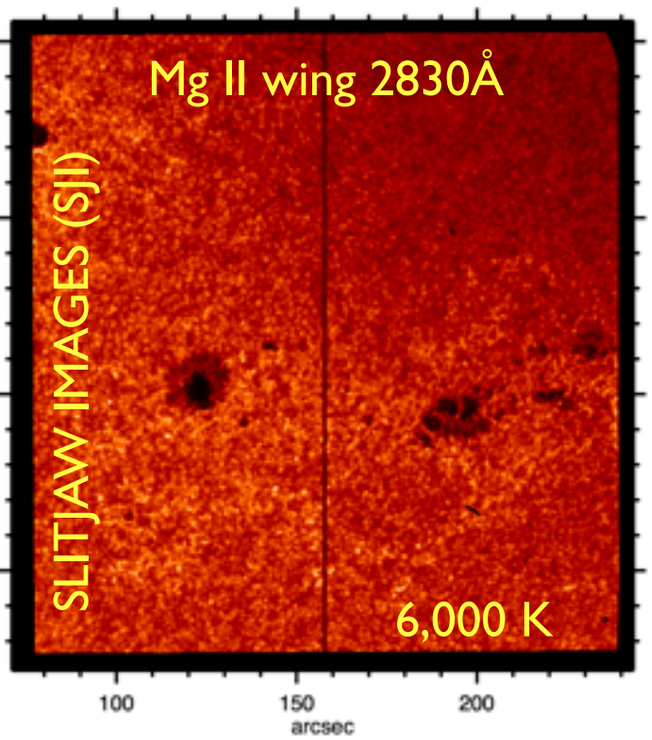
Chromospheric and Transition Region Dynamics as seen by IRIS

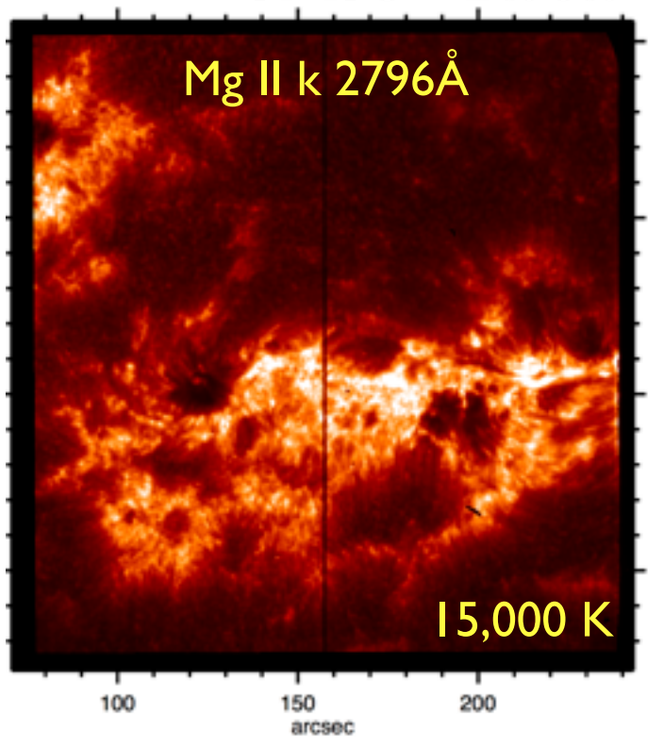
Bart De Pontieu and the IRIS team
Lockheed Martin Solar & Astrophysics Laboratory

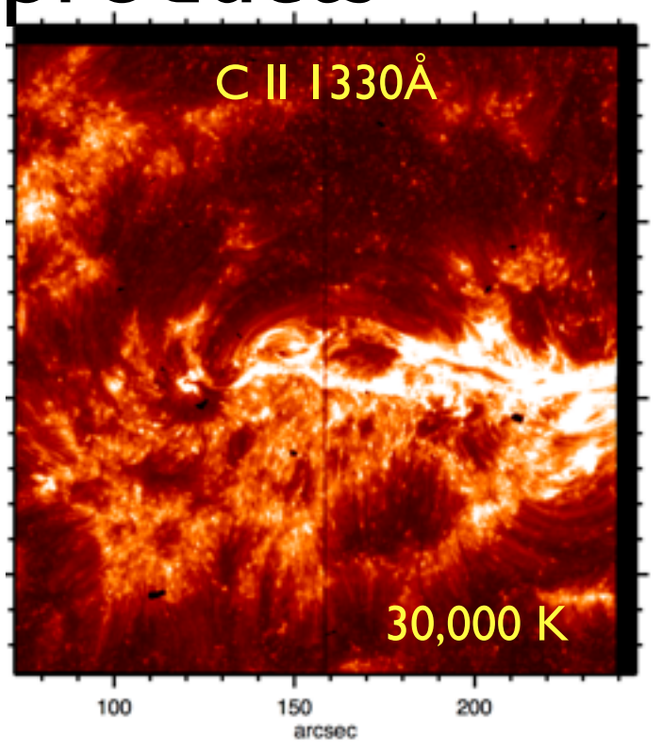
IRIS events

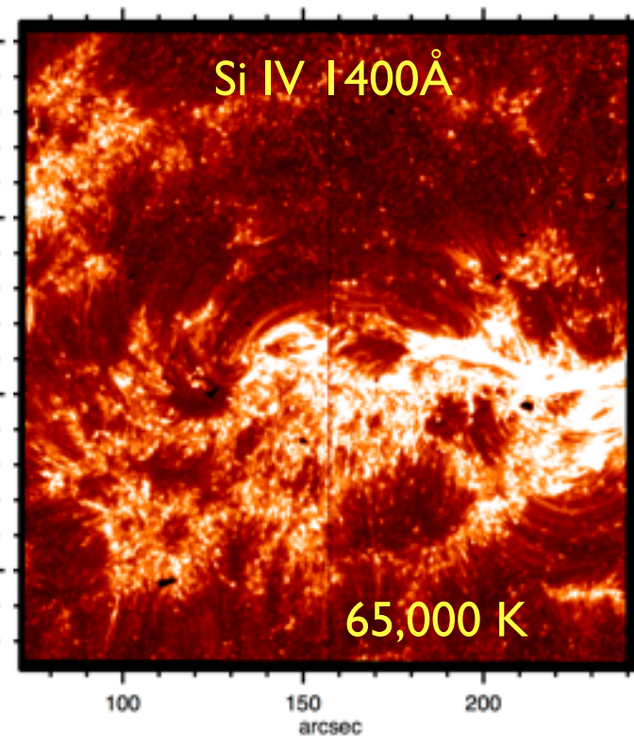
IRIS data products

SLITJAW IMAGES (SJI)

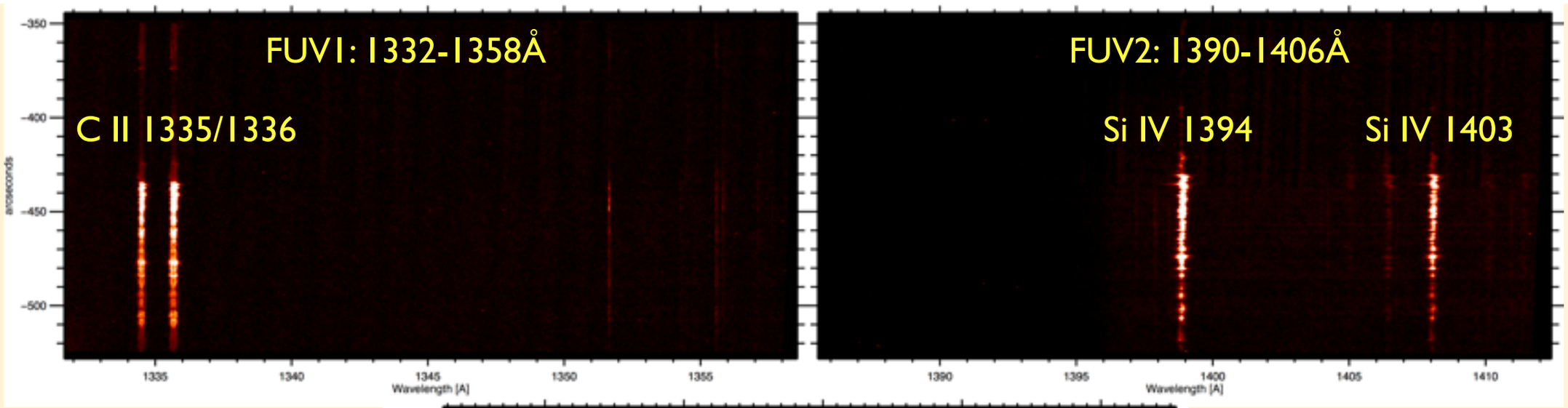


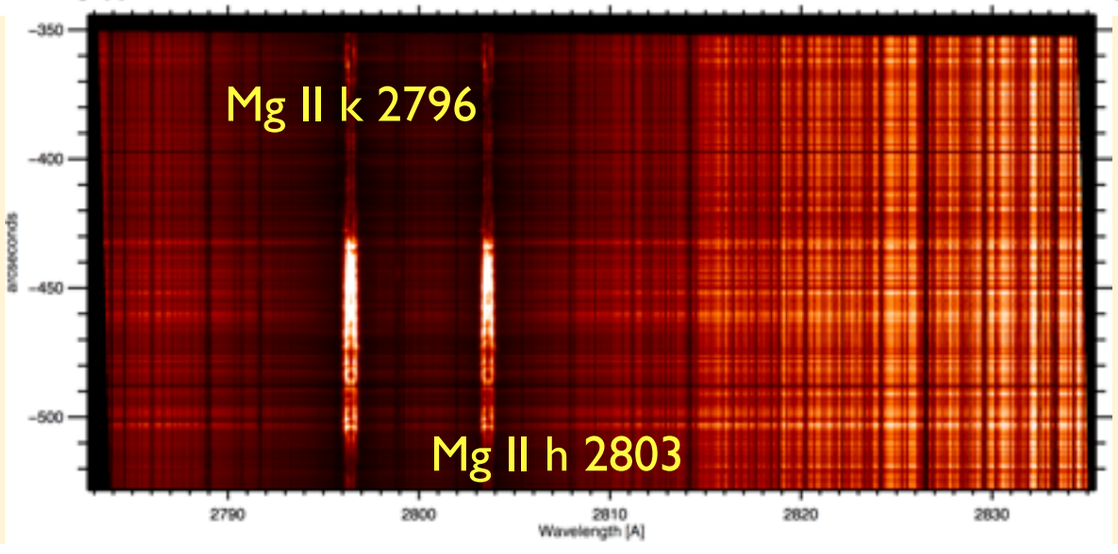






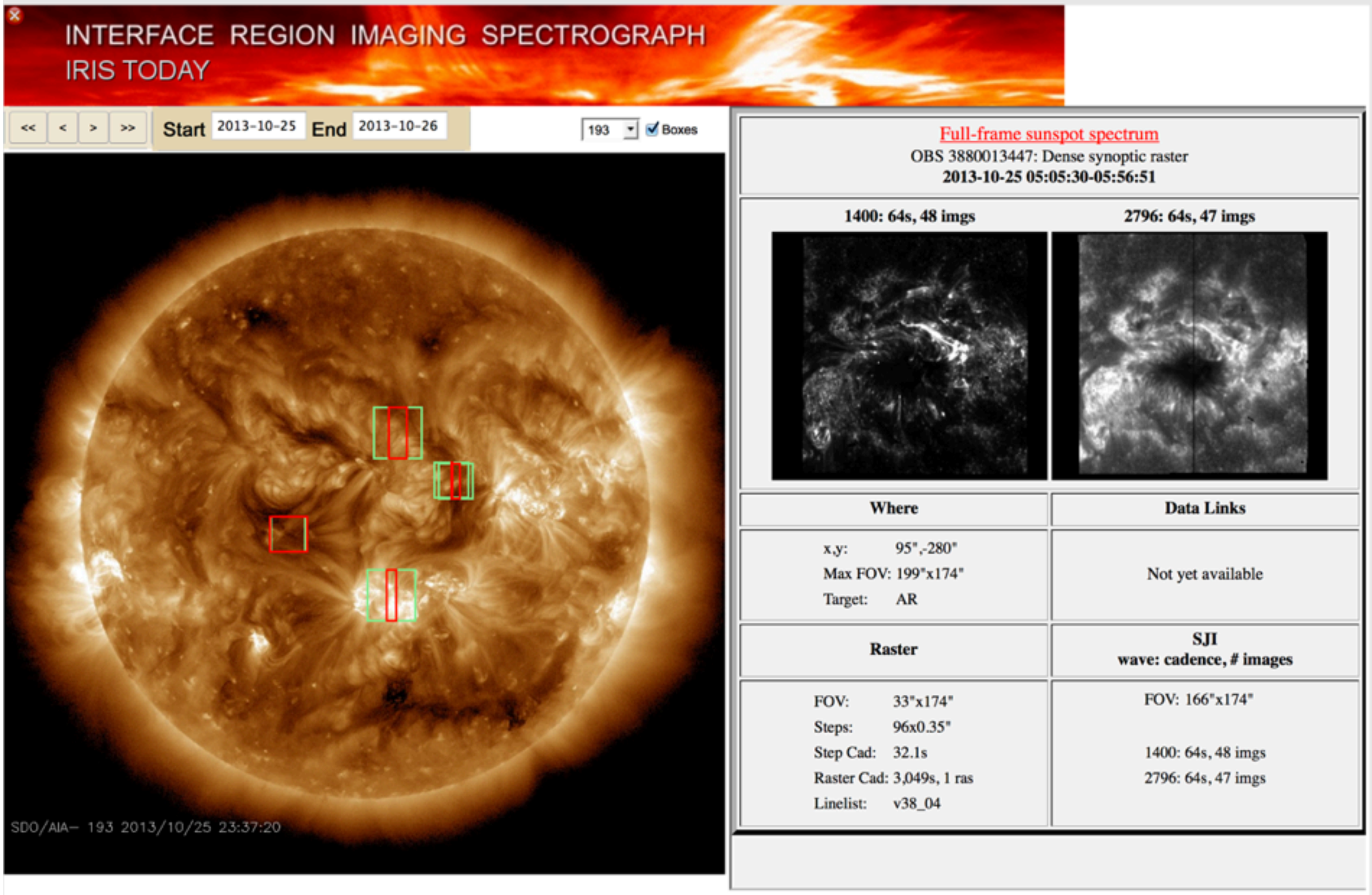
SPECTRA





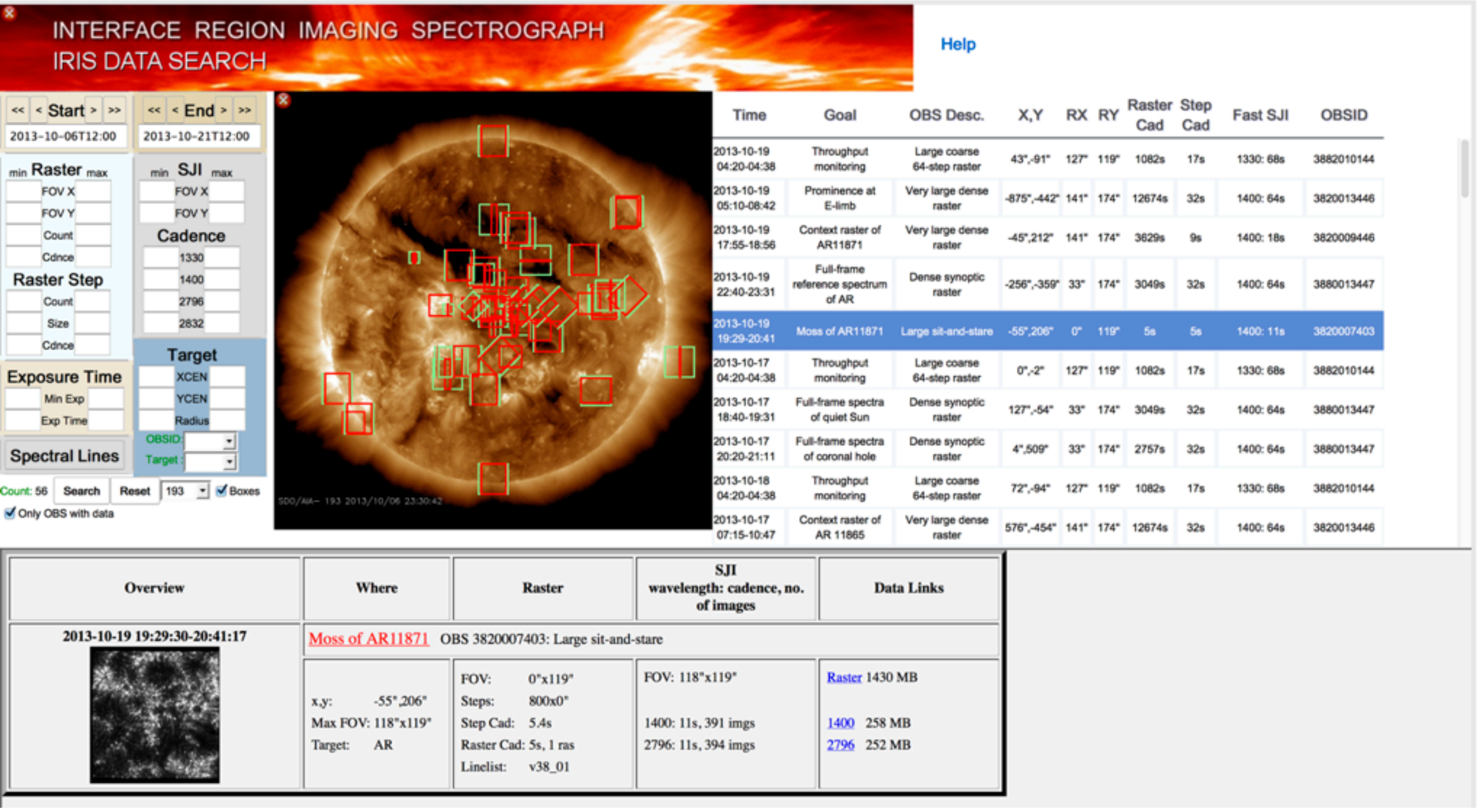
IRIS recent observations

http://iris.lmsal.com/iristoday



IRIS data search

http://iris.lmsal.com/search



Overview	Where	Raster	SJI wavelength: cadence, no. of images	Data Links
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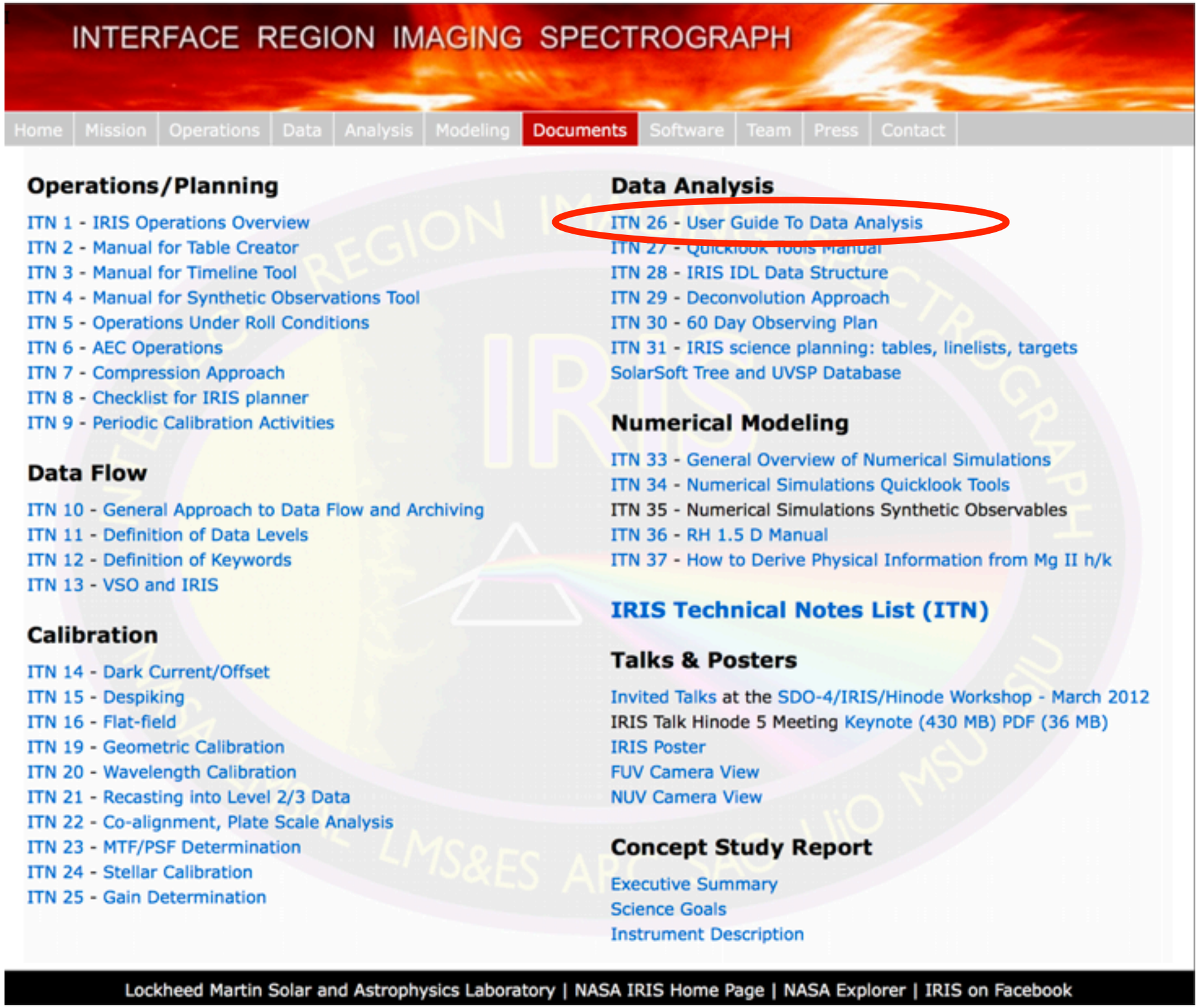
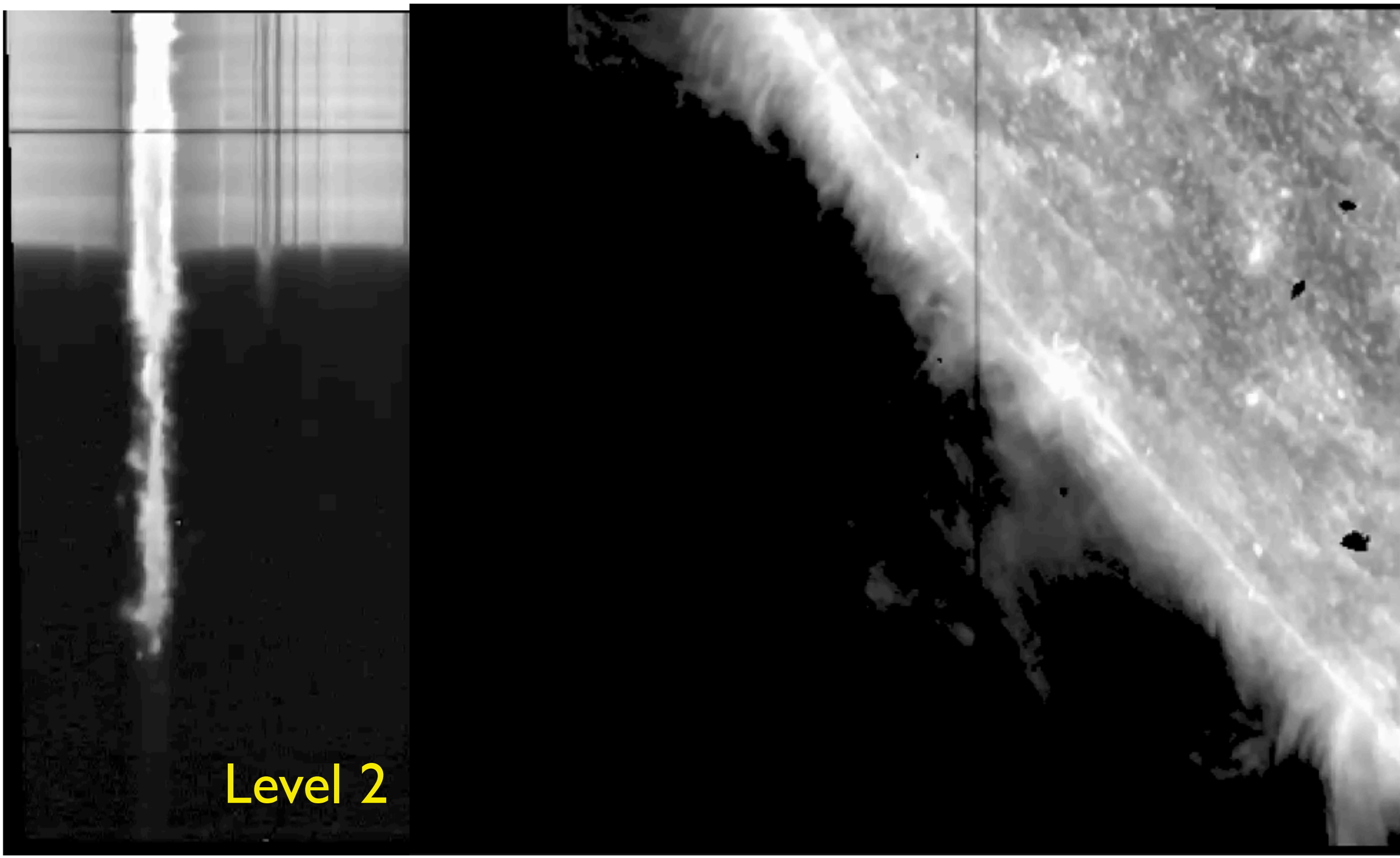
	x,y: -55",206" Max FOV: 118"x119" Target: AR	FOV: 0"x119" Steps: 800x0" Step Cad: 5.4s Raster Cad: 5s, 1 ras Linelist: v38_01	FOV: 118"x119" 1400: 11s, 391 imgs 2796: 11s, 394 imgs	Raster 1430 MB 1400 258 MB 2796 252 MB

