



Facility **InfraRed** Spectropolarimeter

FIRS: A New Instrument for Photospheric and Chromospheric Studies at the Dunn Solar Telescope

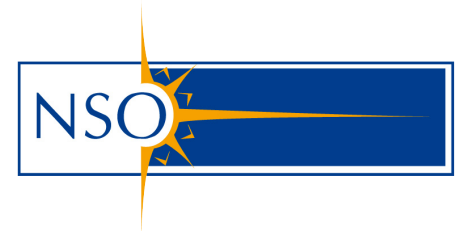
Sarah Jaeggli, Haosheng Lin, Don Mickey, Jeff Kuhn (IfA, U. Hawai'i)

Steve Hegwer, Thomas Rimmele, Matt Penn (NSO)

This project is supported by the National Science Foundation Major Research Program,
Award No. ATM-0421582.



S.Jaeggli for NSO Workshop 25



Solar B, Photosphere to Corona

- Coronal heating
- Vertical wave propagation from the photosphere to chromosphere
- Running penumbral waves
- Normal and inverse Evershed flows
- 3D magnetic structure of sunspots
- Prominence and spicule magnetic fields
- Canopy fields
- Dynamic events and evolution of everything with time



Instrument Requirements



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Multi-Spectral: Multi-Height Diagnostics

Line [$\text{\AA}$]	Species	Landé g	Formation Height
6302	Fe I	1.667, 2.5	mid-photosphere
8542	Ca II	1.1	low chromosphere
10827	Si I	1.5	photosphere
