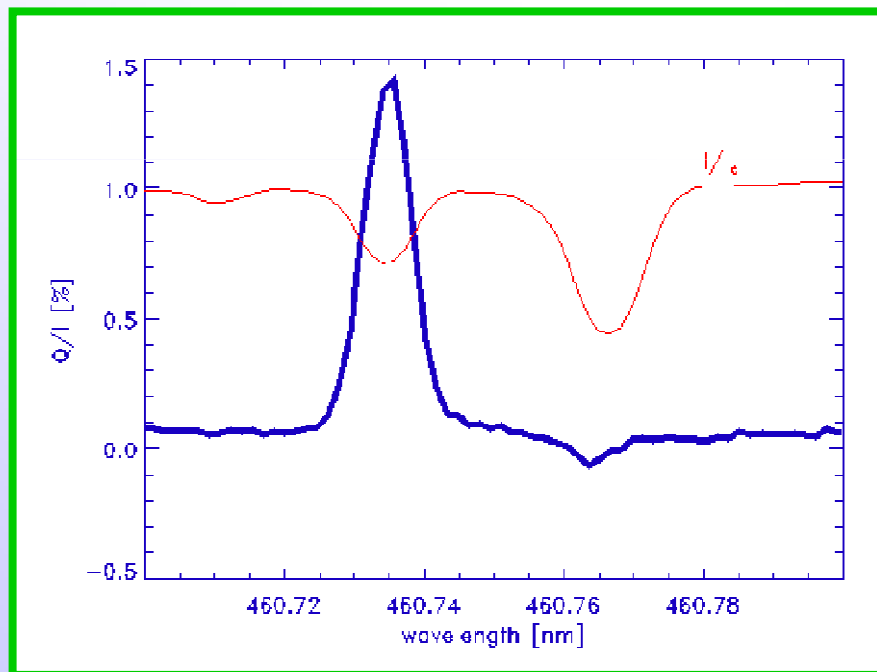
SOLAR SPECTROPOLARIMETRY

- Powerful technique to probe the solar atmosphere
- Magnetic diagnostics via Zeeman effect



SOLAR SPECTROPOLARIMETRY

- Powerful technique to probe the solar atmosphere
- Magnetic diagnostics via Zeeman effect
- Magnetic field diagnostics via Hanle effect

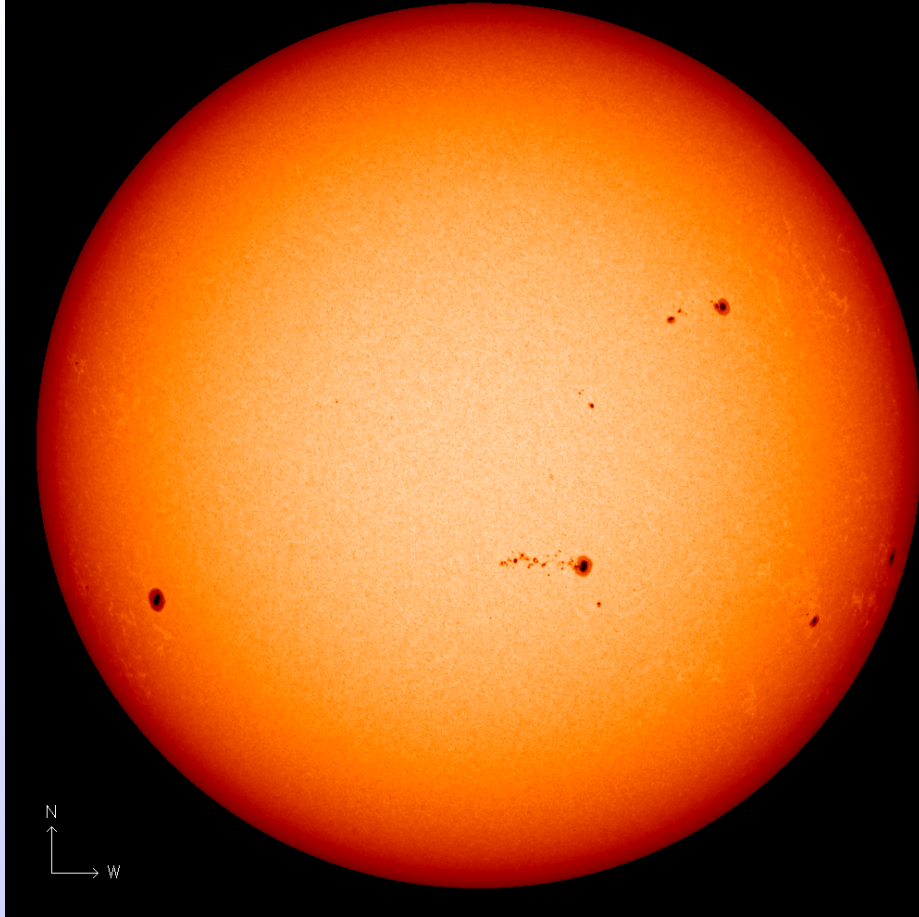


Trujillo Bueno et al. (2005)



A SHORT OVERVIEW OF SOLAR MAGNETISM

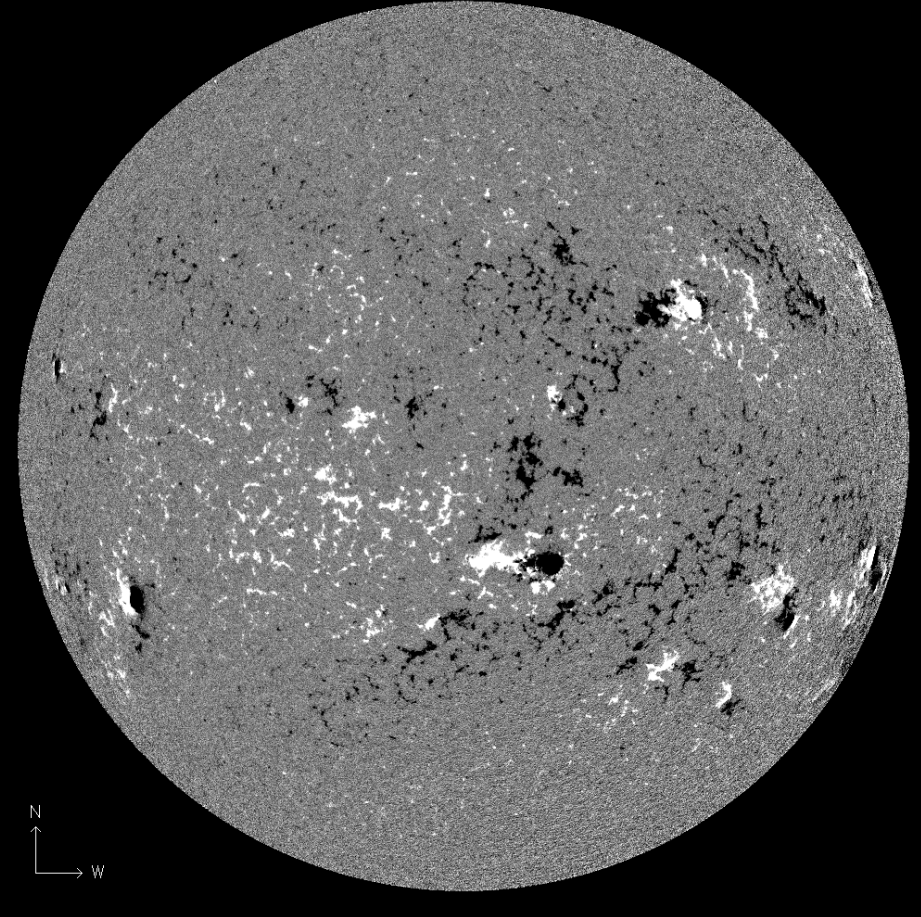
MDI Intensitygram: 2002.06.09_11:12



**Continuum
(Photosphere)**

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MDI Magnetogram: 2002.06.09_07:59