IRIS documentation

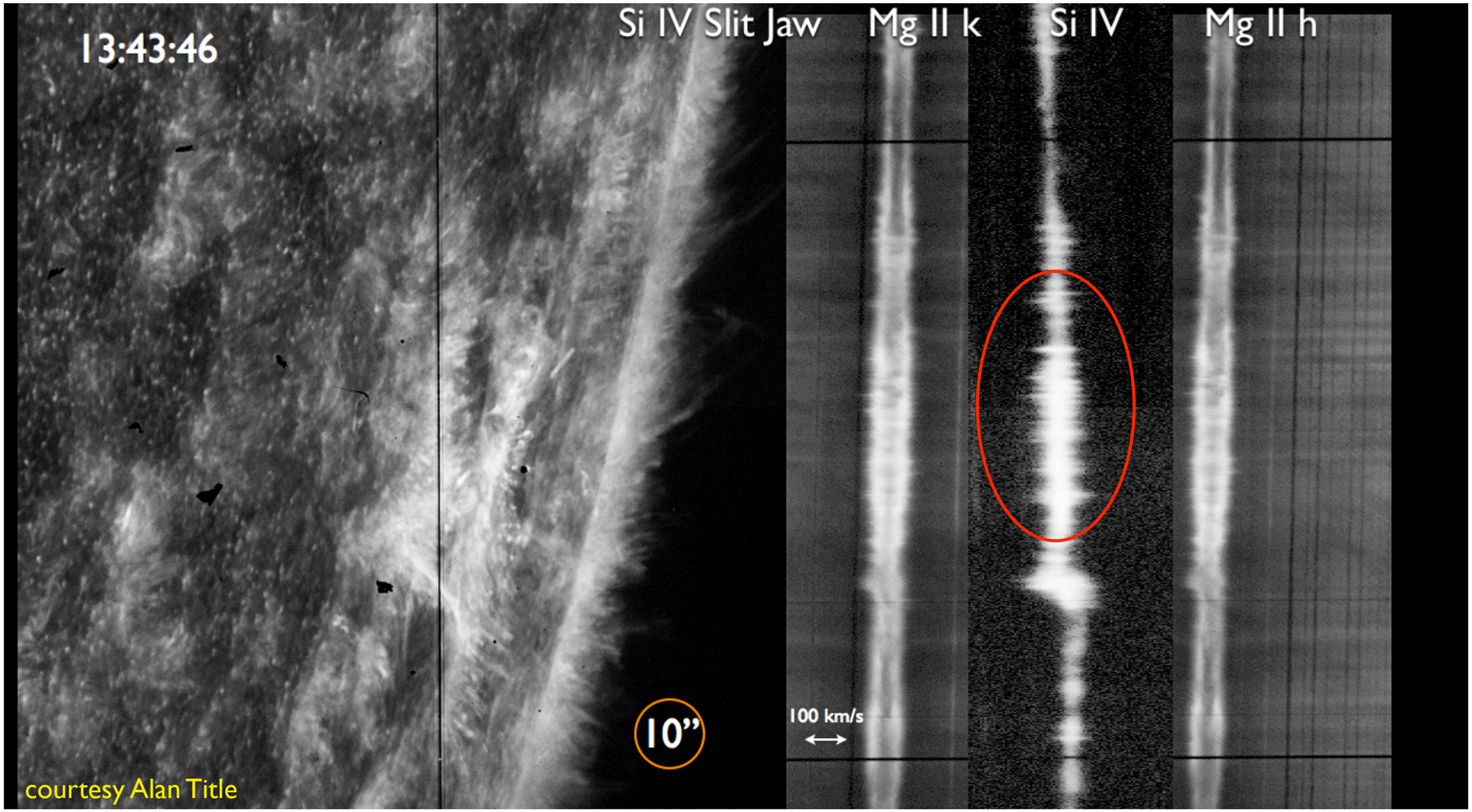
http://iris.lmsal.com/documents.html



IRIS data and calibration

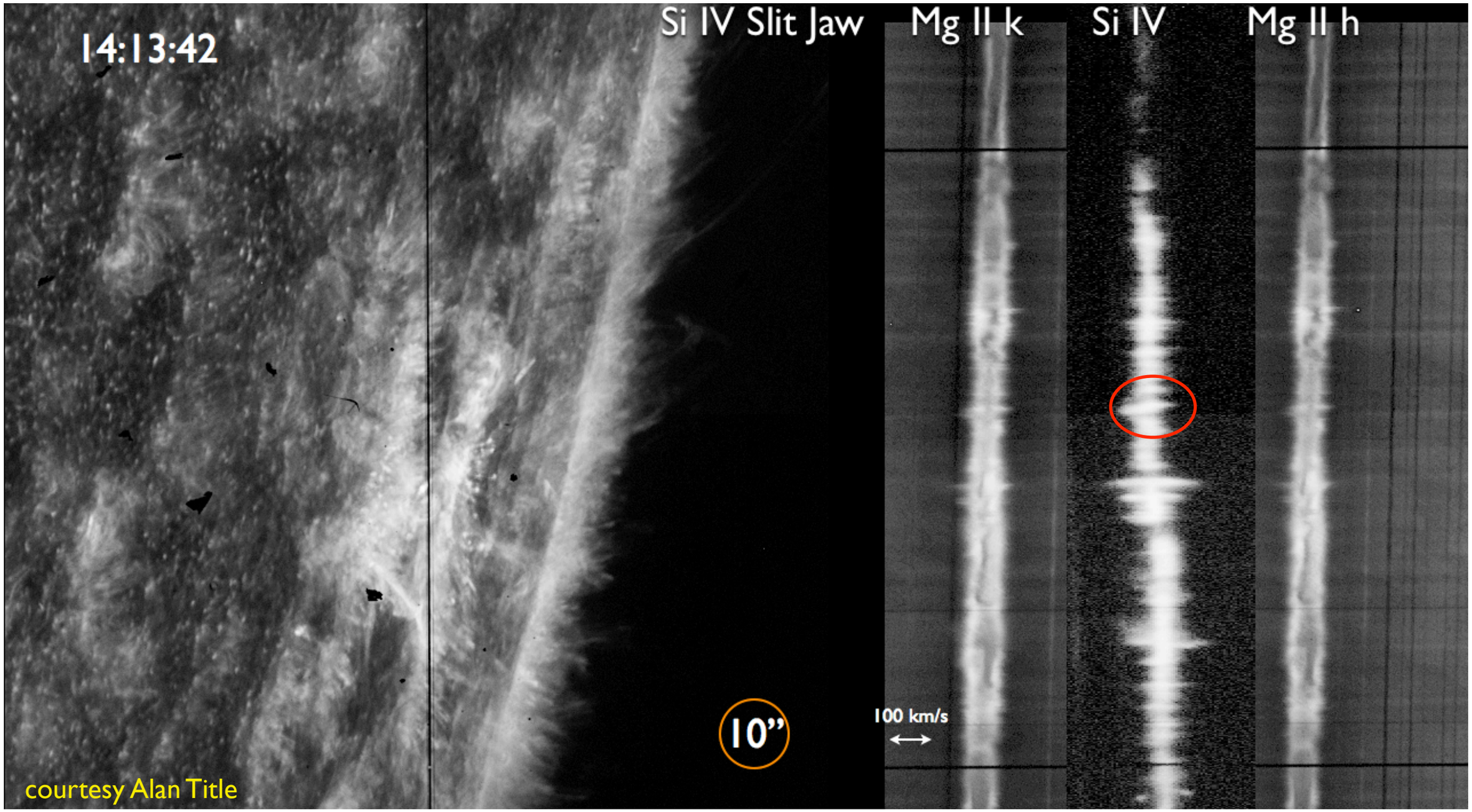


IRIS slitjaw and spectra reveal multitude of high velocity events



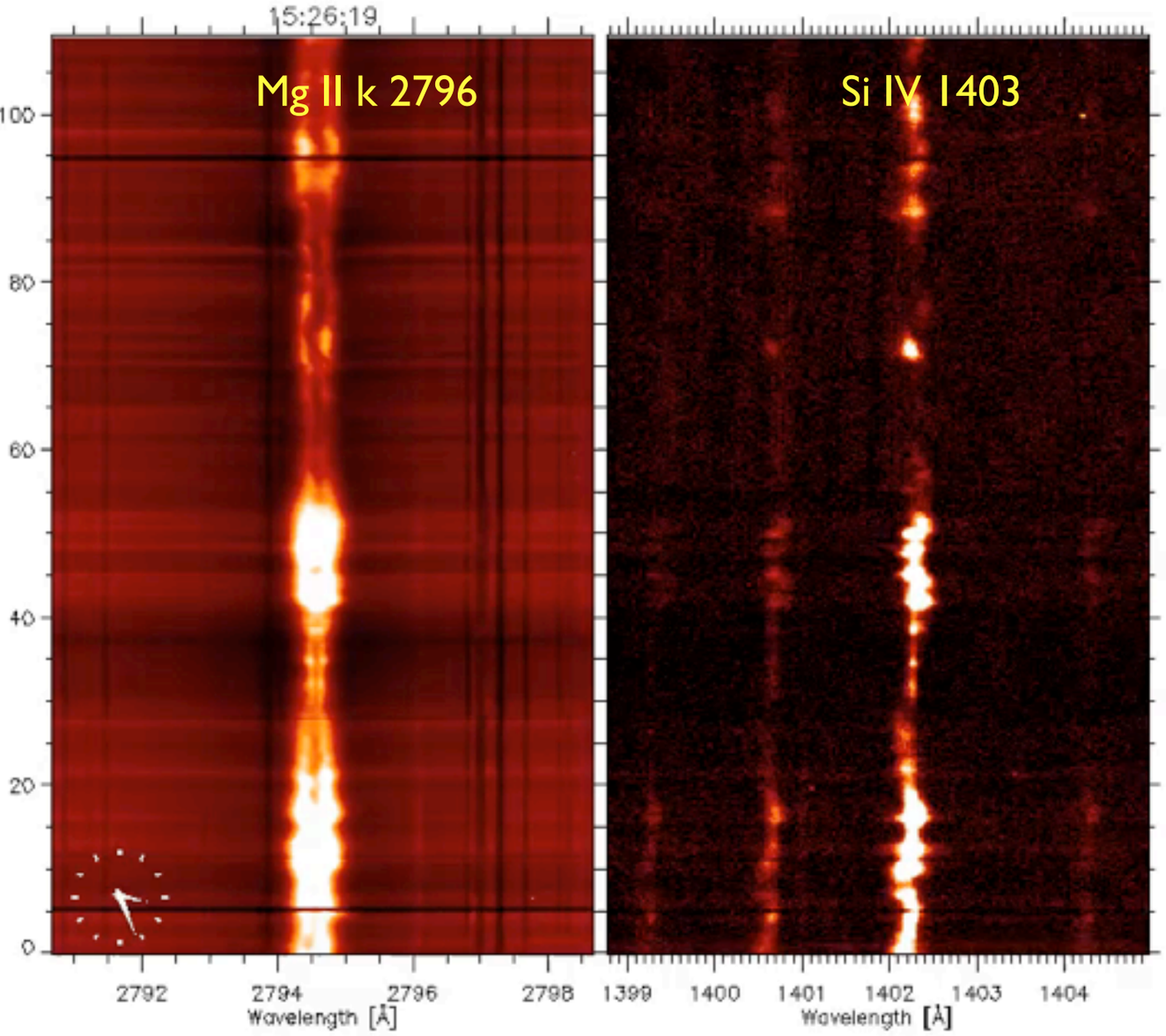
IRIS spectra show a multitude of high velocity events associated with non-thermal broading, both for a wide range of temperatures

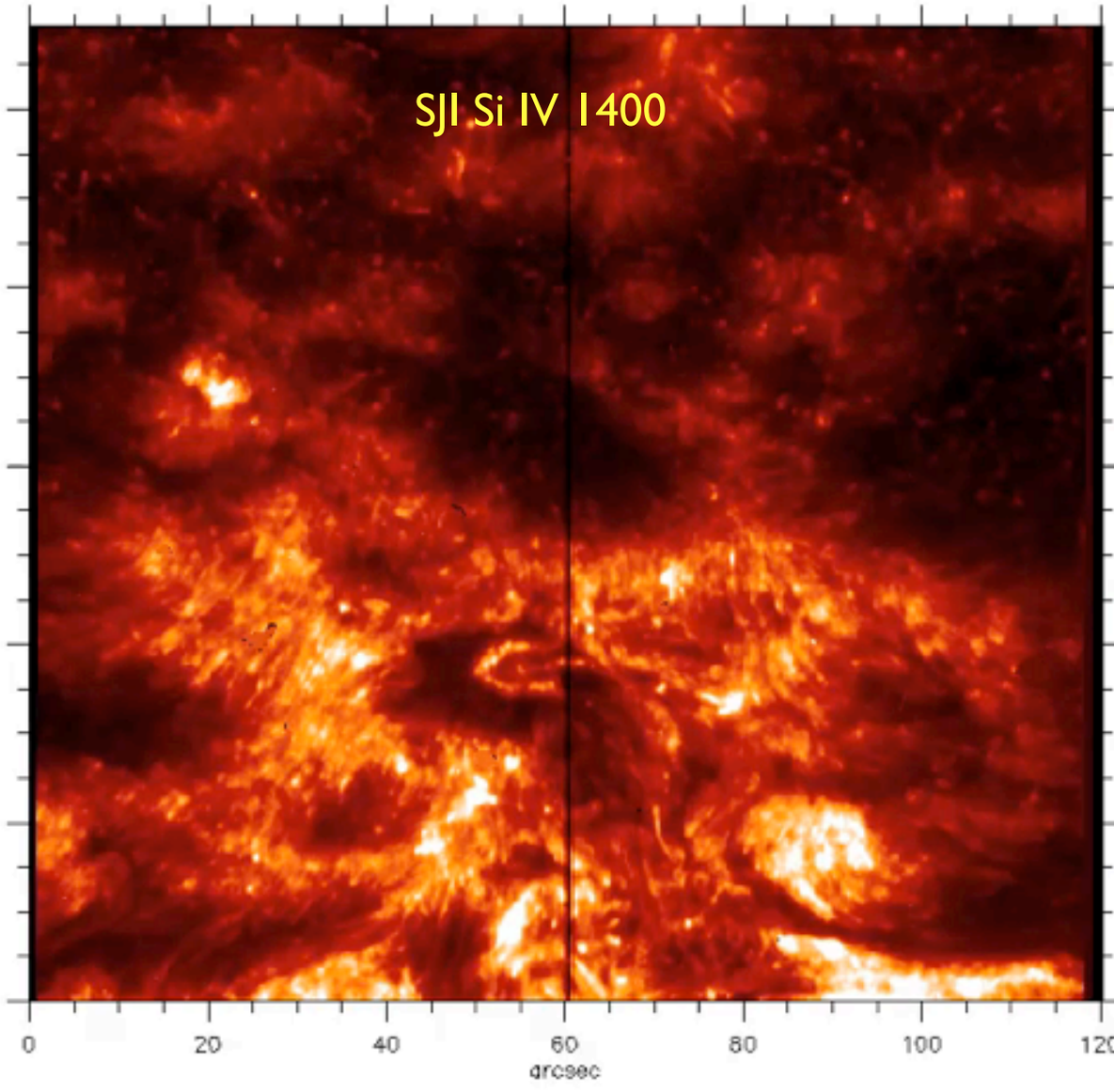
IRIS slitjaw and spectra reveal multitude of high velocity events



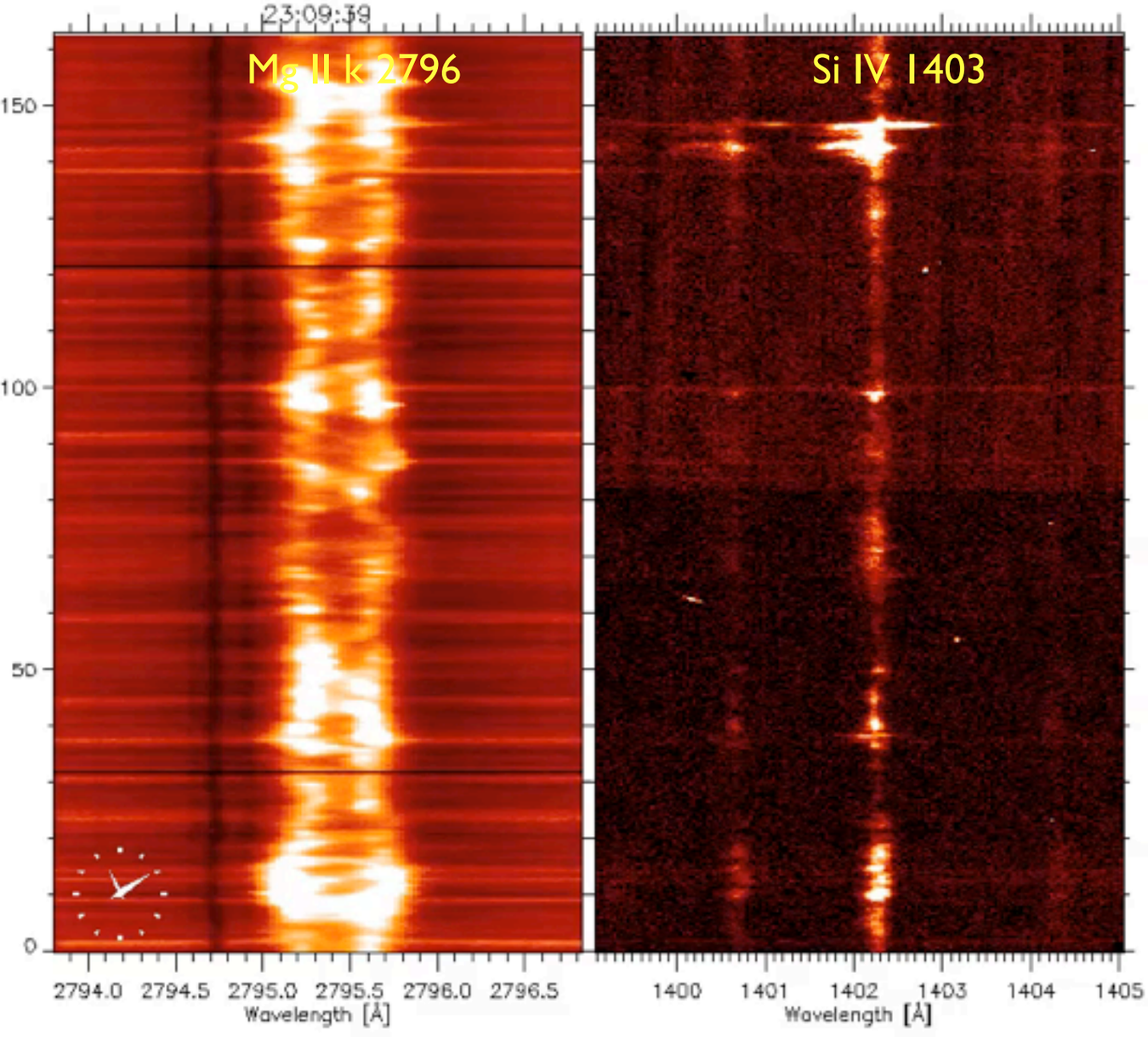
IRIS spectra show a multitude of high velocity events associated with non-thermal broading, both for a wide range of temperatures

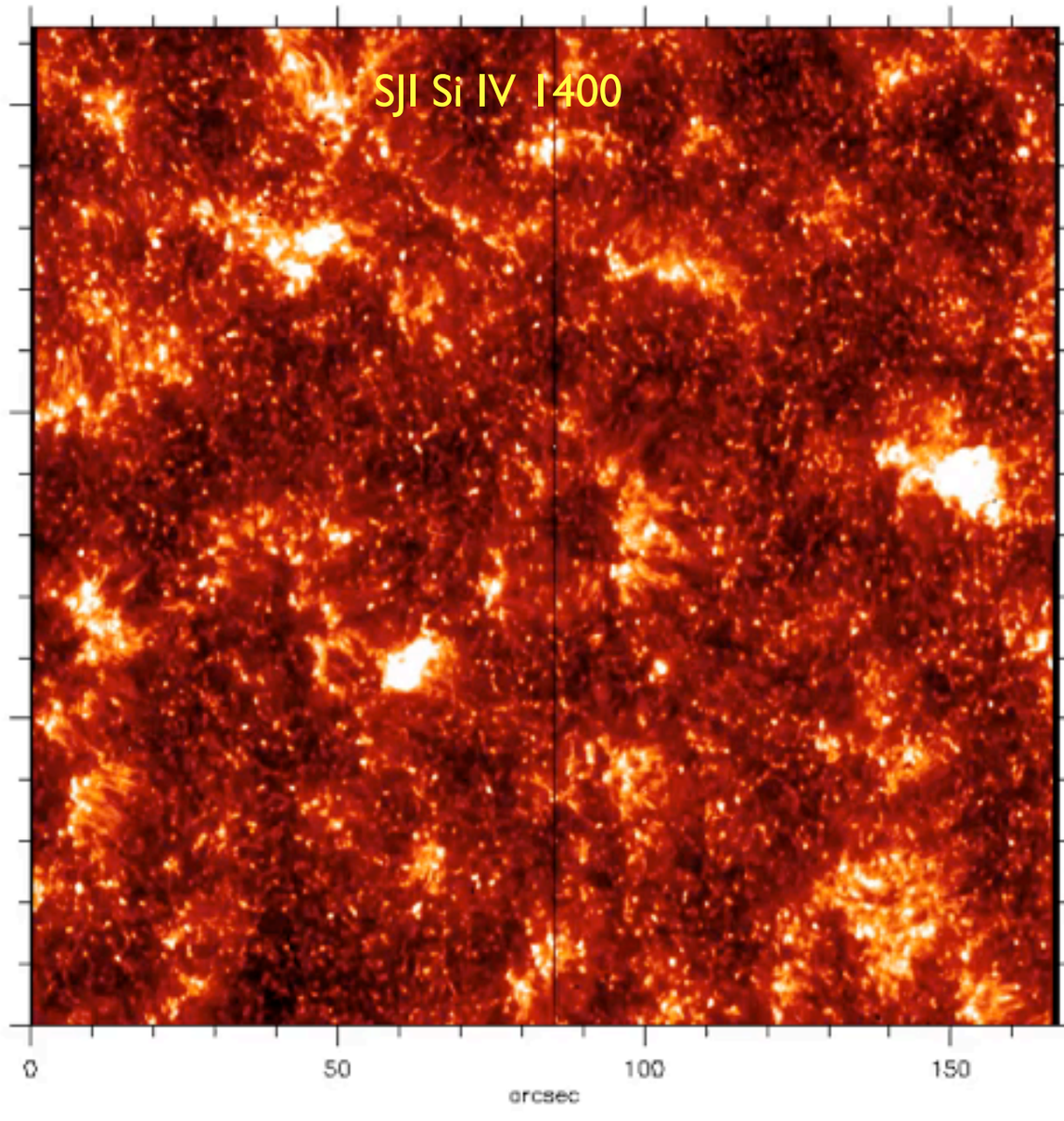
IRIS slitjaw and spectra reveal multitude of high velocity events, both at the limb and on disk





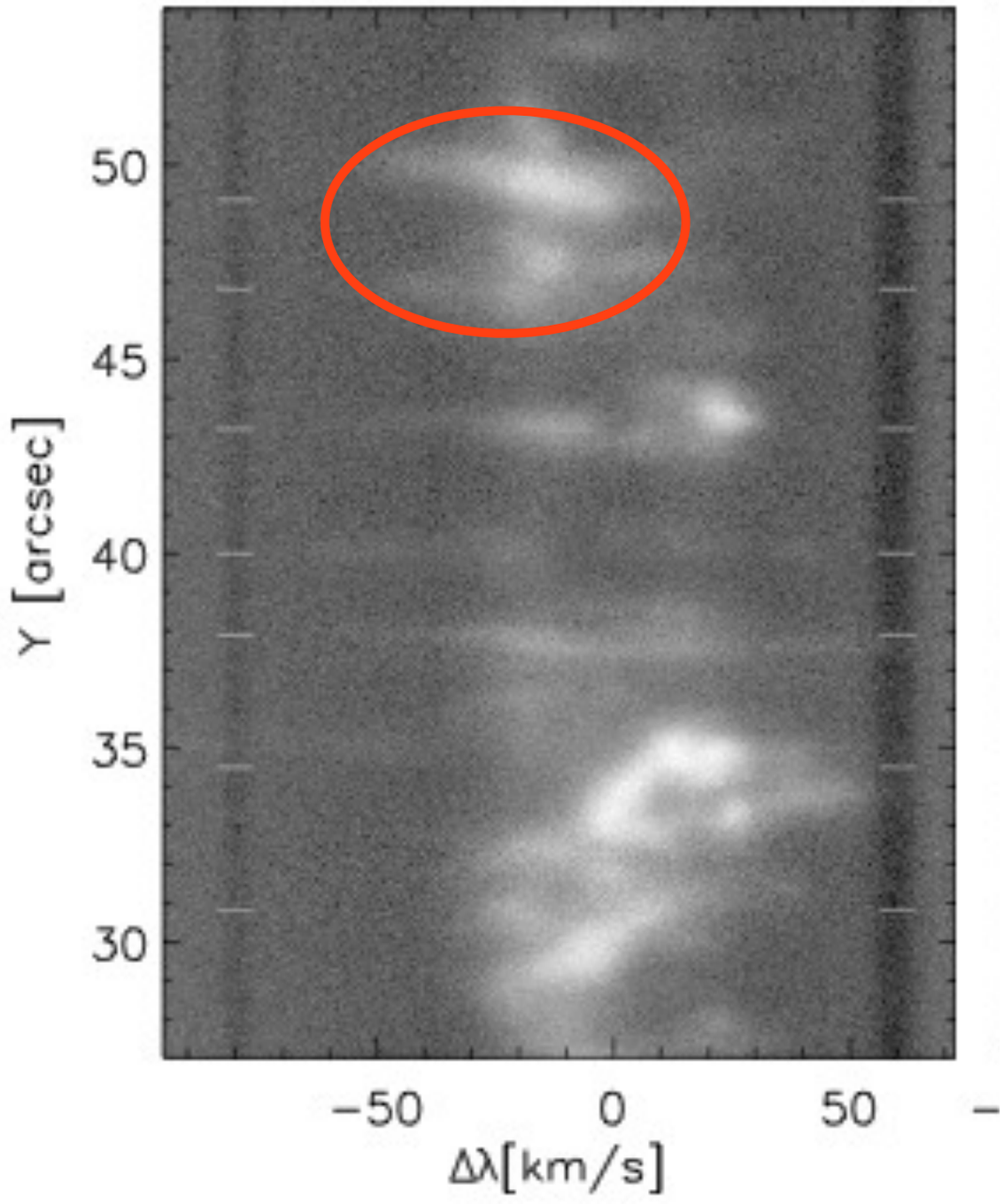
Quiet Sun and coronal hole dynamics also dominated by shocks and high velocity events

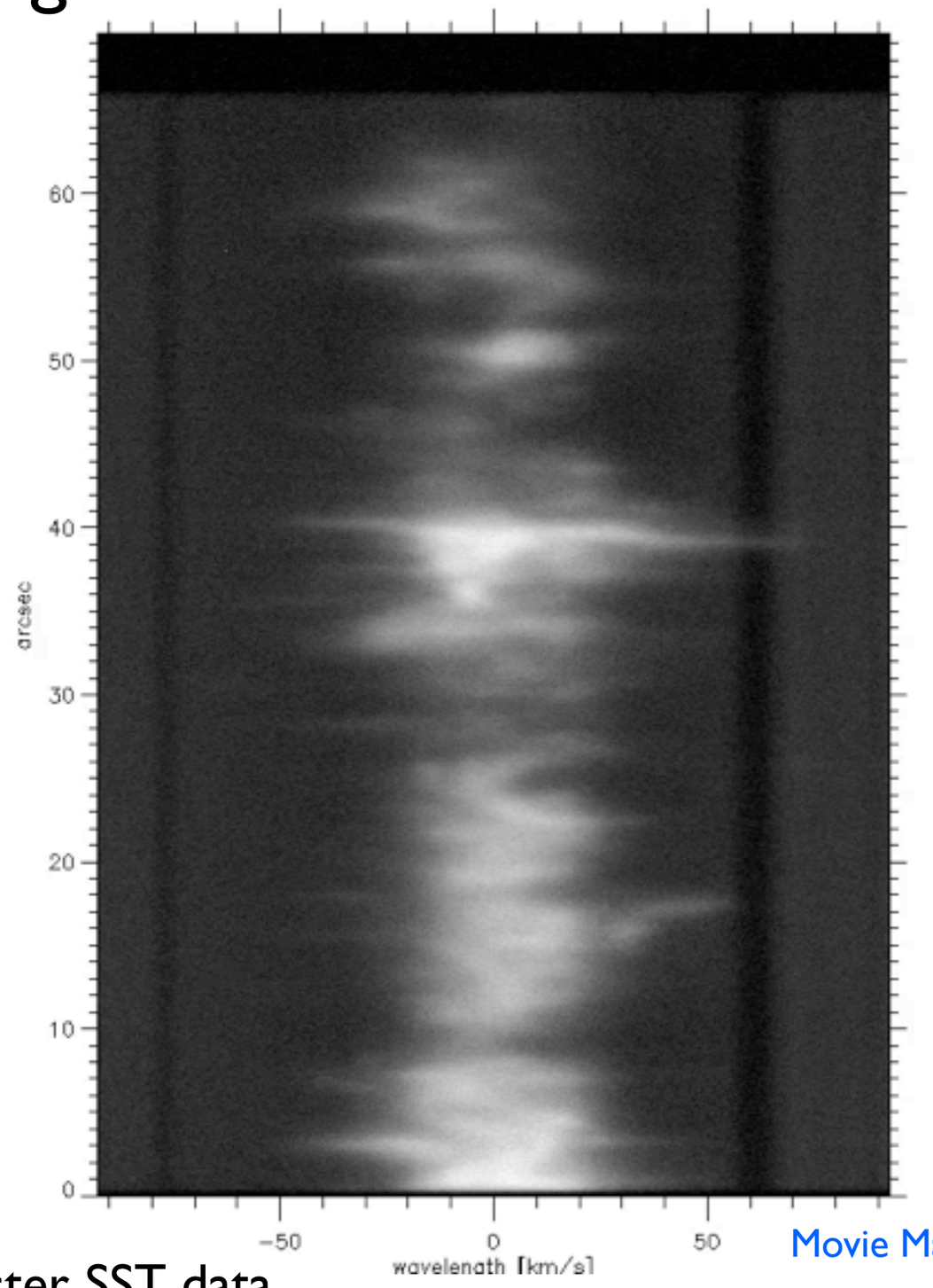




(mix of bi-directional flows and torsional motions?)