10830	He I	2.0, 1.75, 1.25	high chromosphere
15650	Fe I	3, 1.53	low photosphere

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High Spectral Resolution: Detailed Physics

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High Spatial Resolution: Structure Detail

Instrument Requirements

with FIRS



FIRS



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Dual-arm spectrograph for simultaneous visible and infrared observations

Beam splitter to share the beam with IBIS

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with IBIS	* * 8542	Ca II	1.1	low chromosphere
	* 10827	Si I	1.5	photosphere
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Increased throughput with 4 slits



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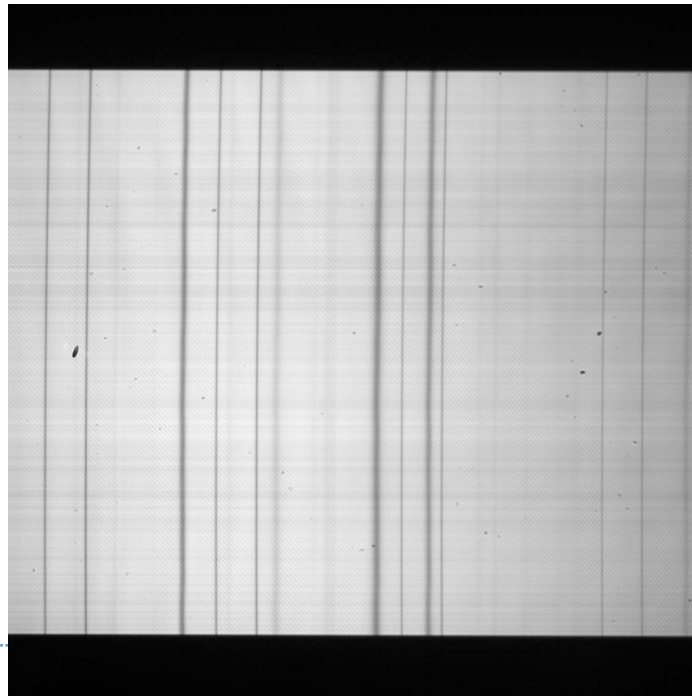
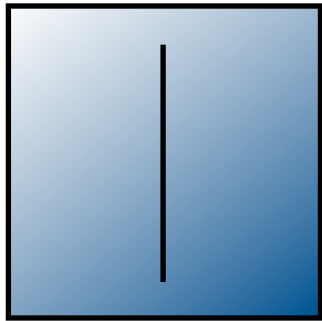
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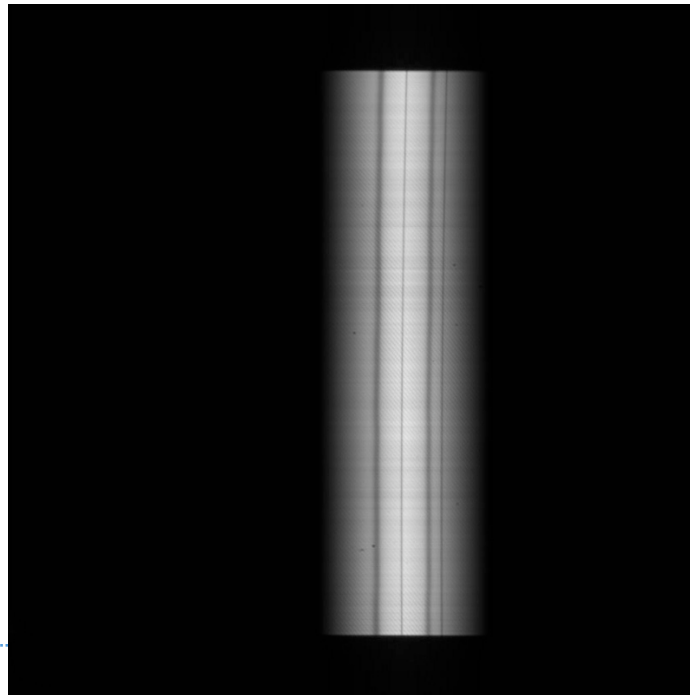
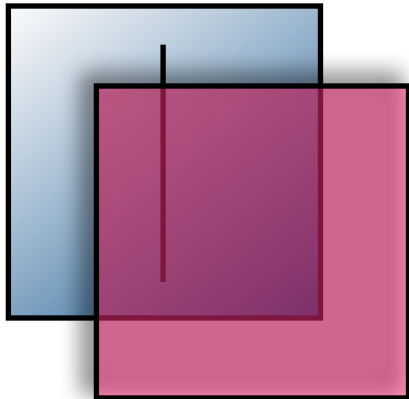
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FIRS



