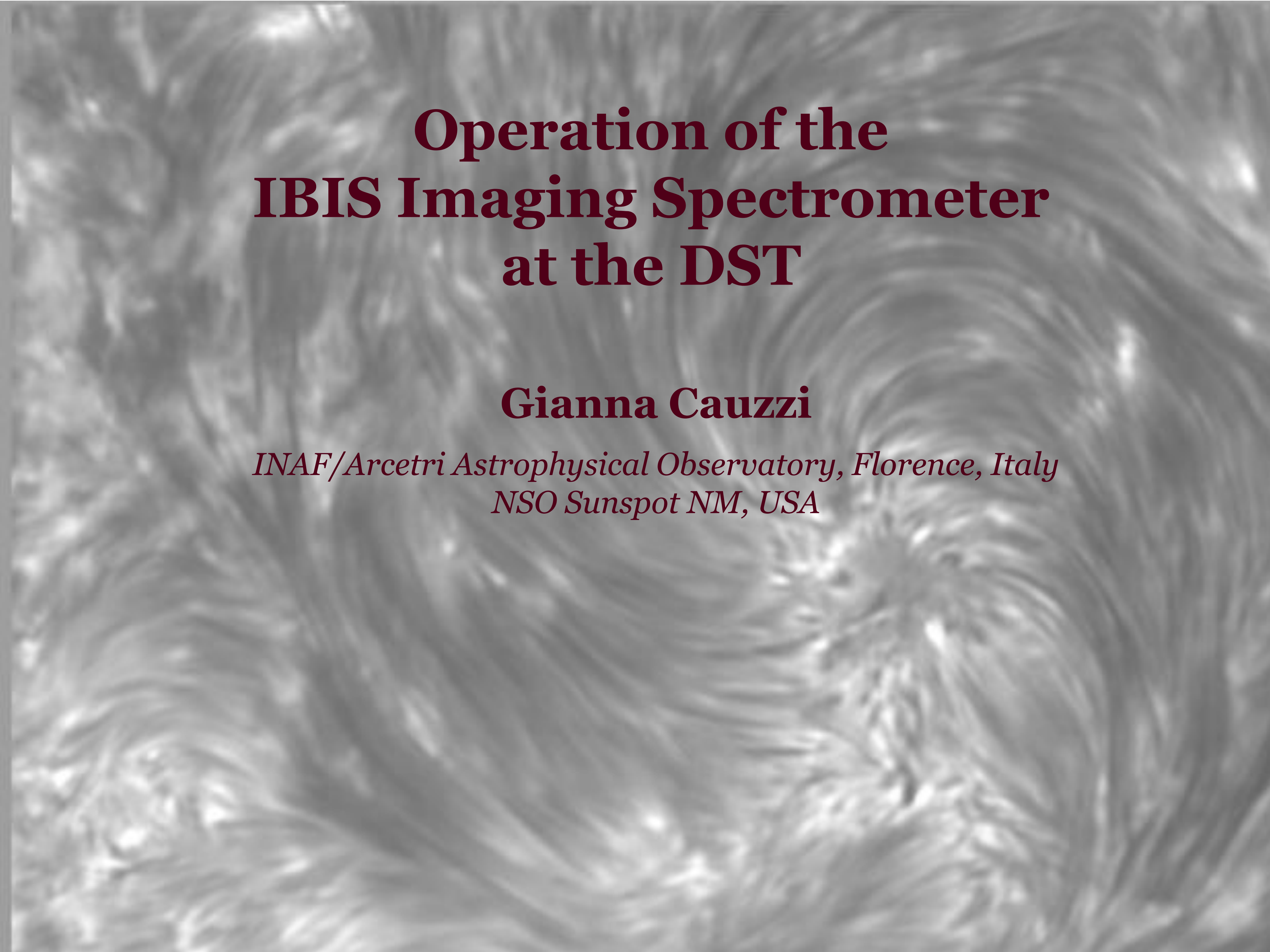


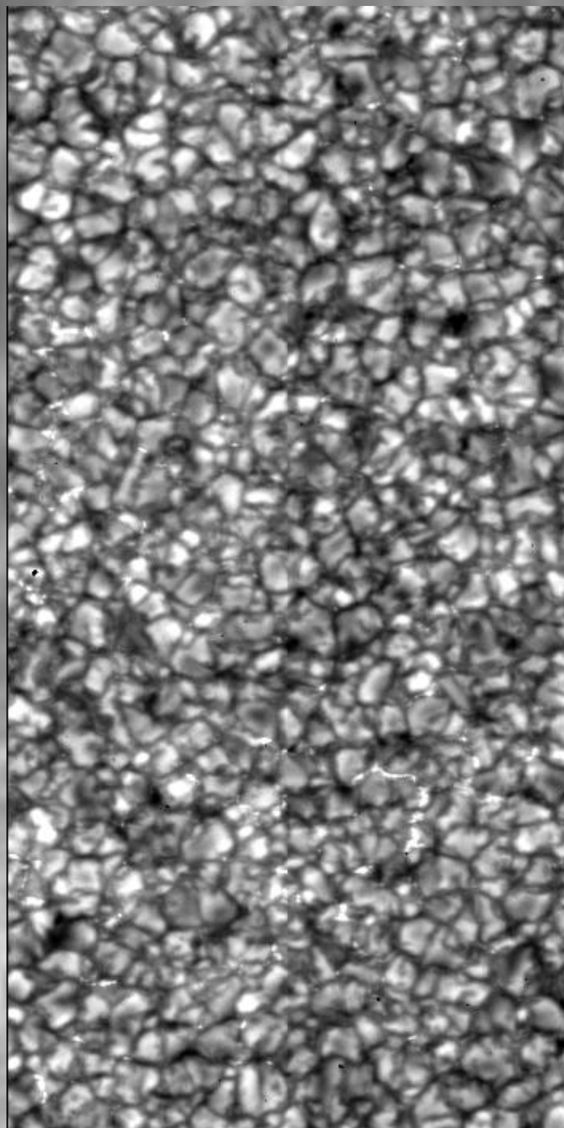
Operation of the IBIS Imaging Spectrometer at the DST

Gianna Cauzzi

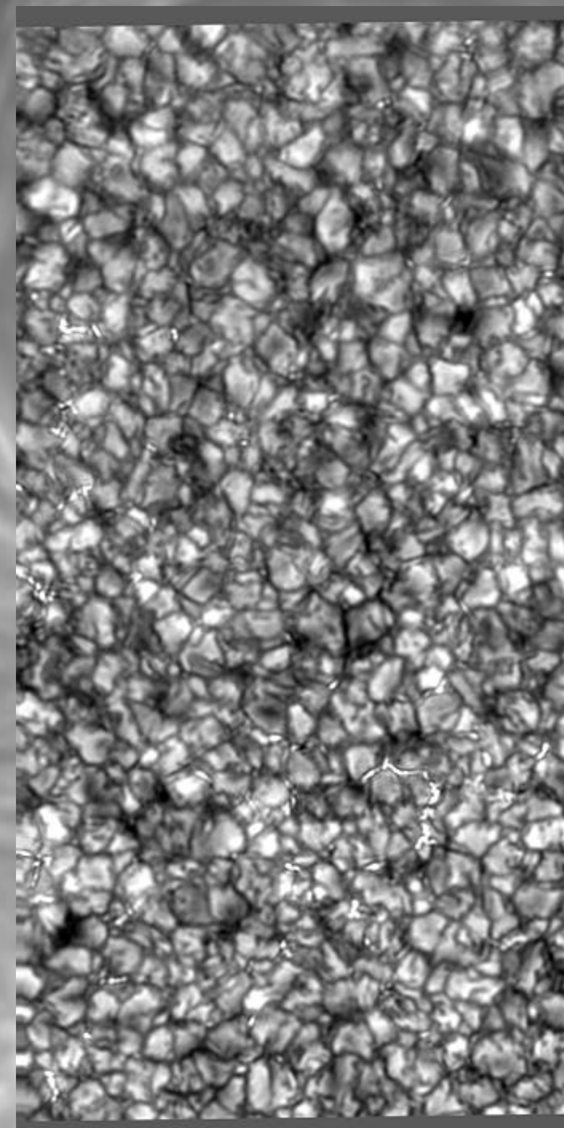
INAF/Arcetri Astrophysical Observatory, Florence, Italy
NSO Sunspot NM, USA

18 April 2008
G-band Images

SOT



DST



Woeger et al. 2008, A&A 488, 375

Overview

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   c) *Chromospheric multi-line thermal analysis*
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   b) *Polarimetry*
   c) *PMJs*
4. Science "hopeful"
   a) *Flares*
5. Service mode

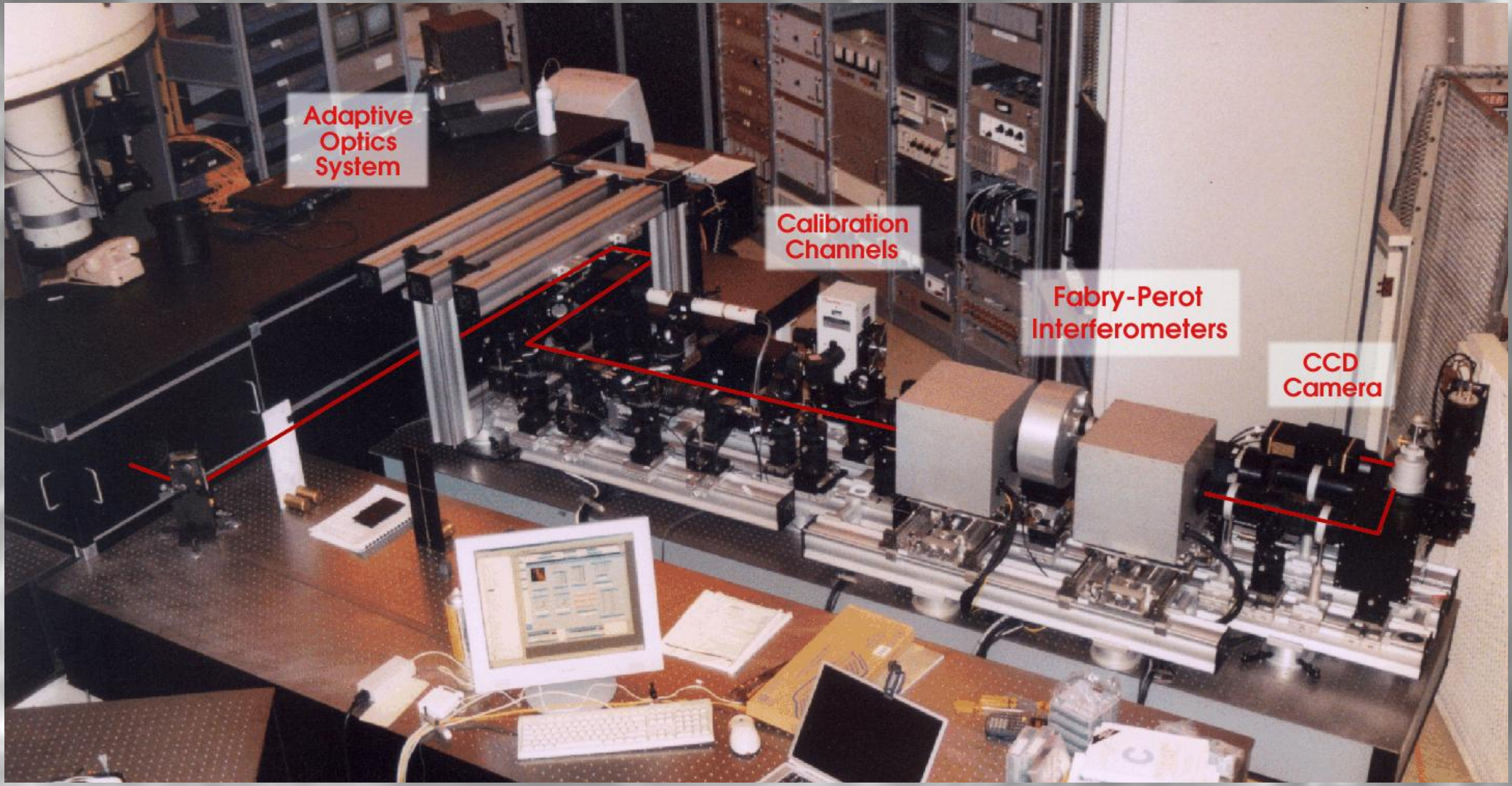
Interferometric BIdimensional Spectrometer (IBIS)

Dual Fabry-Perot Imaging Spectrometer

P.I. - Fabio Cavallini (INAF/Arcetri)