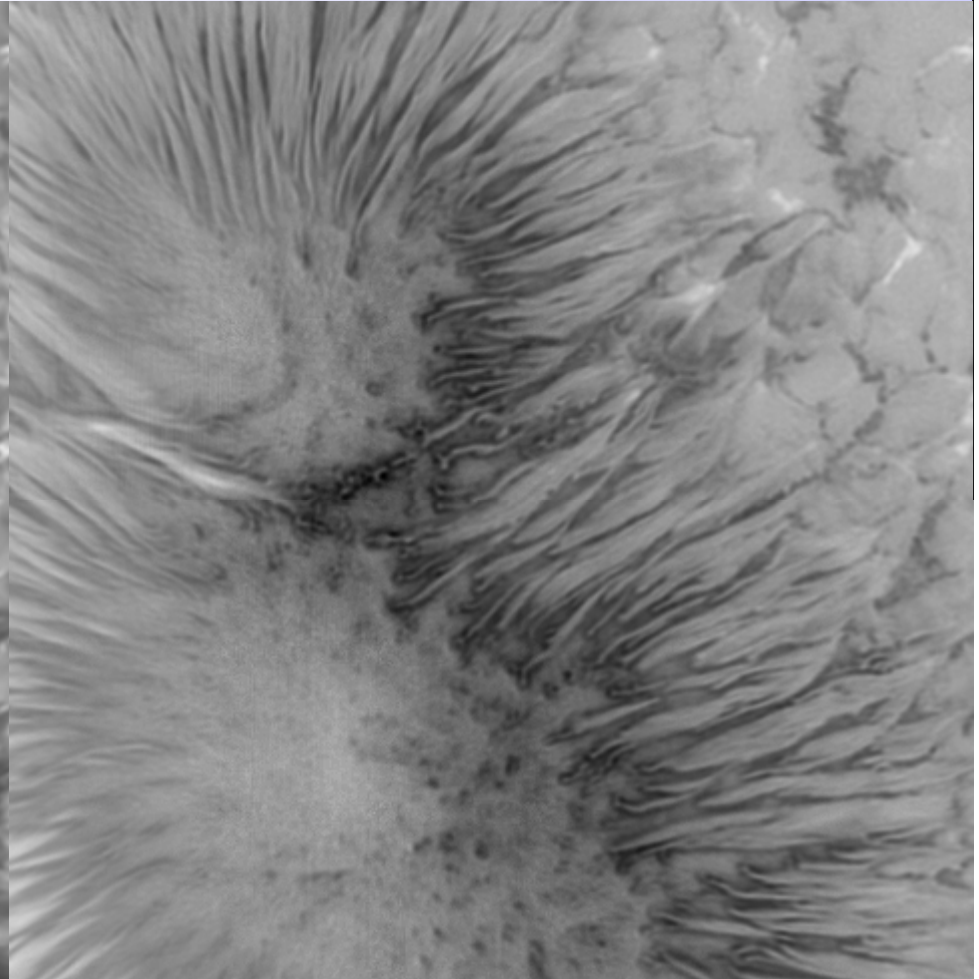
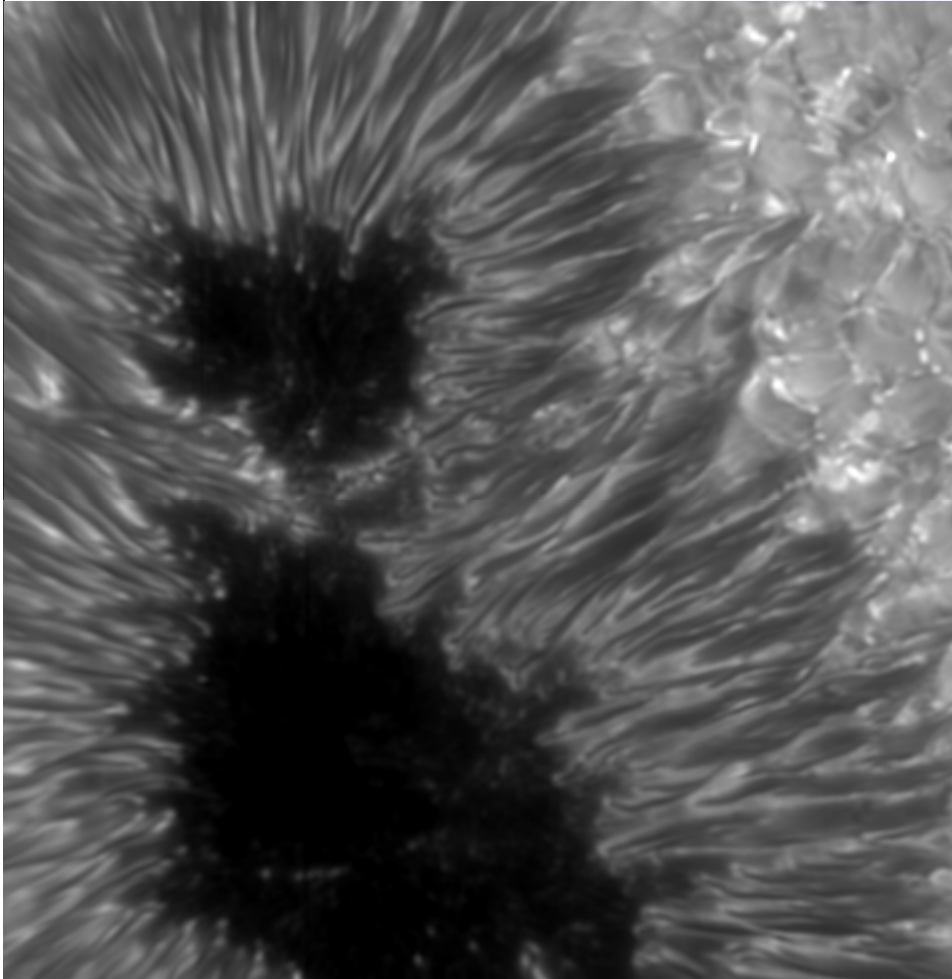


Magnetogram

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Angular Resolution : $\sim 0.1''$ (70 km)