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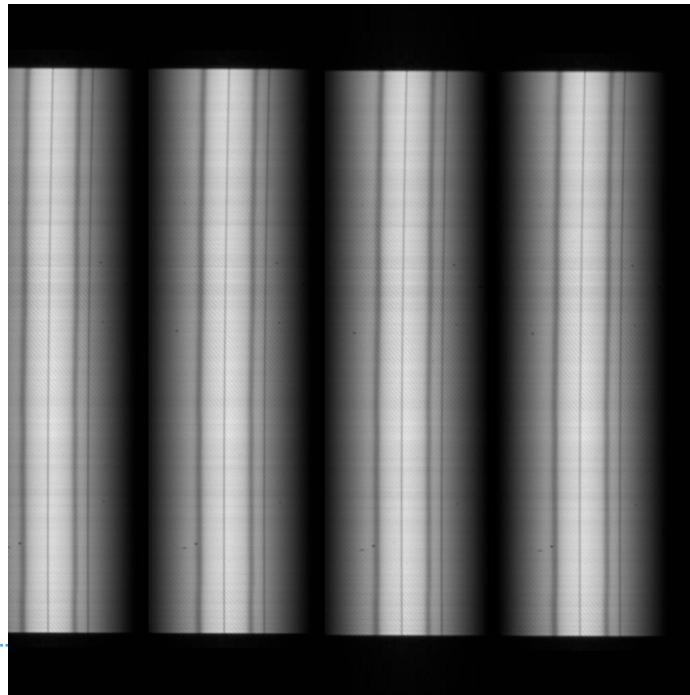
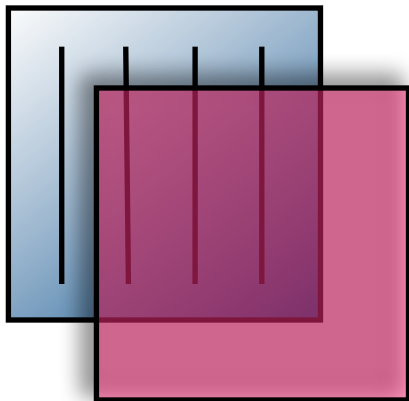
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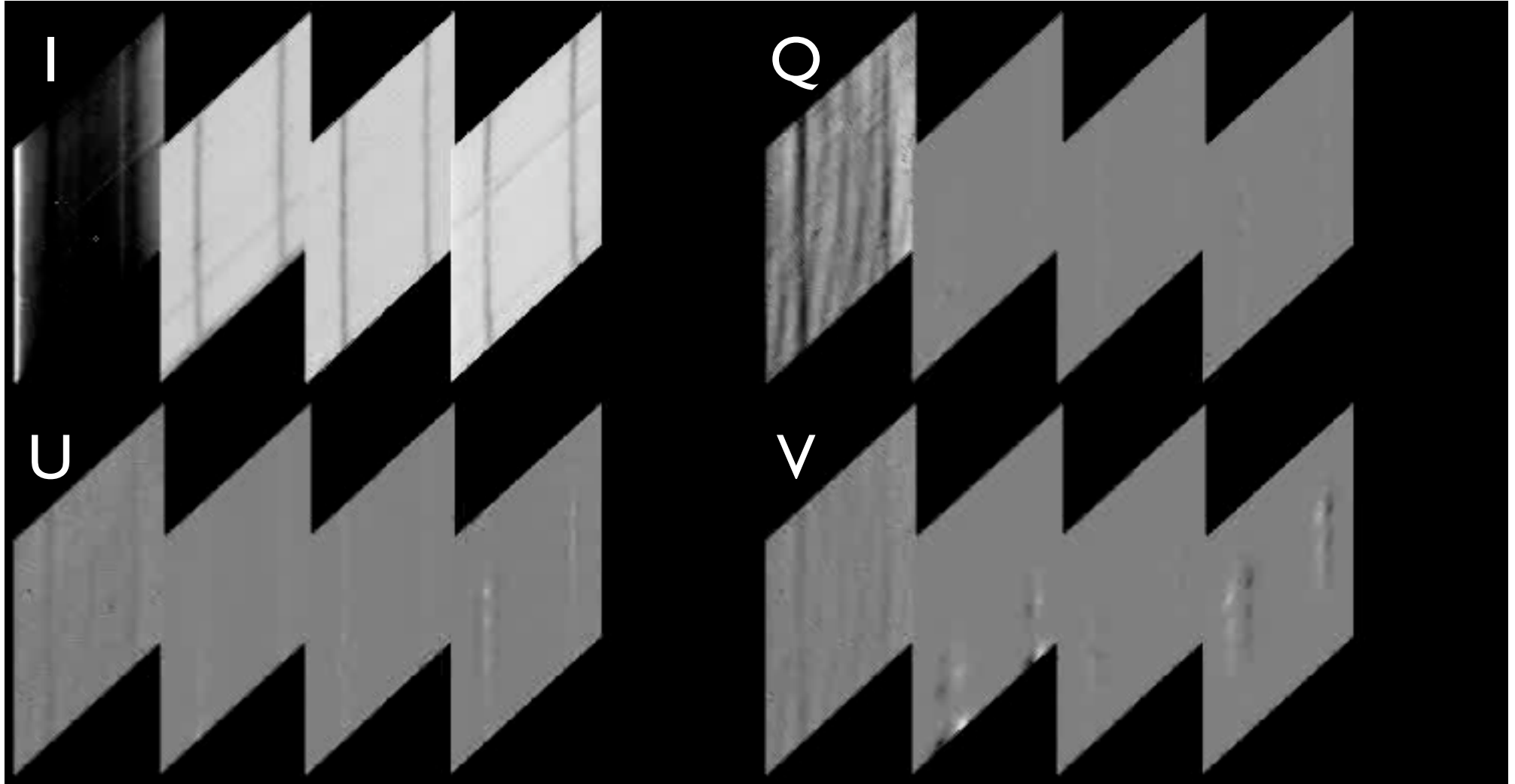
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FIRS