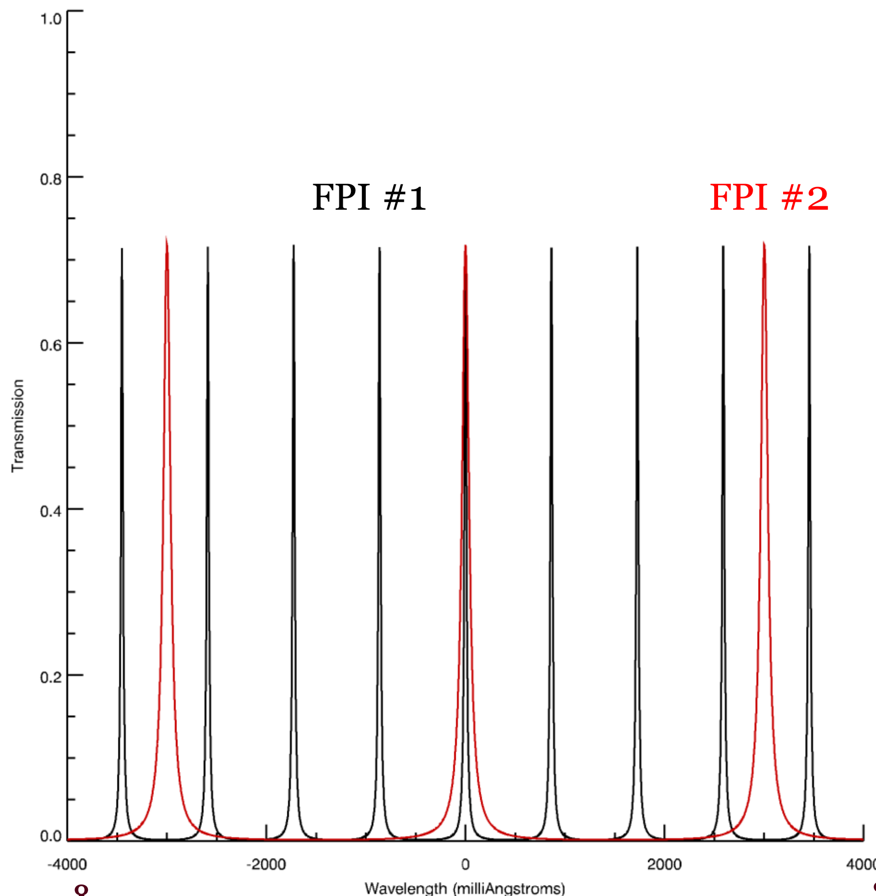
Operated in Conjunction with the
National Solar Observatory

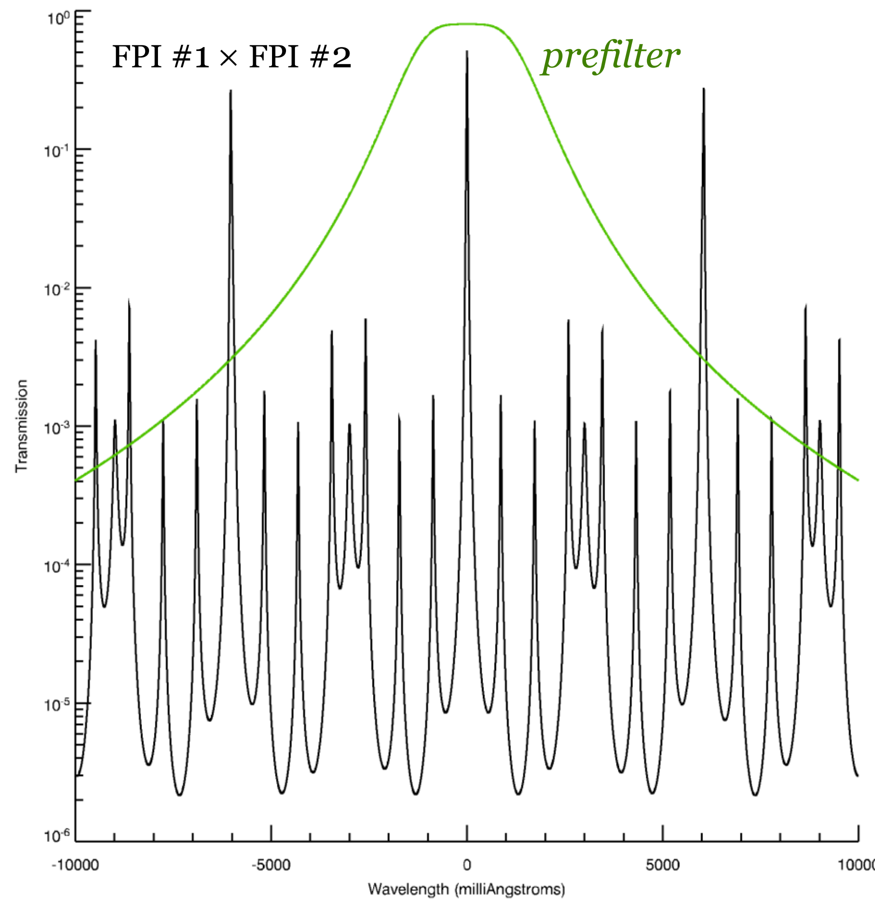
Facility Instrument at the Dunn Solar Telescope