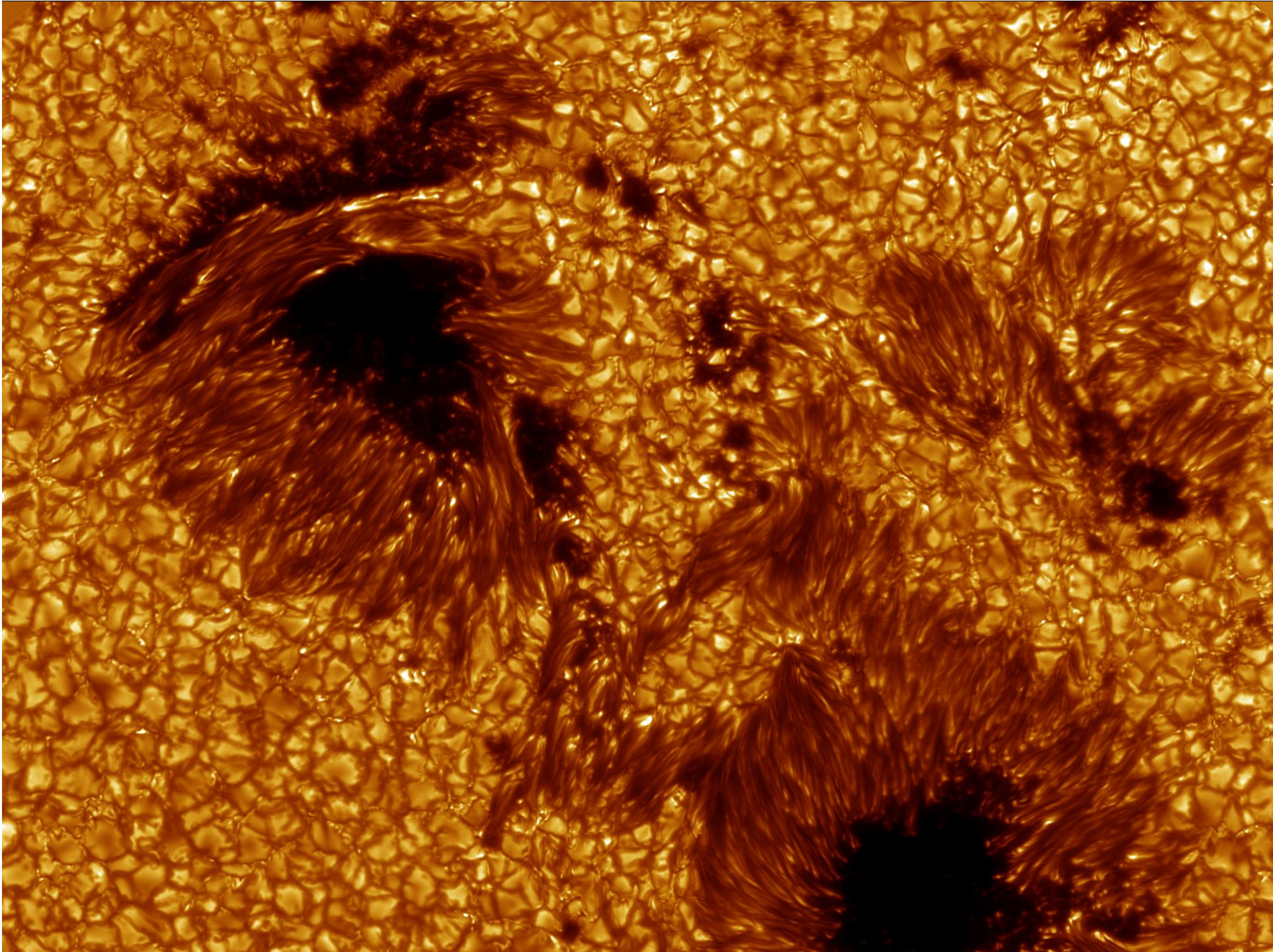
**Line Wing
(Photosphere)**

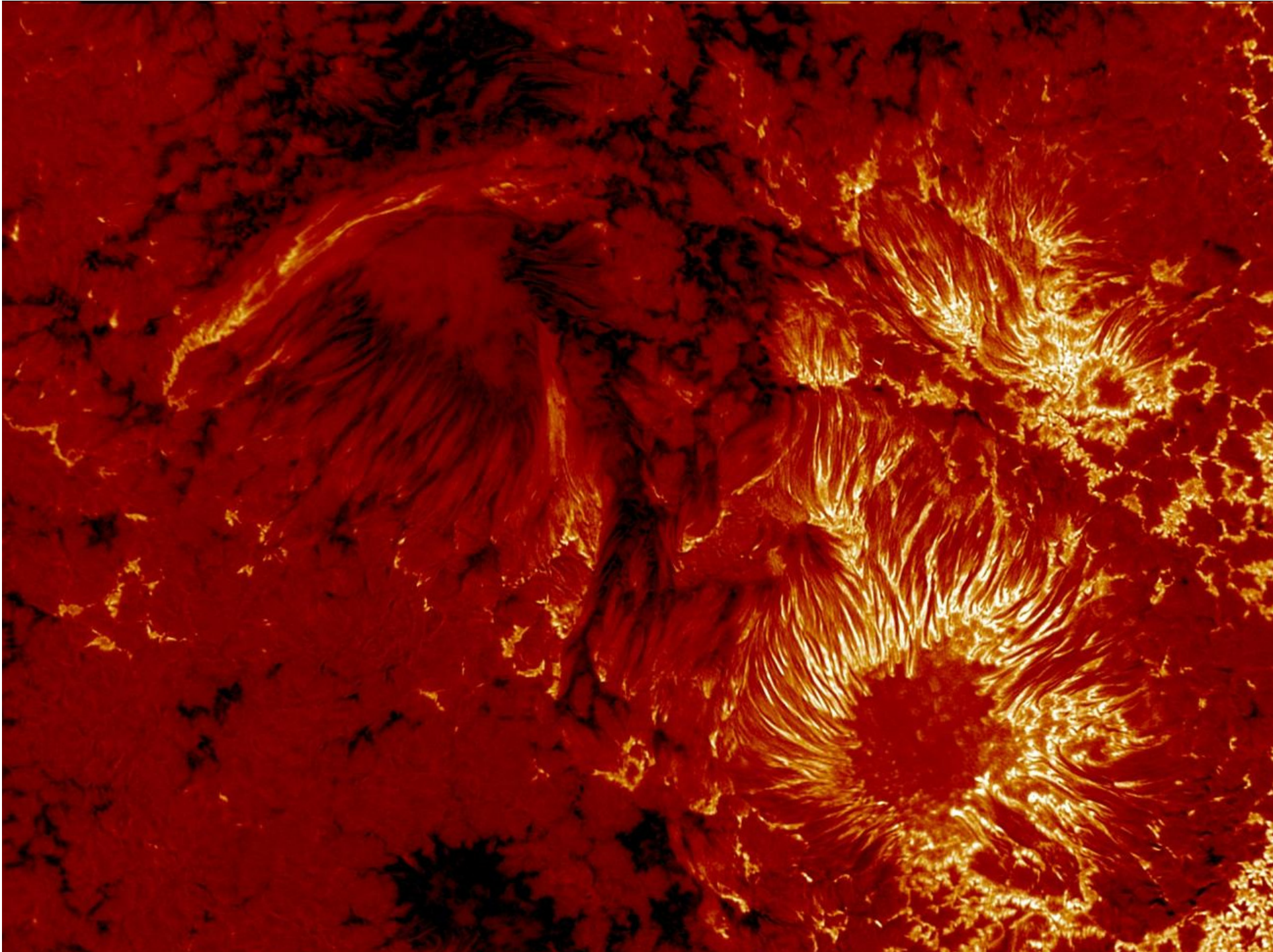
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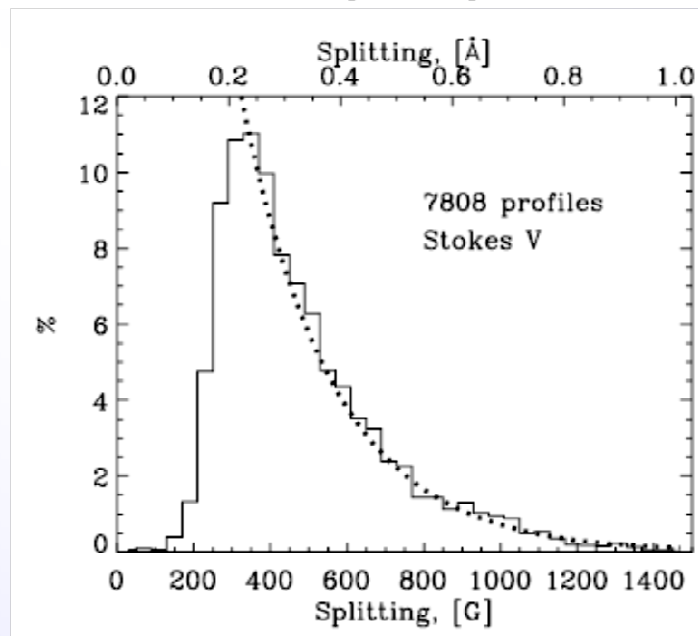
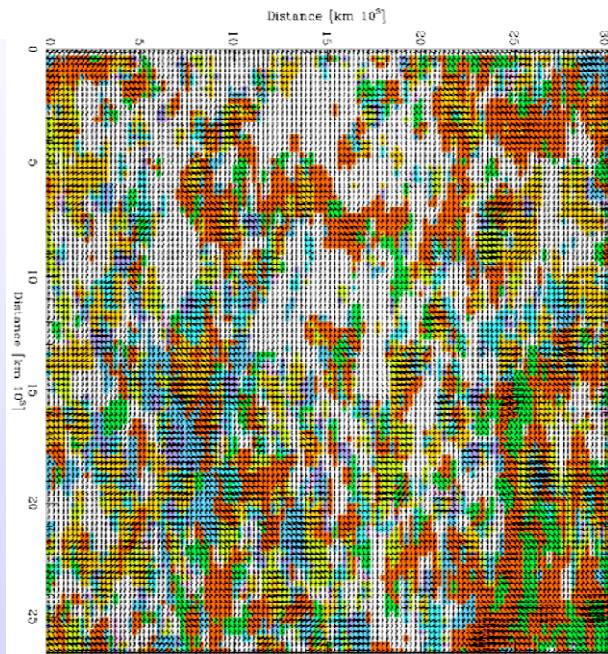
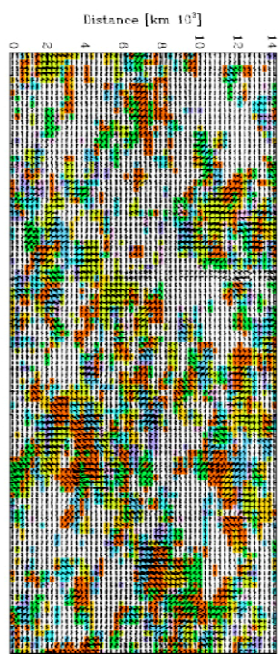
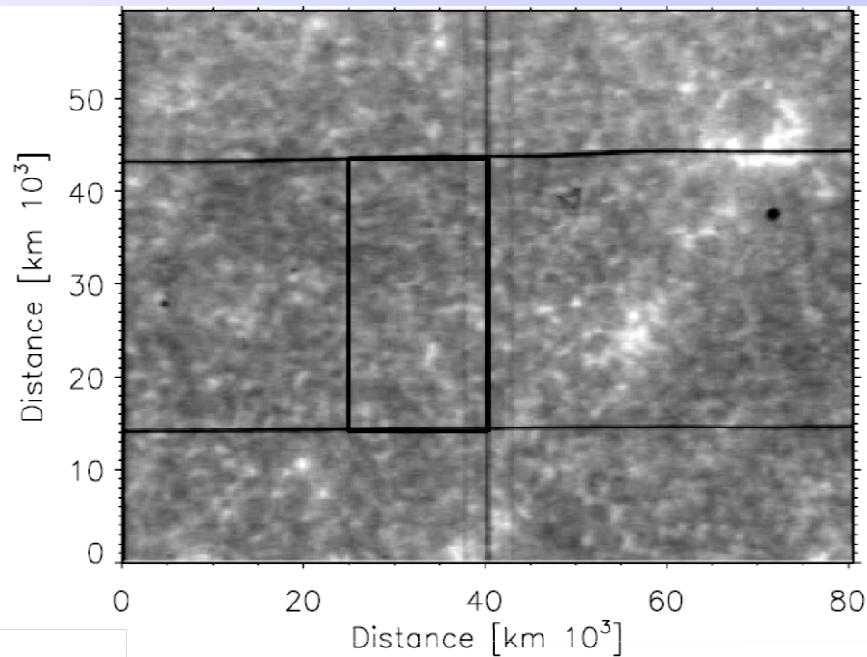
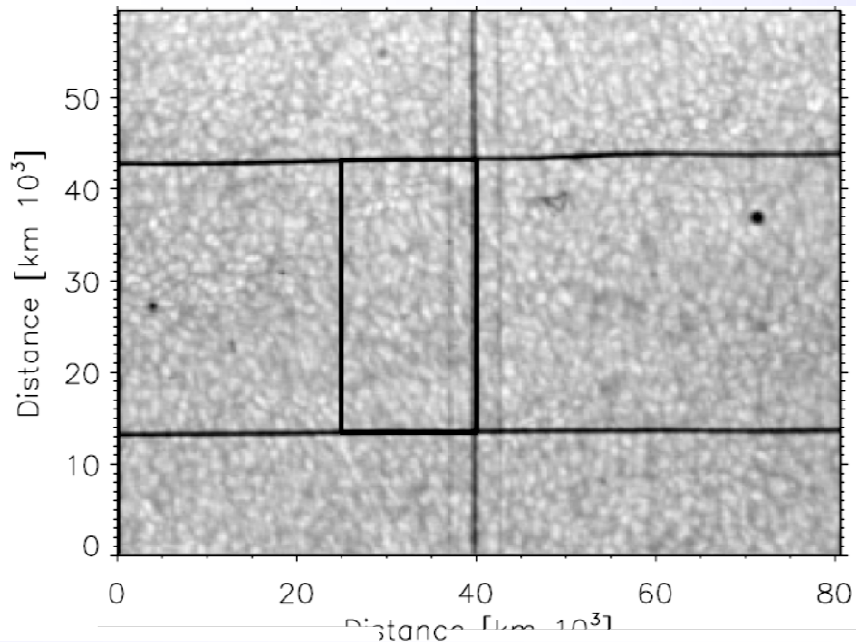
Magnetogram