Building a Scan with 4 Slits



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with FIRS

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Large IR grating with steep blaze

300,000 for the IR, 600,000 for the visible (3pm measured with HeNe)



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High Spatial Resolution: Structure Detail

Diffraction-limited with HOAO

f/36 and f/108 feed optics for high and low-res modes

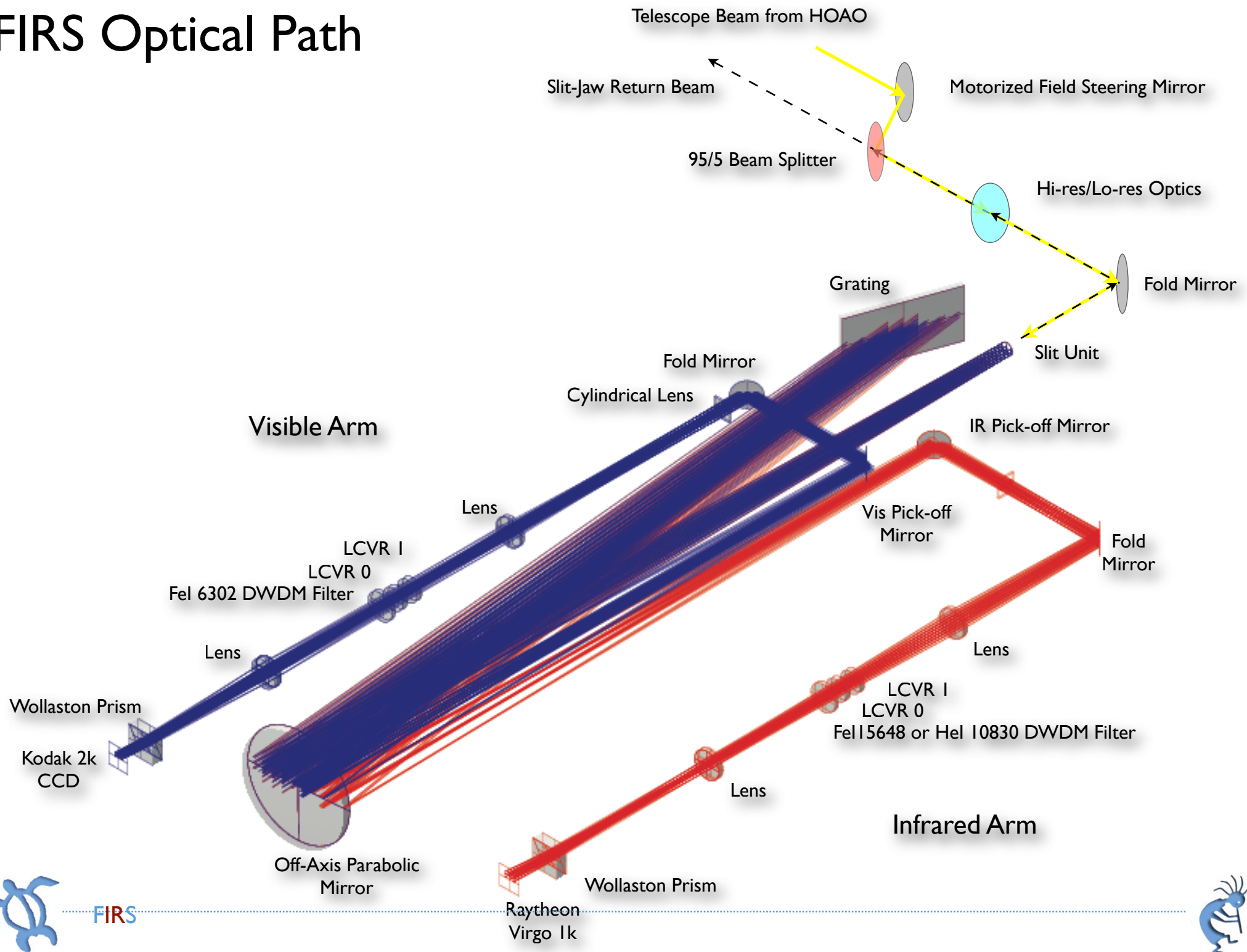




“Tower of Power”
aka f/108 feed optics



FIRS Optical Path



FIRS Properties

* Assuming use of 40 μm slit

** S/N $\sim 10^3$

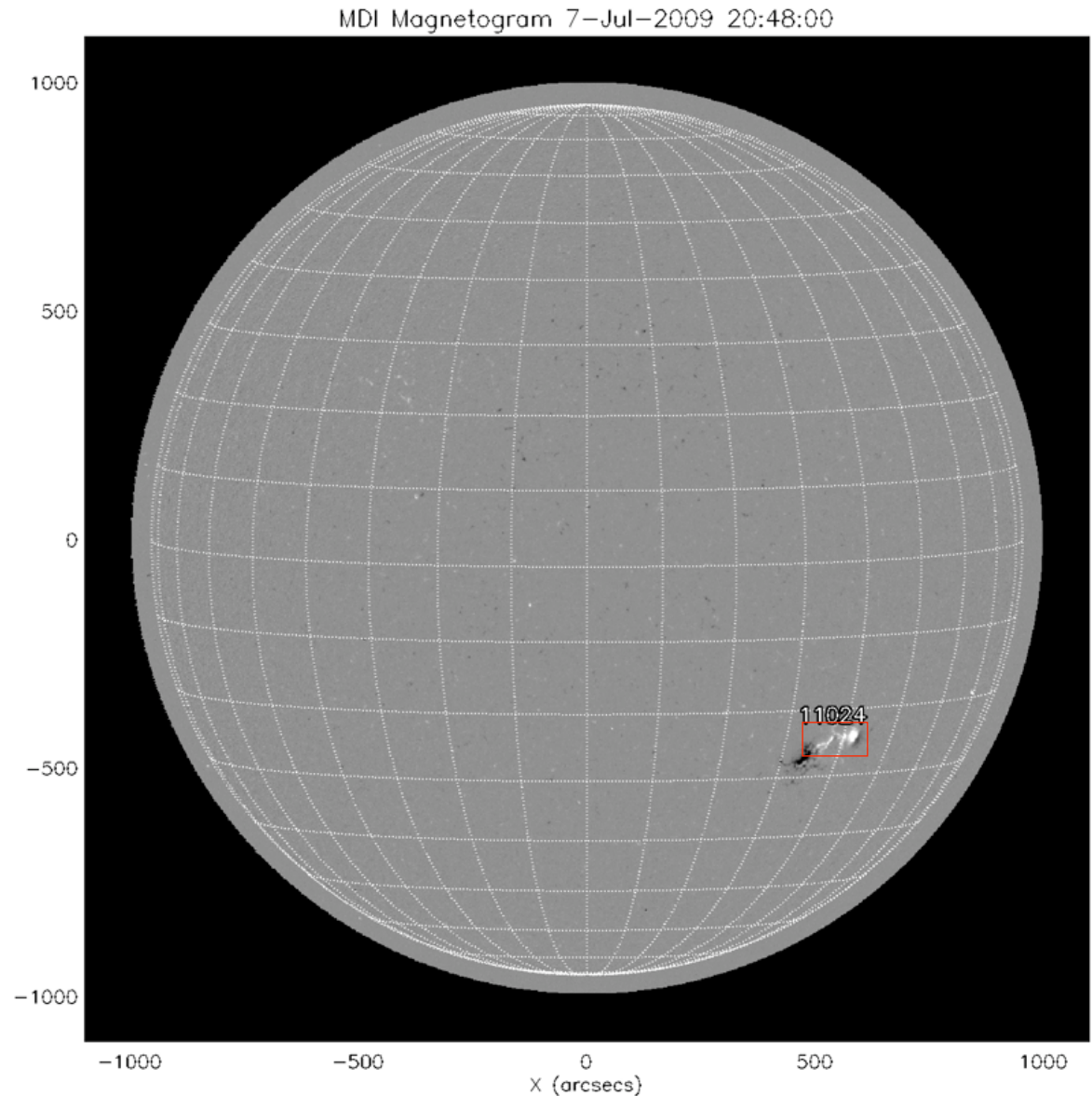
Property	FIRS f/36*	FIRS f/108*	Hinode SOT/SP
Telescope	76.2 cm Solar Tower	...	50 cm Aplanatic Gregorian
Rayleigh limit @ 6302	0.21"	...	0.32"
Rayleigh limit @ 10830	0.36"	...	...
Rayleigh limit @ 15648	0.52"	...	...
Field	174" x 75"	58" x 25"	160" (320" max) x 151"
Vis Spatial Sampling	0.30" x 0.08"/pix	0.10" x 0.03"/pix	0.15" x 0.16"/pix
IR Spatial Sampling	0.30" x 0.15"/pix	0.10" x 0.05"/pix	...
Nominal Scan Time**	20 min	...	83 min
6302 Spectral Resolution (Sampling)	0.03 (0.01) Å	...	0.03 (0.02) Å
10830 Spectral Resolution (Sampling)	... (0.04) Å	...	...
15648 Spectral Resolution (Sampling)	0.17 (0.05) Å	...	...