Spicules dominated by three types of motions
field-aligned upflows, swaying motions and torsional motions



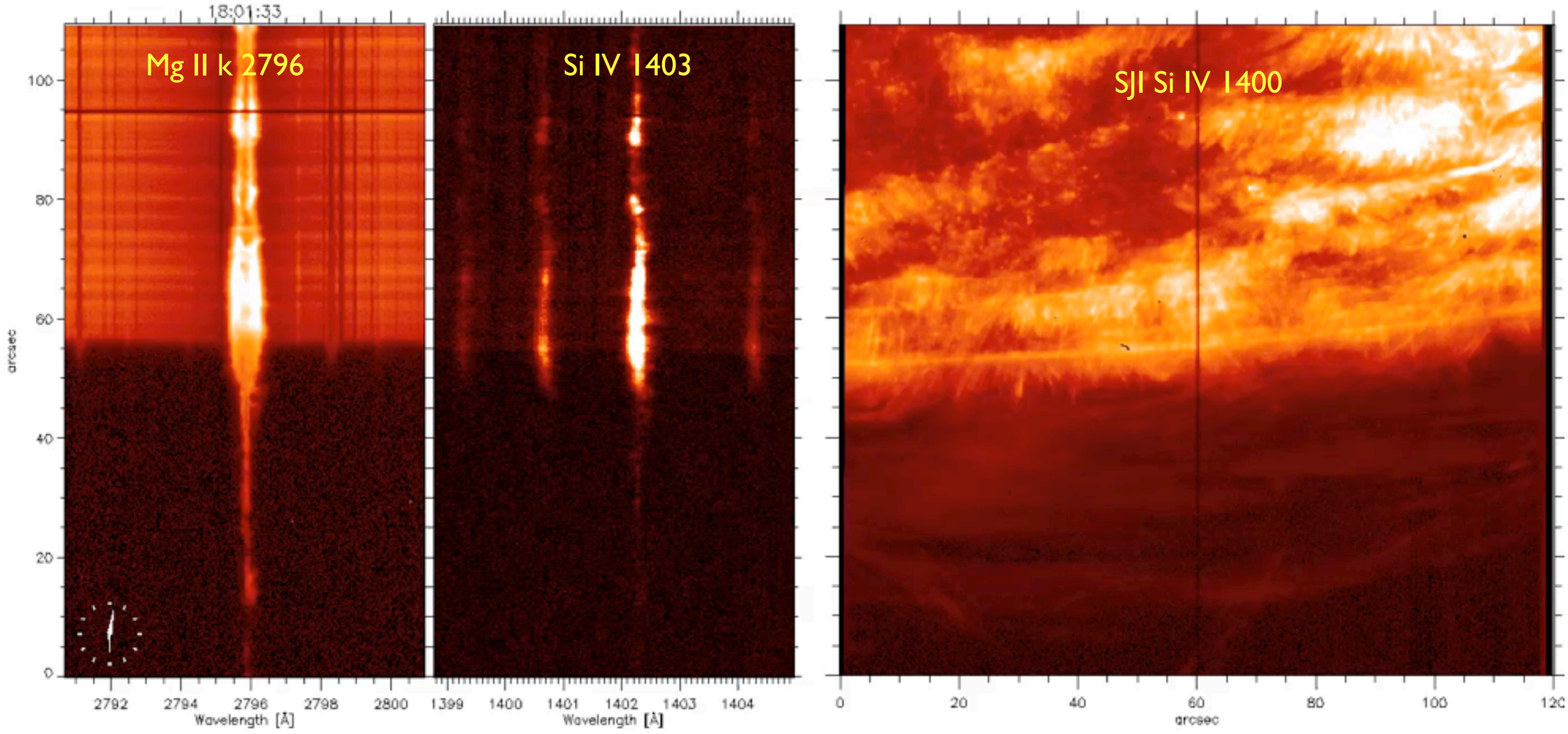


Movie Mats Carlsson

De Pontieu et al., 2012, see Skogsrud et al. poster, SST data

Inclined spectra in spicules indicate red/blueshift pattern across spicule compatible with strong torsional motion of 20-30 km/s

Presence of strong "bidirectional flows" at the limb supports strong torsional motions



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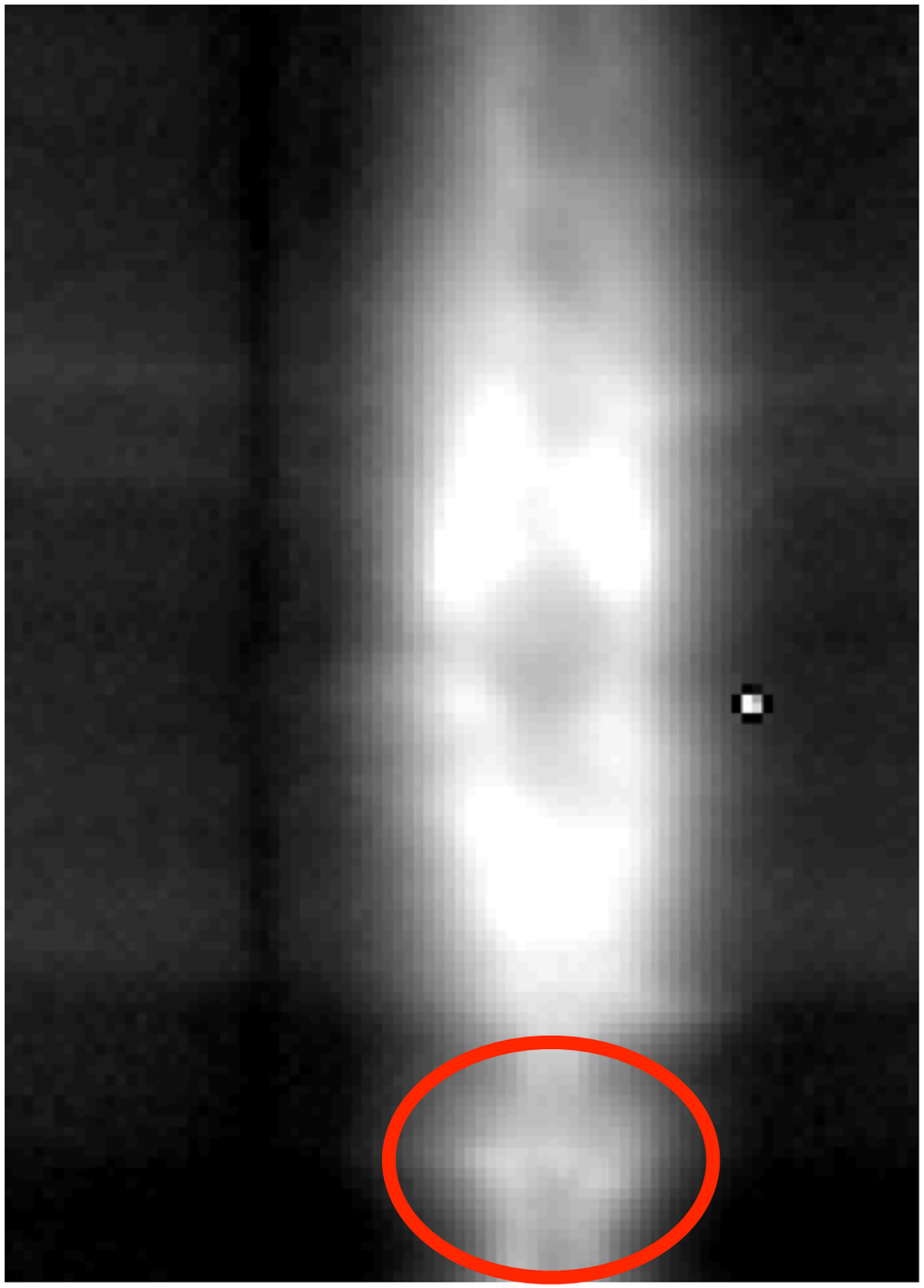
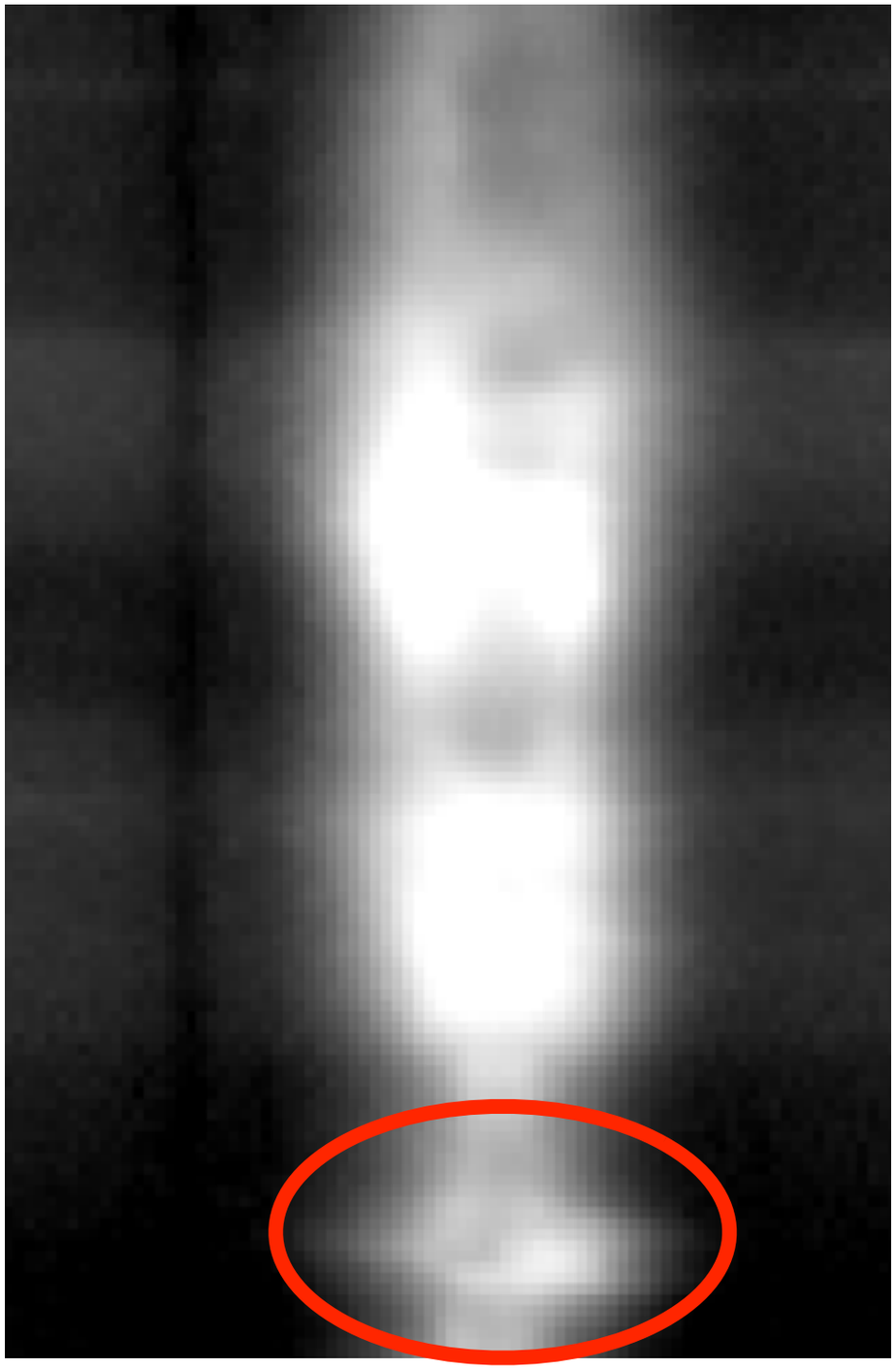
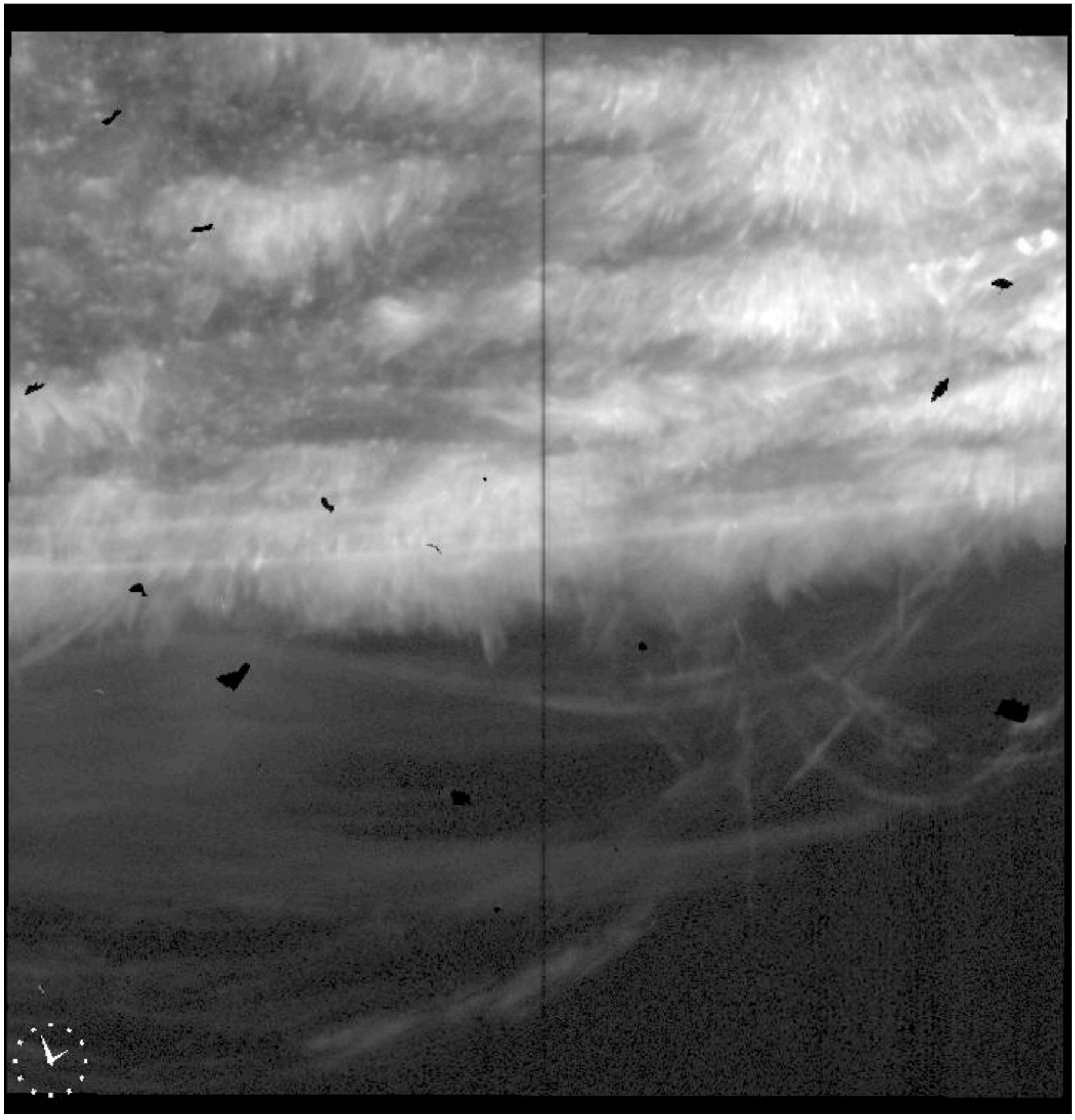




2-Oct-2013

Si IV 1400



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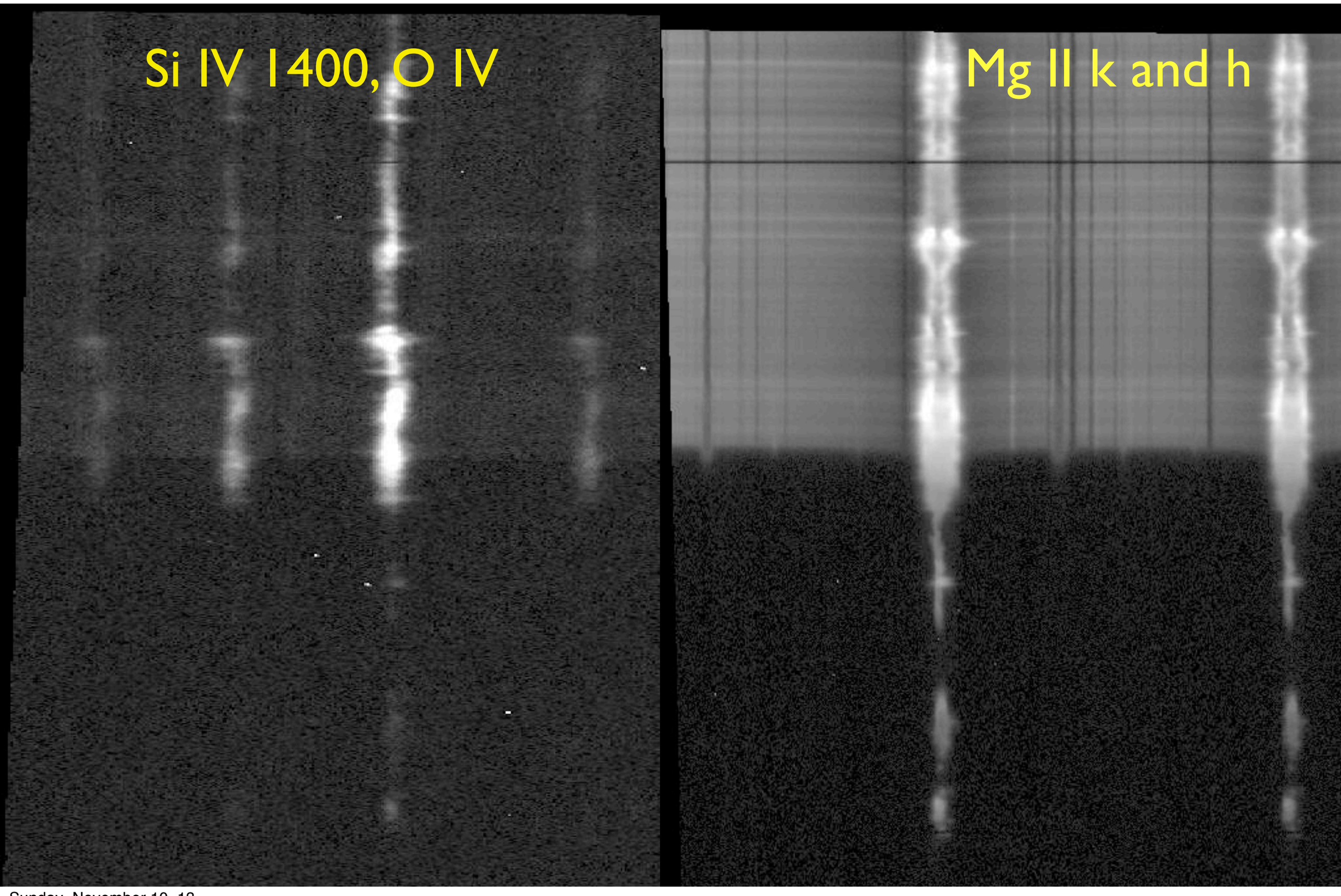
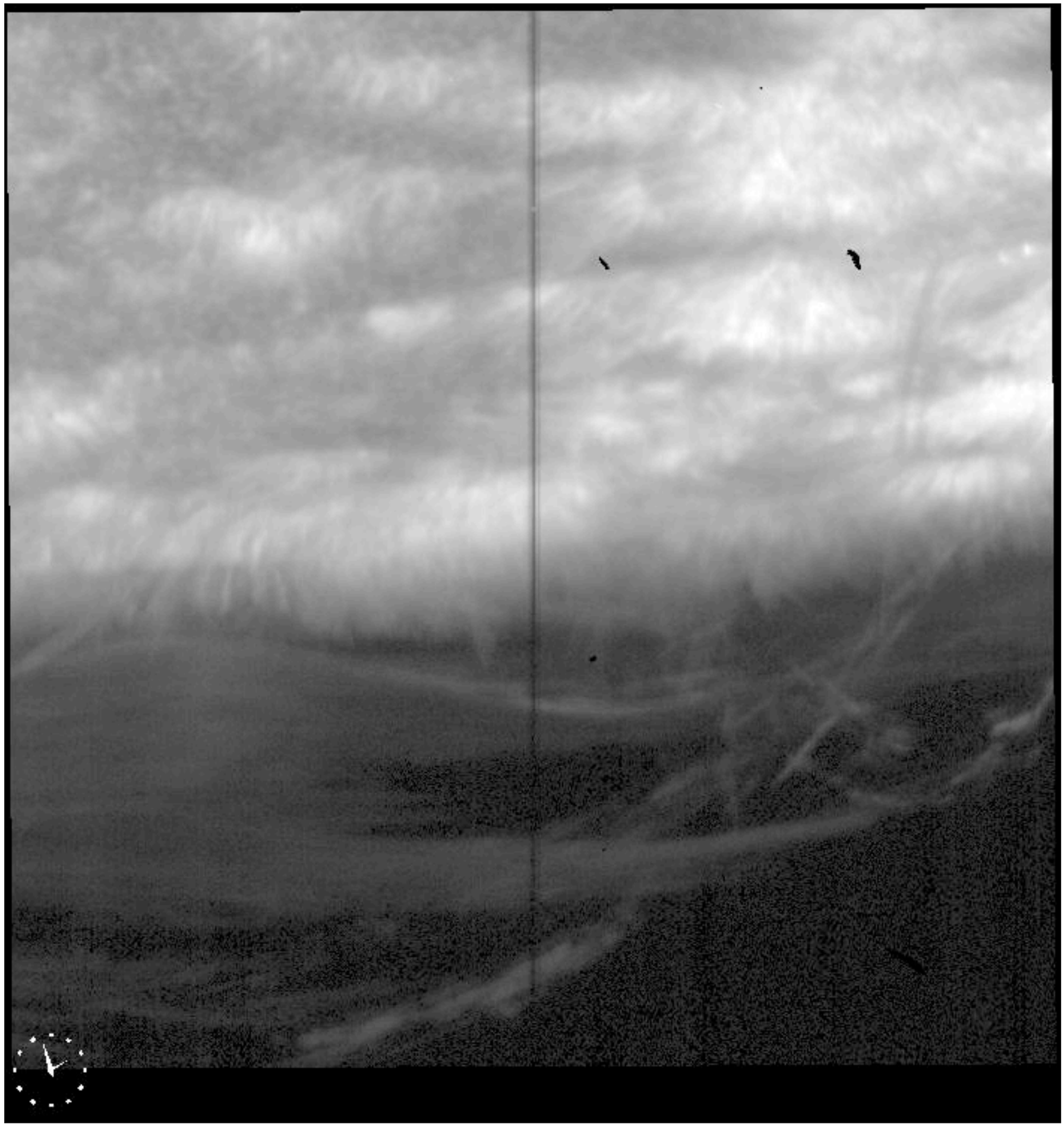
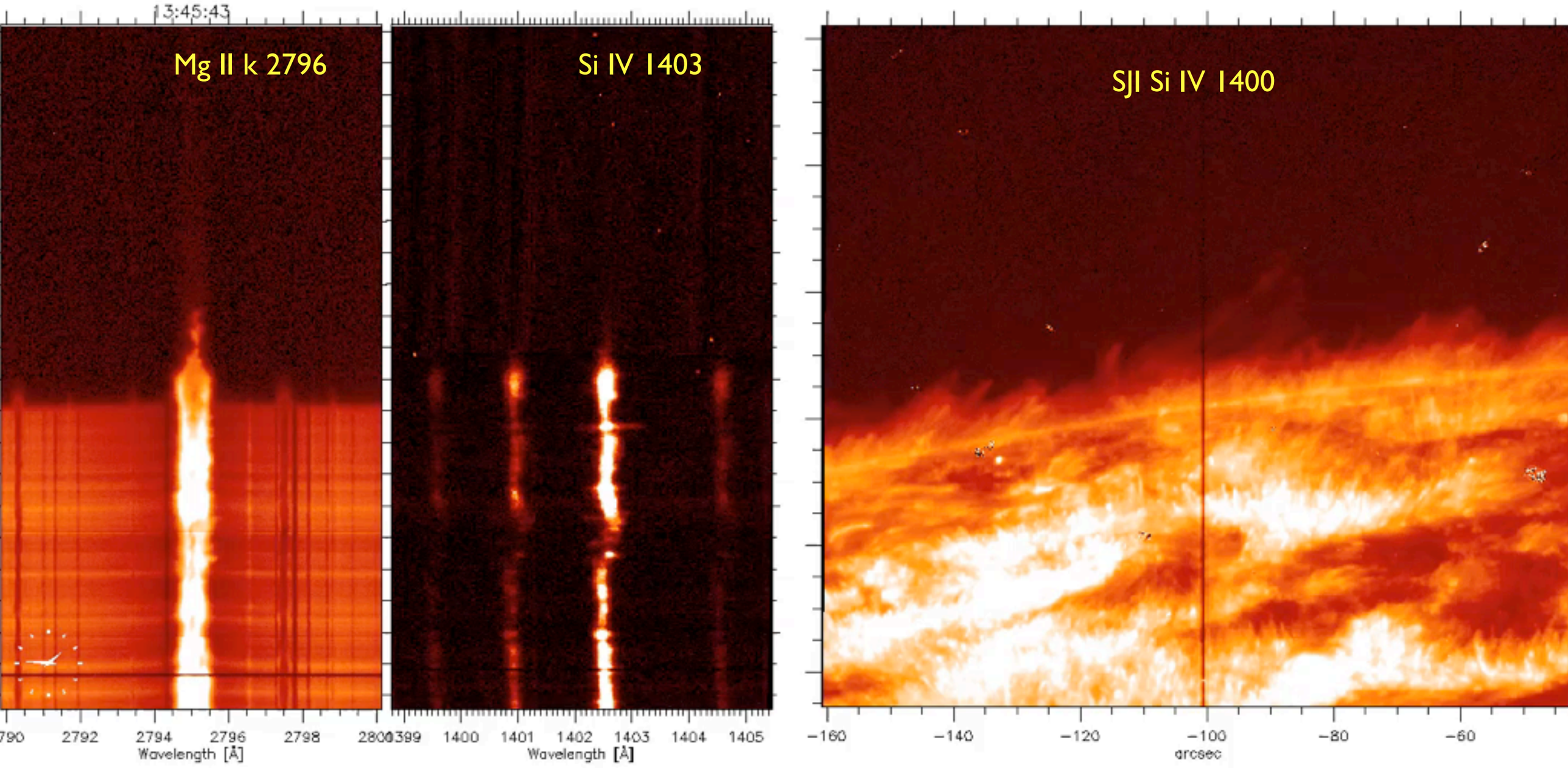