Interferometric BIdimensional Spectrometer

Dual Fabry-Perot Imaging Spectrometer

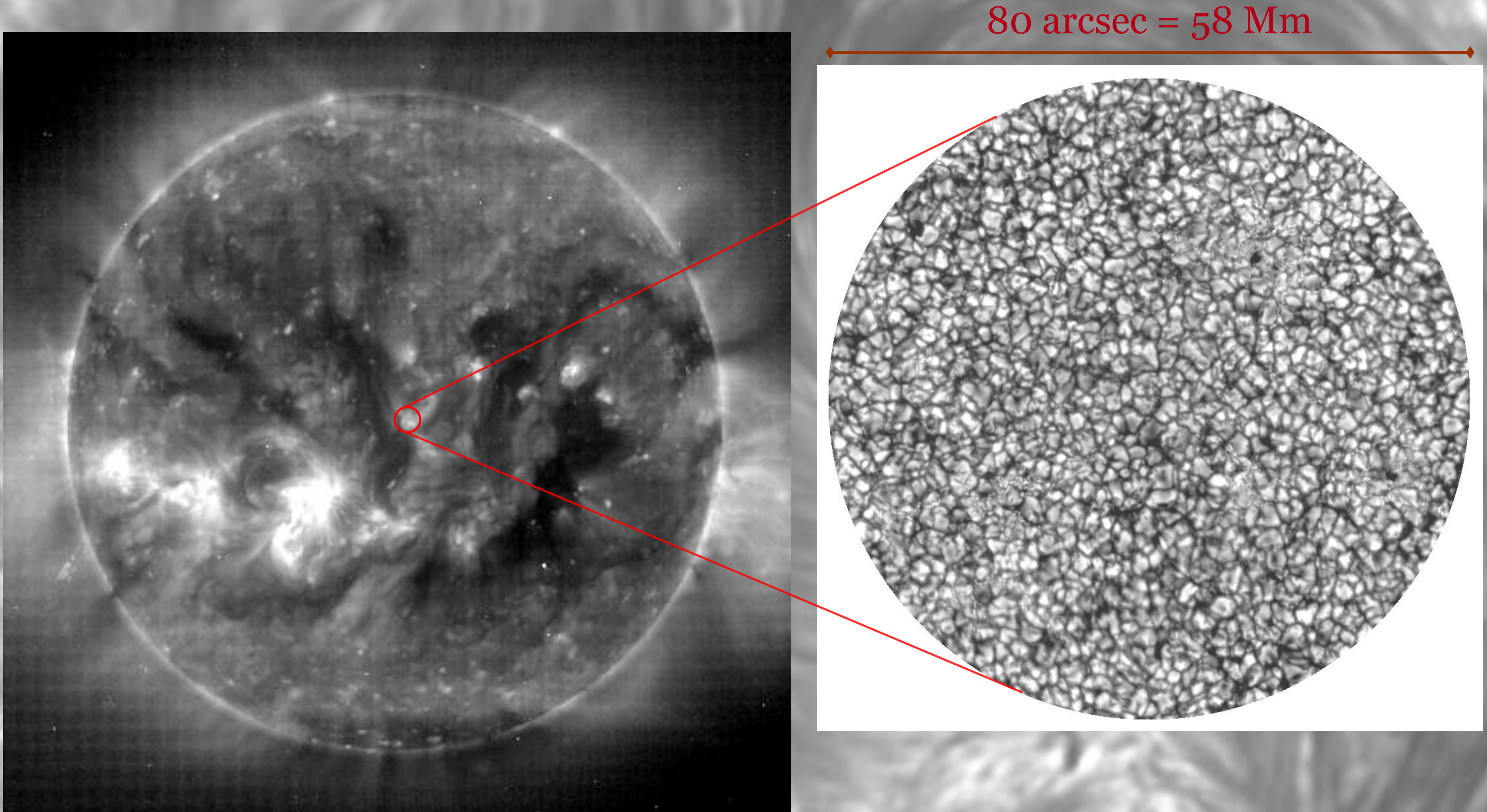




- 4 Å **+ 4 Å**

sidelobes at +/- 6 Å

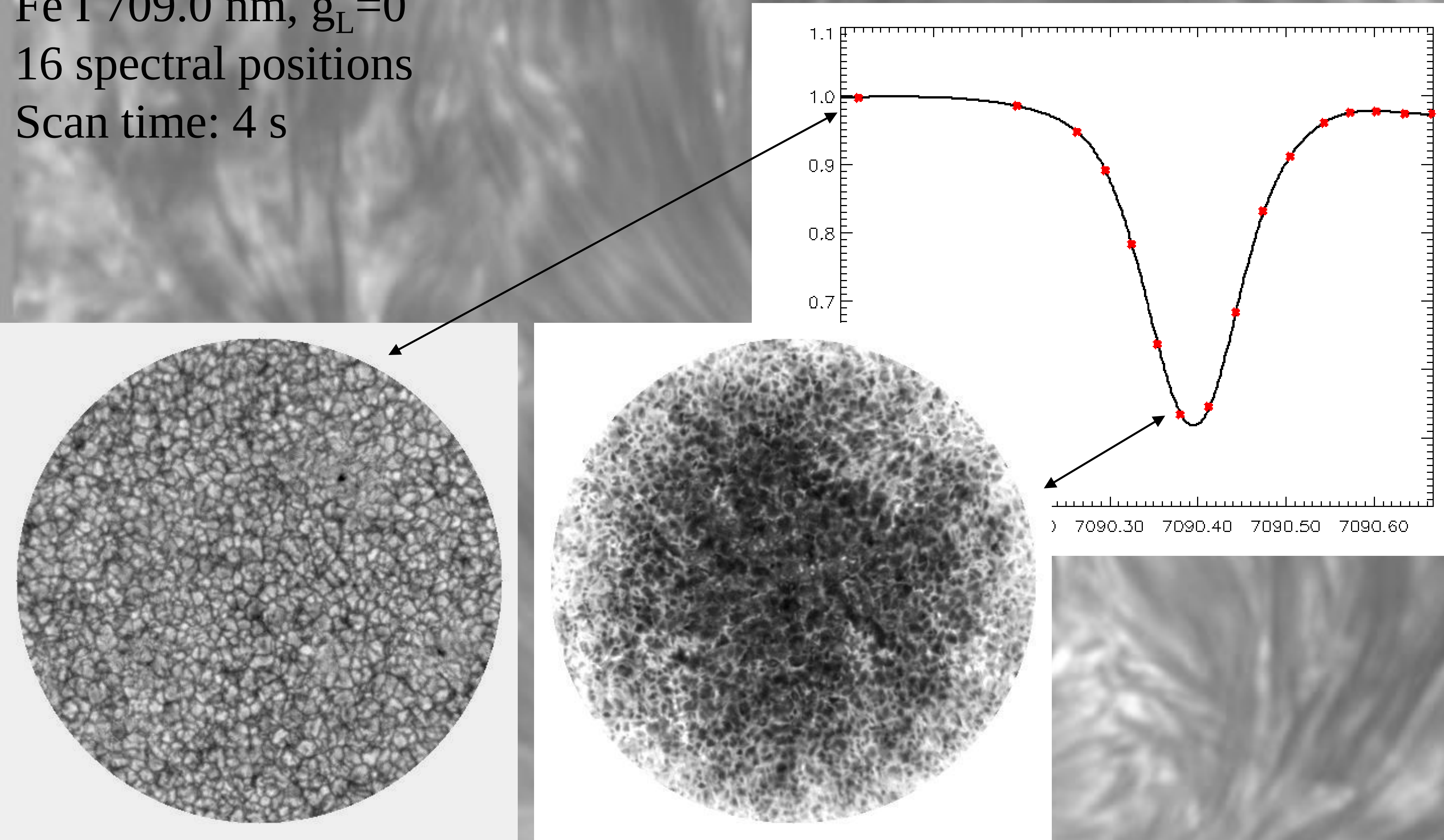
IBIS Field of View - *Solar Microscopy*

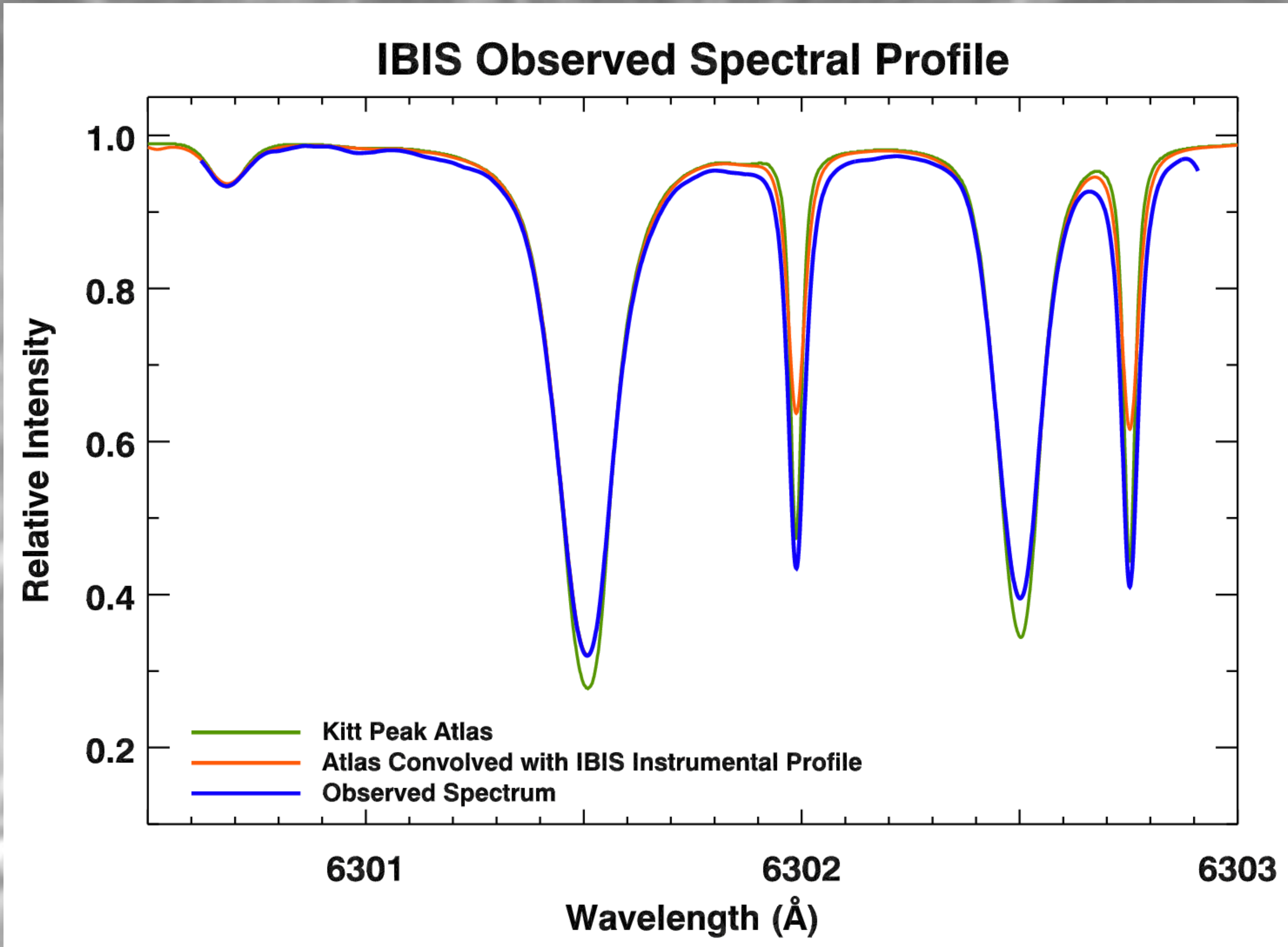


Pixel Scale: 0.08 – 0.16 arcsec/pixel

Spectral line sampling

Fe I 709.0 nm, g_L=0
16 spectral positions
Scan time: 4 s

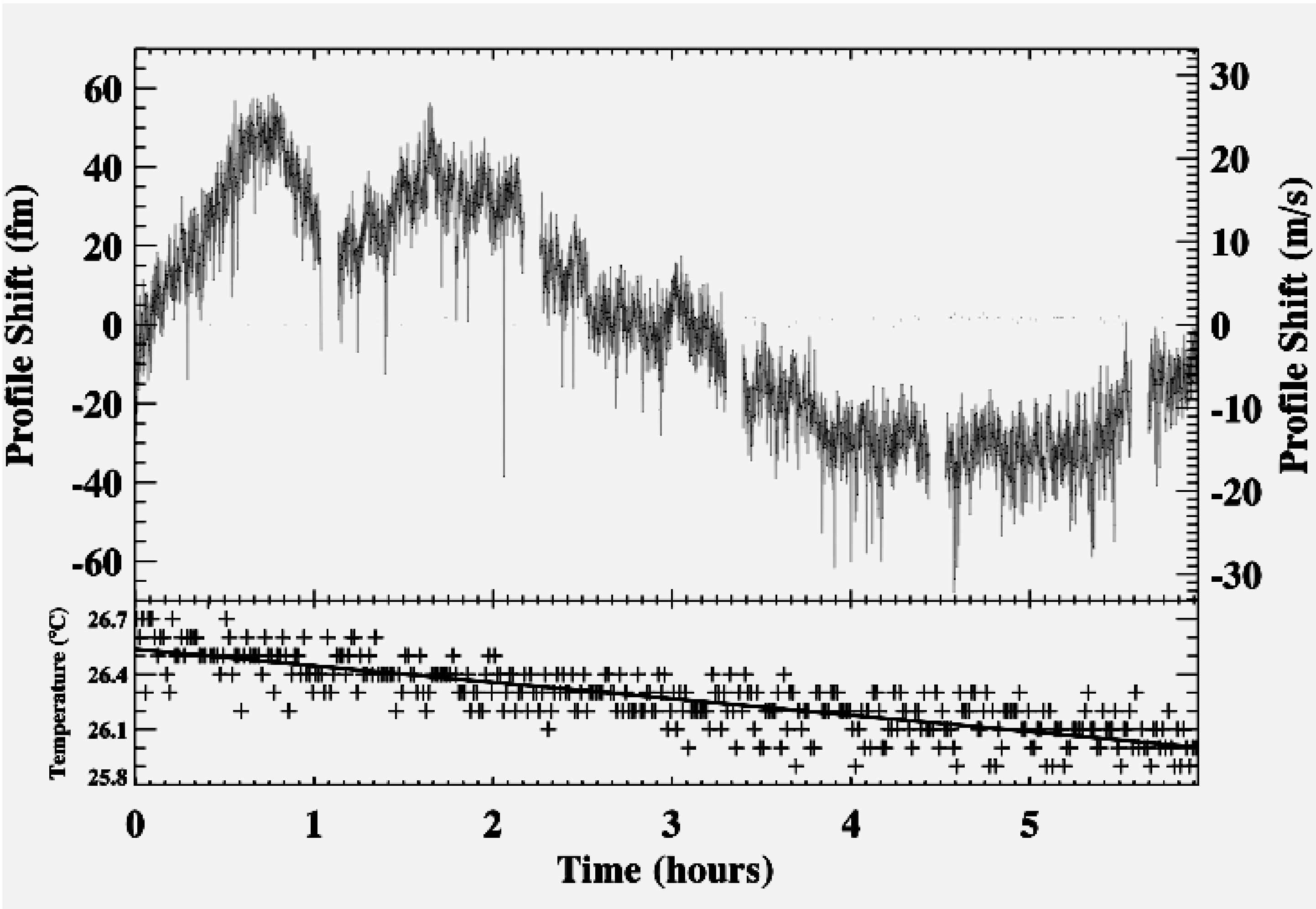




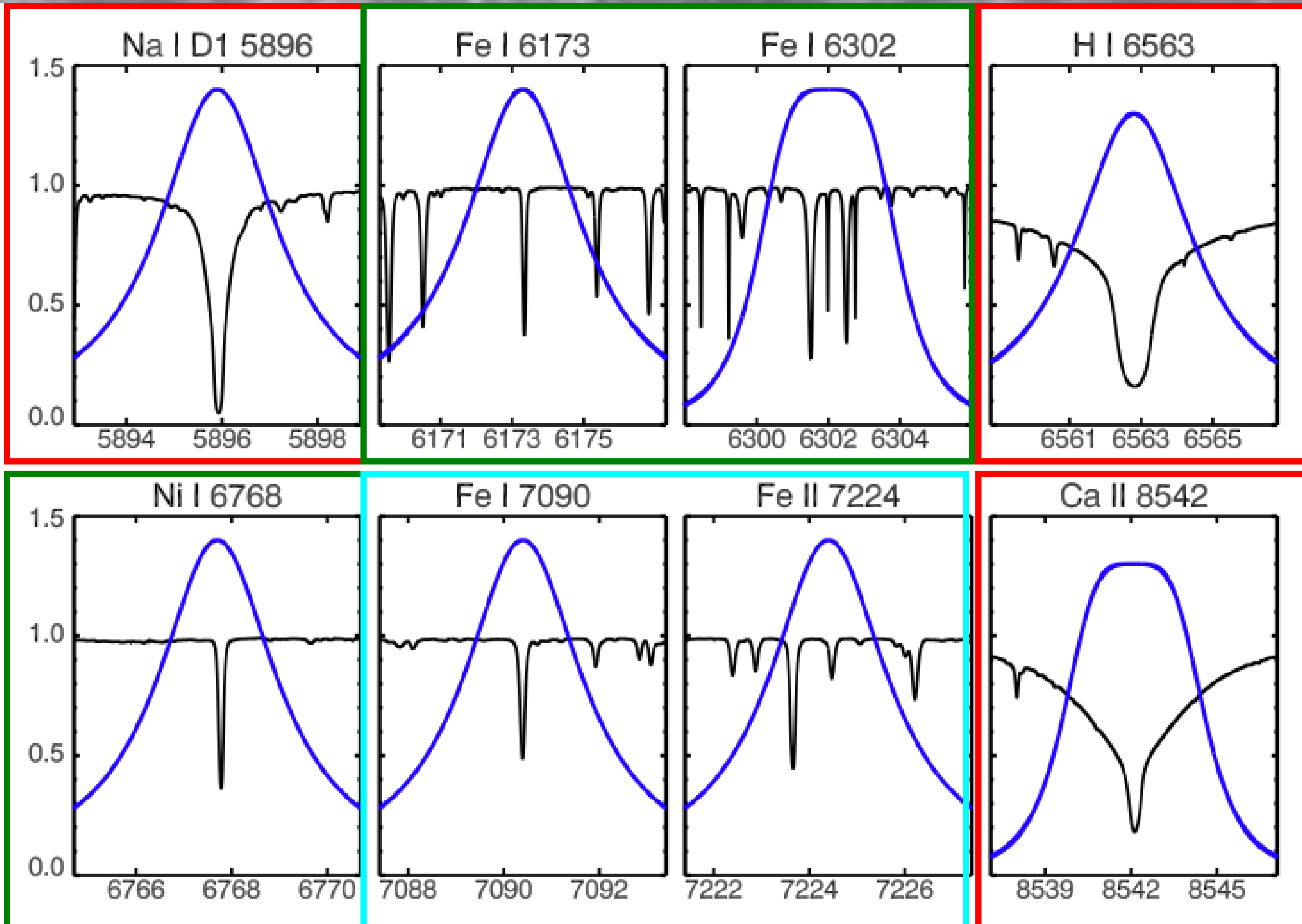
Spectral resolution ~ 300,000

IBIS Instrumental Profile Stability

Measured Wavelength Fluctuations