FIRS Data

First Light 30 April,
2007

So far: 6 regions, 20
days, various
configurations

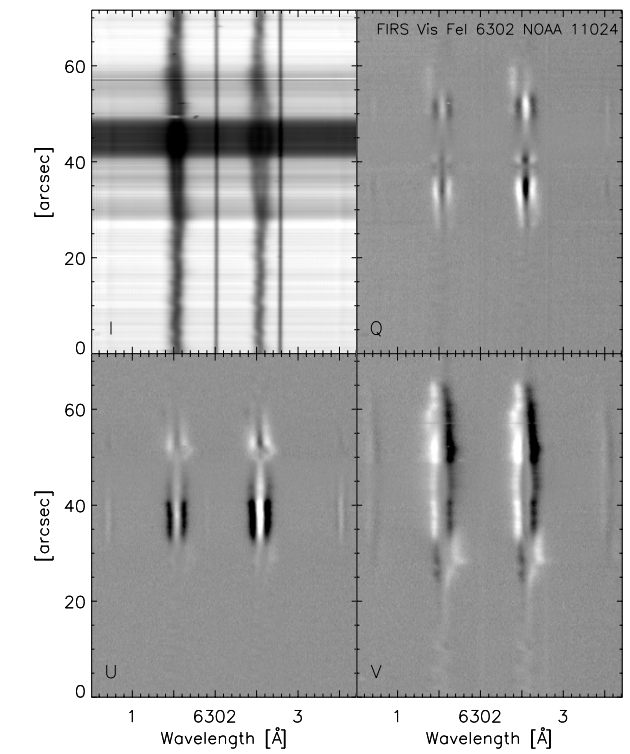