2-Oct-2013

Mg II h/k
2796

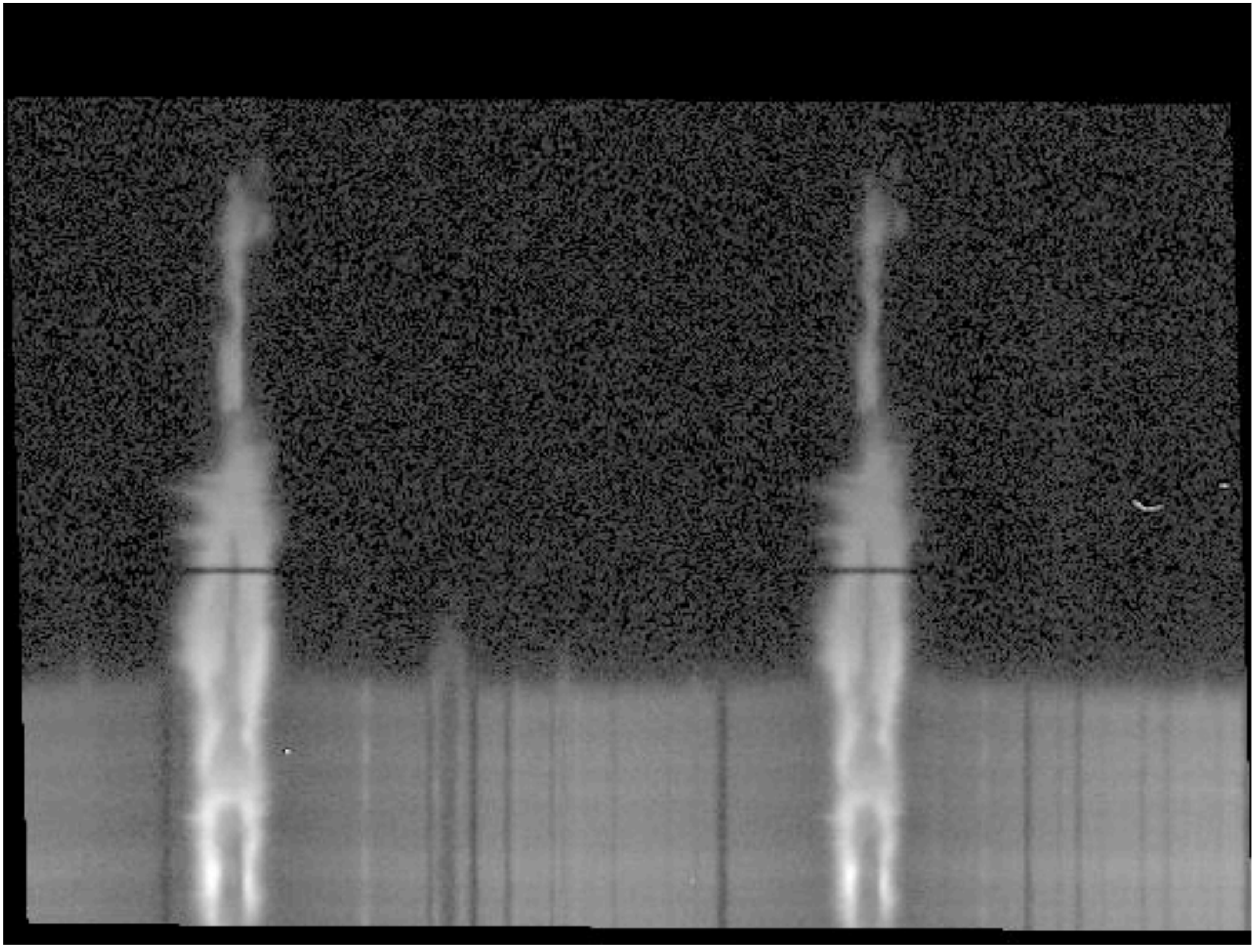


Limb spectra suggest torsional motions ubiquitous

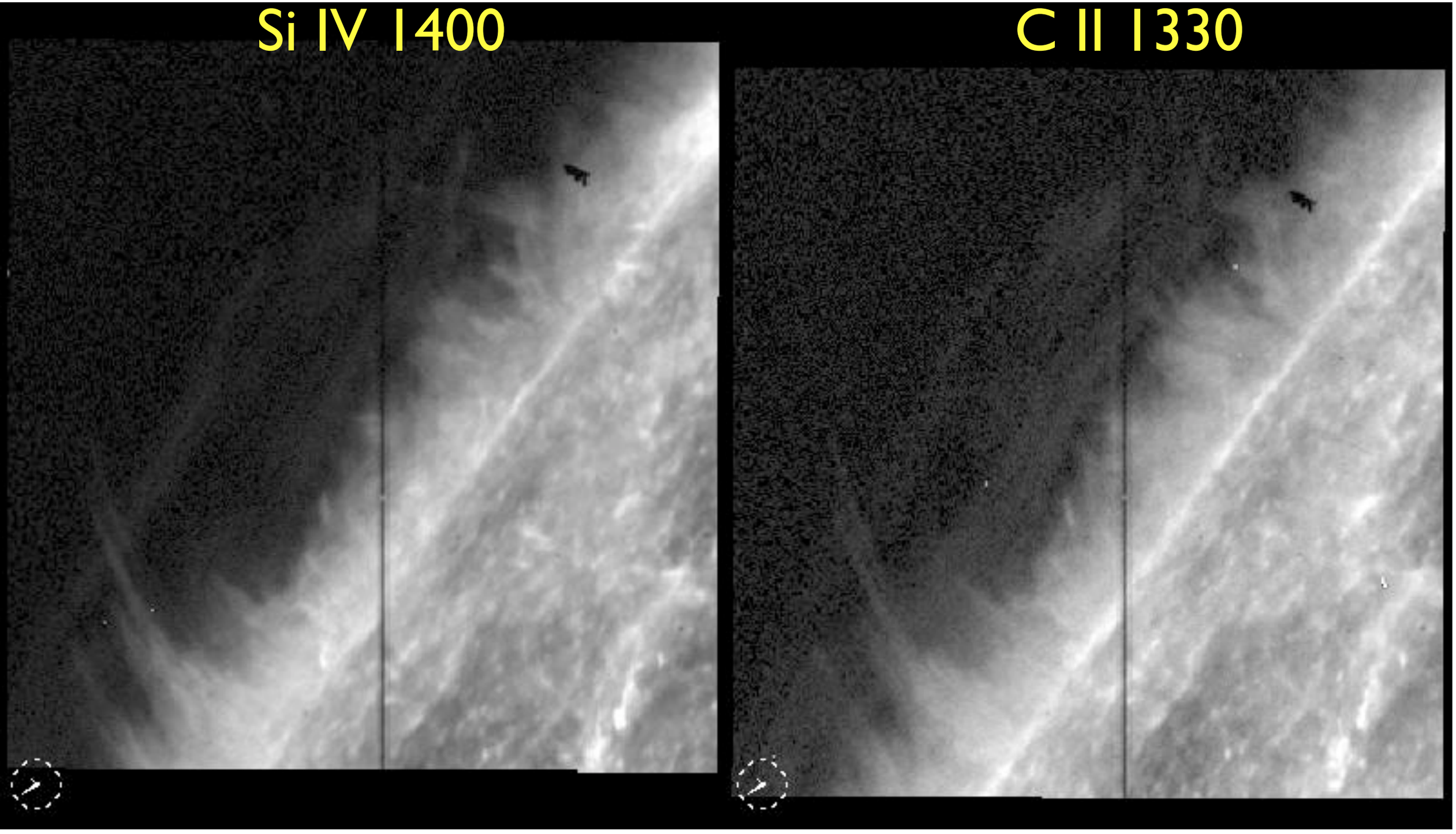


24-Sep-2013

Mg II k and h



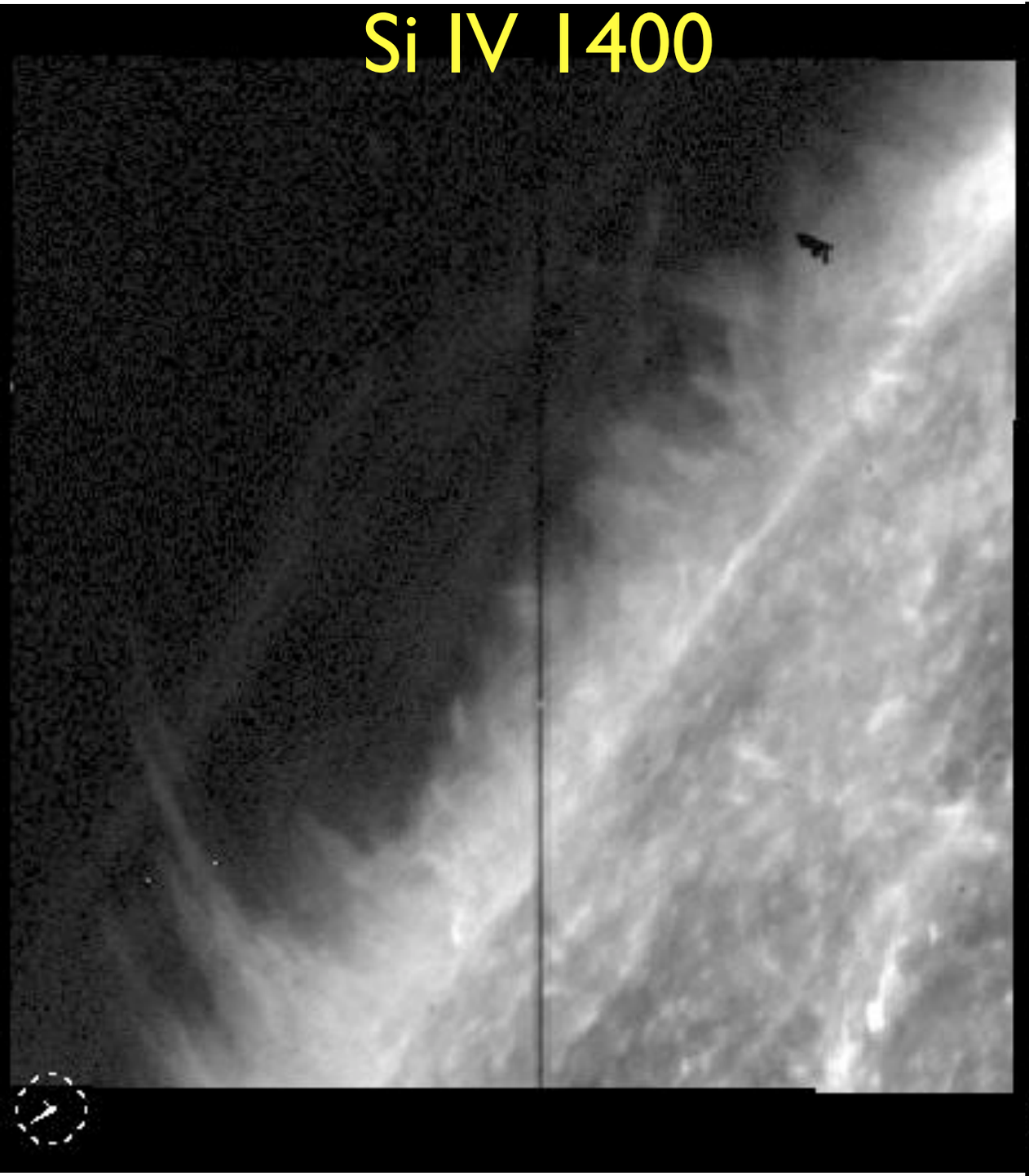
Thermal evolution of spicules

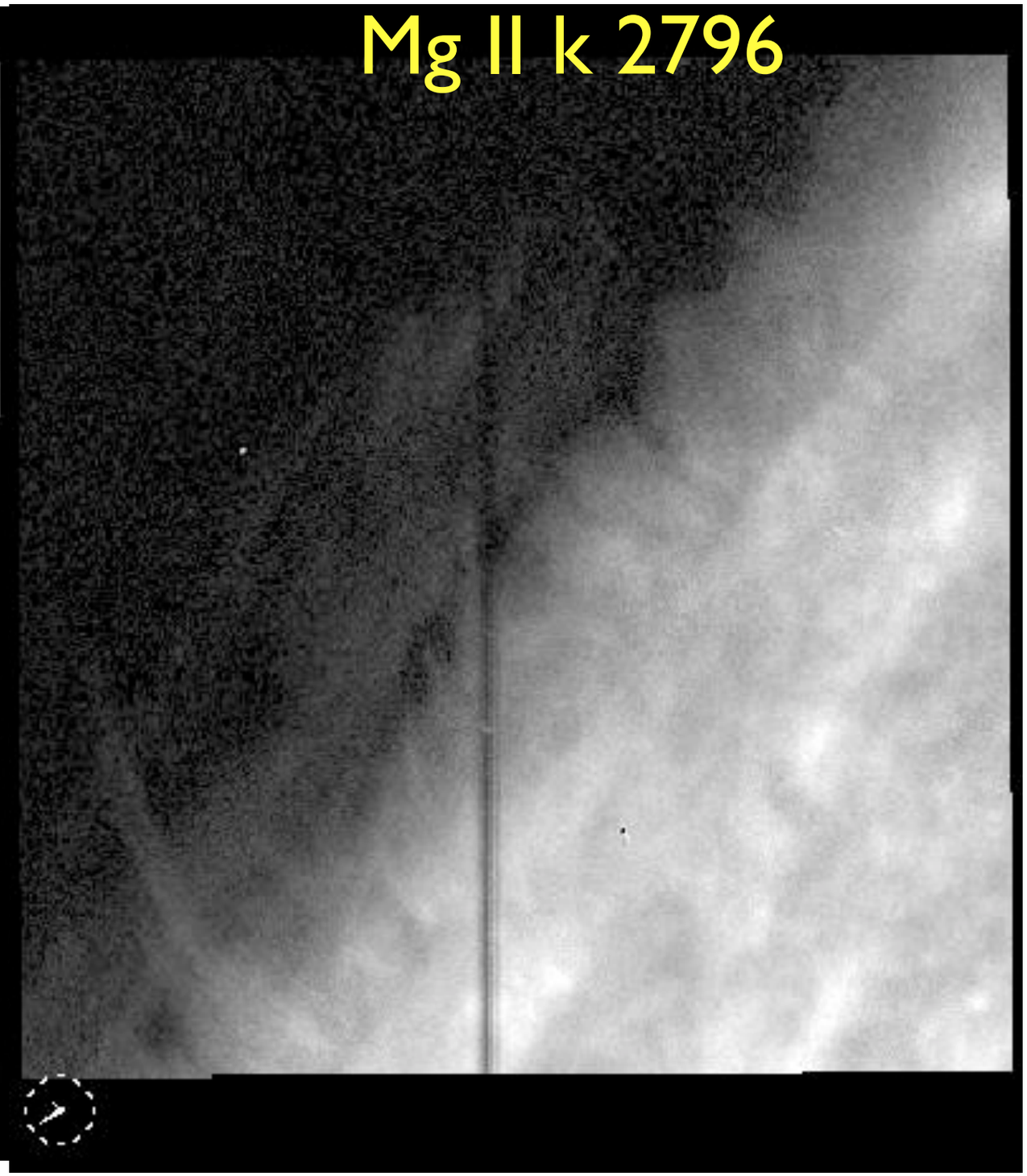


24-Sep-2013

See Tiago Pereira's talk this week

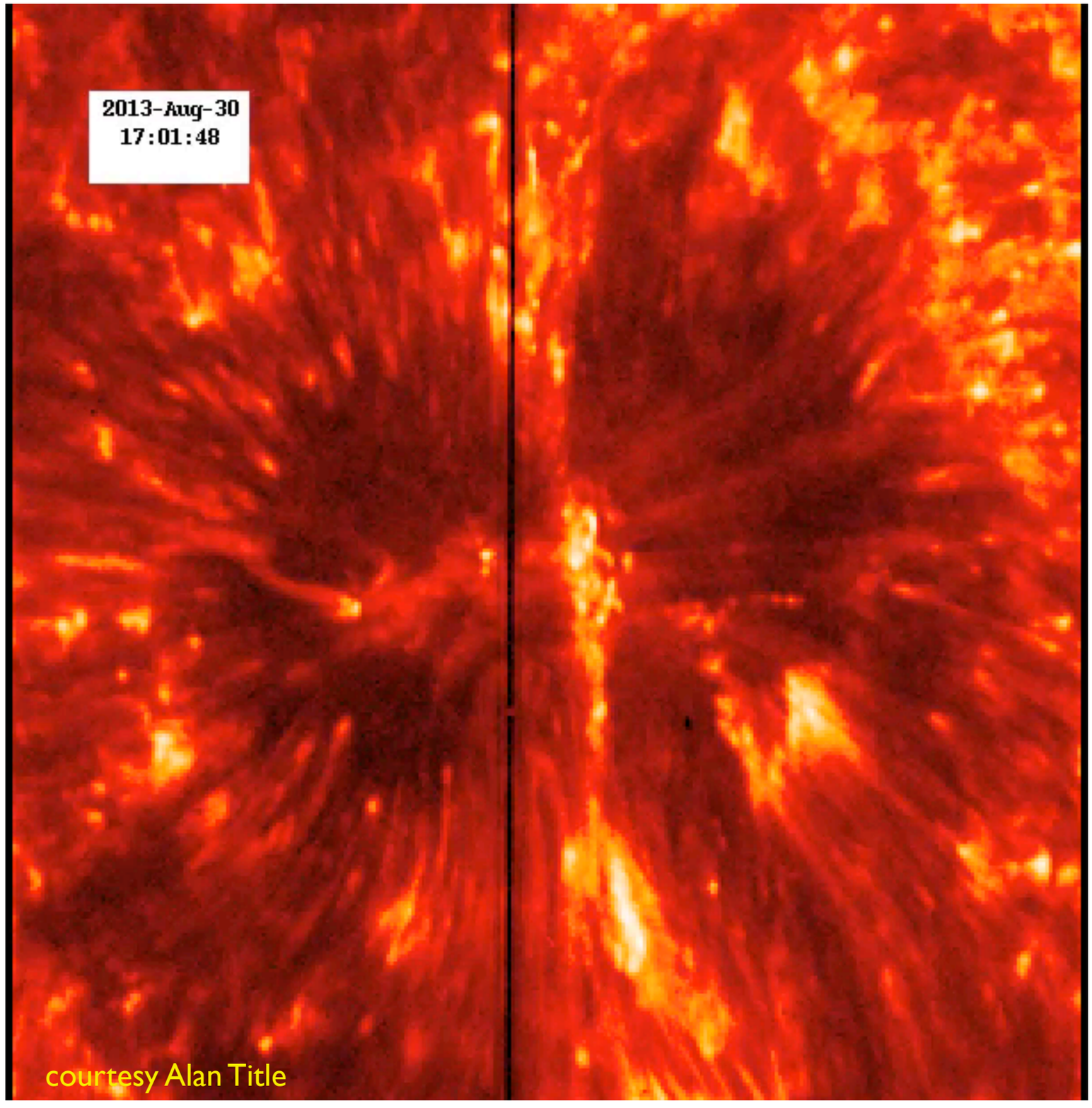
Thermal evolution of spicules



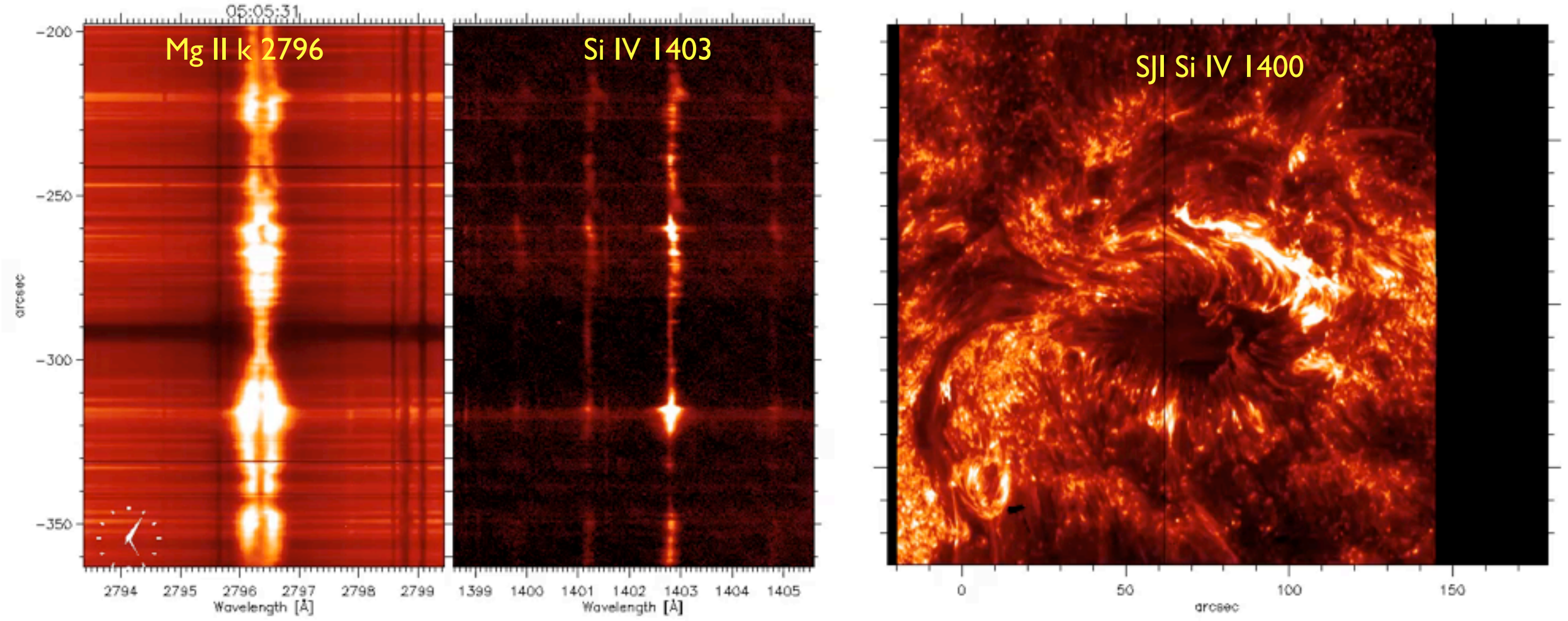


See Tiago Pereira's talk this week

Sunspot dynamics



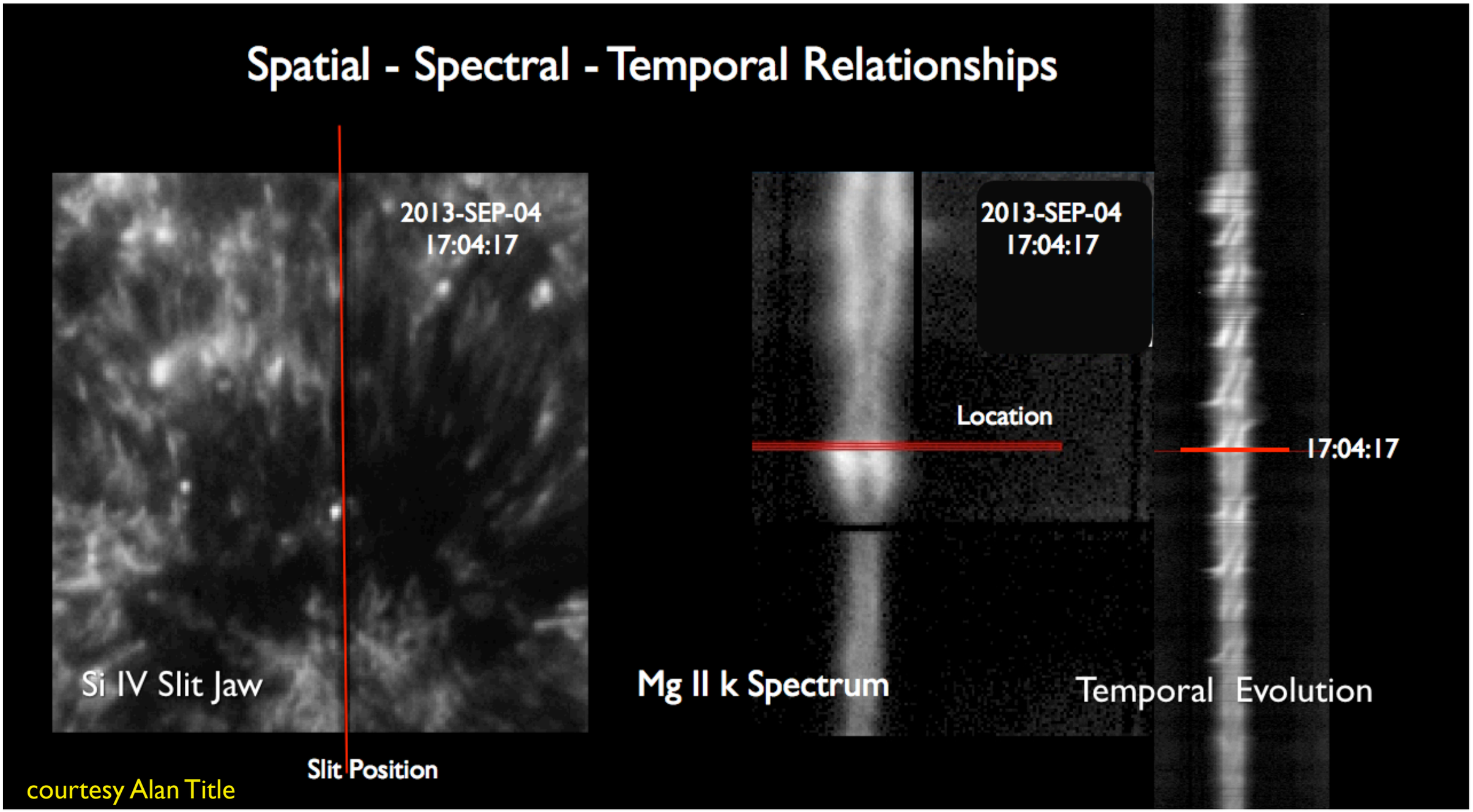
Sunspot dynamics



Strong umbral shocks shown propagating into TR lines

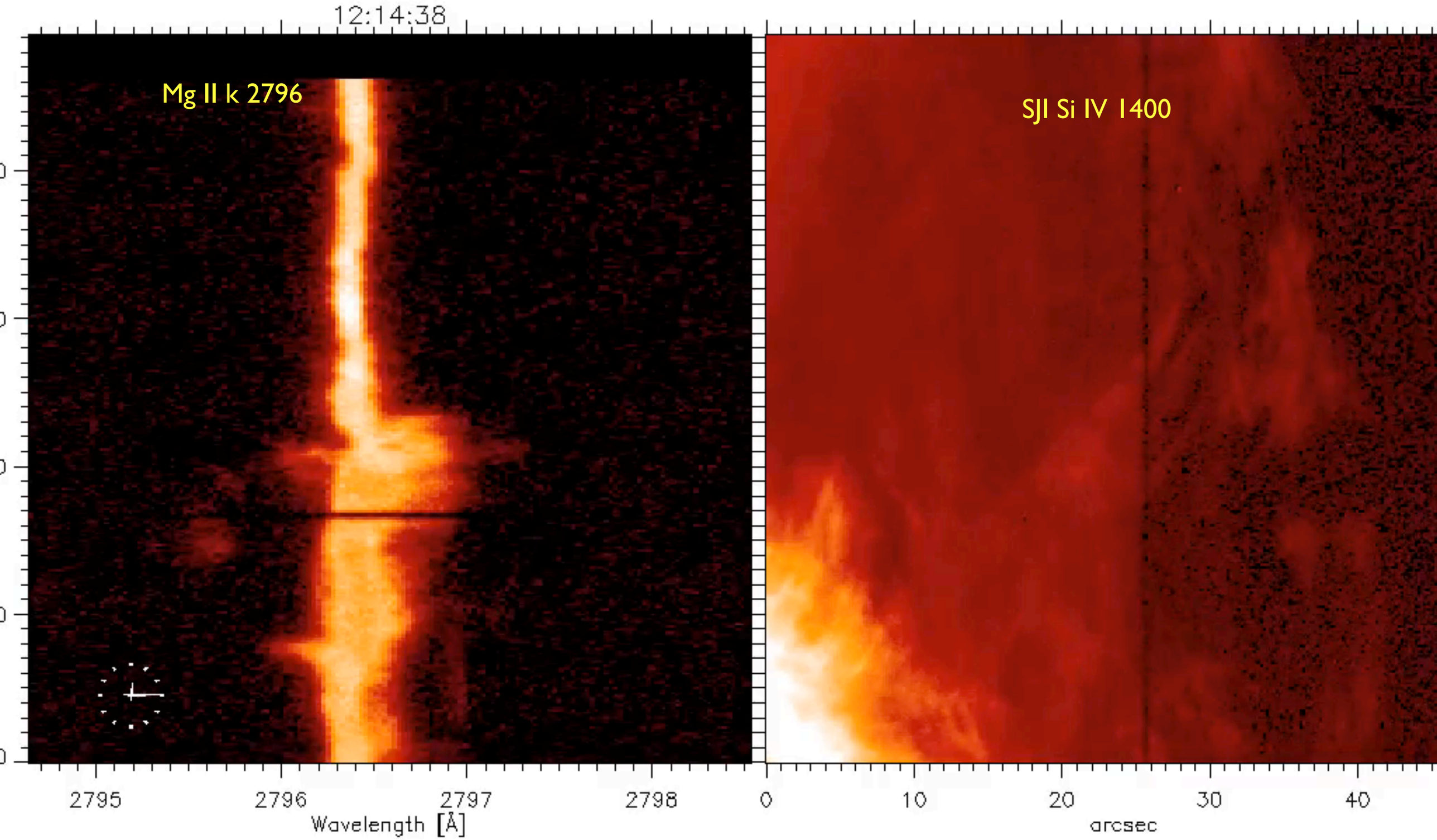
Strong downflows above sunspots (see also HRTS)