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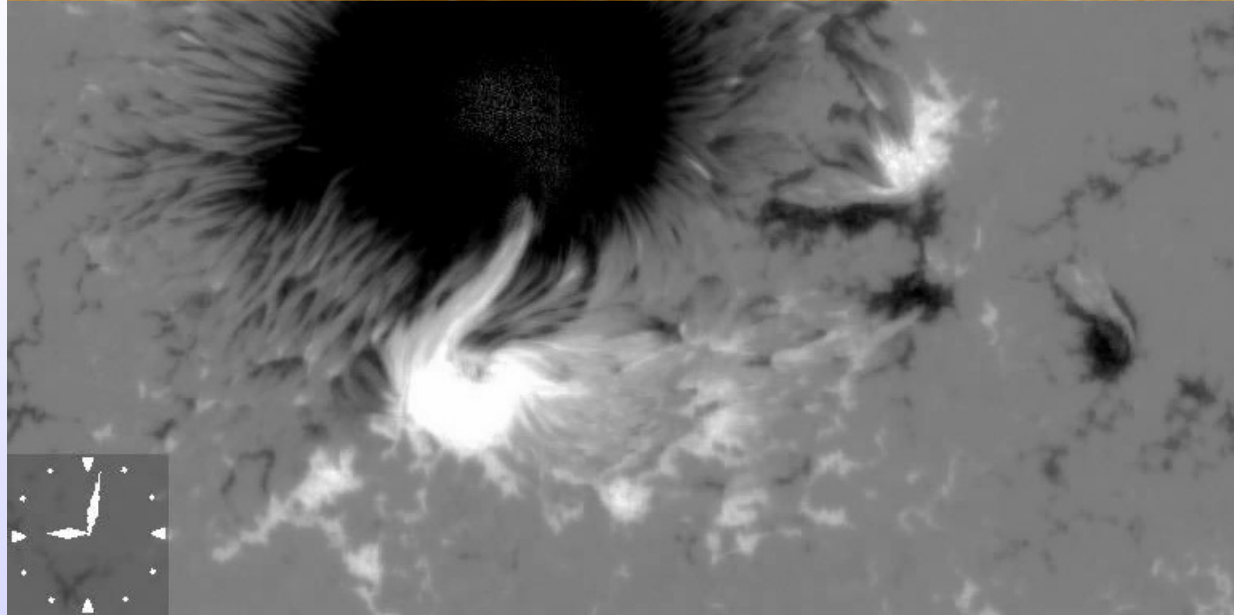
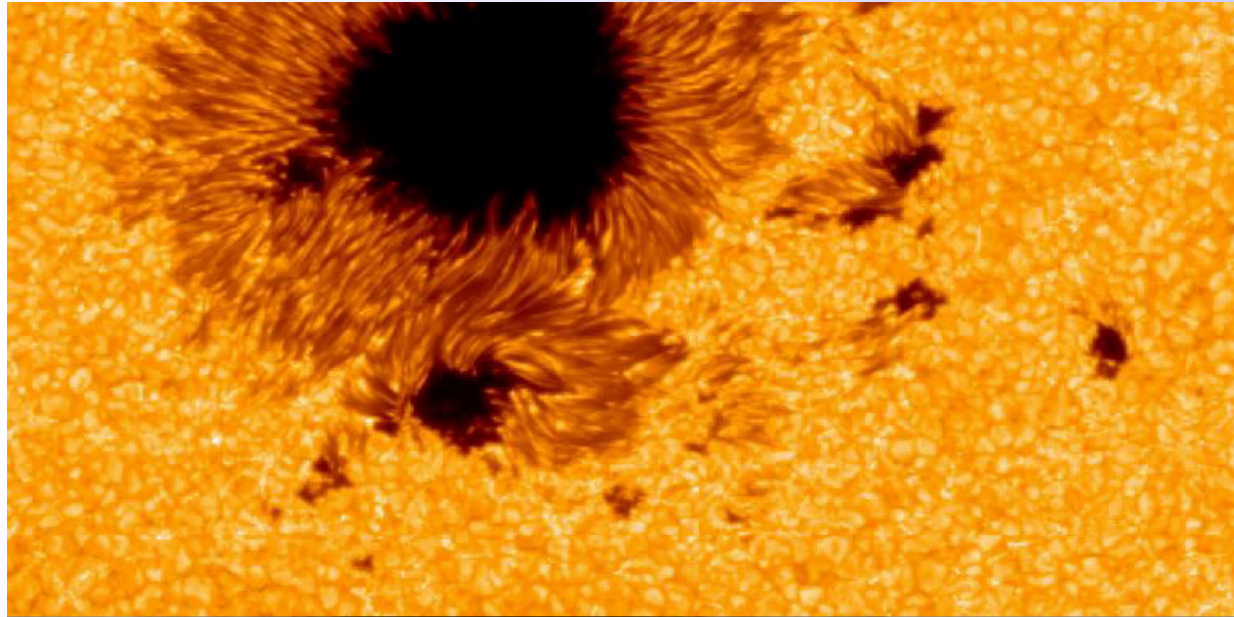
PHOTOSPHERE: TEMPORAL EVOLUTION

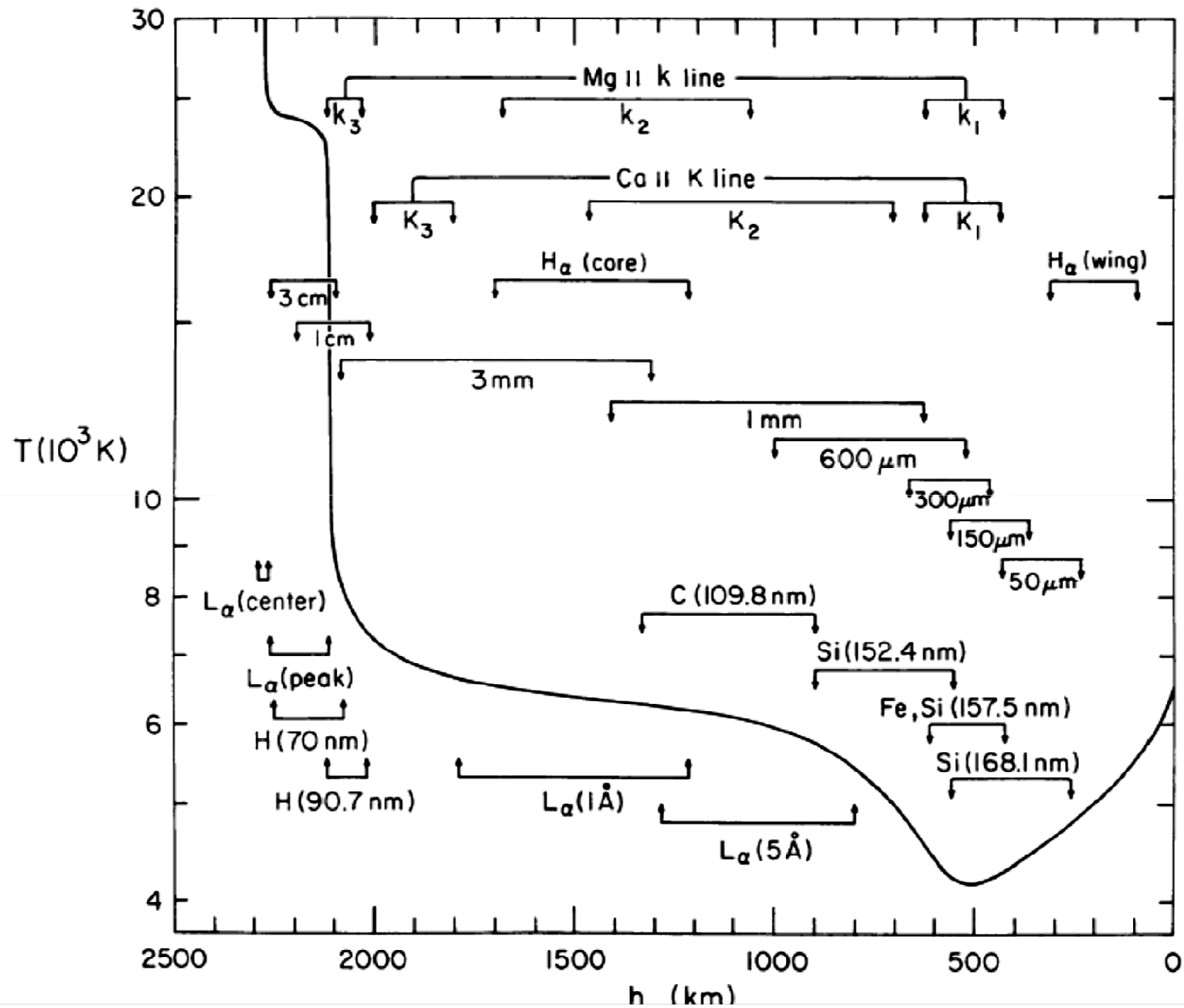
PHOTOSPHERE:

Velocities
~ few km/s

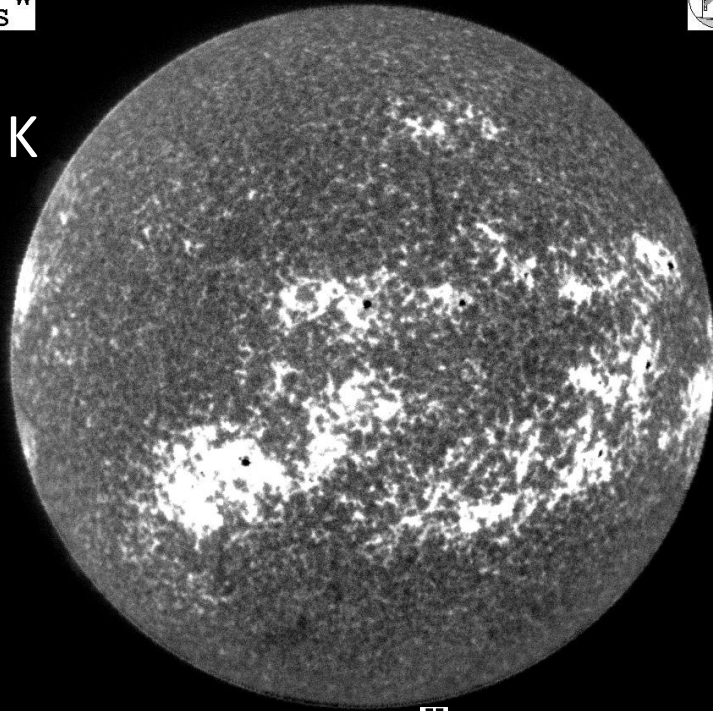


~3 s maximum
integration time



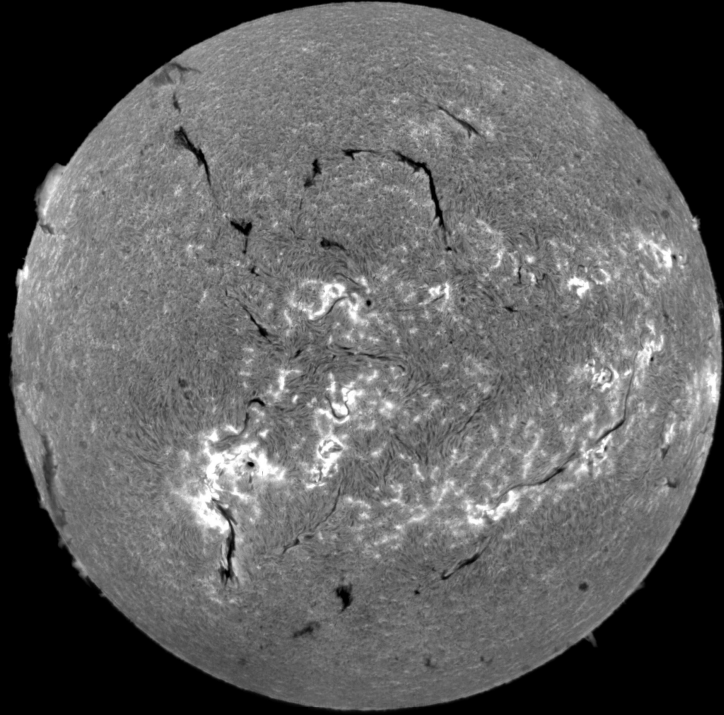


Ca II K



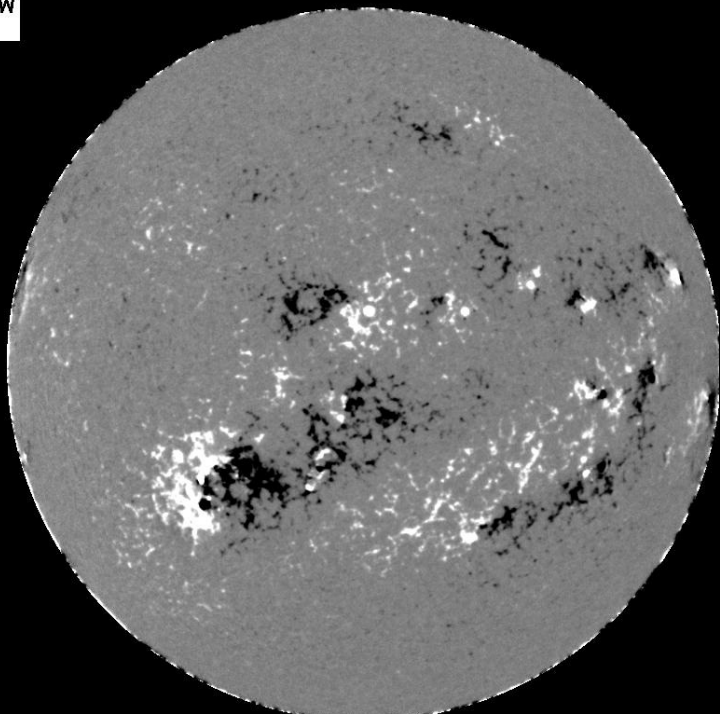
W
S

H α



W

Magnetogram



CHROMOSPHERE: TEMPORAL EVOLUTION

CHROMOSPHERE:

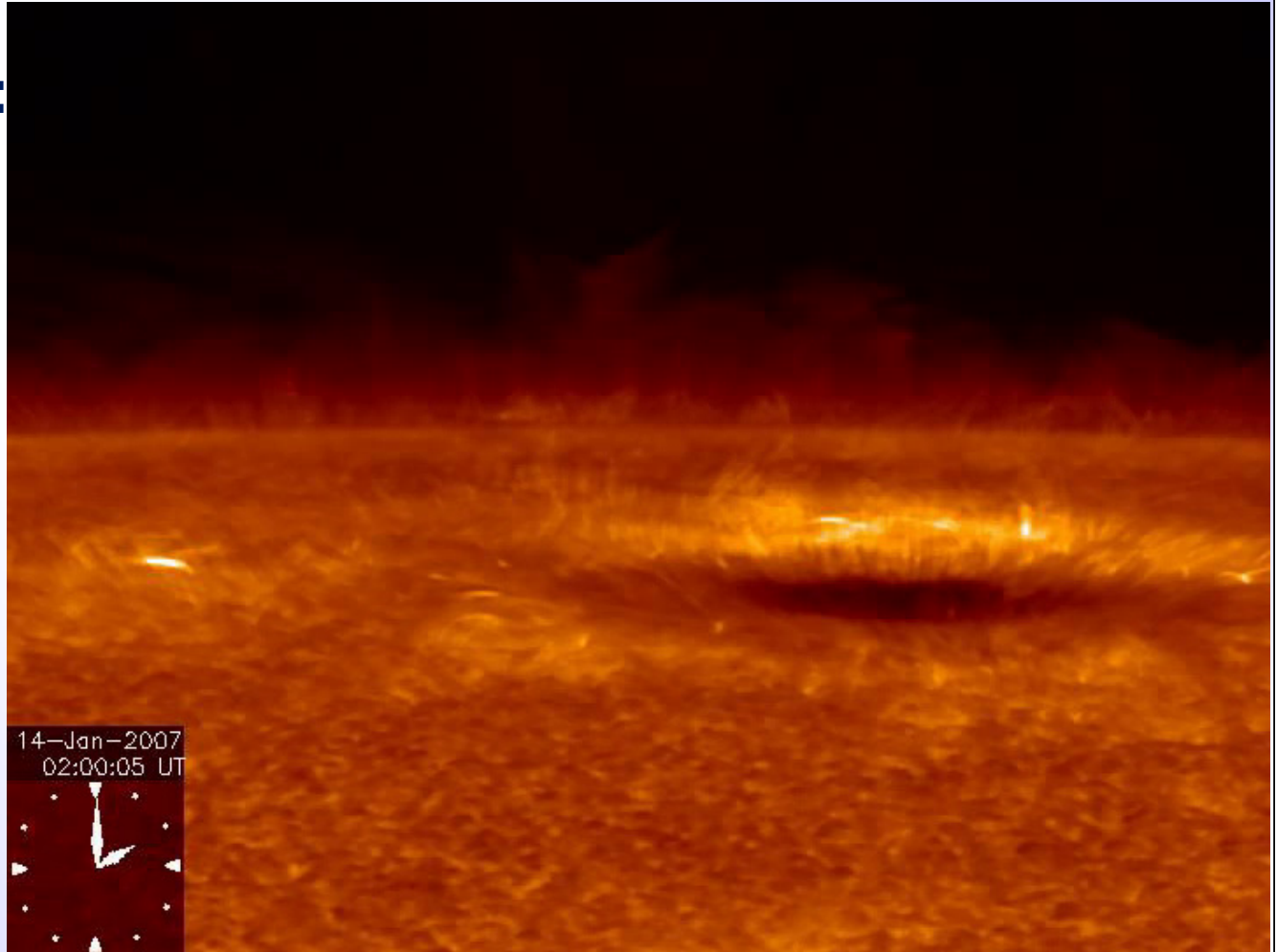
Velocities

~ tens of km/s

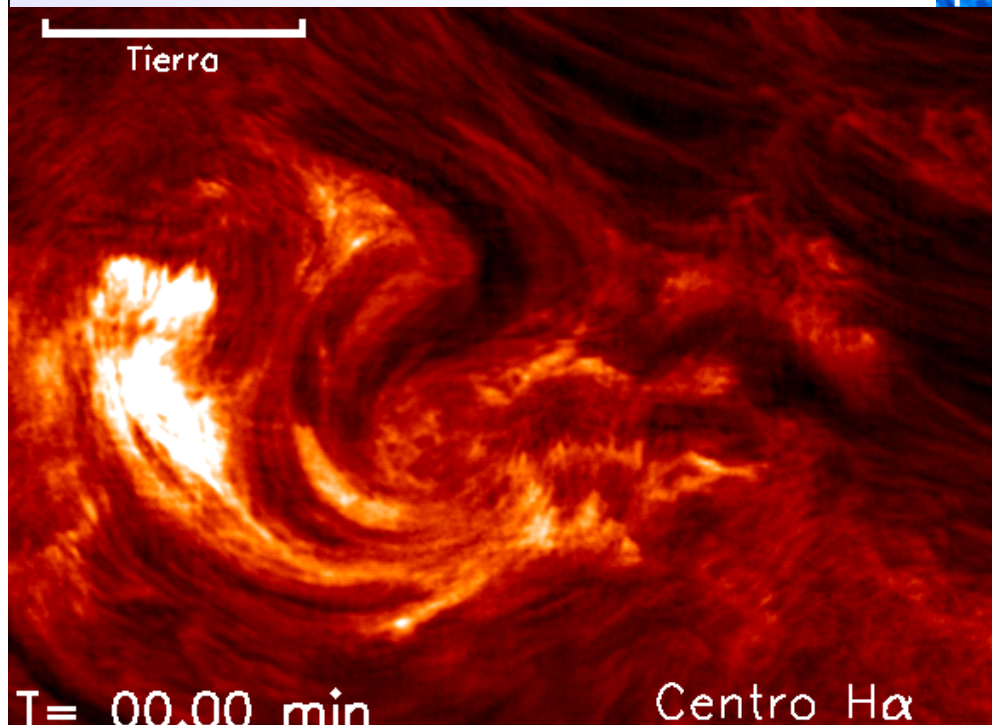
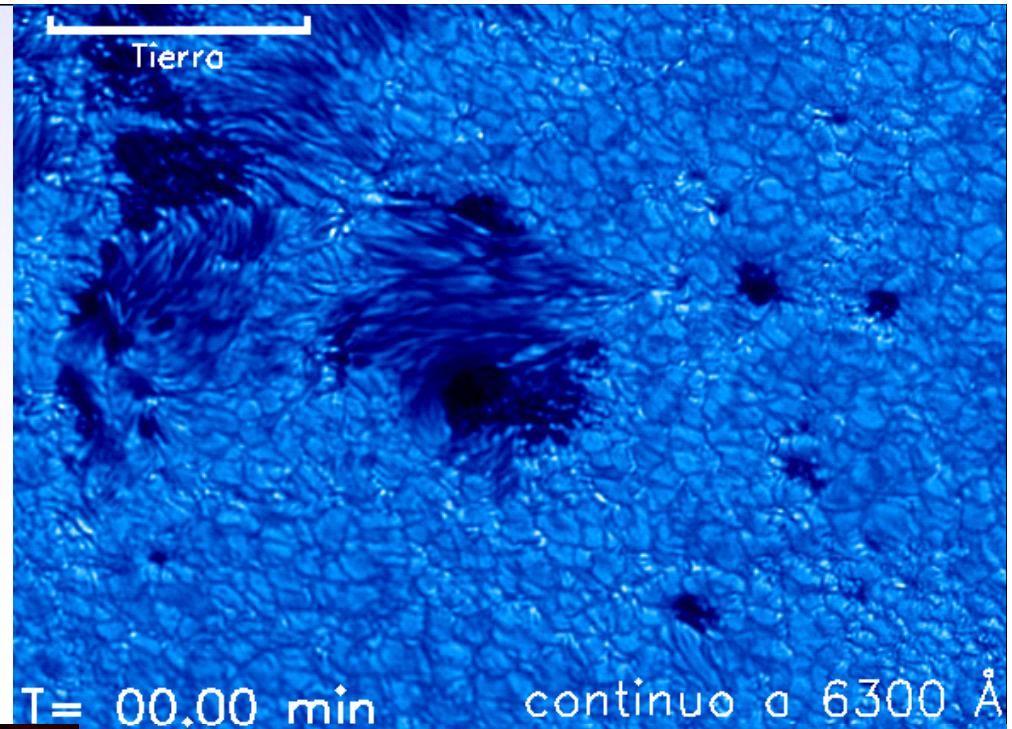
Magnetogram