Current Pre-filter Passbands



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   a) ***Flares***
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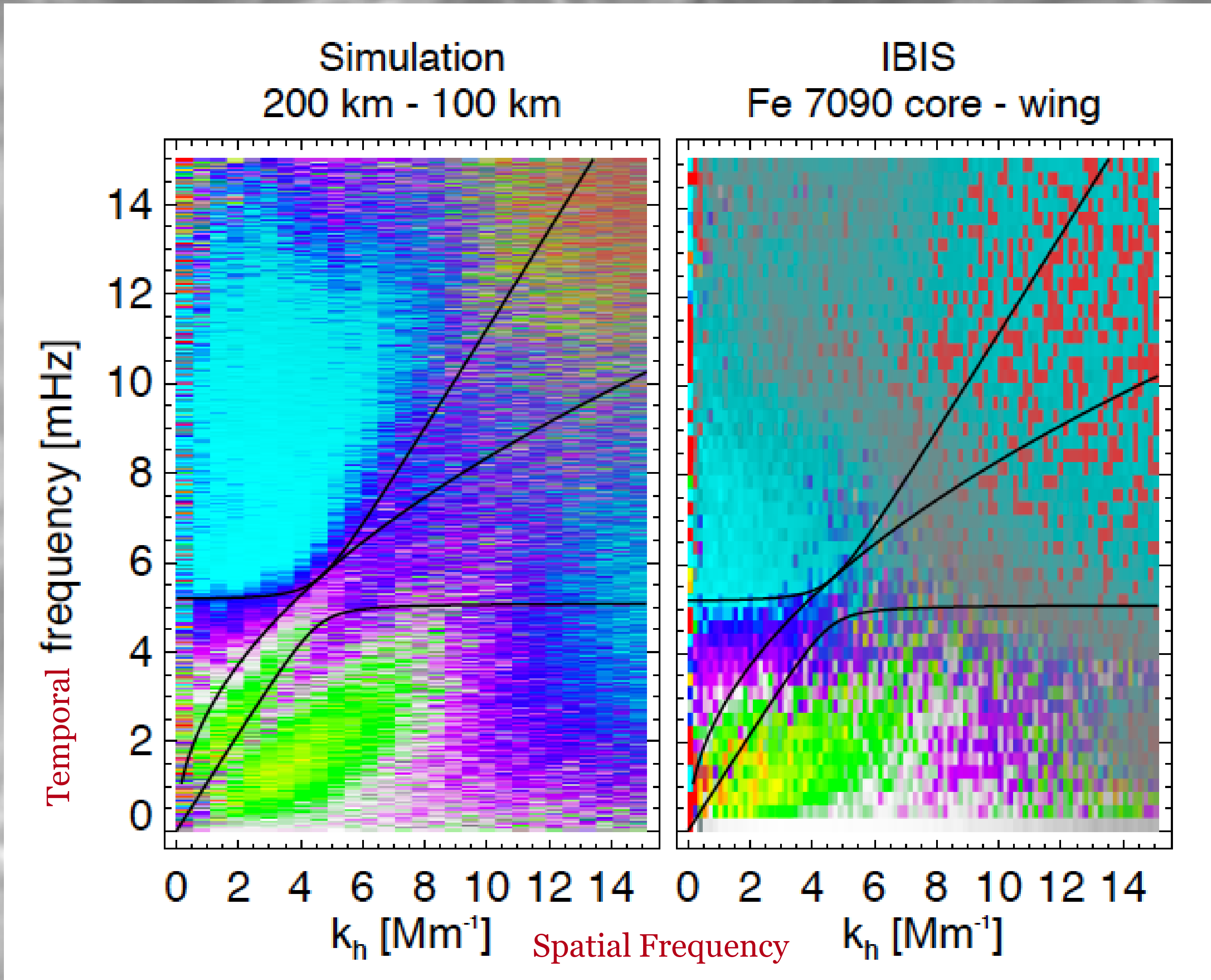
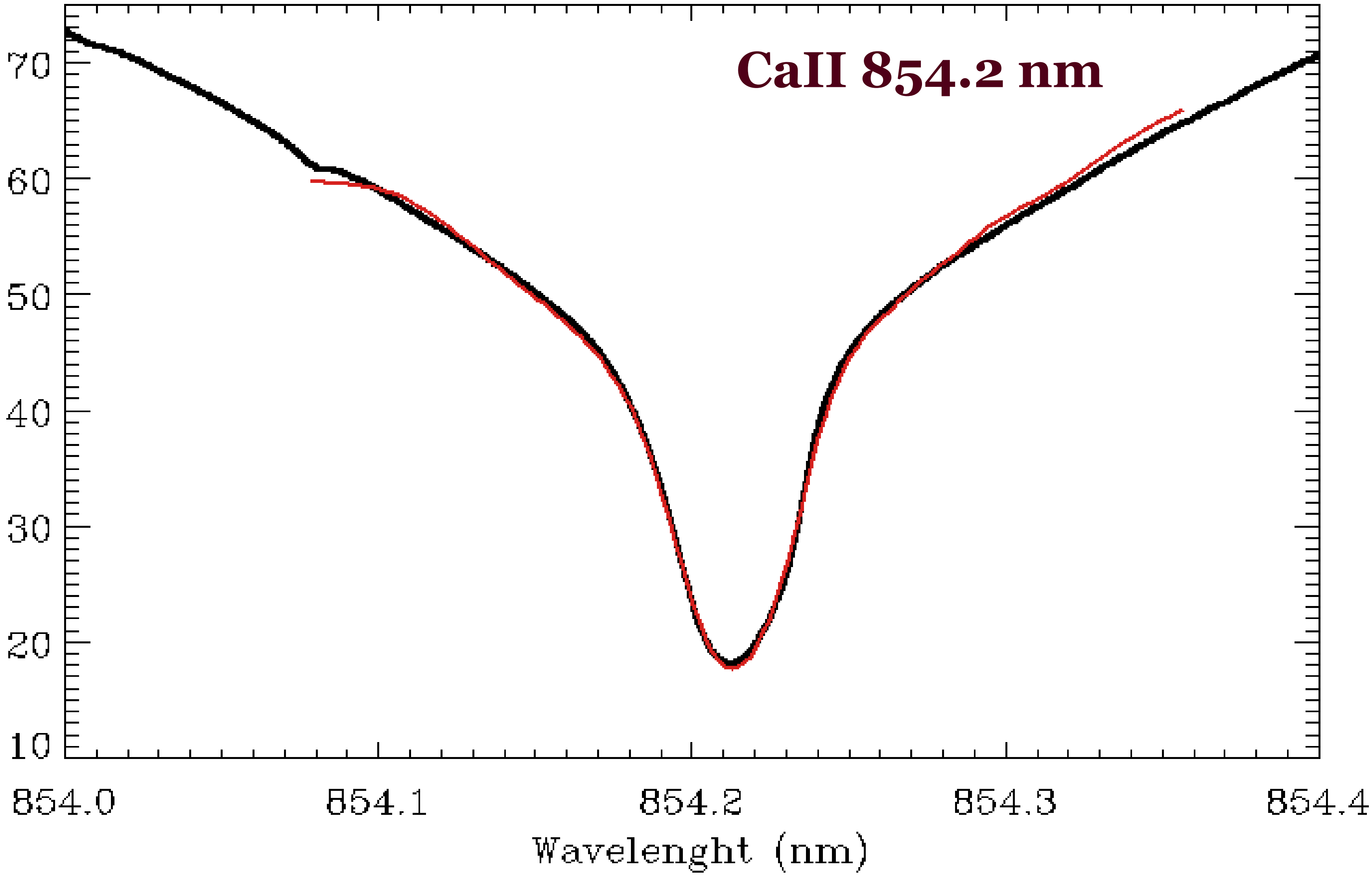
Comparison With Simulations - Oscillatory Behavior

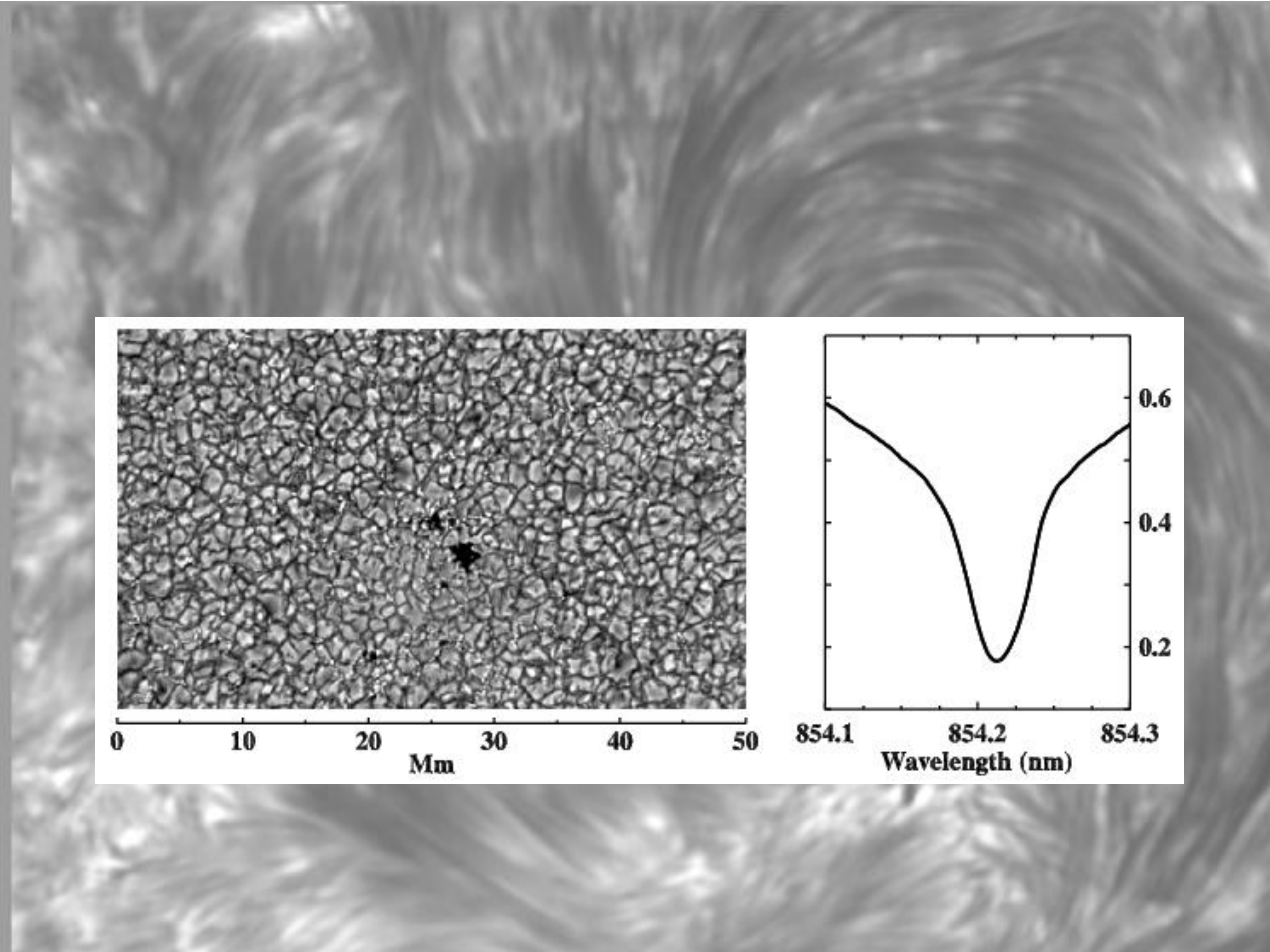


Straus et al. 2008, ApJL 681, 125

Chromospheric Dynamics



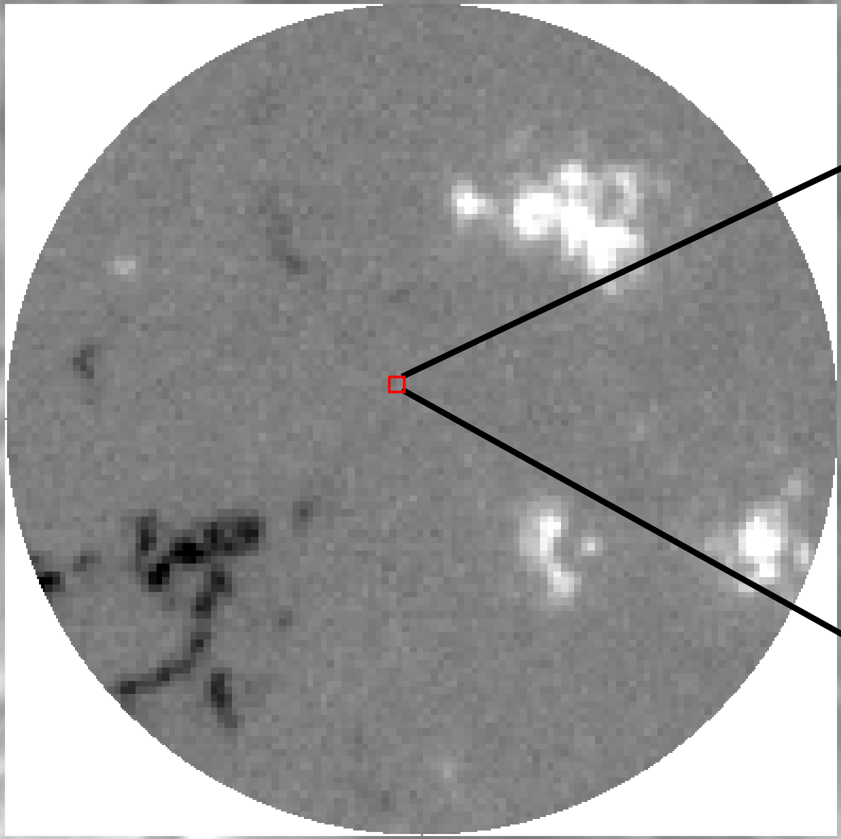
Cauzzi et al. 2008, A&A 480, 515



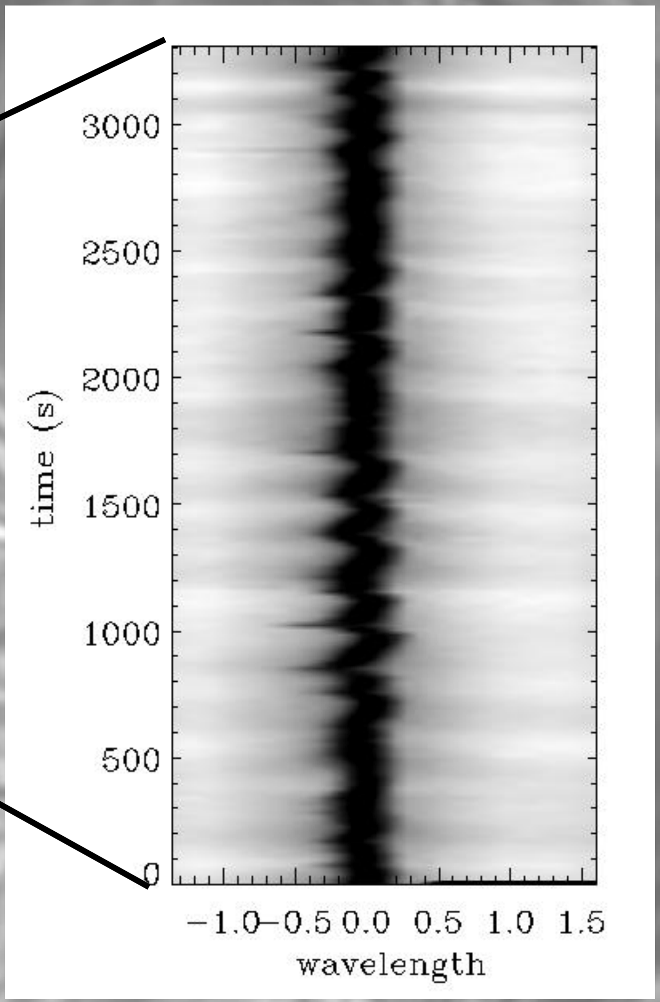
0
10
20
30
40
50
Mm
0.6
0.4
0.2
854.1
854.2
854.3
Wavelength (nm)