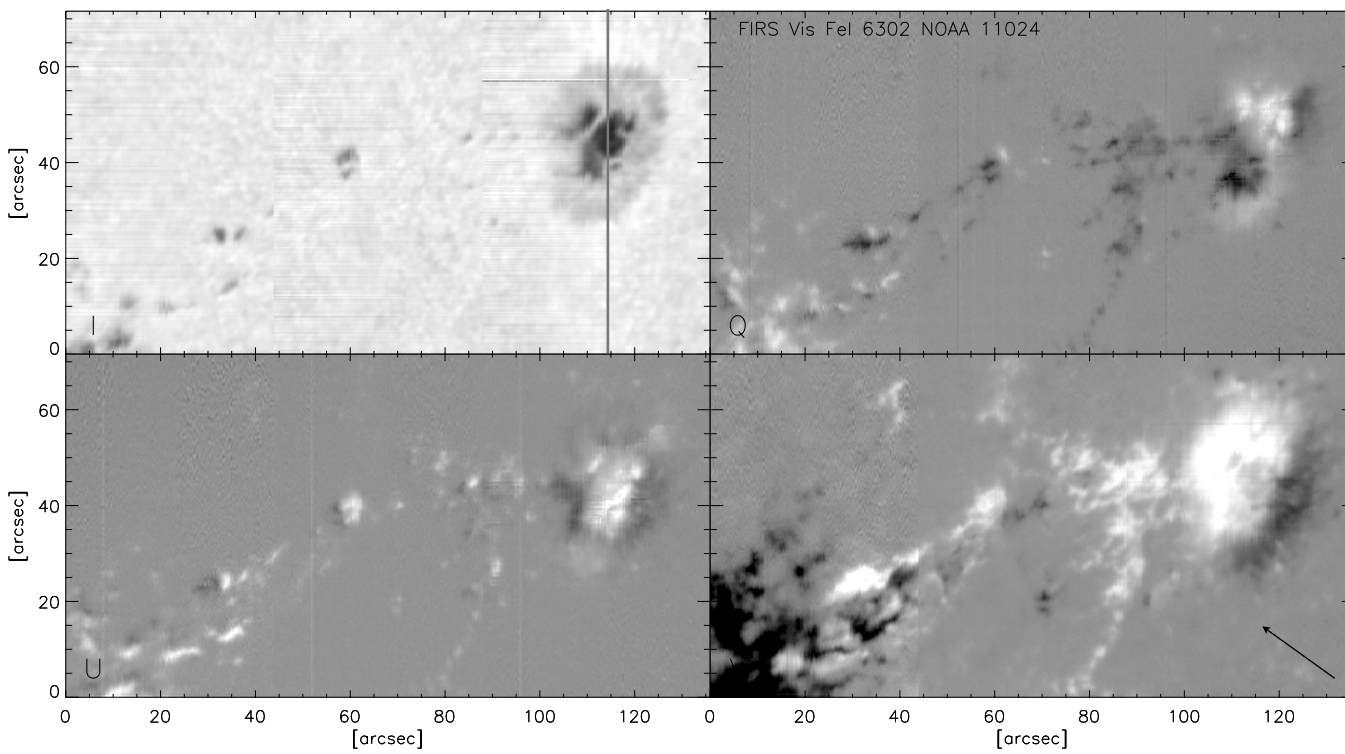
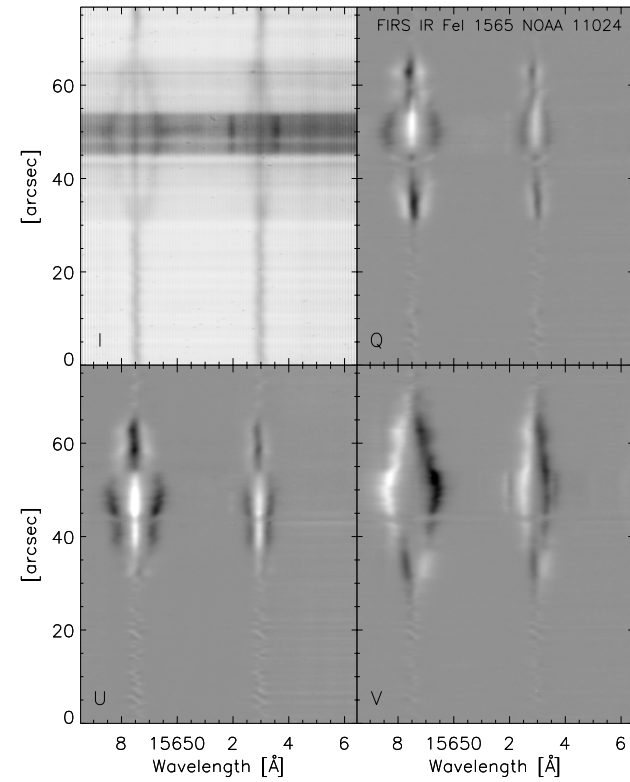
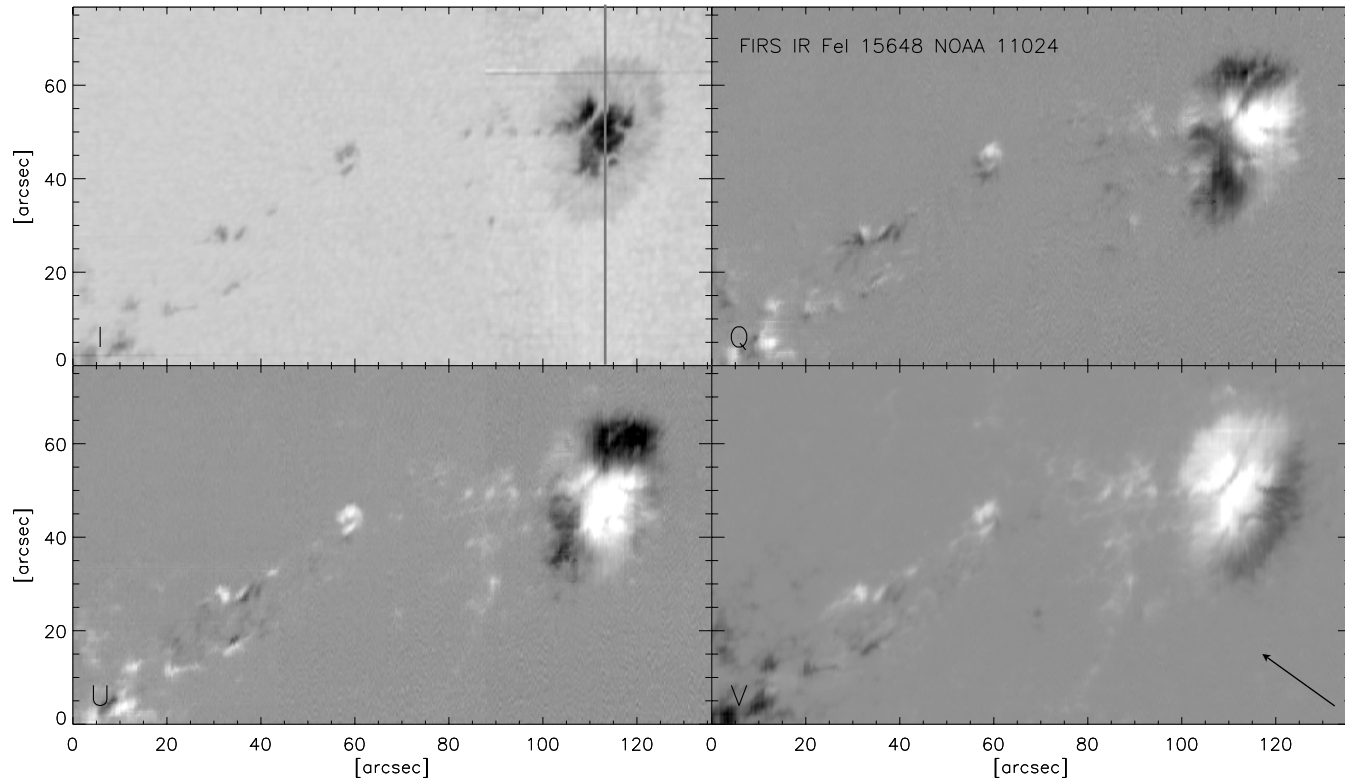
Best yet: NOAA
11024, 7 July, 2009