<1 s maximum
integration time



PHOTOSPHERE



CHROMOSPHERE

Not enough photons to study the magnetic field properties and evolution

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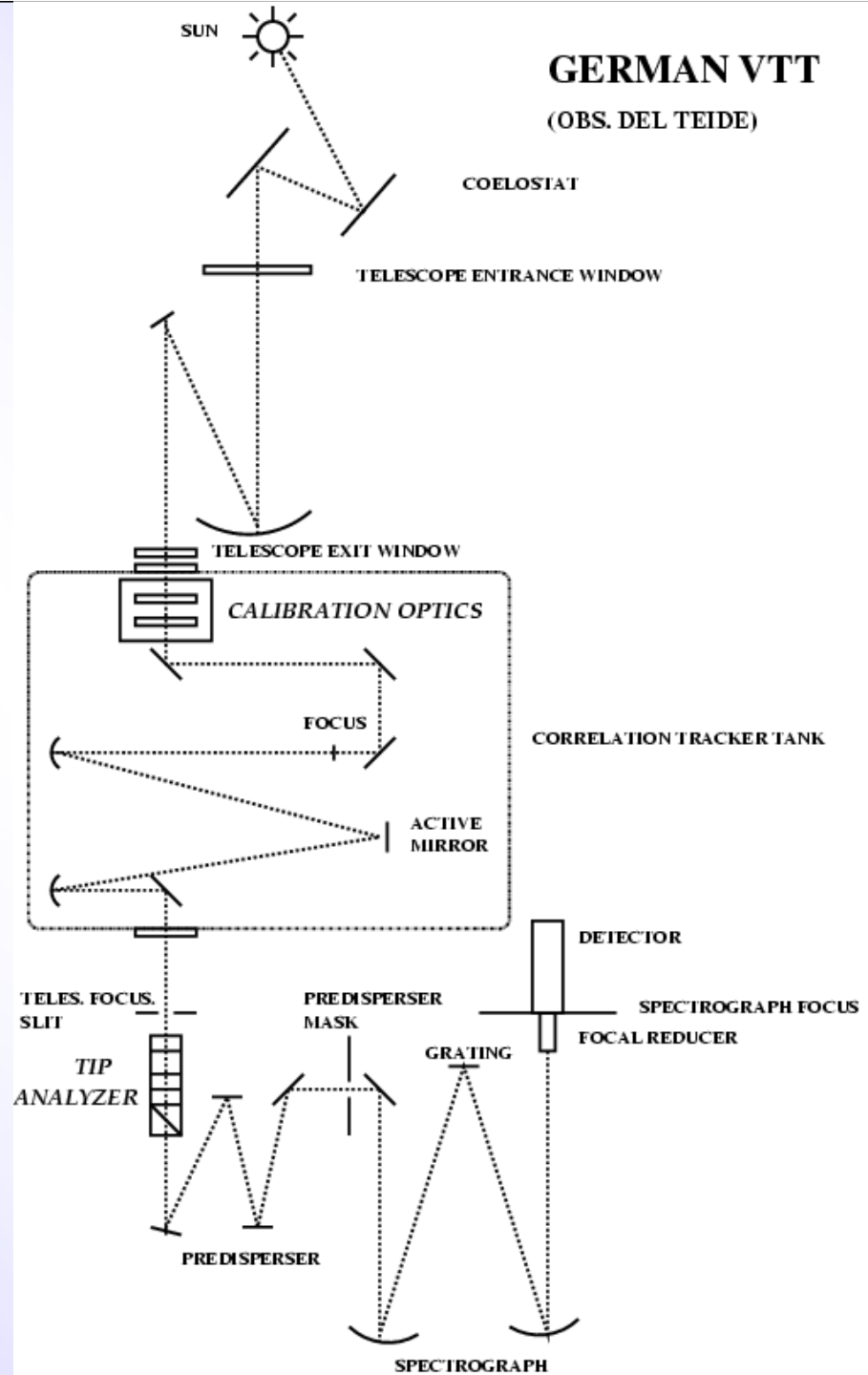


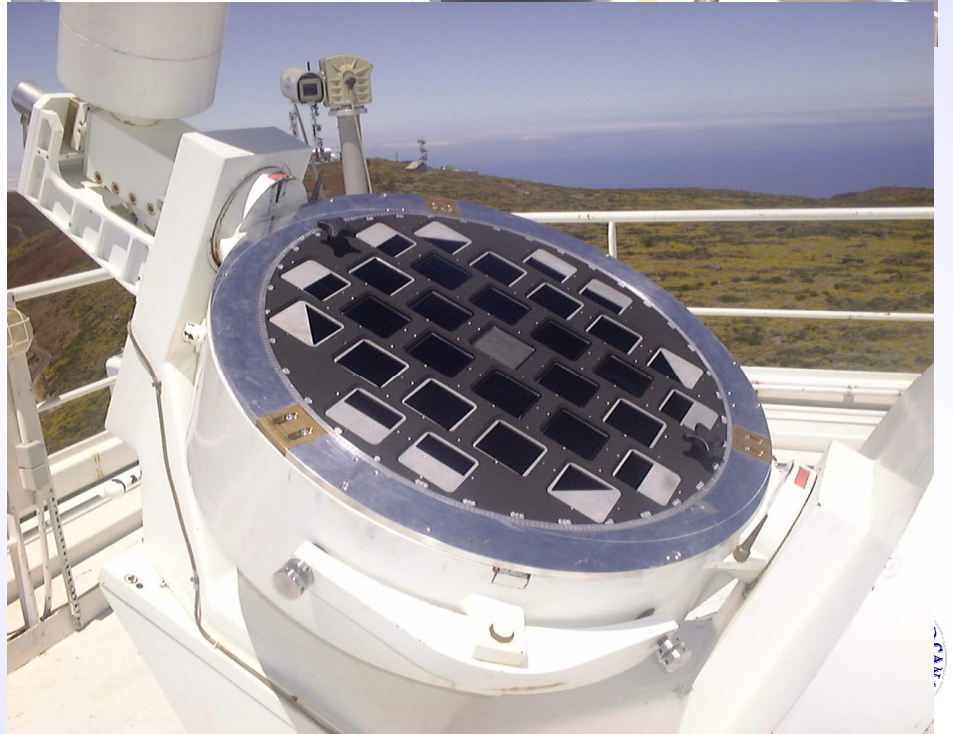
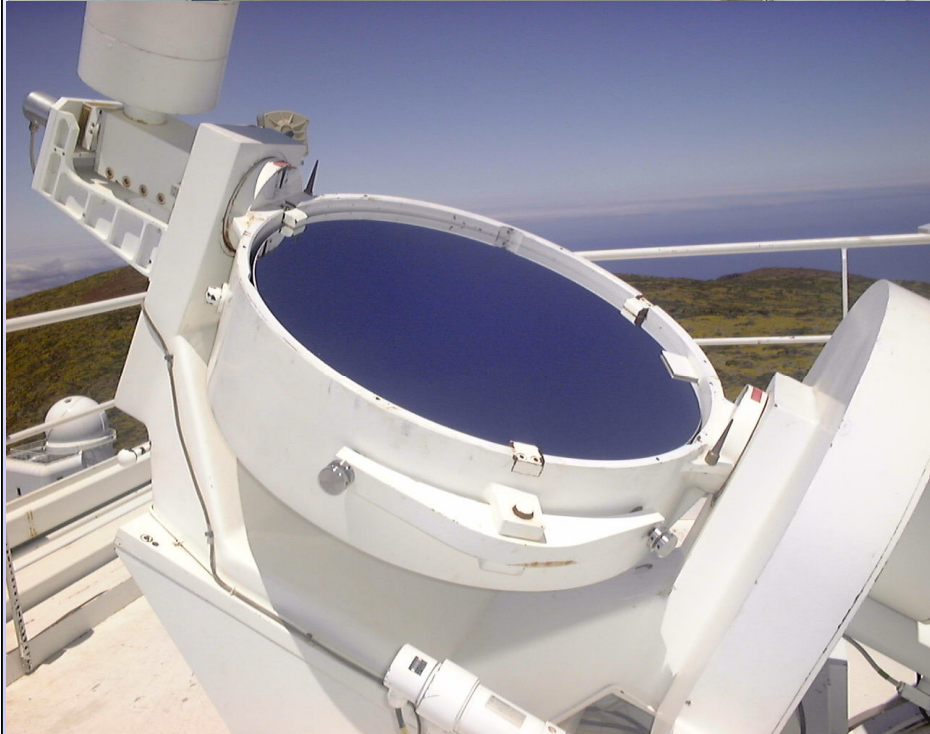
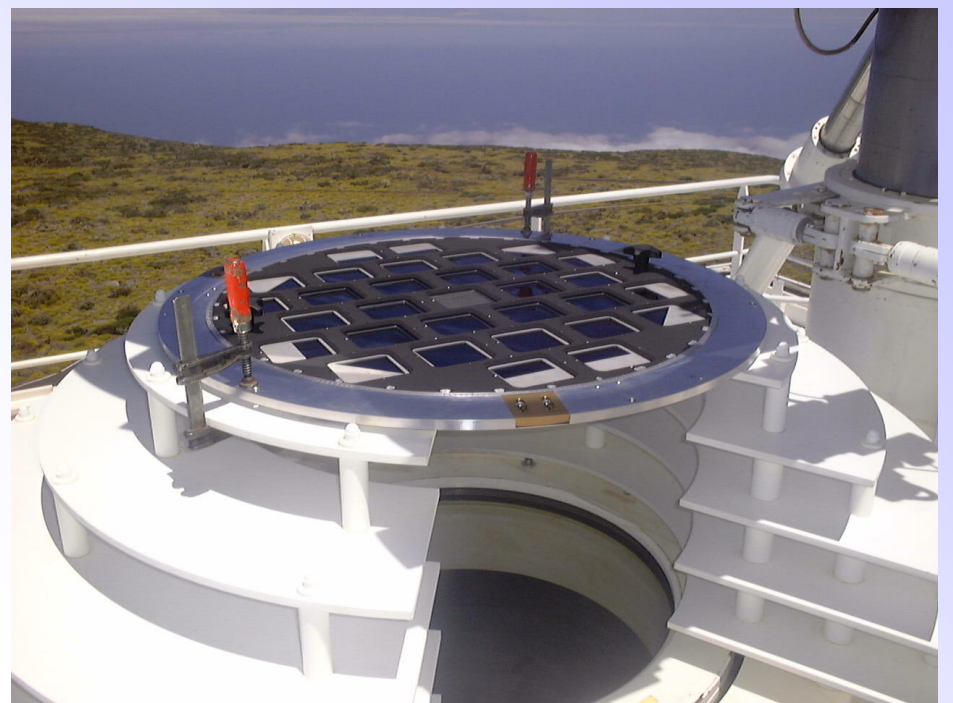
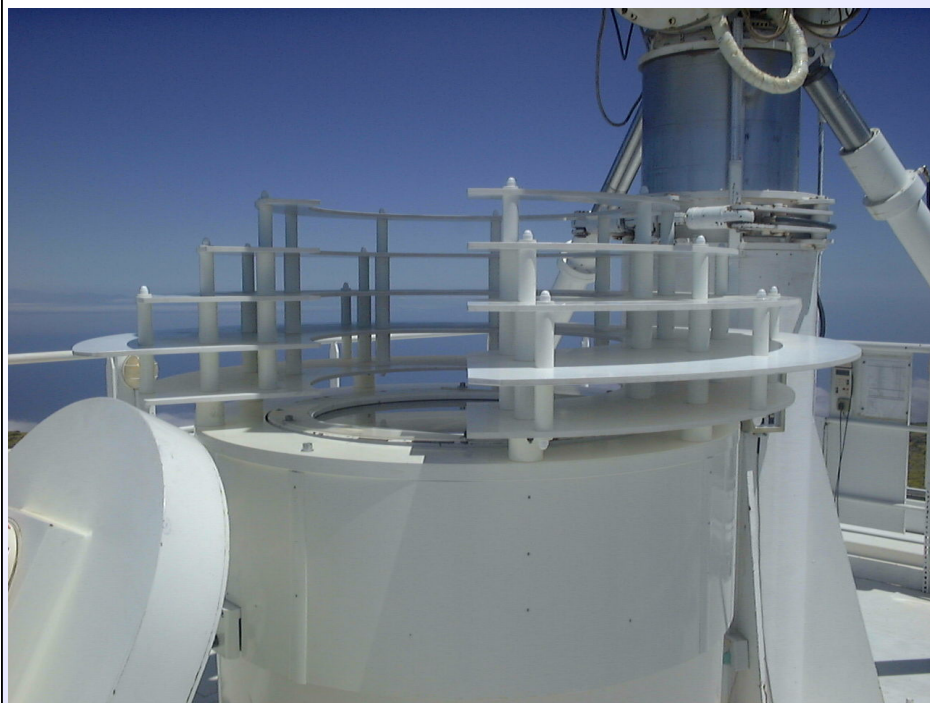
Most present telescopes were not designed for
polarimetric measurements