Sunspot dynamics

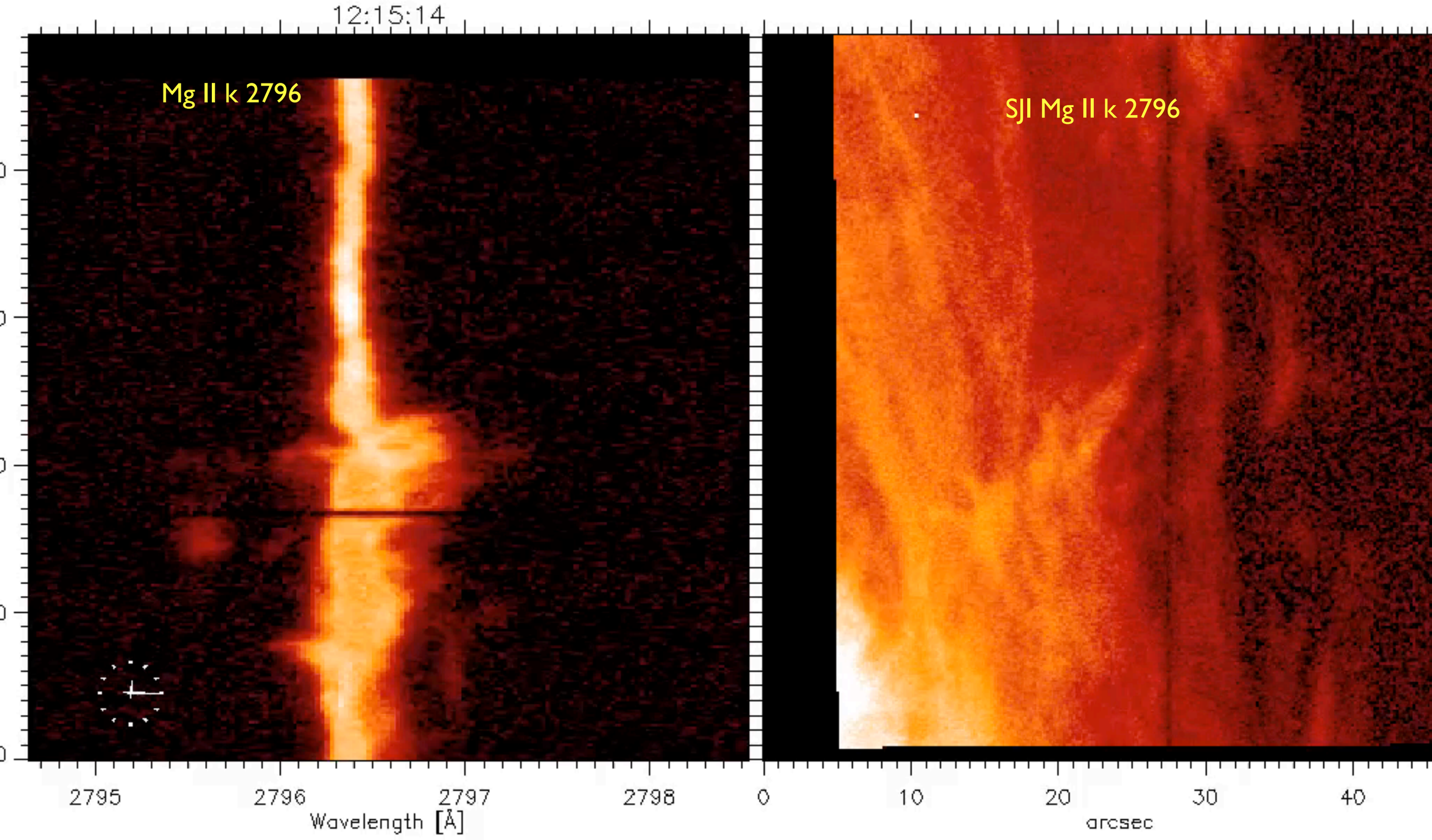


Strong umbral shocks shown propagating into TR lines

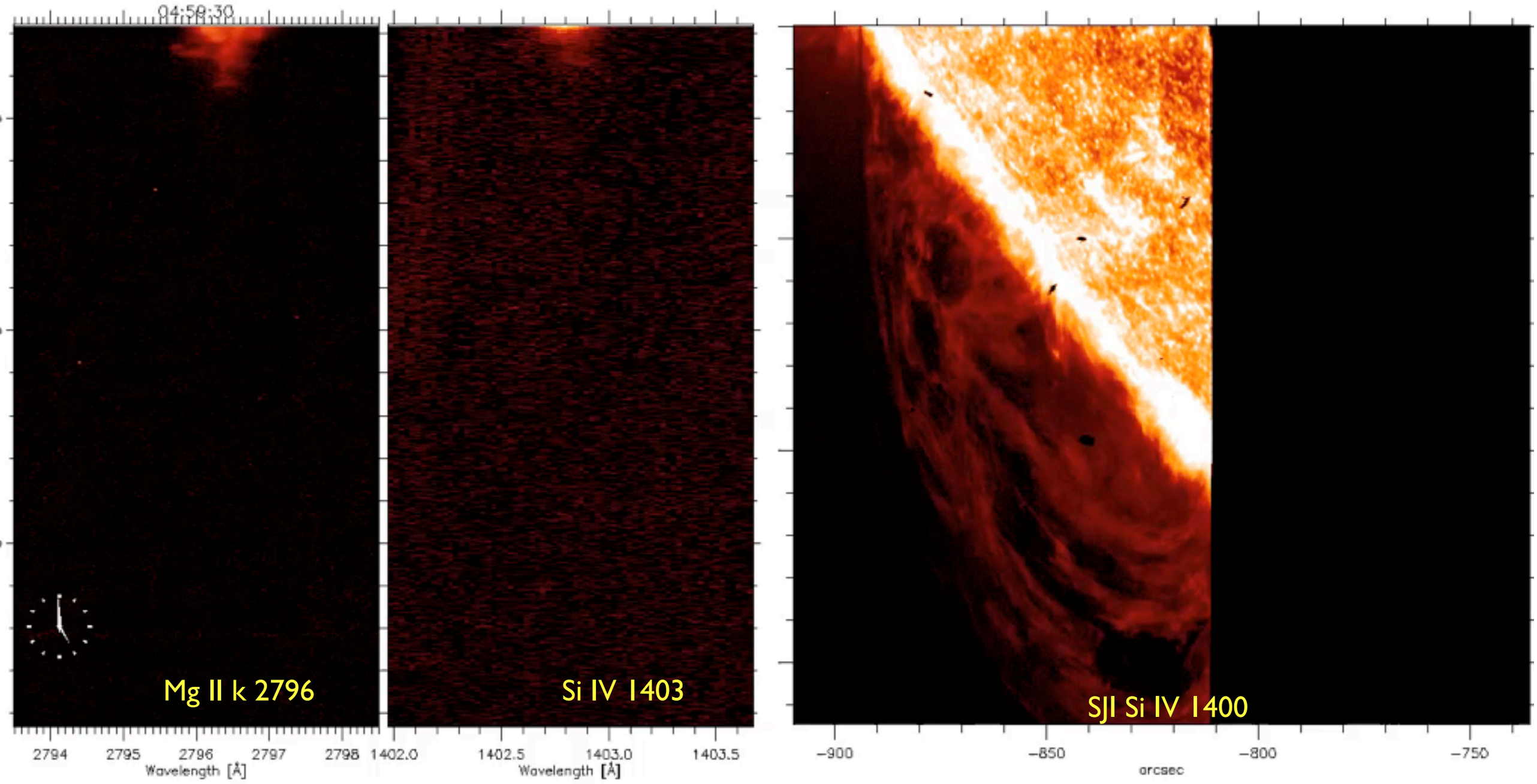
Prominence dynamics



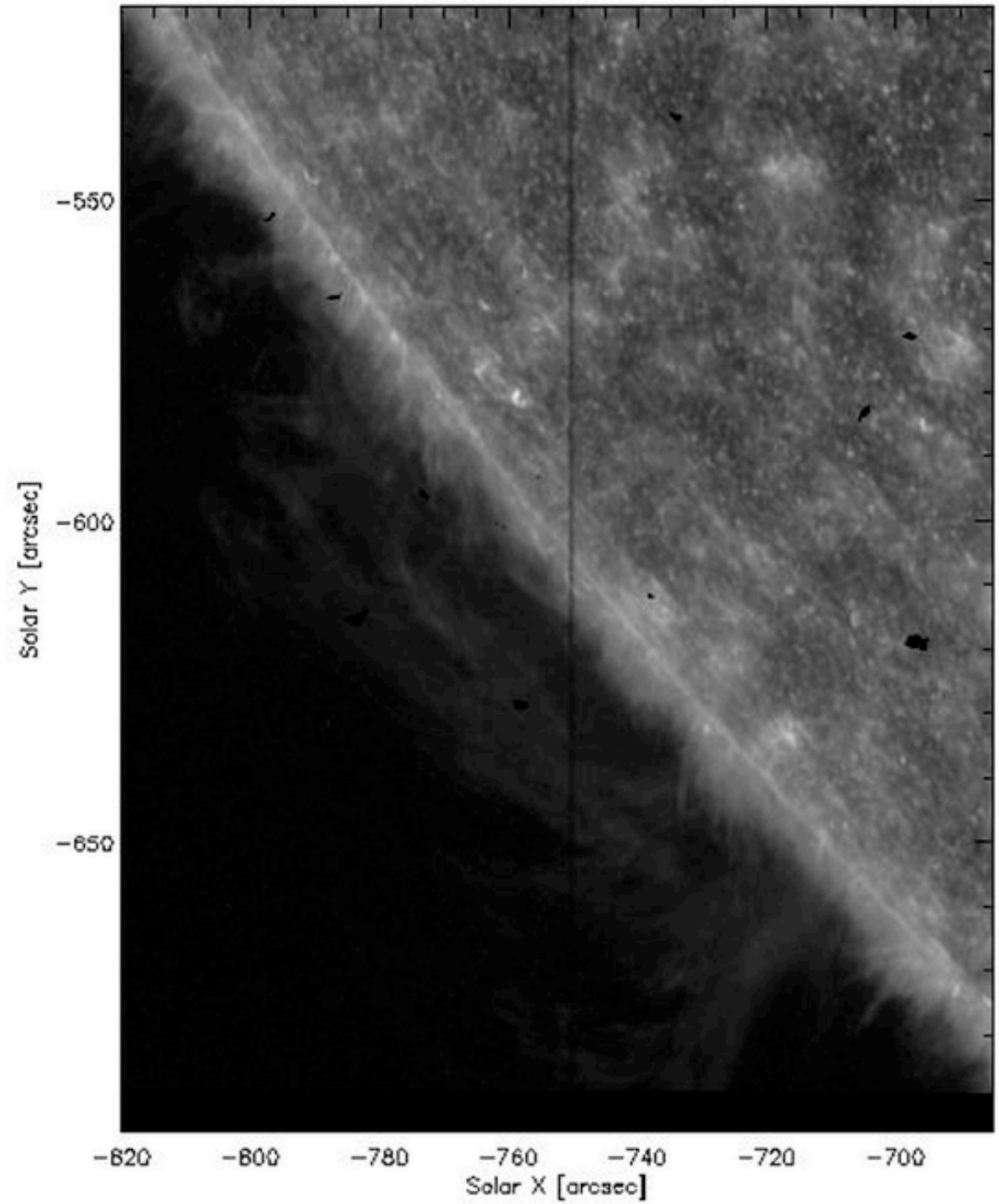
Prominence dynamics



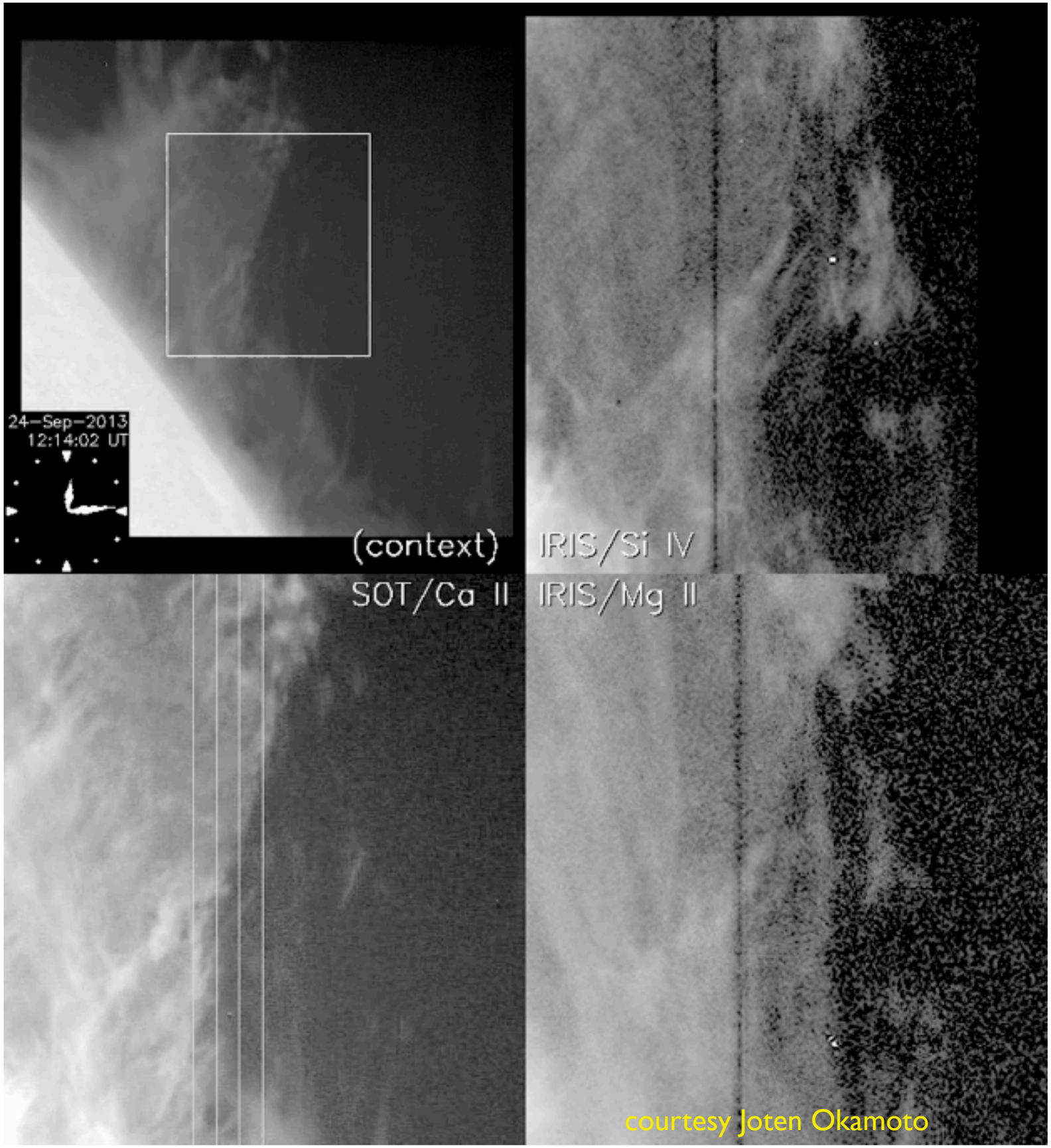
Prominence dynamics



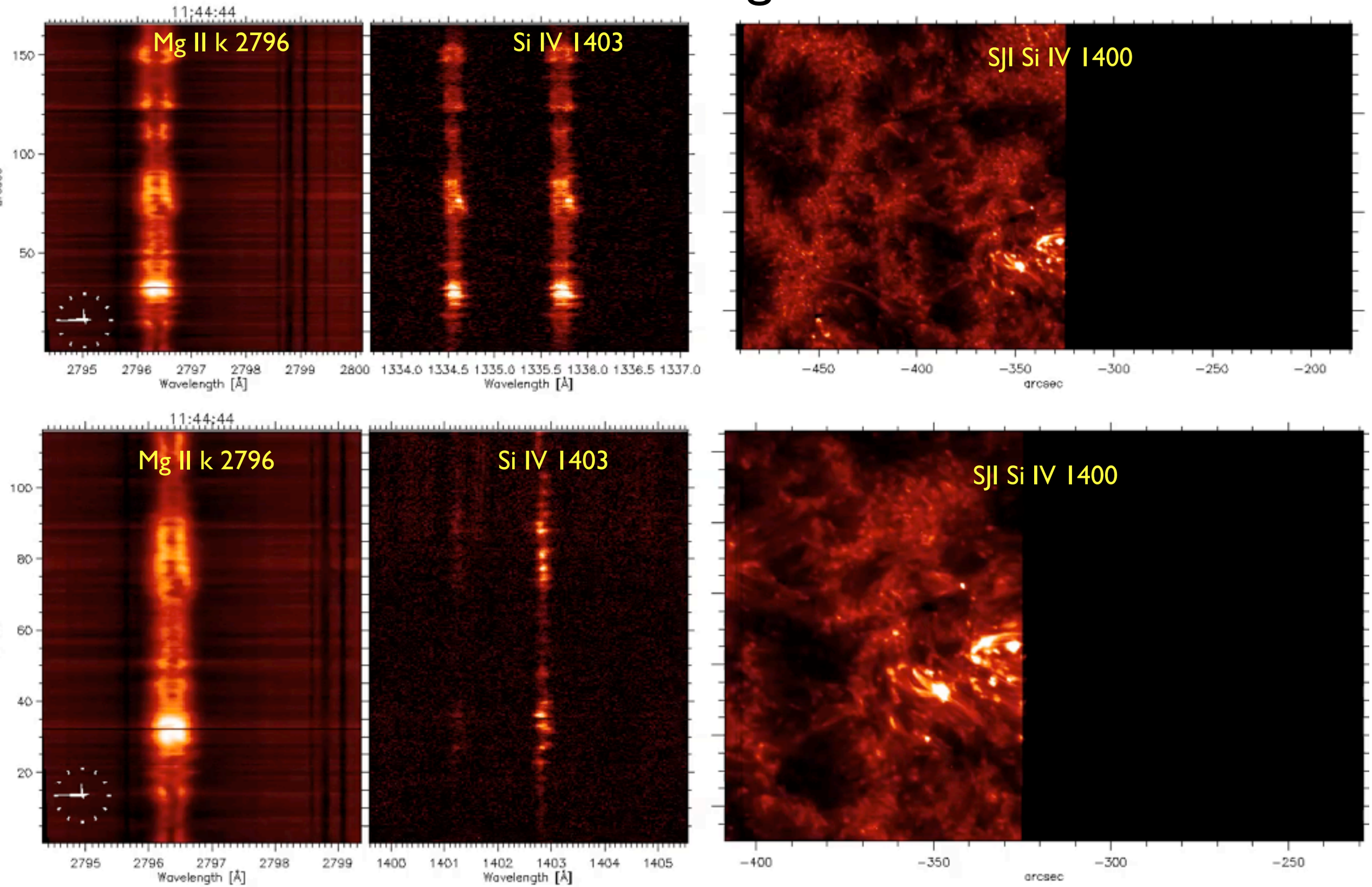
Prominence dynamics



Prominence dynamics, coordinated with Hinode

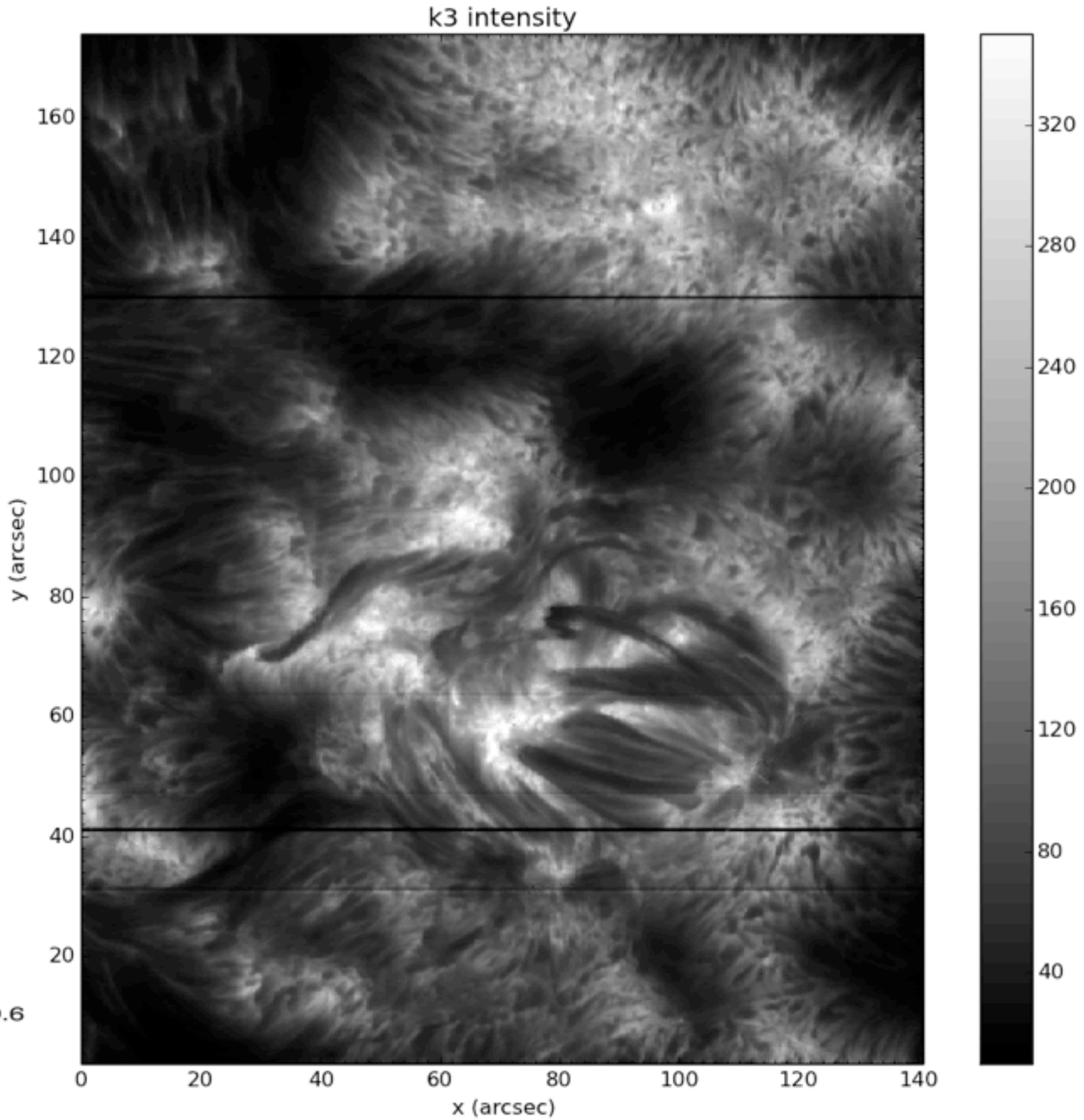


Flux emergence



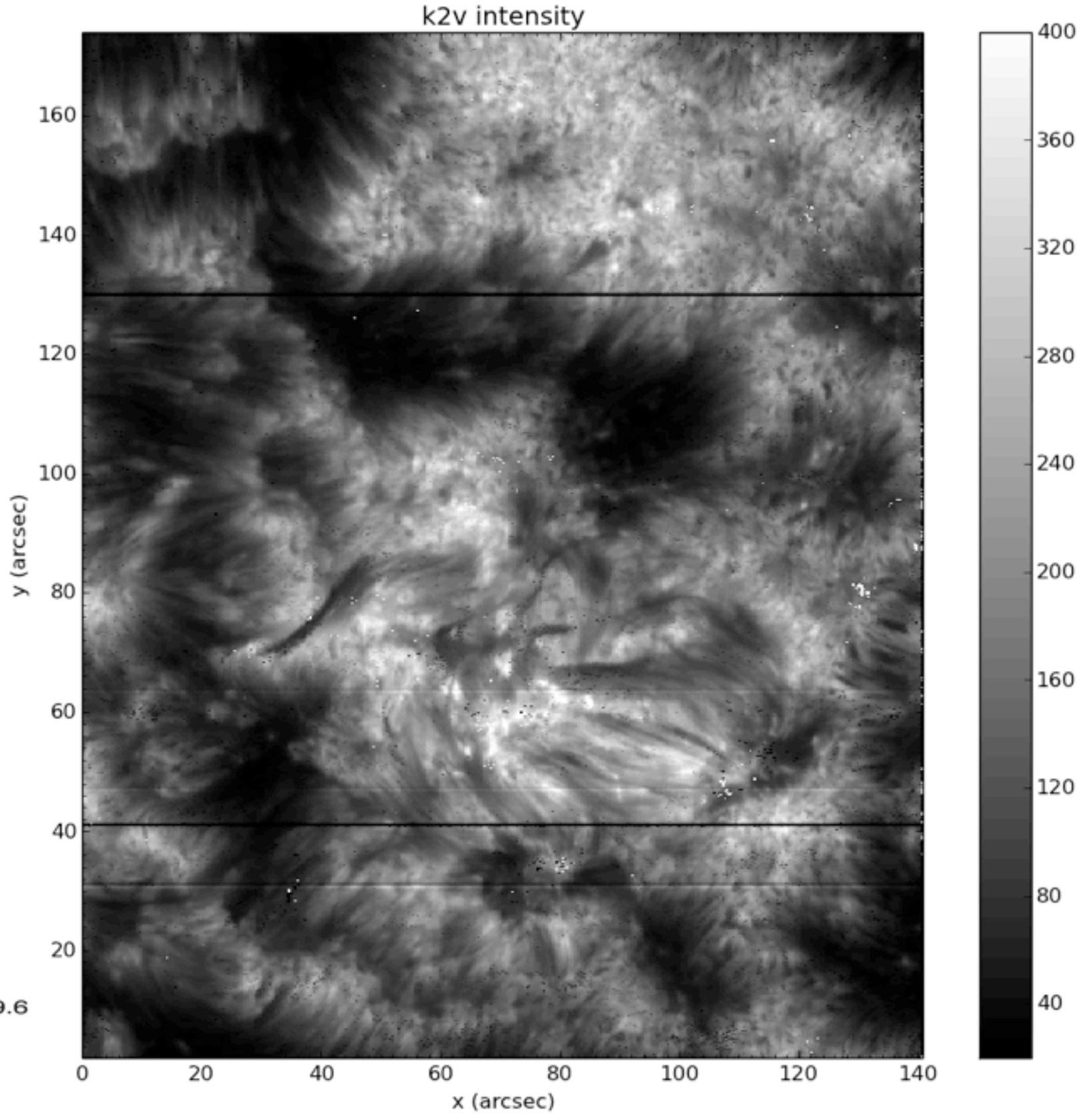
Flux emergence reveals very strange profiles suggesting multiple components and very low-lying hot plasma (Ellerman bombs)

Provides diagnostics over whole range of heights: TR corrugation



courtesy Tiago Pereira

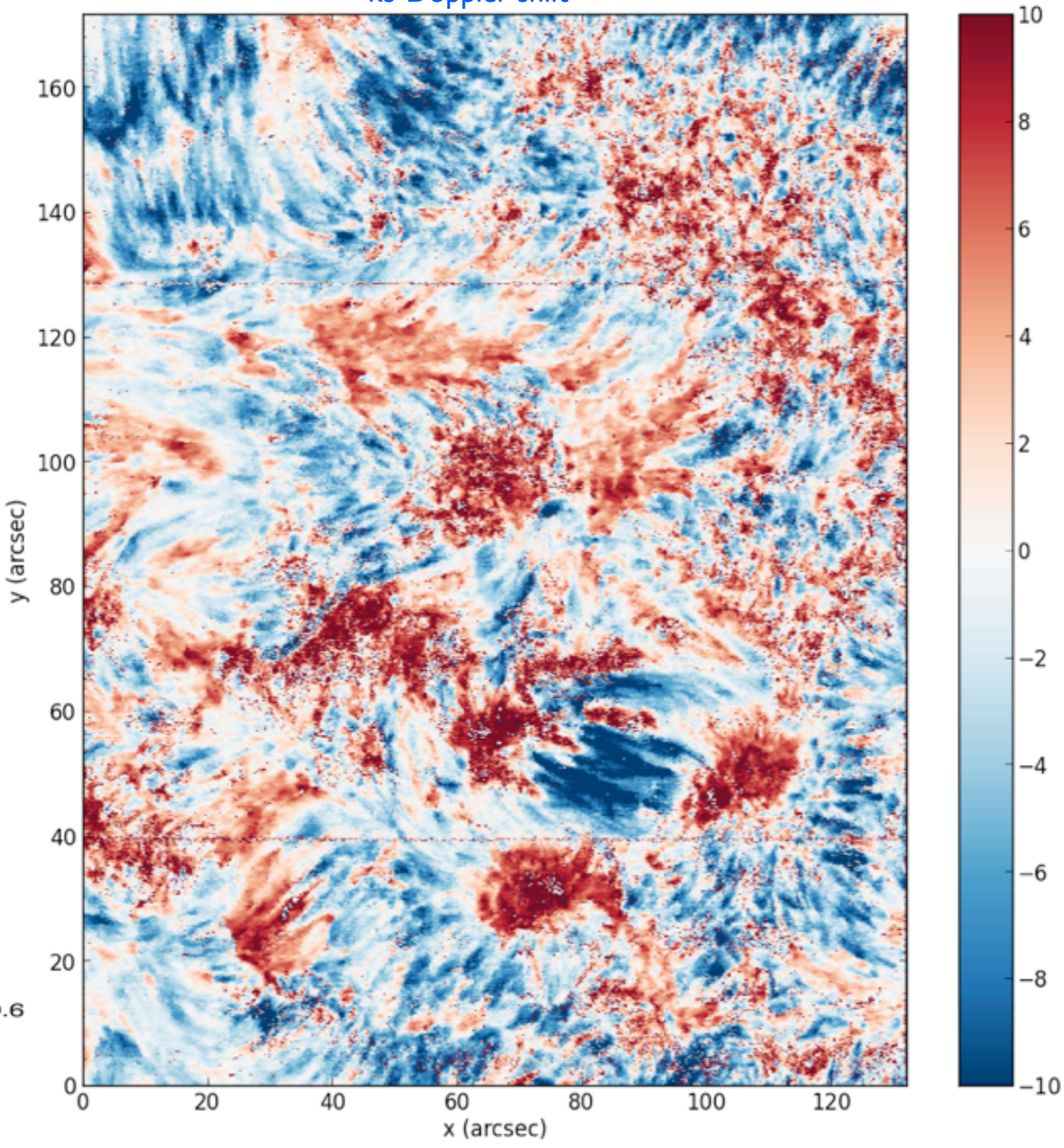
Provides diagnostics over whole range of heights: mid chromo Temperature