Acoustic shocks in the internetwork

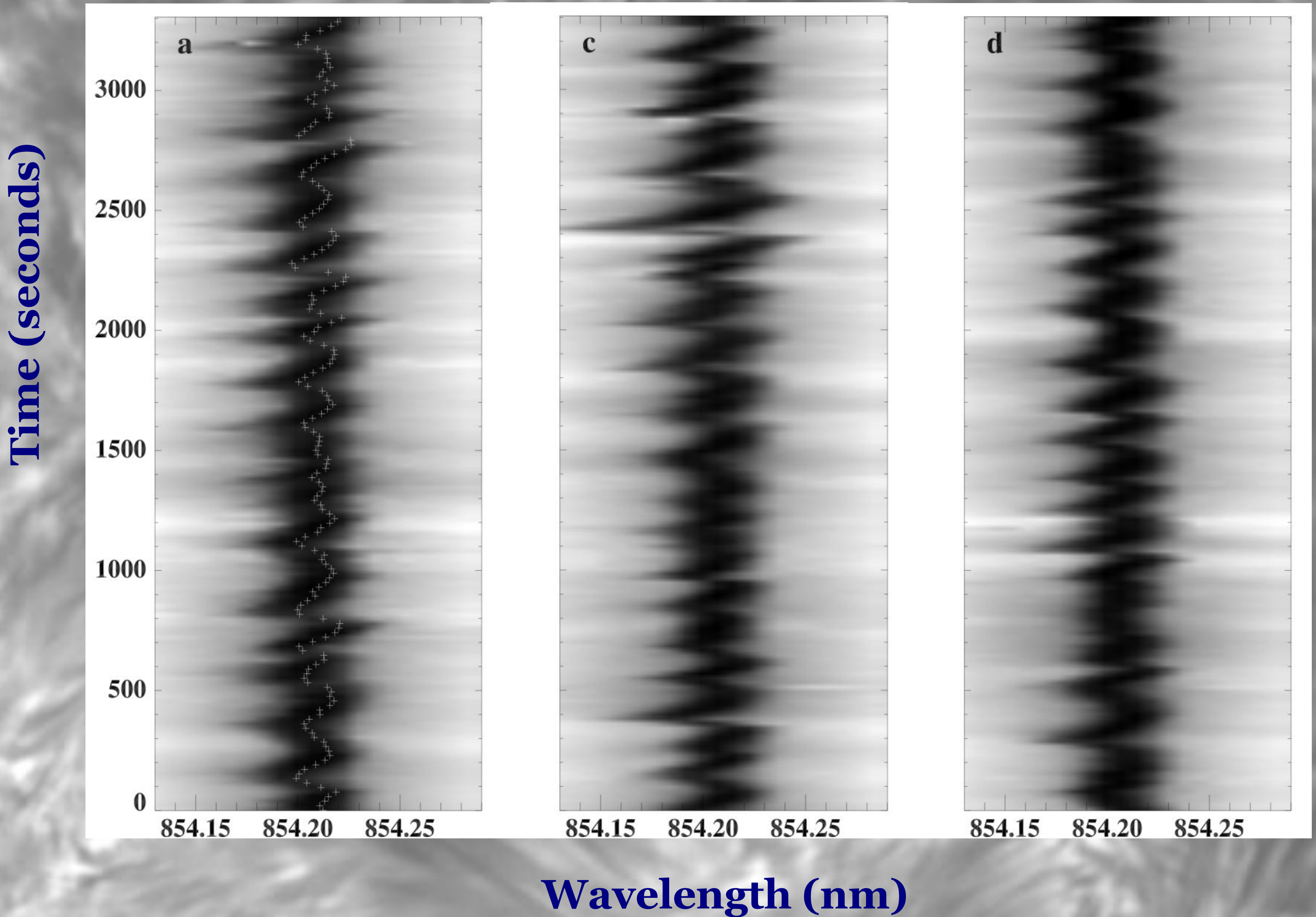
MDI magnetogram



Ca II spectra time-stack



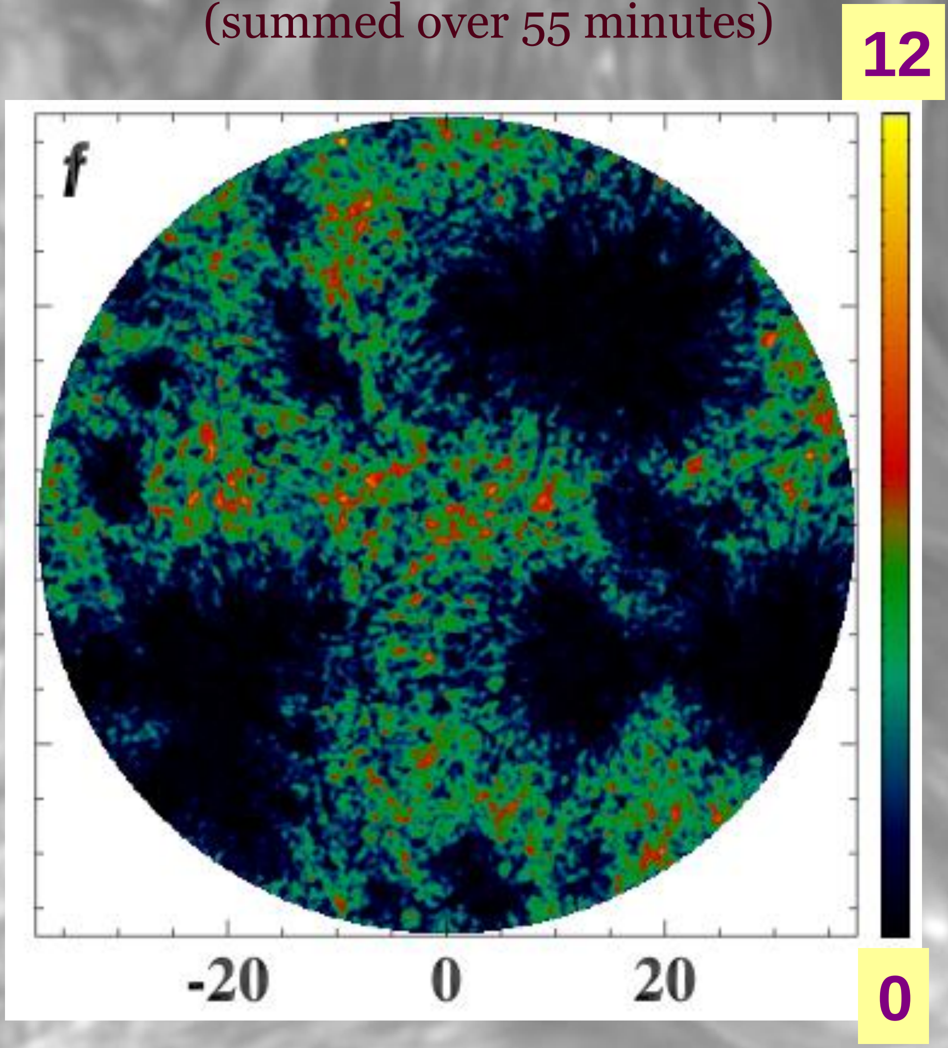
Internetwork Spectral Behavior



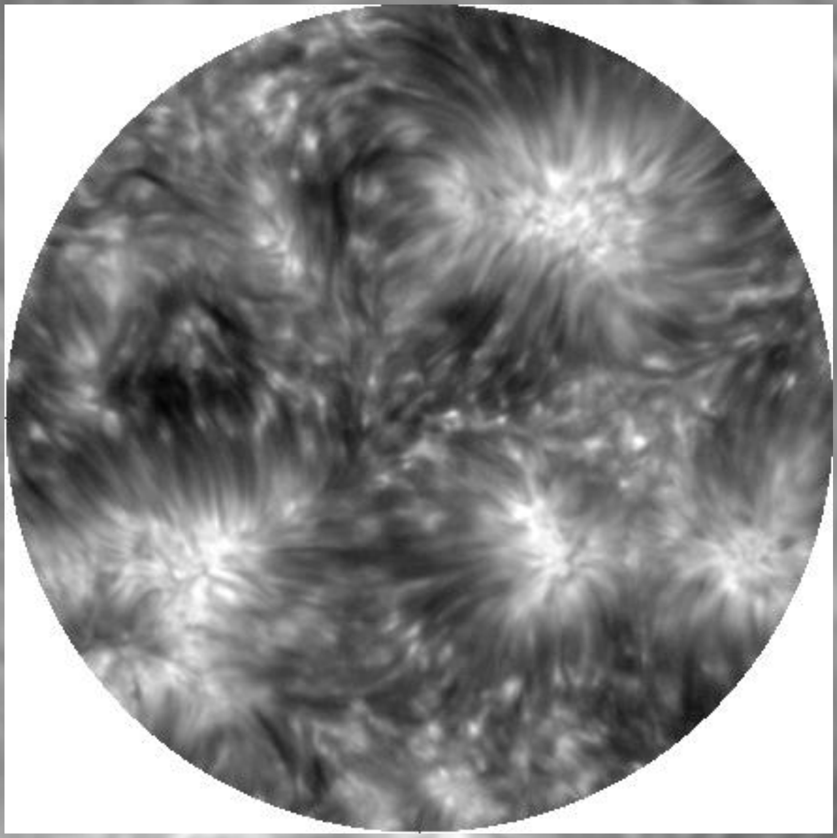
Vecchio et al. 2008, A&A in press

Shock Statistics

Cumulative Shock Map
(summed over 55 minutes)