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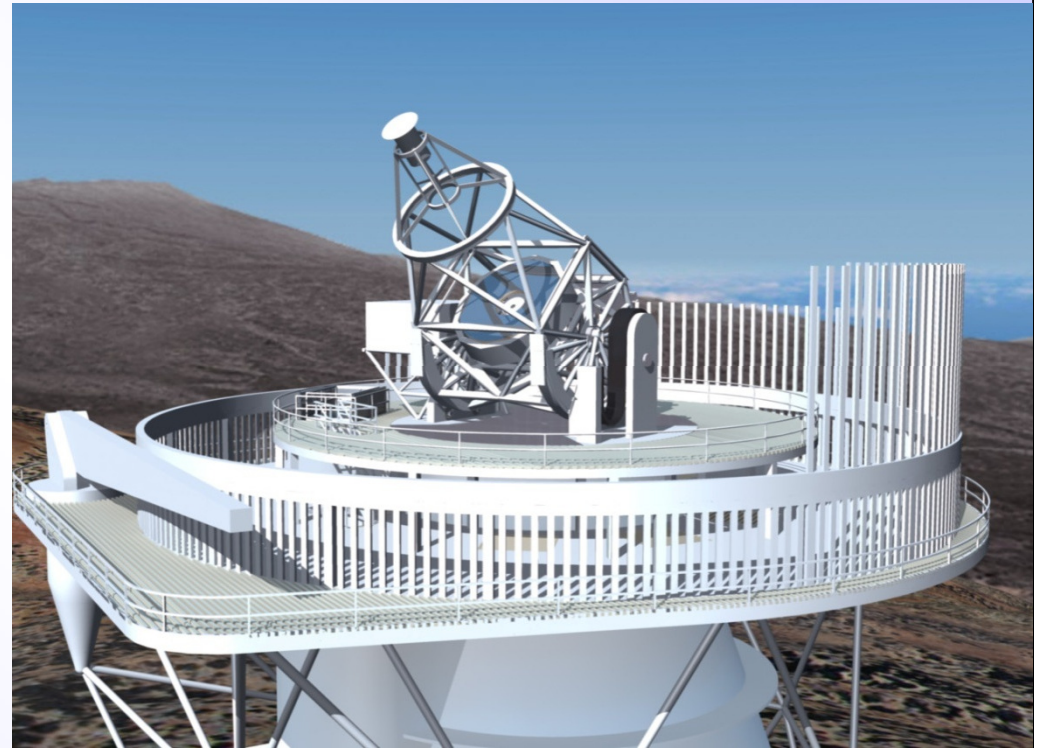




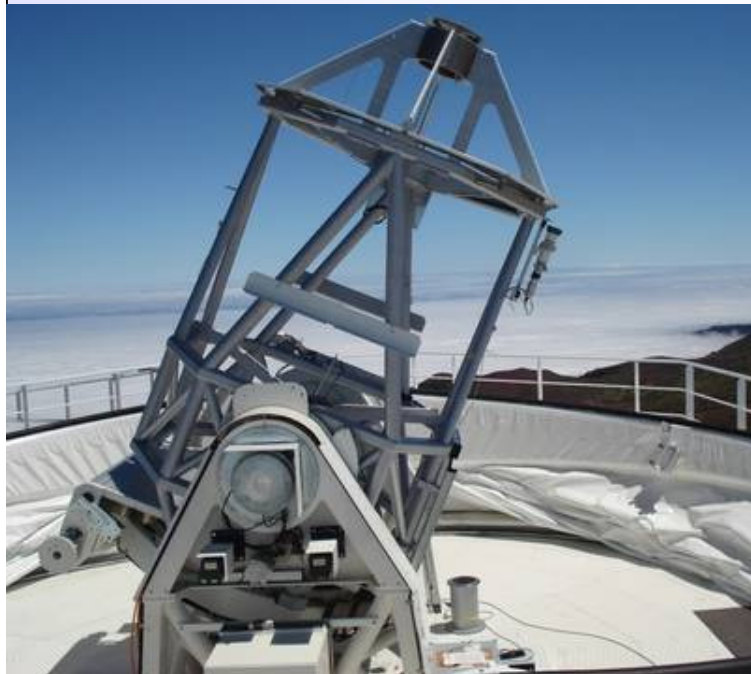


THEMIS

Polarization-free telescopes



EST

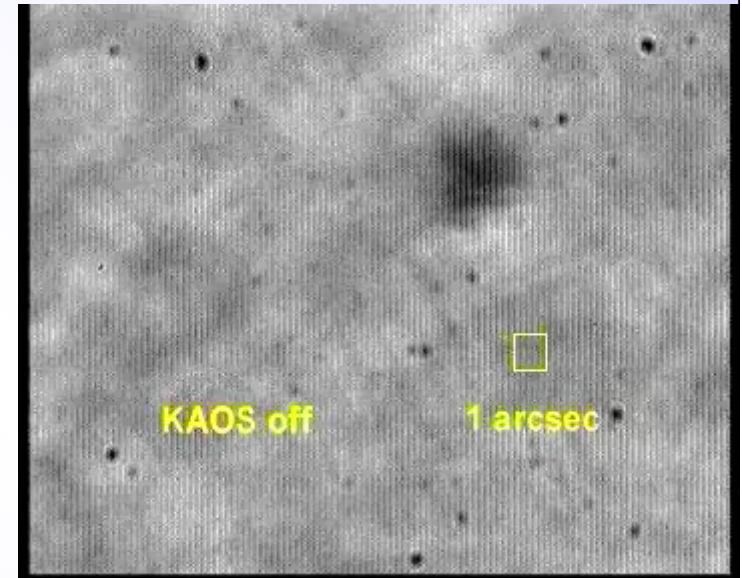
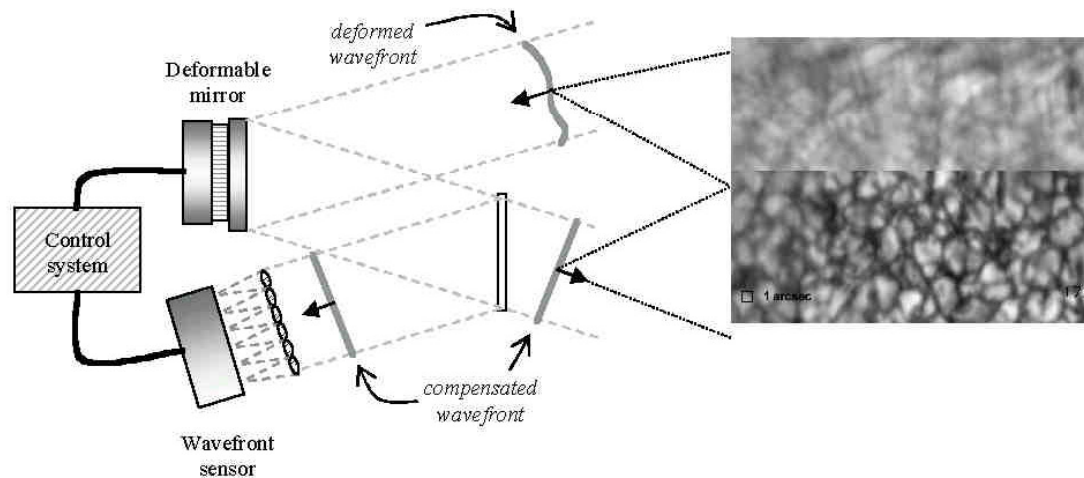