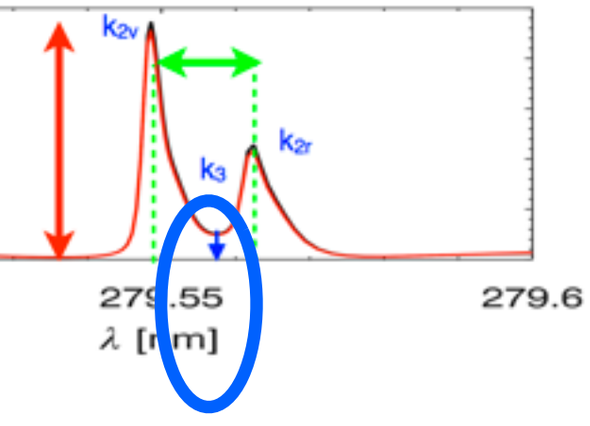


courtesy Tiago Pereira

Provides diagnostics over whole range of heights: upper chromo velocity

k3 Doppler shift

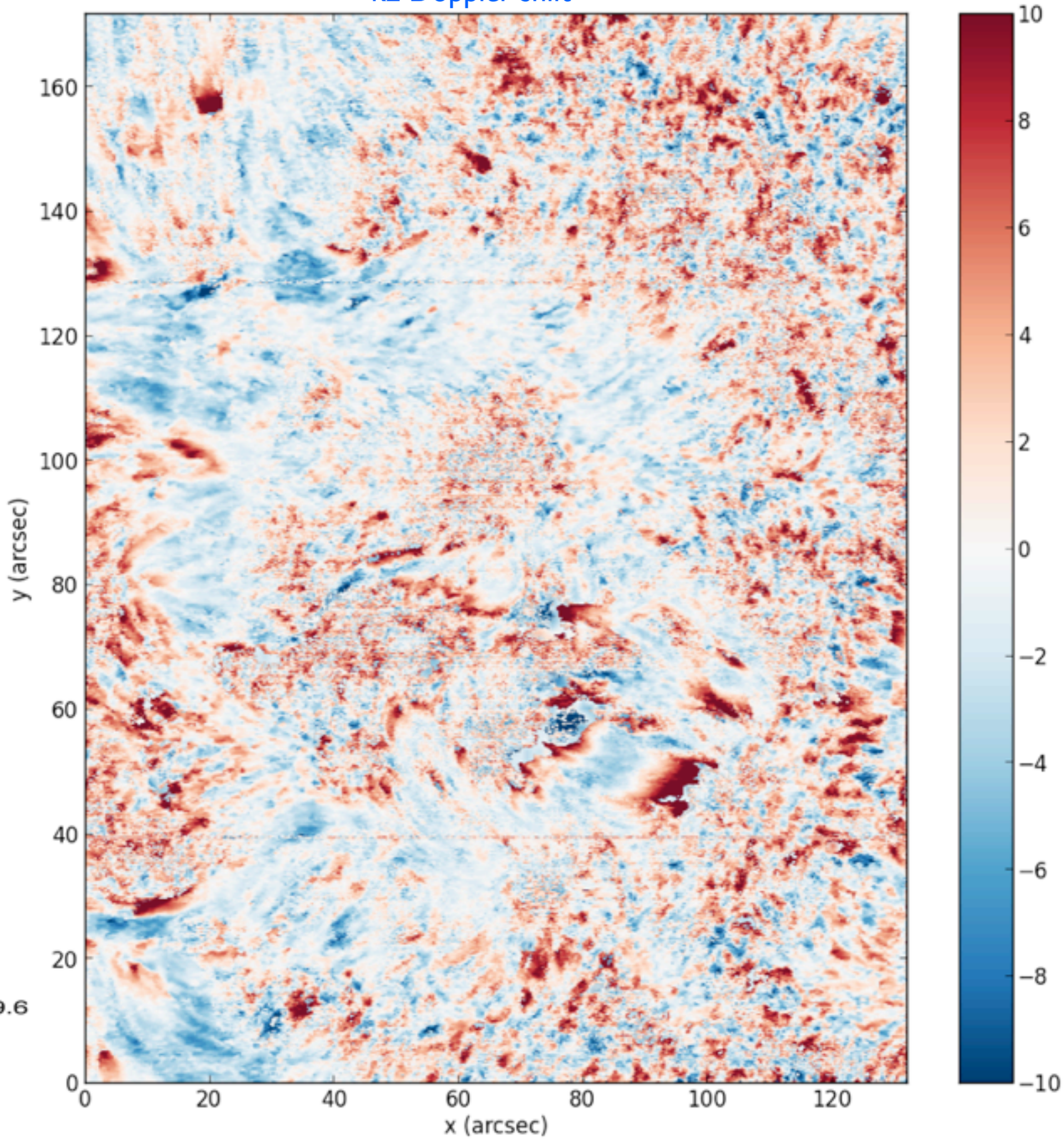


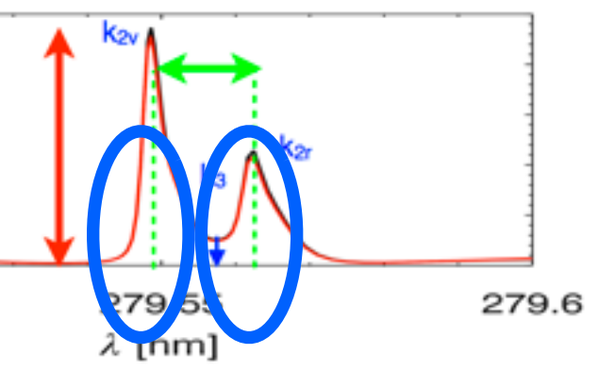


courtesy Tiago Pereira

Provides diagnostics over whole range of heights: mid chromo velocities

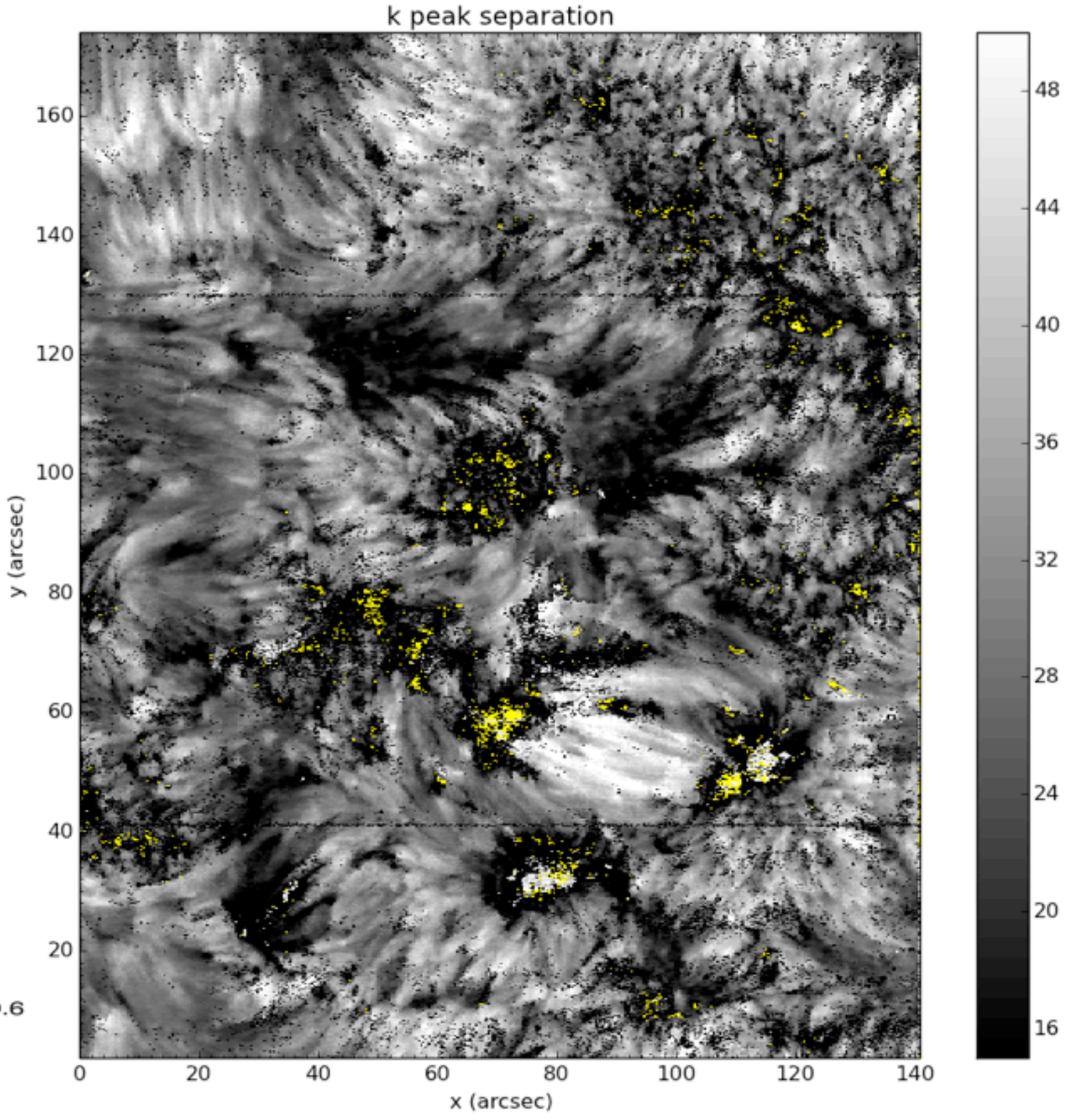
k2 Doppler shift





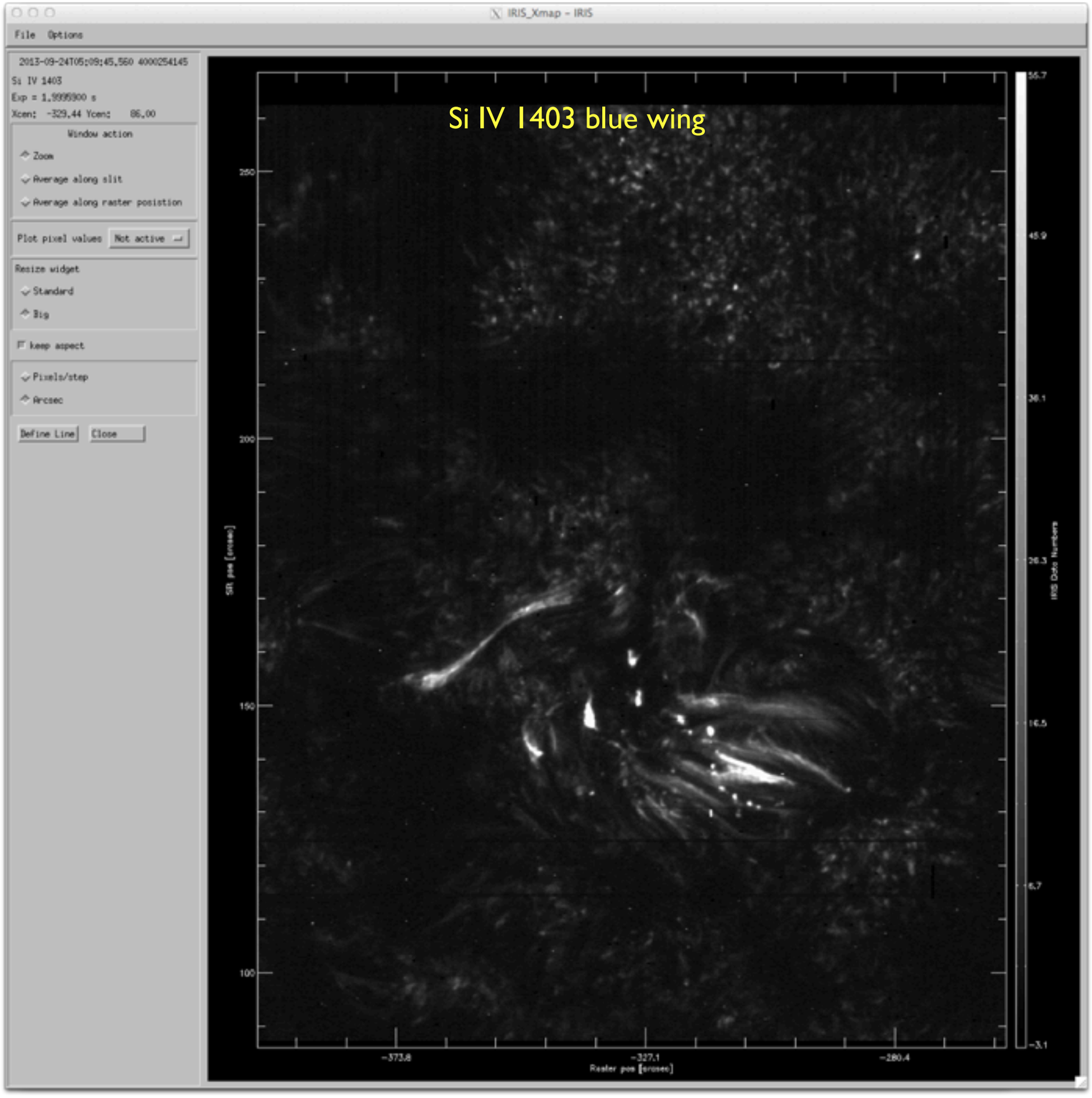
courtesy Tiago Pereira

Provides diagnostics over whole range of heights: turbulence

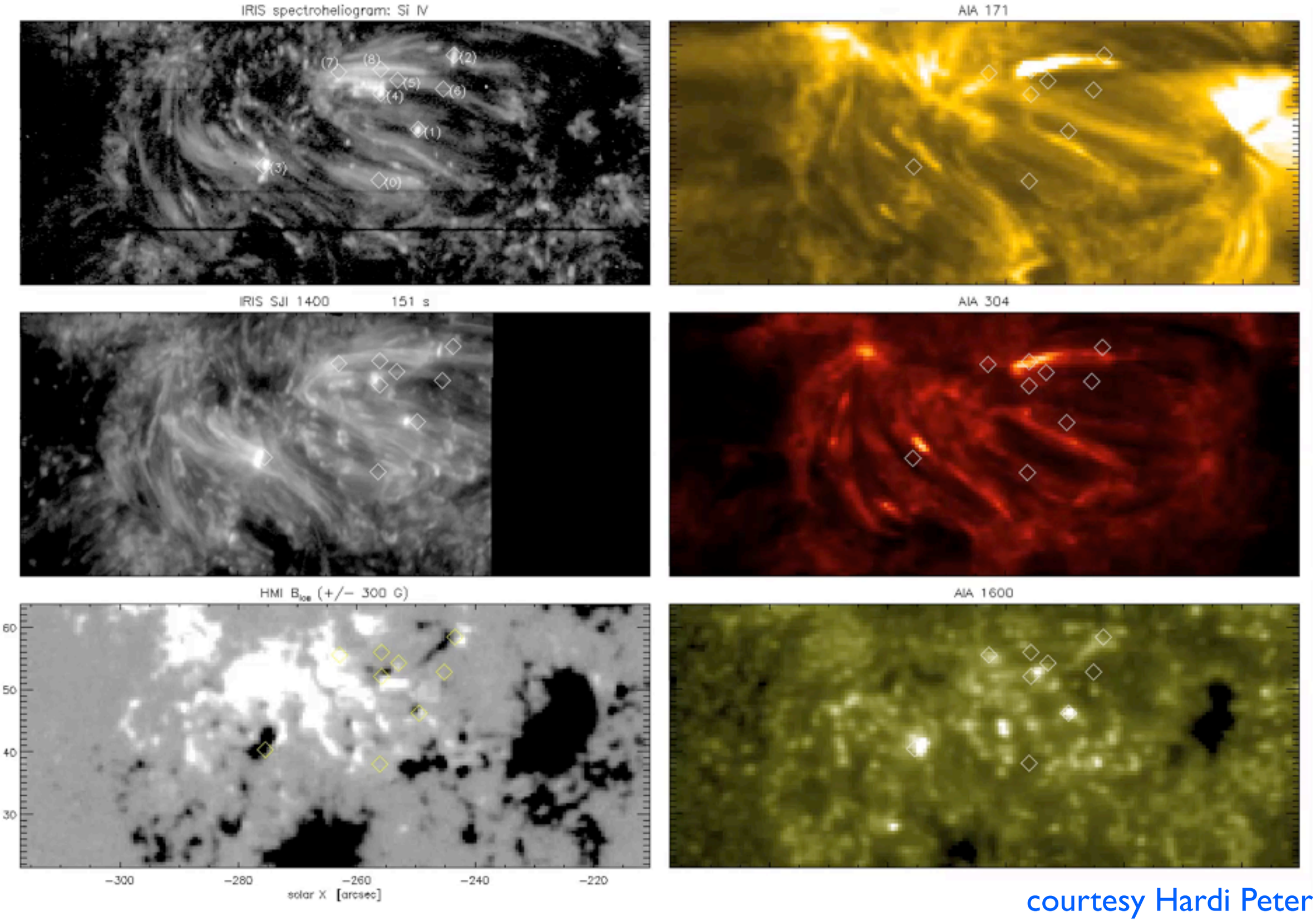


courtesy Tiago Pereira

Importance of temperature coverage



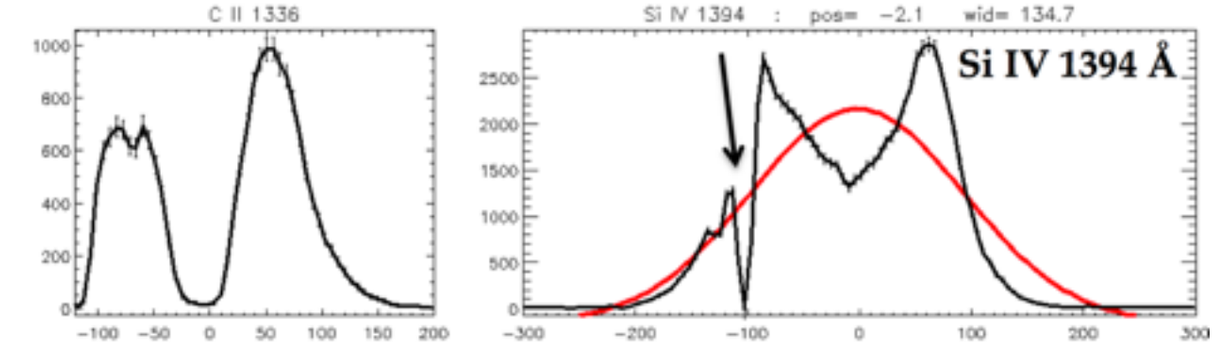
Flux emergence

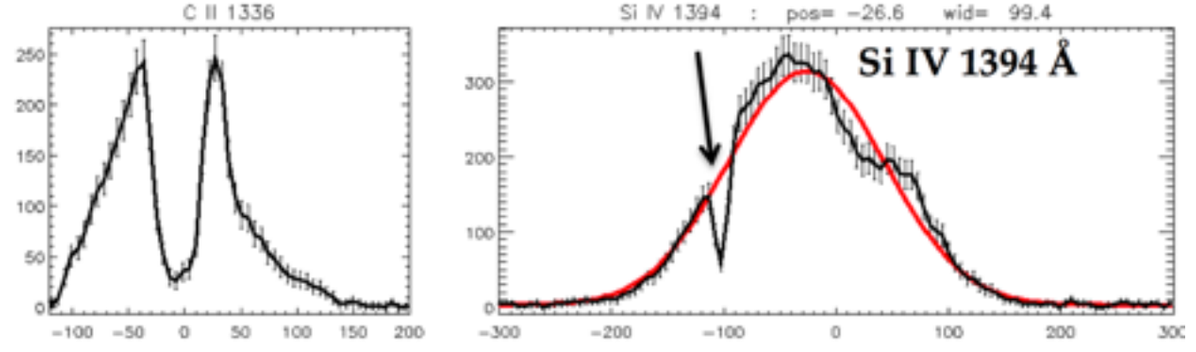


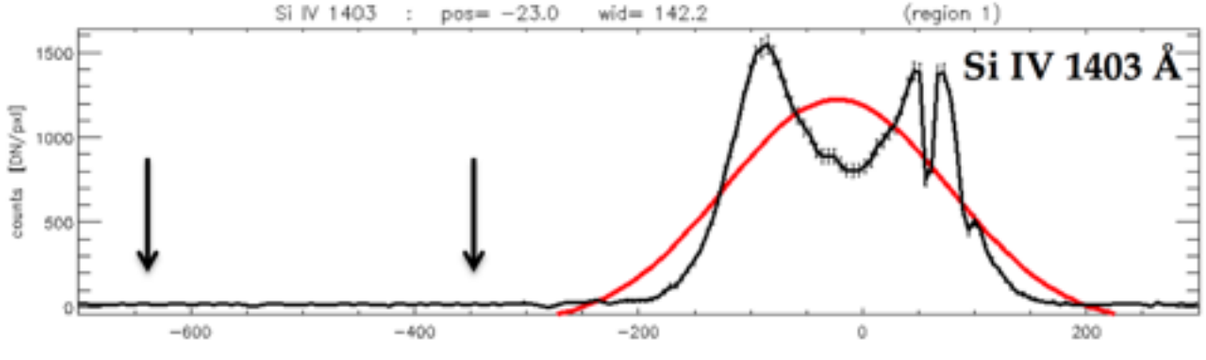
courtesy Hardi Peter

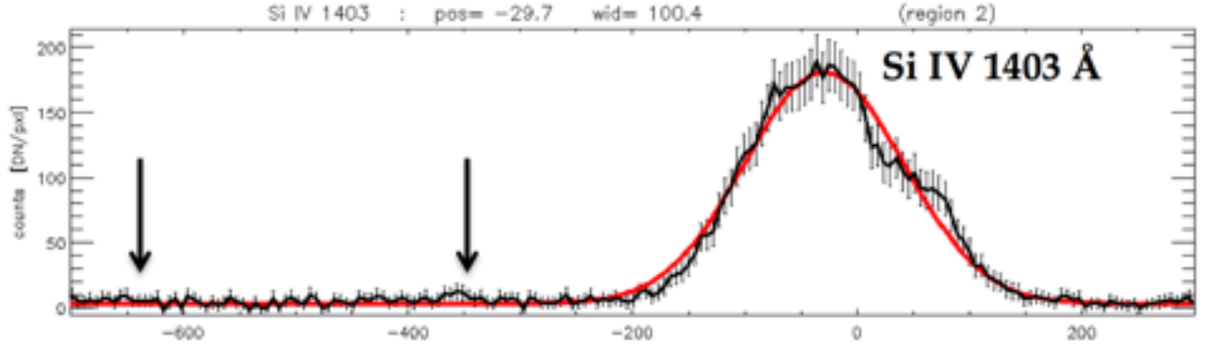
Overlying corona initially barely disturbed by emergence of TR loops