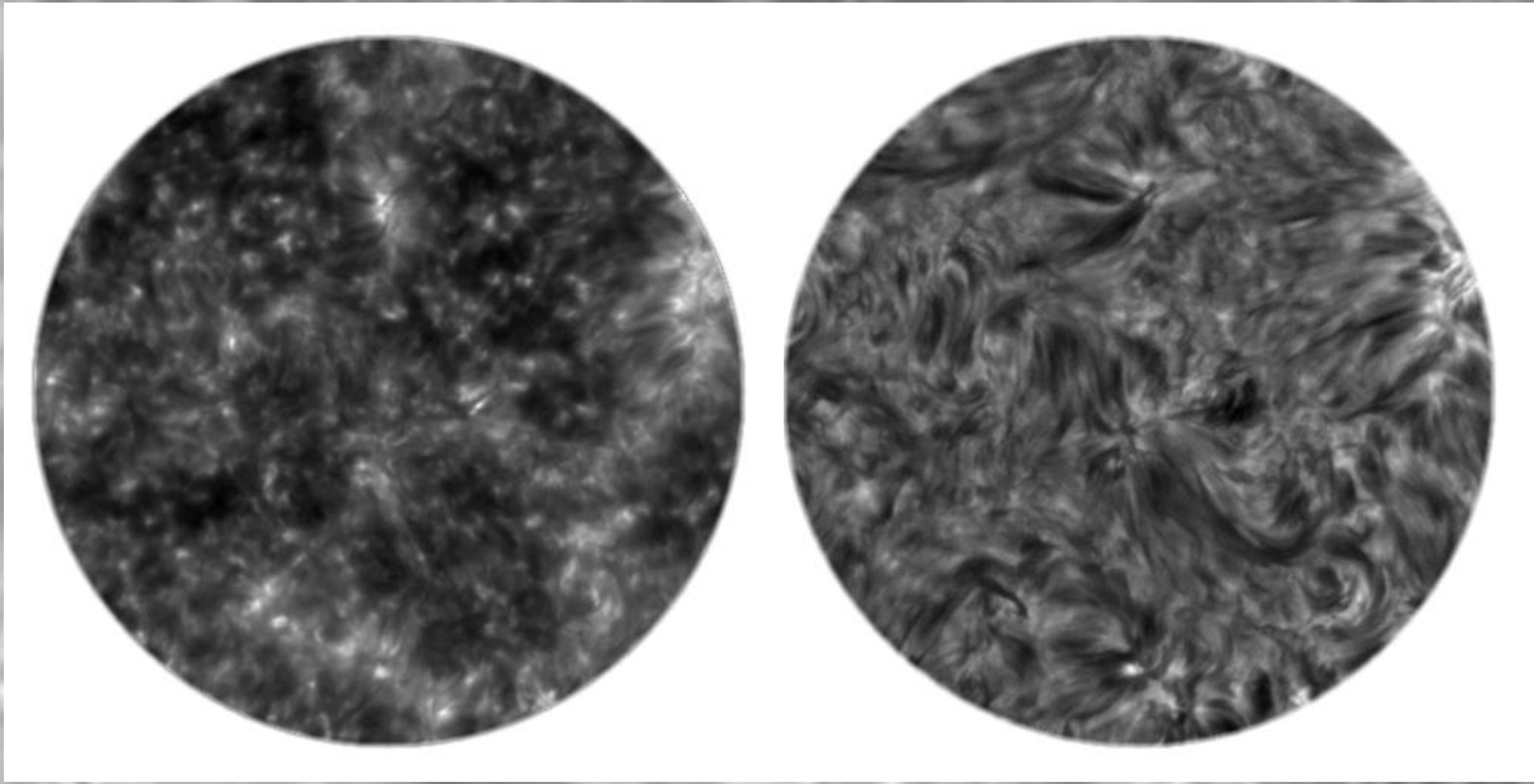


Ca II 8542 Line Core Intensity



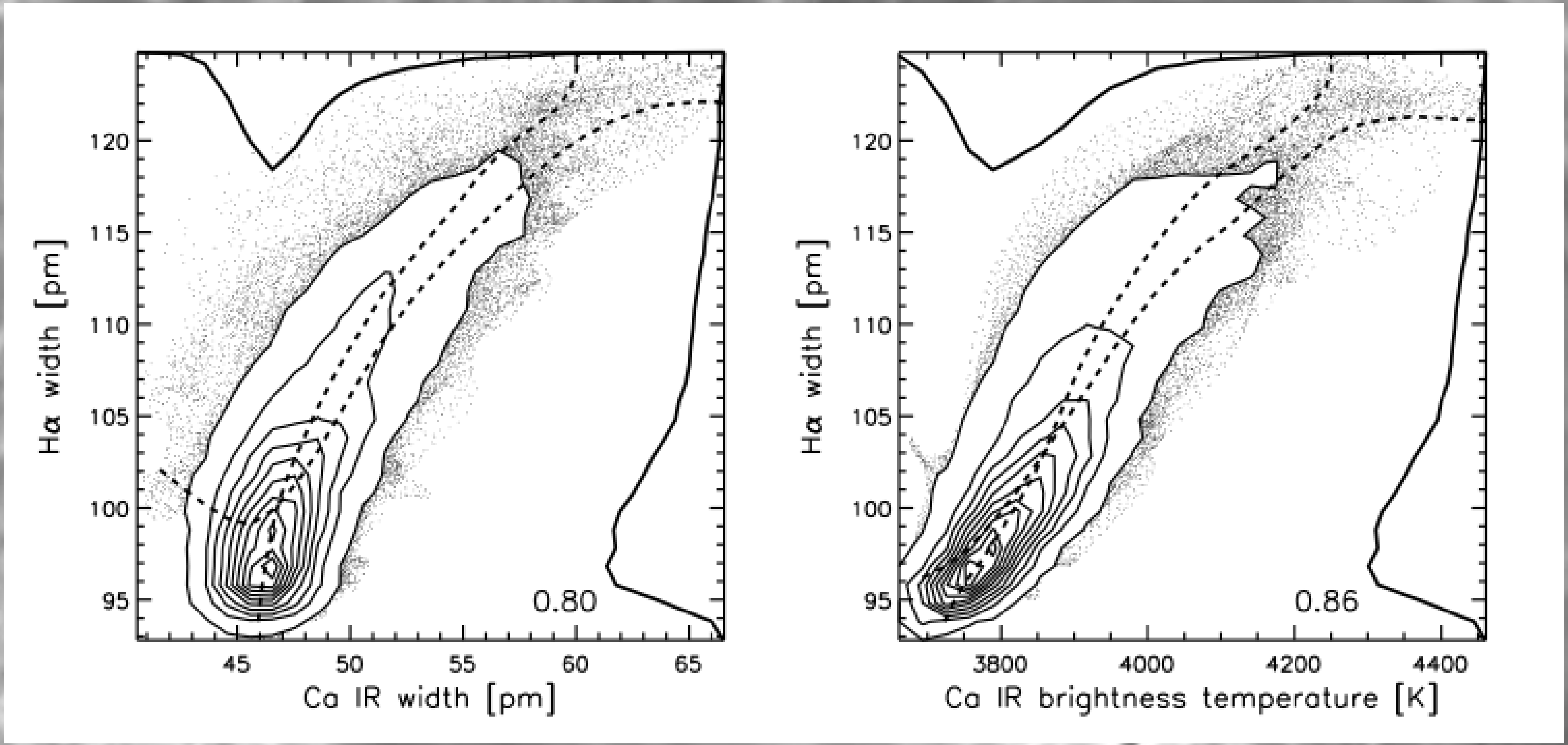
Vecchio et al. 2008, A&A in press

Dual-Line Thermal Analysis



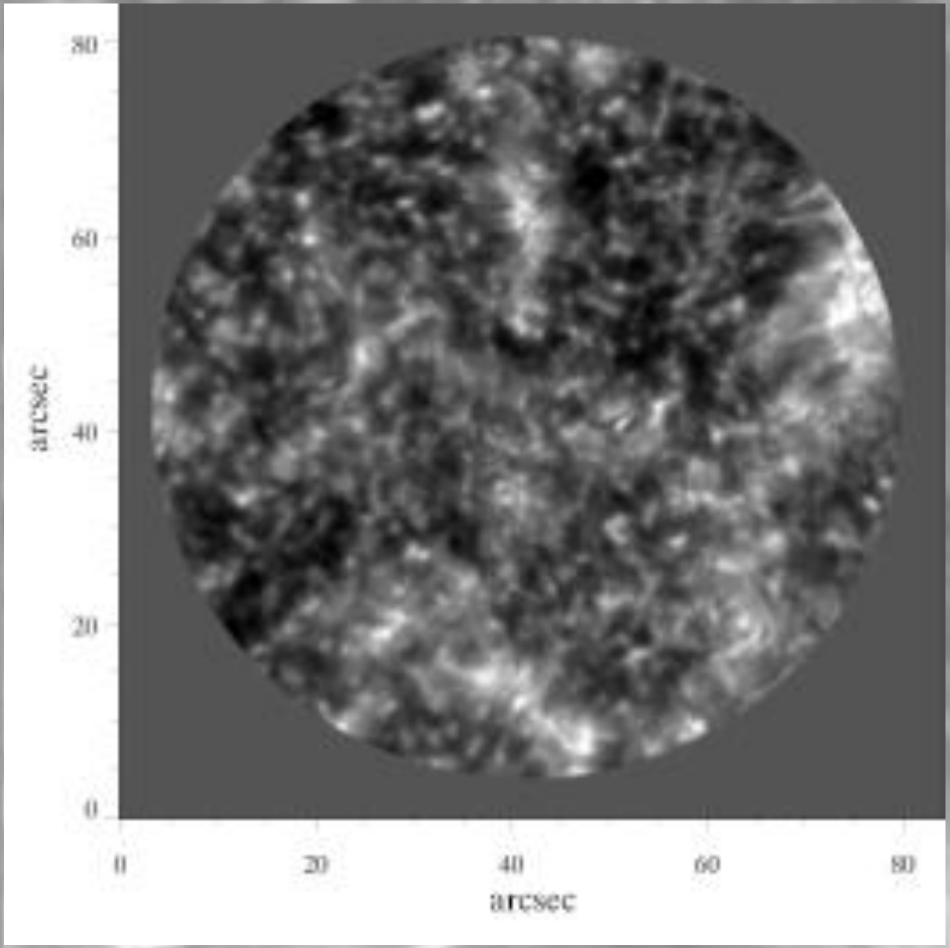
Cauzzi et al. 2008, A&A to be submitted

Width-Width & Width- Intensity Comparison

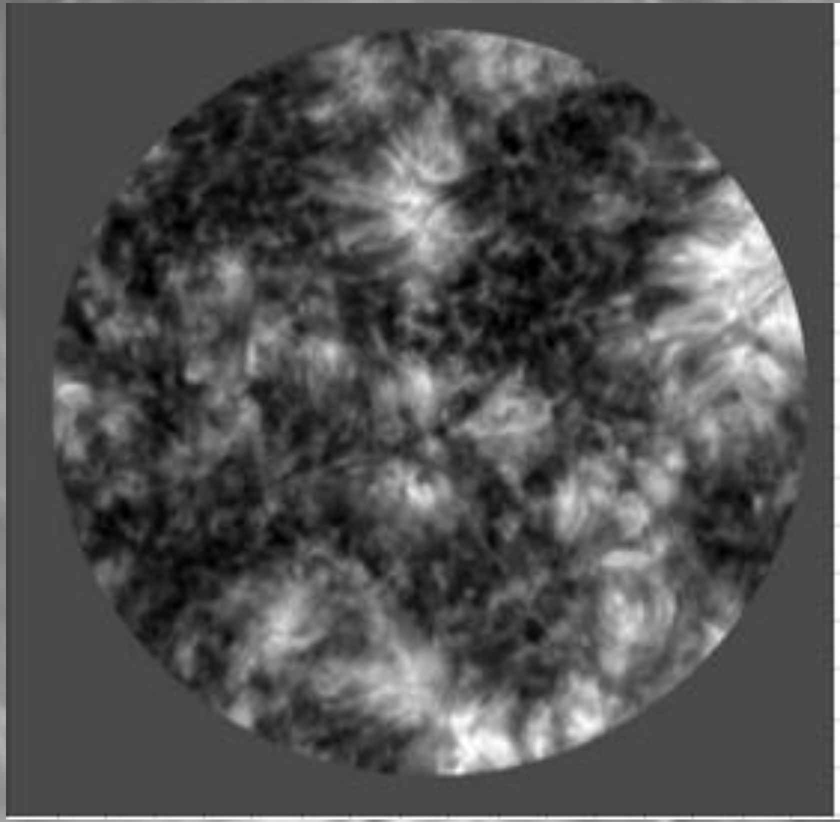


Dual-Line Thermal Analysis

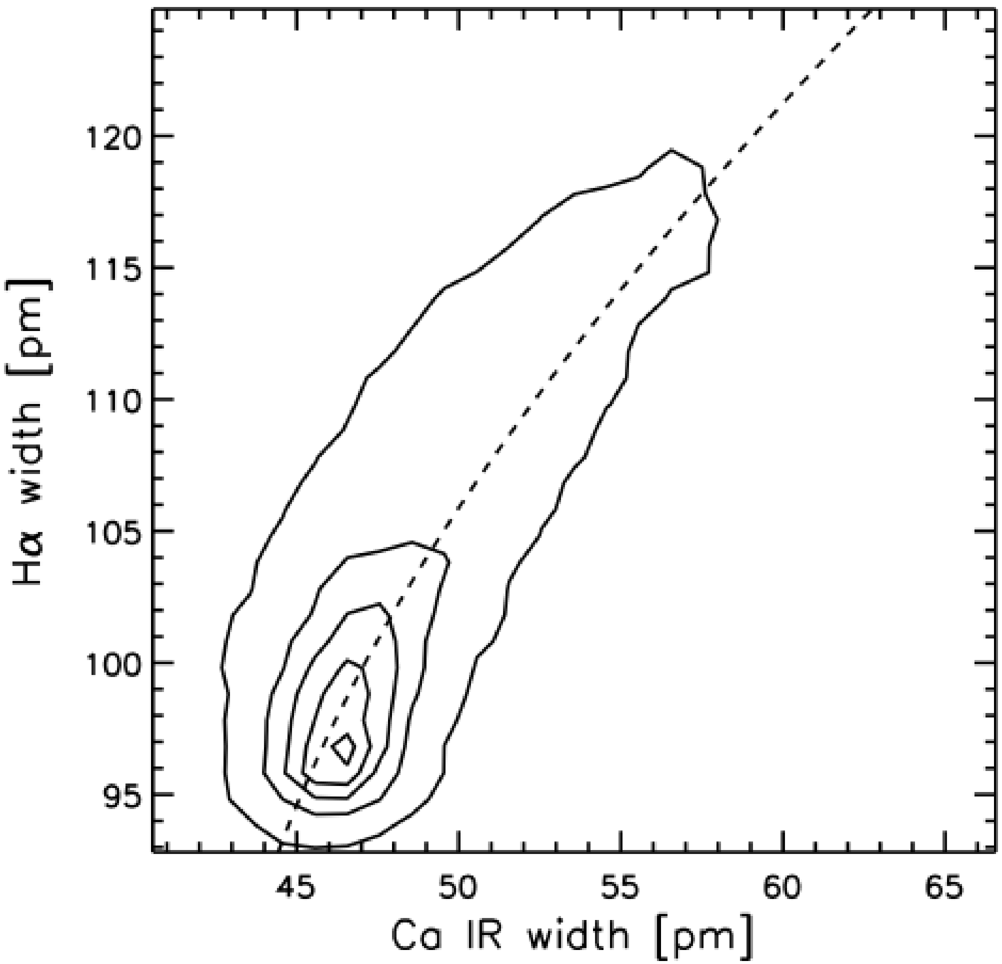
Ca II 8542
Line Minimum Intensity



Hα 6563
Line width



Line Width - Intensity Comparison



Vmicro =
2+12T/(Tmax-Tmin) [km/s]