GREGOR

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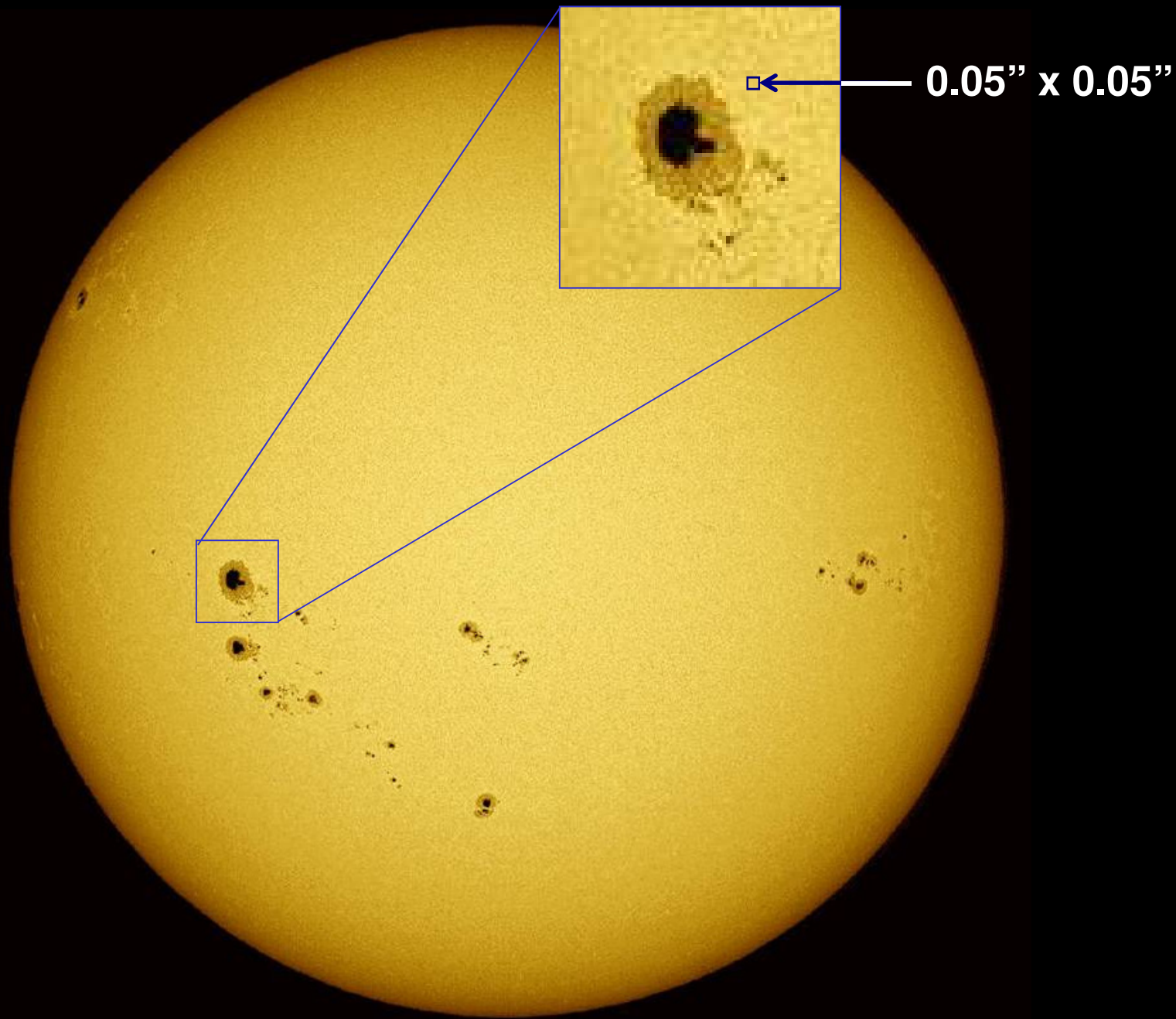
TURBULENCE IMPLIES: need for ADAPTIVE OPTICS and FAST POLARIMETRIC MODULATION + ACCUMULATIONS



POLARIMETRIC TECHNIQUES

- 1 rotating waveplate (ASP, POLIS, SPINOR)
- 2 retarders with discrete orientations (THEMIS)
- 2 nematic liquid crystals (ViSP, IMaX, SST)
- 2 ferroelectric liquid crystals (TIP)
- 2 piezoelastic modulators (ZIMPOL)





0.05" x 0.05"

← 0.05" x 0.05"

Tiny faint "object"

$m_{v, \text{full sun}} \sim -27$

1 px $\sim 10^{-9}$ Solar surface

$\Rightarrow m_{v, \text{pixel}} \sim -4$

Maximum integration
time ~ 3 seconds

\Rightarrow

1 px during 3 seconds

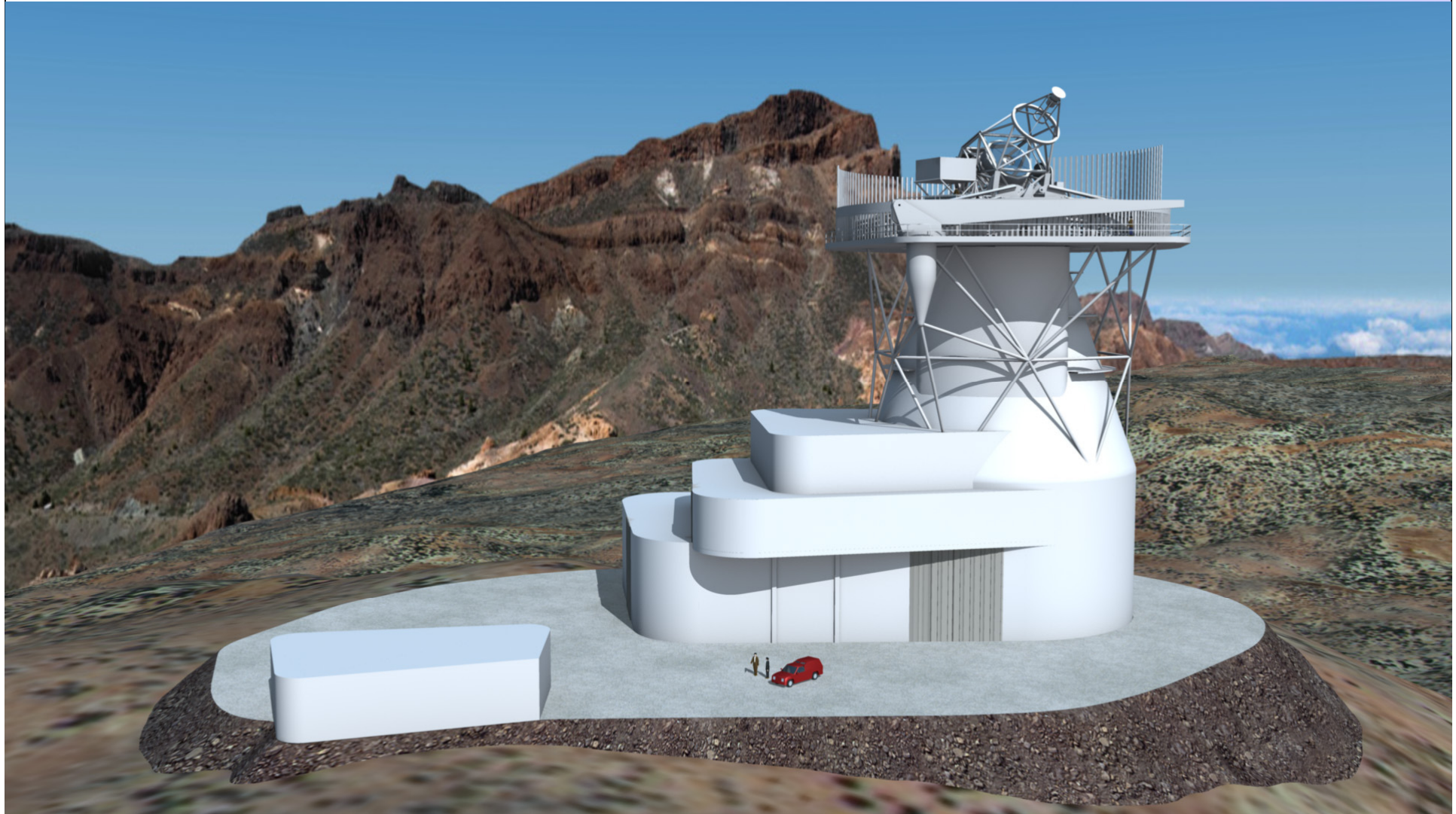
is equivalent to

a star of $m_v = 2$

With an integration time of
15 minutes



4-metre EST



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