Flux emergence and Ellerman Bombs

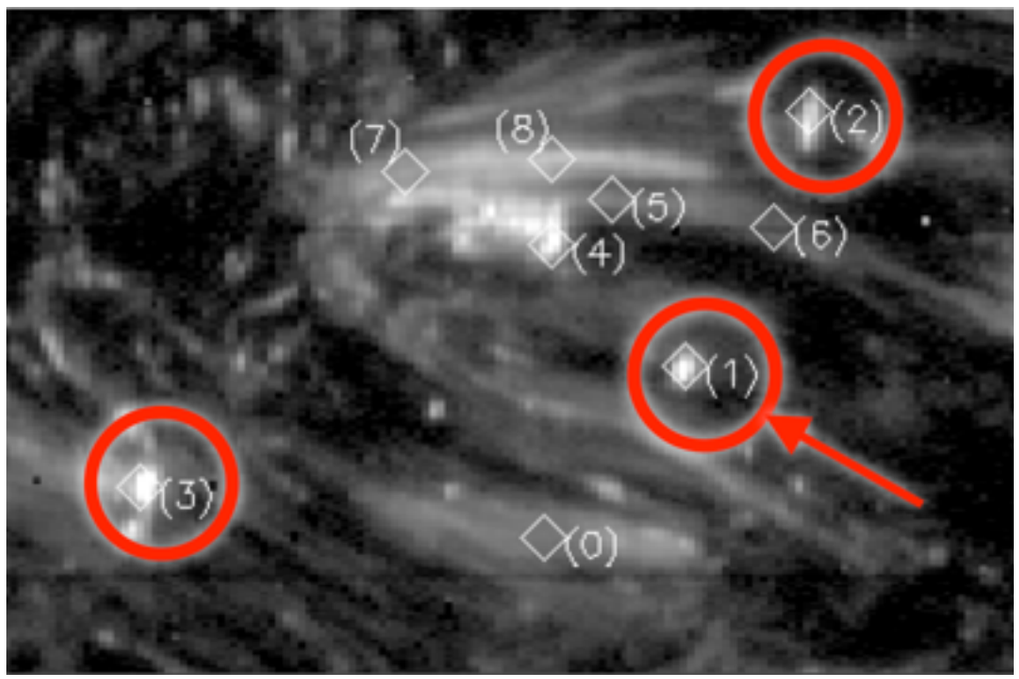


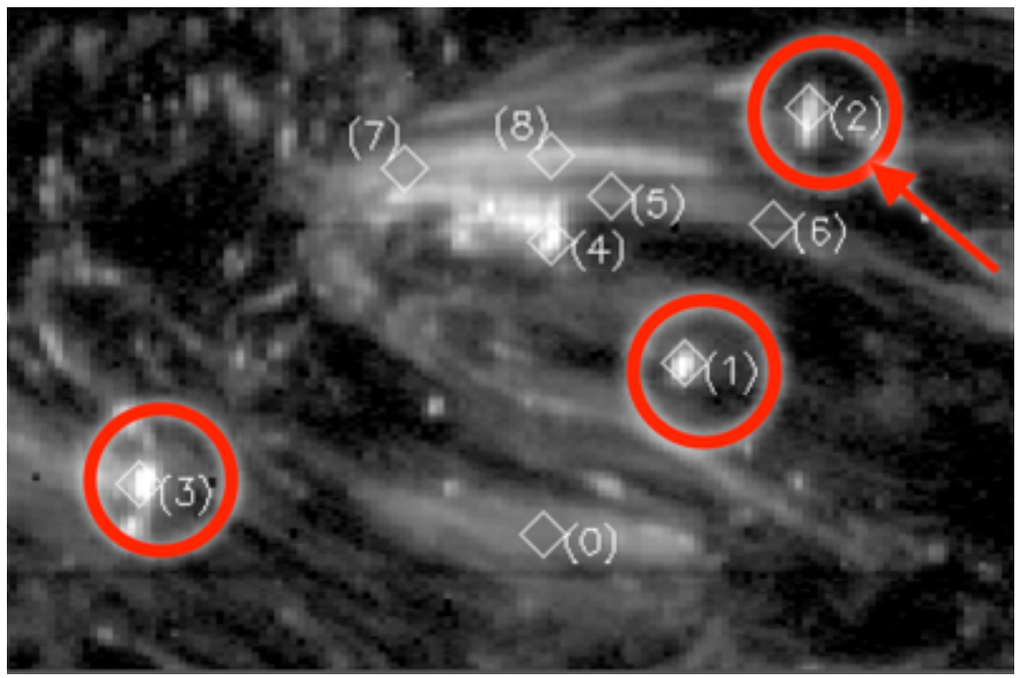






courtesy Hardi Peter

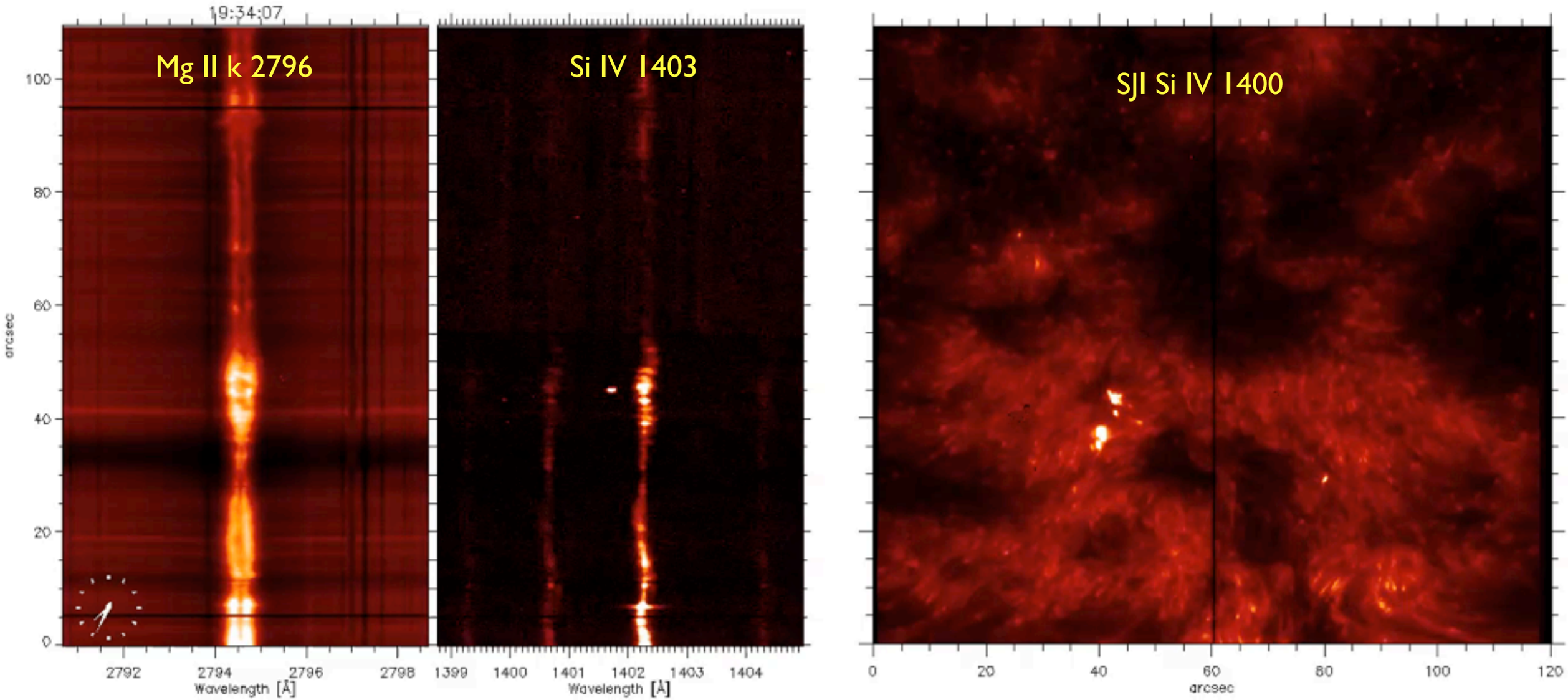




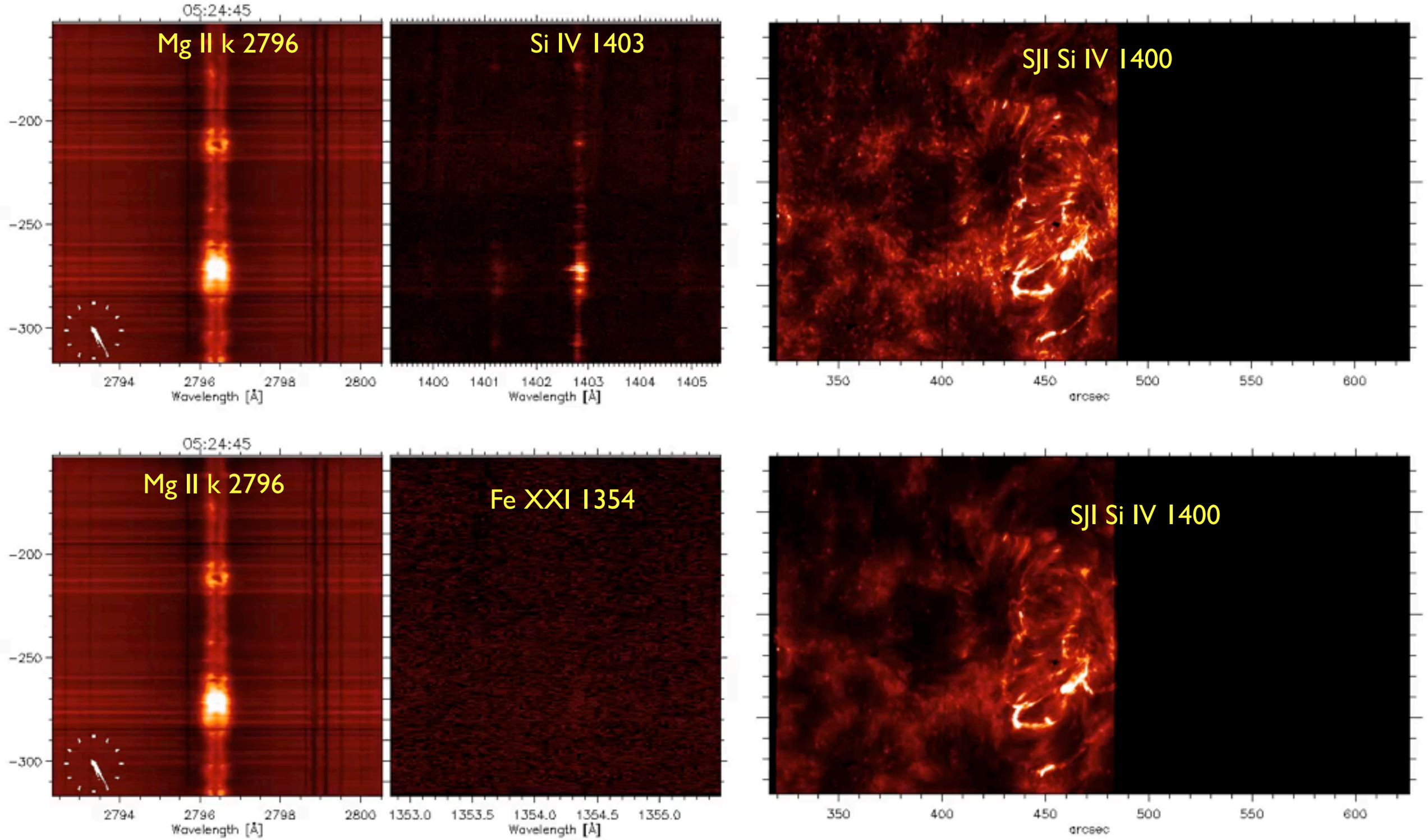
Bi-directional flows not always present

Presence of absorbing Ni II line suggests 0.1 MK formed at low chromospheric heights

Flare evolution very complex with both red- and blueshifts present in closely neighboring locations



Flare evolution very complex with both red- and blueshifts present in closely neighboring locations
Hot (>10 MK) plasma present even in small C flares



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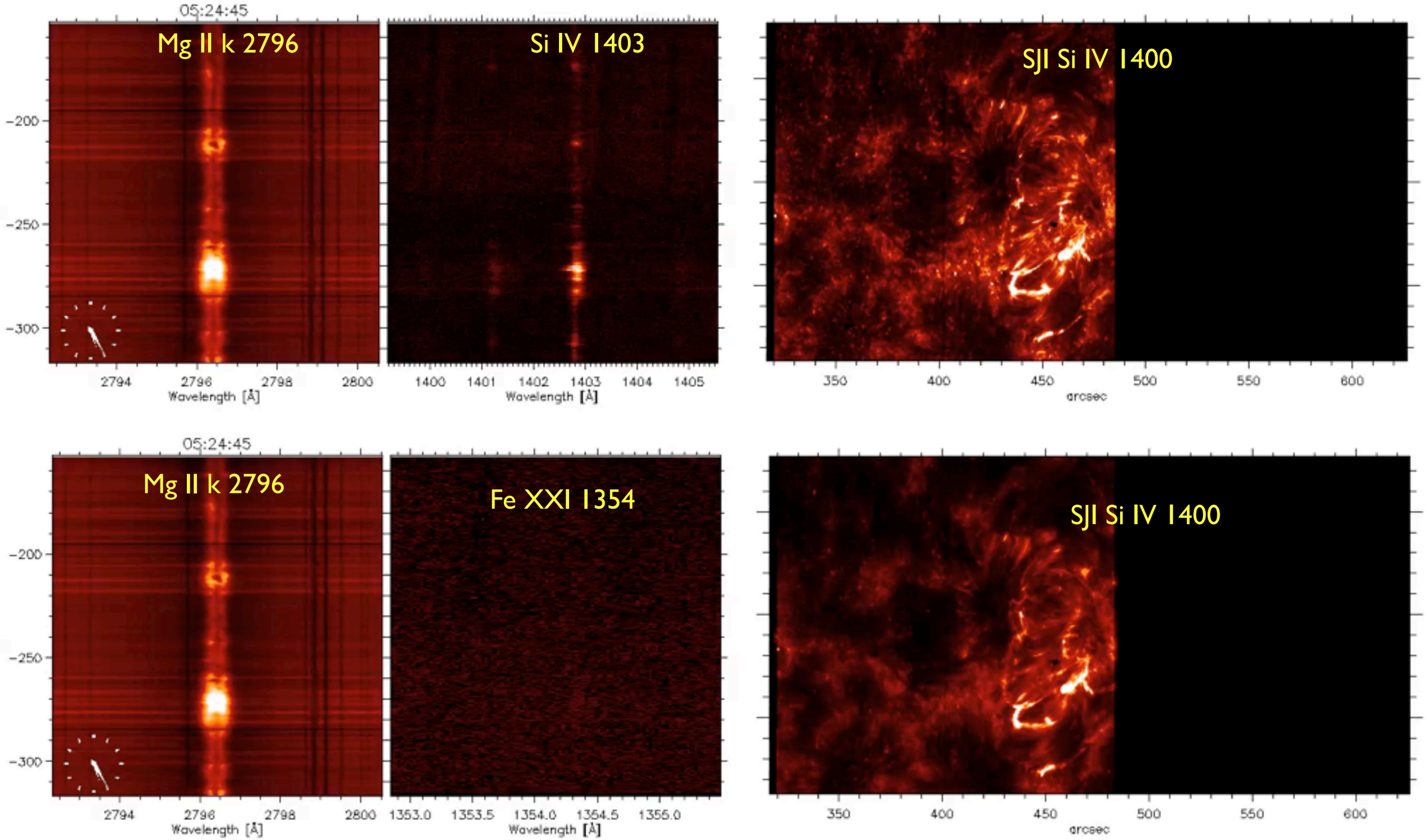
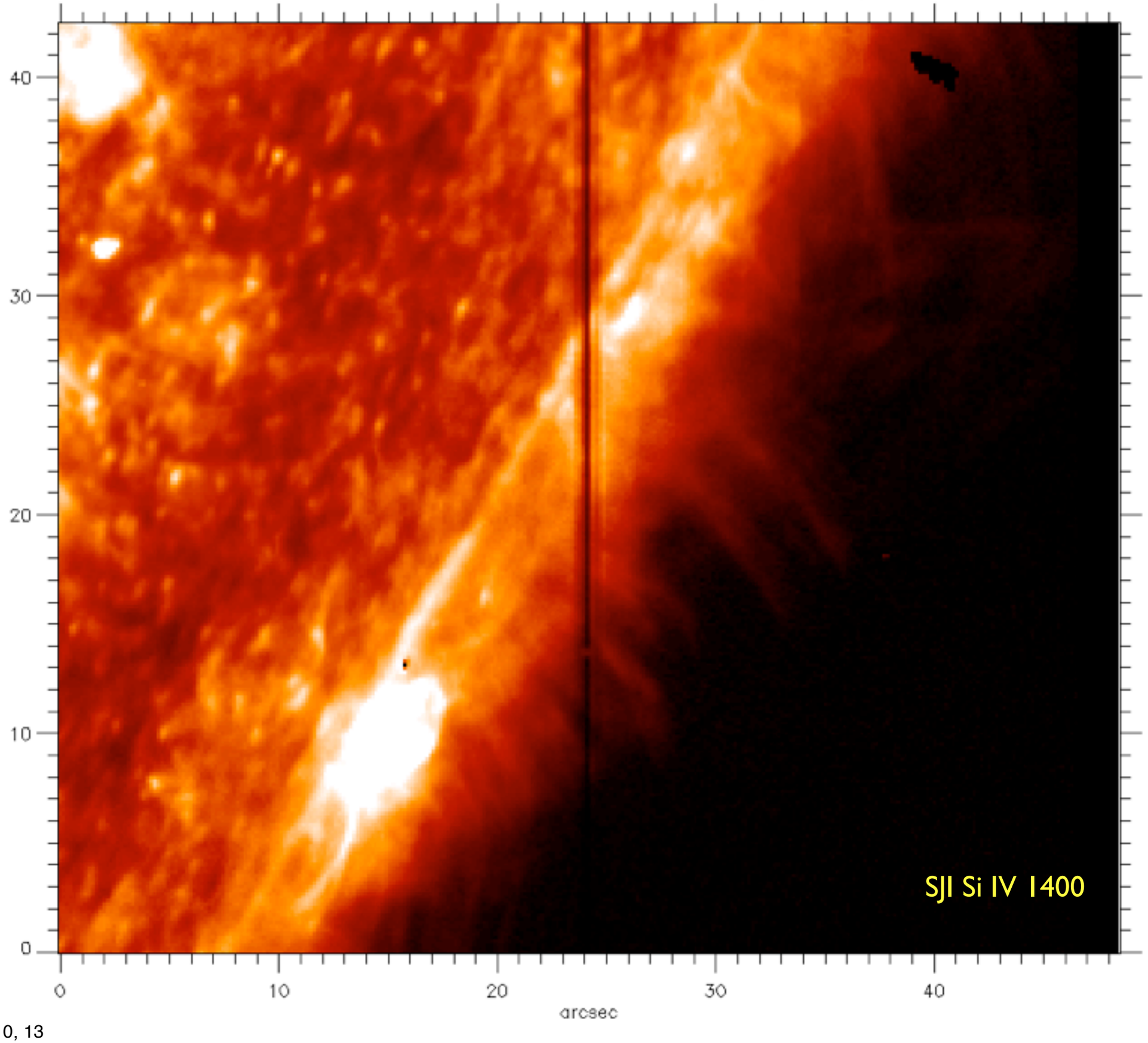


Short, small-scale and dynamic loops prevalent at the limb
Unresolved Fine Structure (UFS) resolved?