T= 10--80,000 K

Vintrins =
40 km/s (Ha)
15 km/s (CaII)

$$\Delta\lambda_W \equiv (\lambda/c)\sqrt{v_{\rm therm}^2 + v_{\rm micro}^2 + v_{\rm intrins}^2}$$

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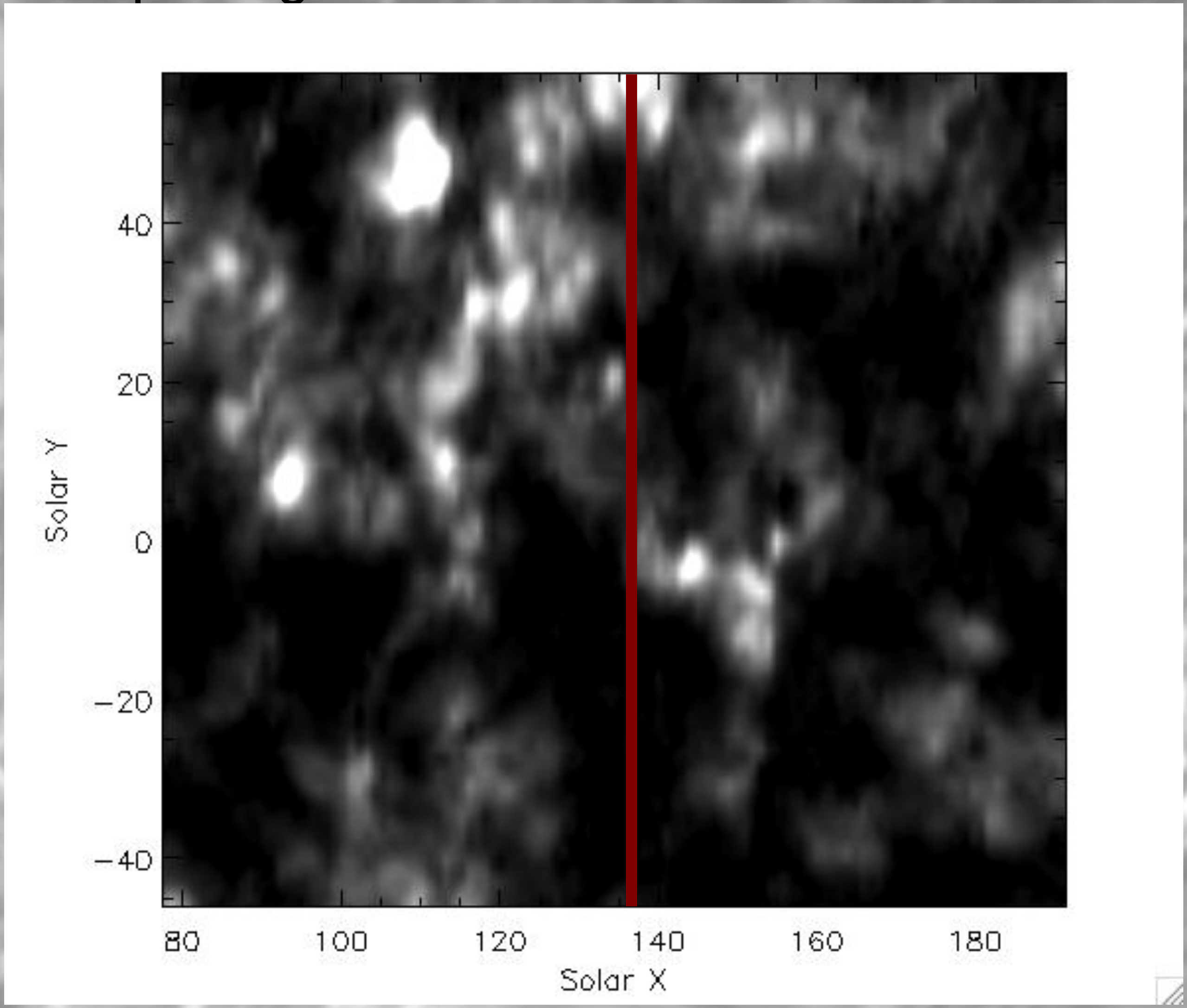
April 18, 2007
SUMER Si IV 140.2 nm + continuum

Opening raster



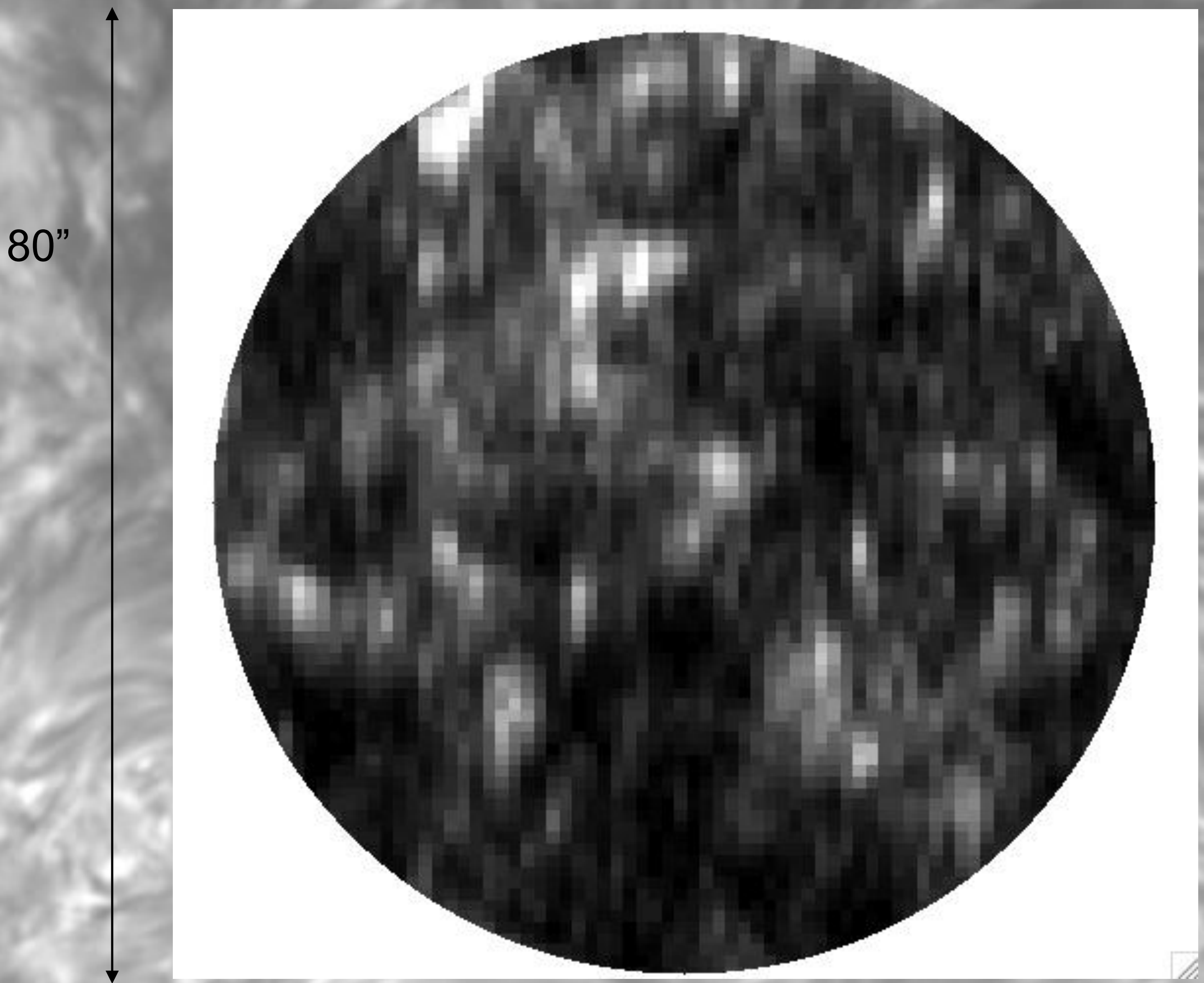
dx ~ dy ~ 1''
dt ~ 10 s
texp ~ 10 s
Δt ~ 19 min

Si IV radiance

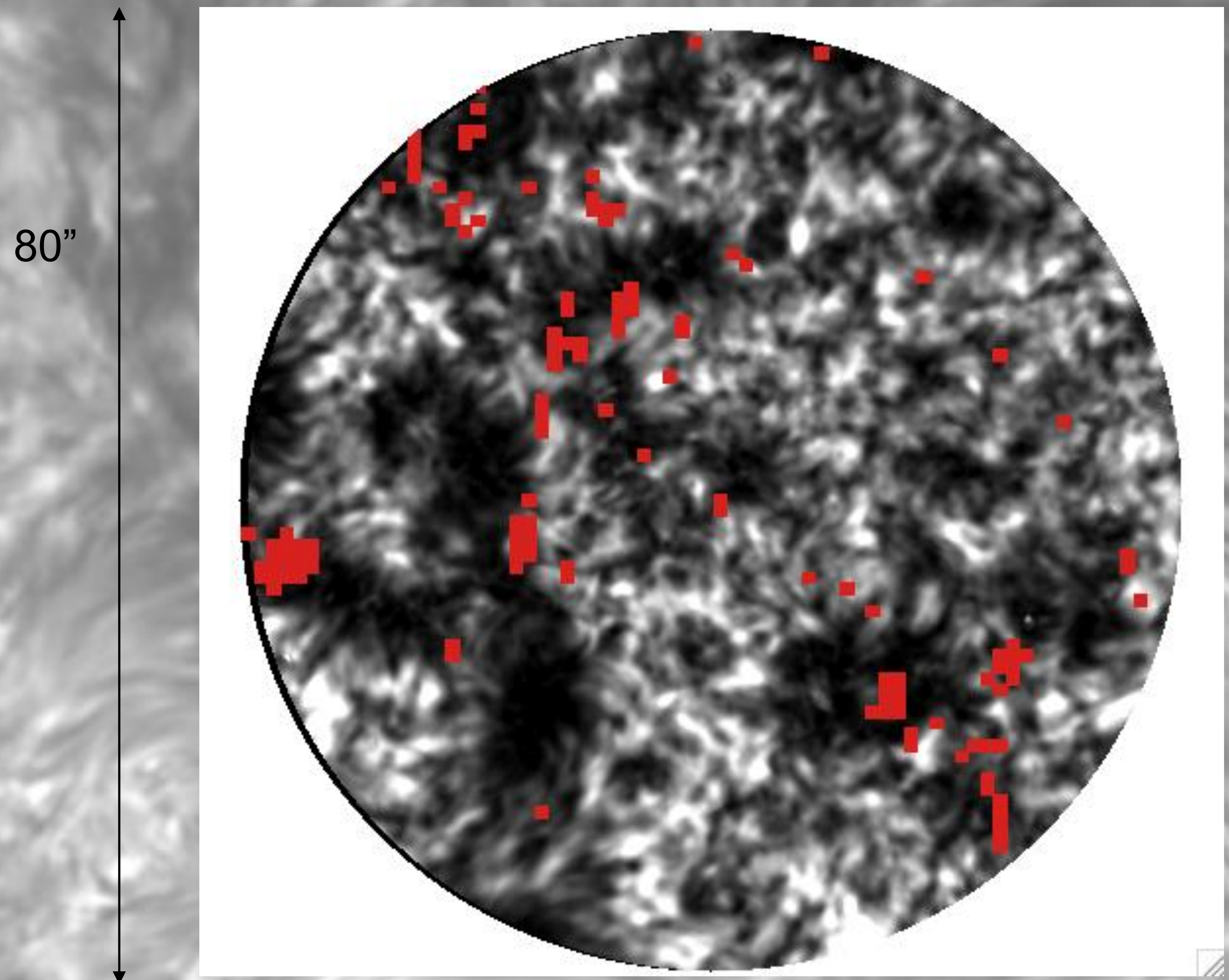
Continuum 141 nm

Teriaca et al., in prep

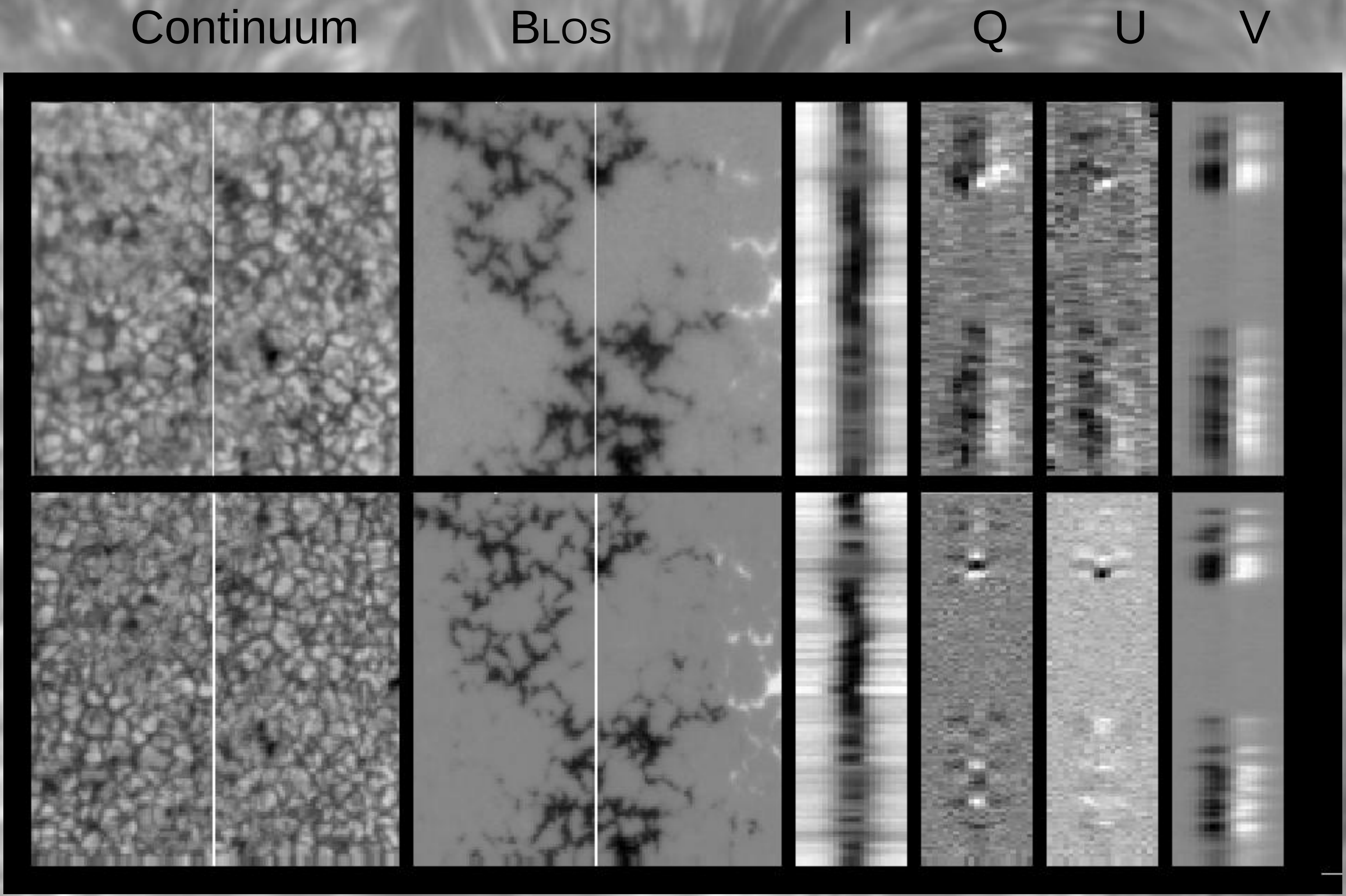
Alignment IBIS -SUMER



3 min power map of CaII velocity + position of EEs



Polarimetry



Courtesy of P. Judge

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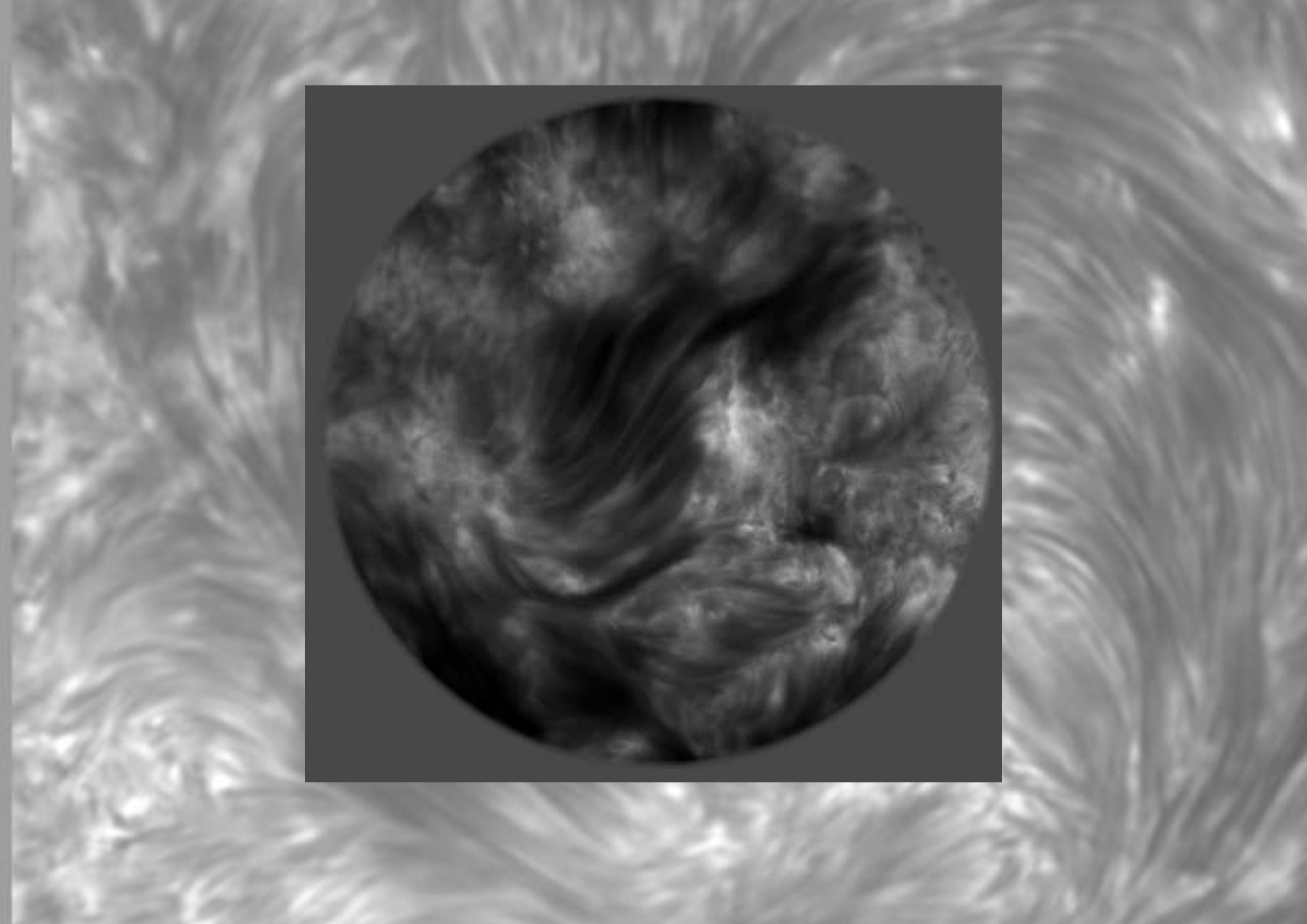
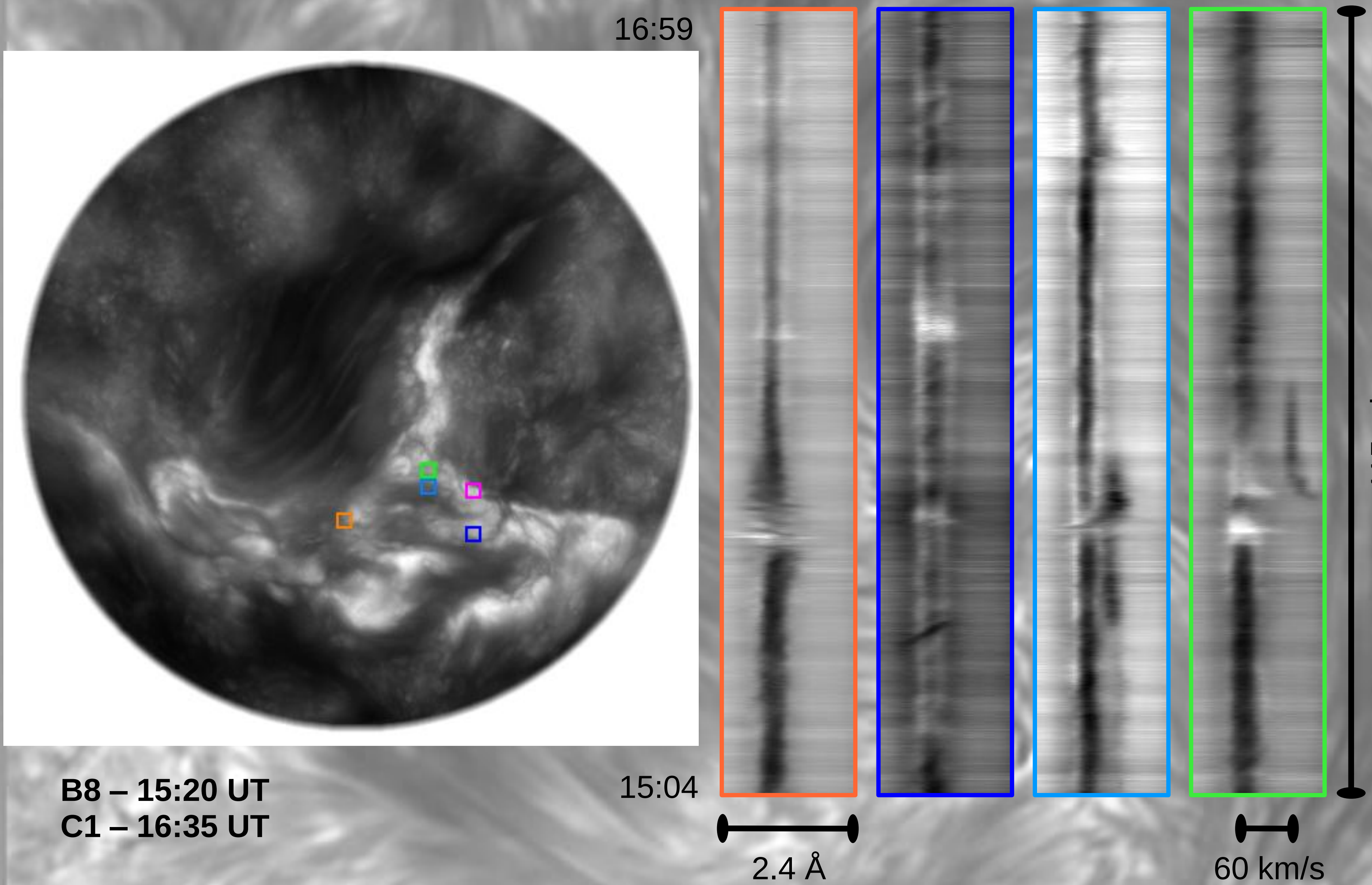
March 19 2004 B8+C1 flares. CaII 854.2 core. 2.5 hrs @ 6 s cade



Flare Imaging Spectroscopy – 19 Mar 2004



B8 – 15:20 UT
C1 – 16:35 UT

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Problems with GBOs

Ground-based observations are **inefficient:**

- ***weather***
- ***scheduling***
- ***data philosophy***

Weather:

◆clouds or terrible seeing may prevent observing

◆poor seeing may render observations borderline useful Þ *worst case!*

Scheduling:

◆schedule set 3-12 months in advance

◆significant amount of time for instrument setup

◆not responsive to changes in solar conditions or coordinated campaigns

Data Philosophy:

◆only raw data is provided!

◆seldom is there a predefined data pipeline

◆system flexibility complicates standardized reduction processes

◆seeing adds irregularity

◆***tiny amount of money for development of data reduction packages!***

Can we operate a ground-based telescope more like a spacecraft?

Service Mode Observations

PI defines observational programs based on science goals
Observations are scheduled according to solar/meteo conditions
PI does not need to go to telescope

Requires **stability**, but not at cost of **flexibility**

-- rapid instrumental reconfiguration, and *repeatable*
-- flexibility in observation definition not instrument configuration
-- reliable instrument performance

Advantage of imaging spectroscopy
– instrument “fixed”, science goals addressed in observation definition

IBIS Service Mode Observations

Coordinated observations with Hinode
and NSO/Dunn Solar Telescope (IBIS)

Approach

- 1-2 week block of observations set aside for both observatories
- Researchers propose observing programs for different targets *(i.e. quiet Sun, sunspot, prominences, etc.)*
- Observing target chosen based on solar conditions
- IBIS observations obtained by NSO staff
- Reduced data provided to external researchers for analysis

IBIS Service Mode Observations

Coordinated observations with Hinode
and NSO/Dunn Solar Telescope (IBIS)

Goals

- Provide simple(r) access to ground-based instrumentation
- Convenient coordination between multiple observatories
- Low(er) barrier of entry for non-specialists
- Condition dependent observations for efficient use of solar telescopes
- Testing of future observing modes for large telescopes (e.g. ATST)

First tests April and July, 2008

Upcoming: 21 January - 1 February 2009


Thank you