See Viggo Hansteen's talk this week

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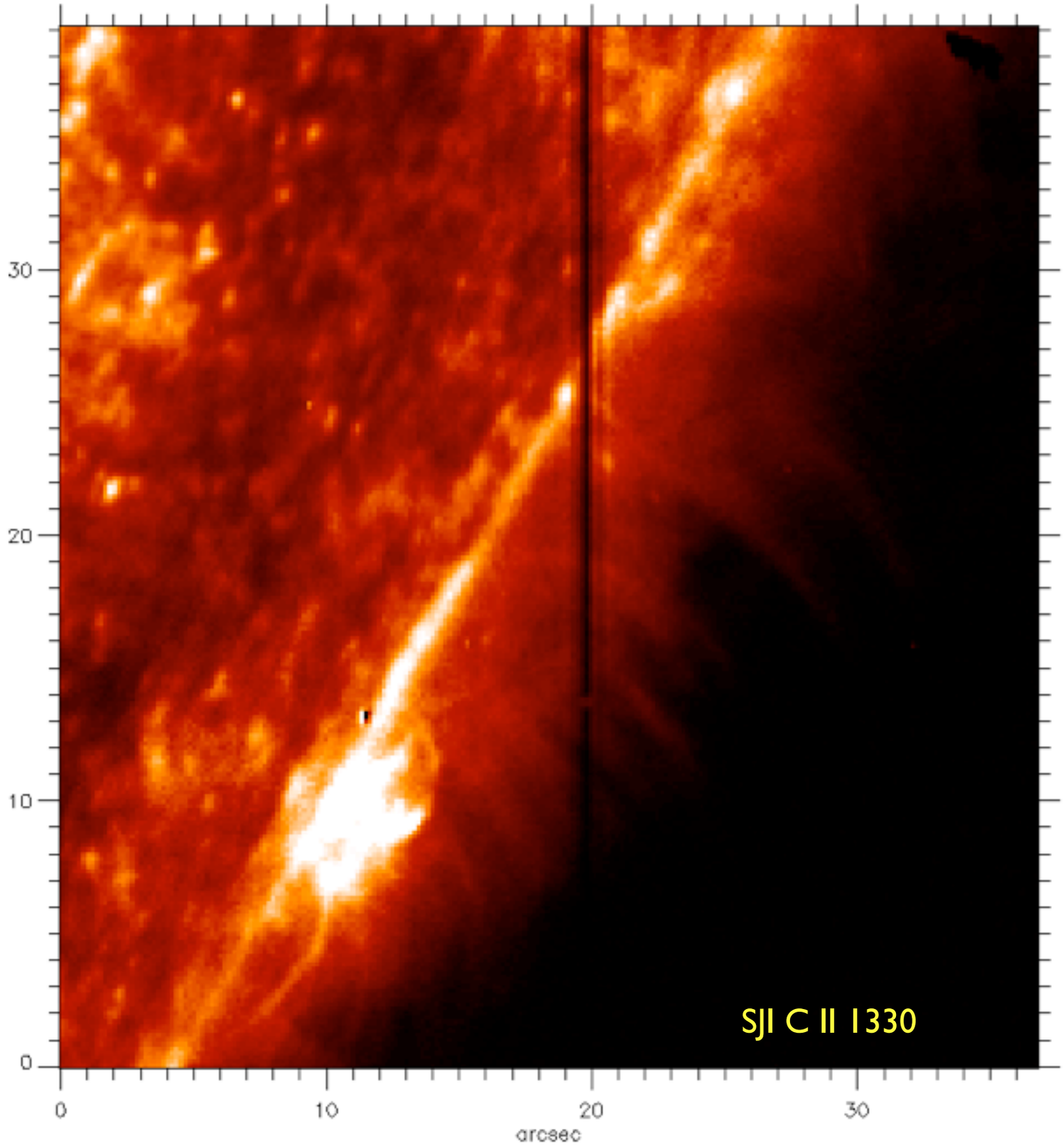

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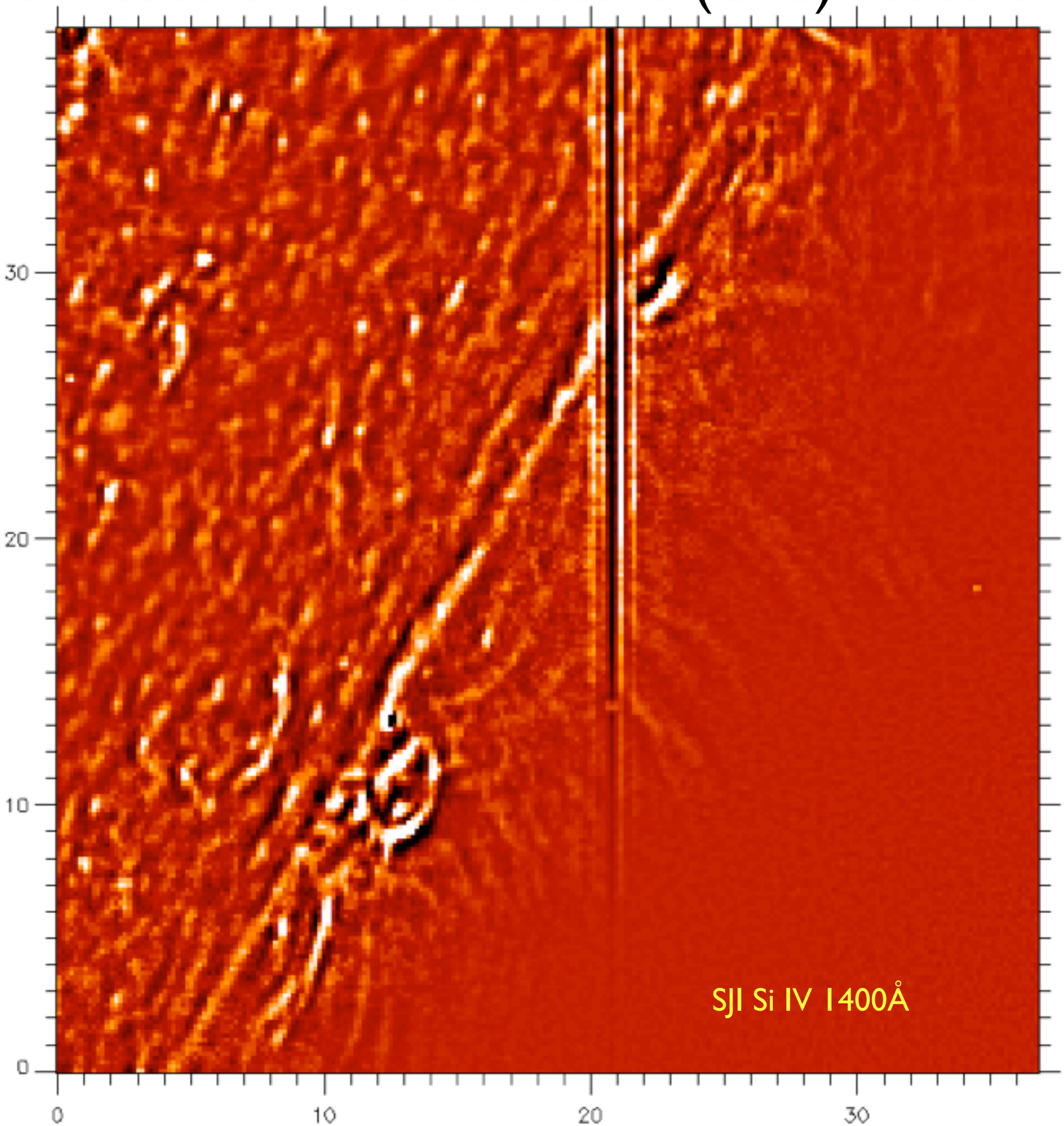

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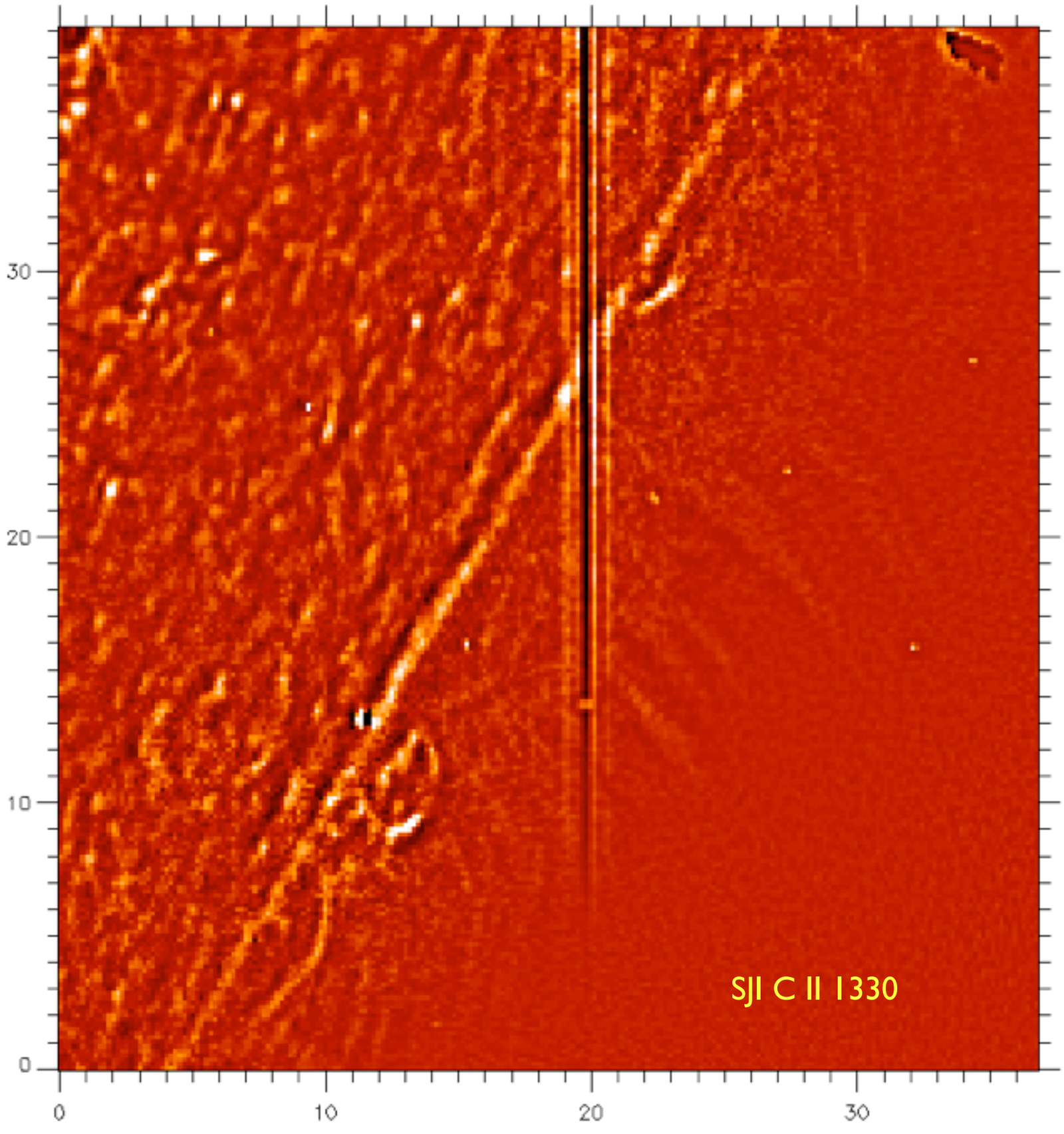

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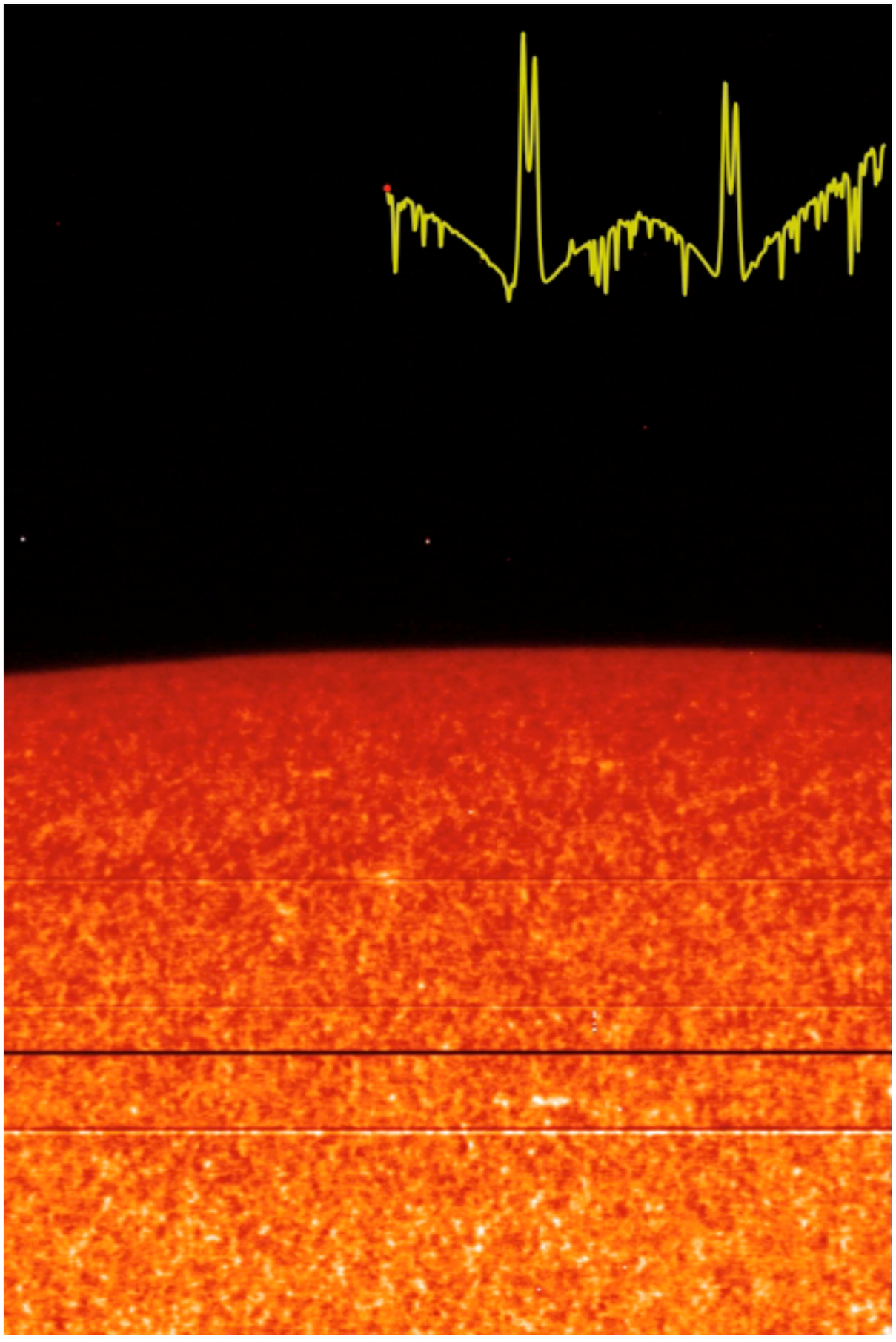
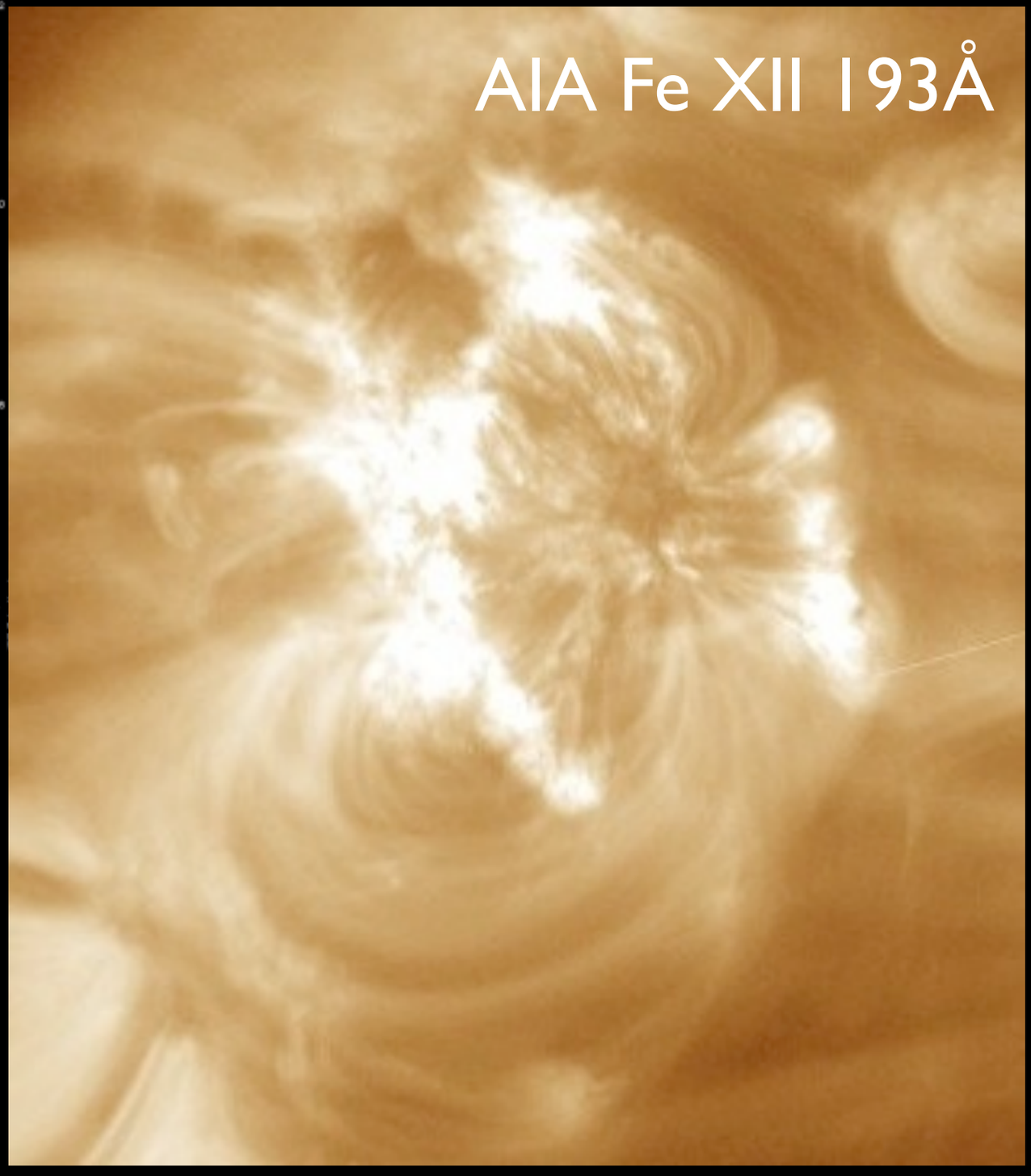
Diagnostic capabilities of NUV spectra



courtesy Tiago Pereira

Coronal line Fe XII 1349Å



High resolution spectral scans possible,
but line too faint for high cadence spectroscopy

Conclusions

- IRIS functioning well: high resolution spectra and images obtained daily

- Preliminary analysis highlights include:
  - prevalence of high velocity events in chromosphere and TR

  - prevalence of twist and associated heating everywhere

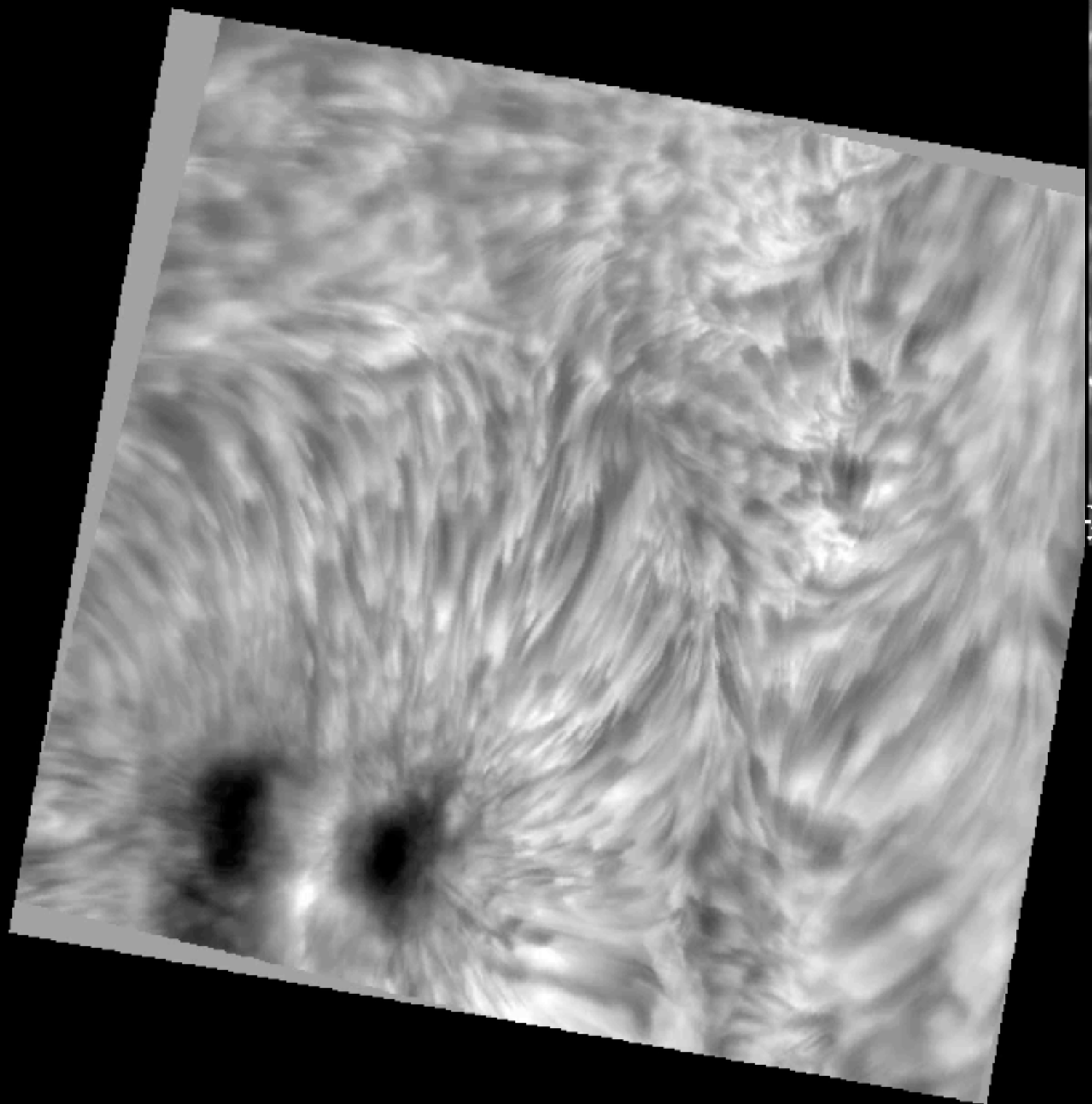
  - UFS resolved?

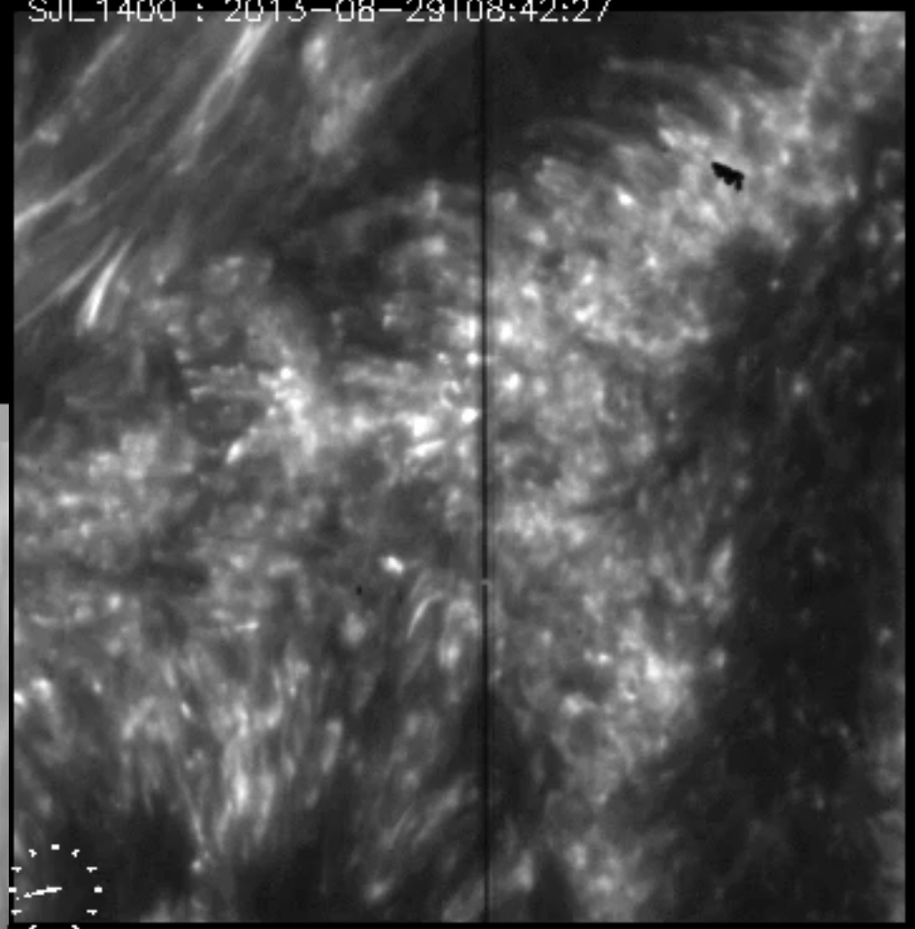
  - Mg II k/h excellent diagnostics of chromospheric dynamics and energetics

  - connection between chromosphere and corona requires high throughput, high cadence, high resolution spectra

- IRIS data available at: http://iris.lmsal.com/search

Large FOV 2D spectroscopy important

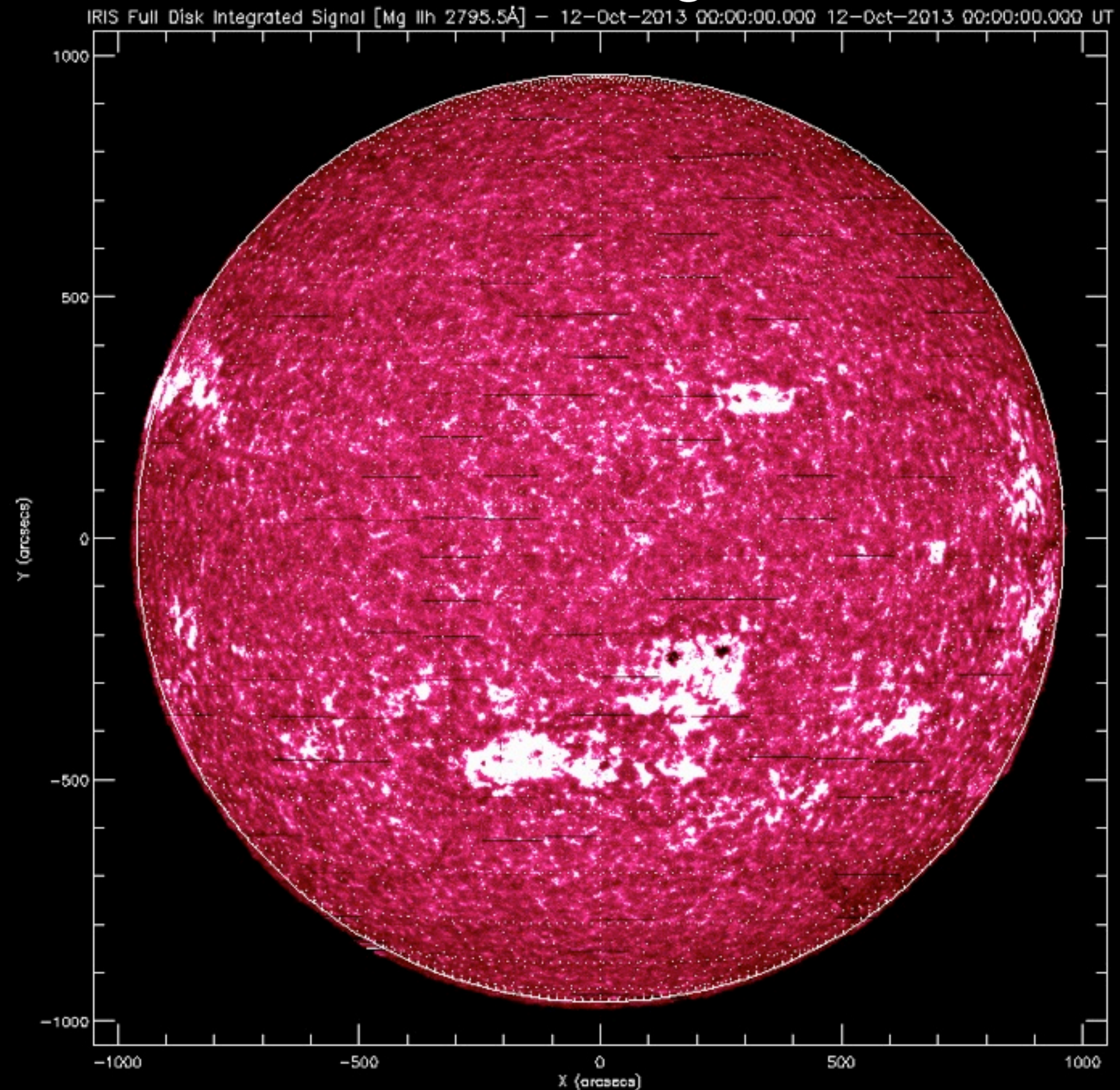




courtesy Luc Rouppe van der Voort

CRISP / IRIS not same scale / cadence

Full disk mosaic Mg II k 2796Å



courtesy Scott McIntosh

Full disk mosaic Mg II k 2796Å

Intensity

Velocity

Line width

courtesy Scott McIntosh