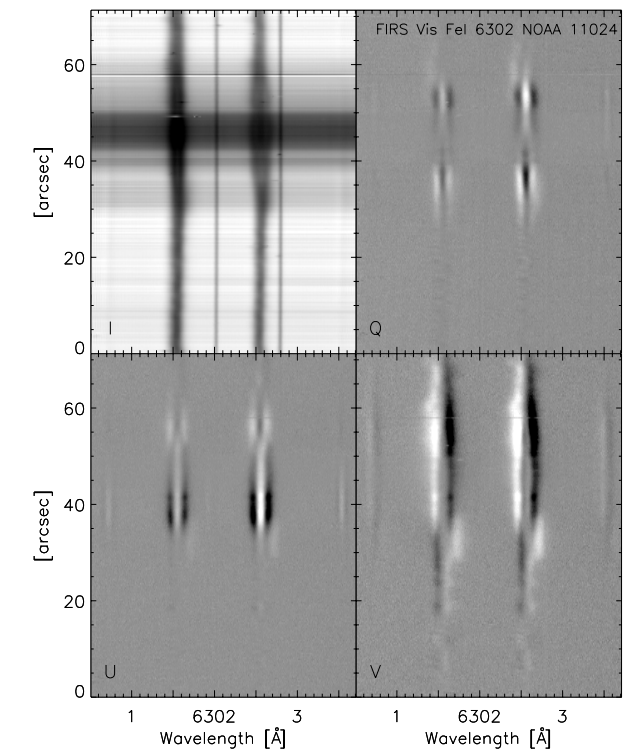
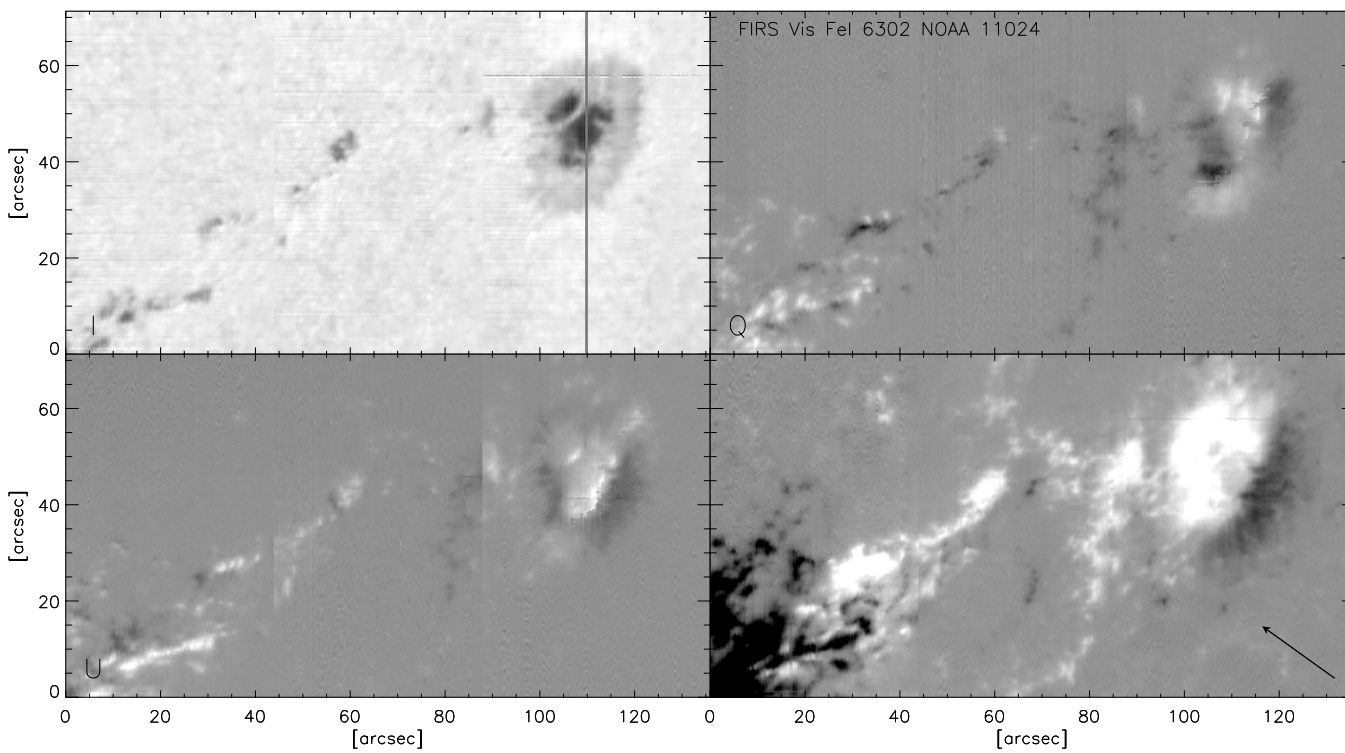
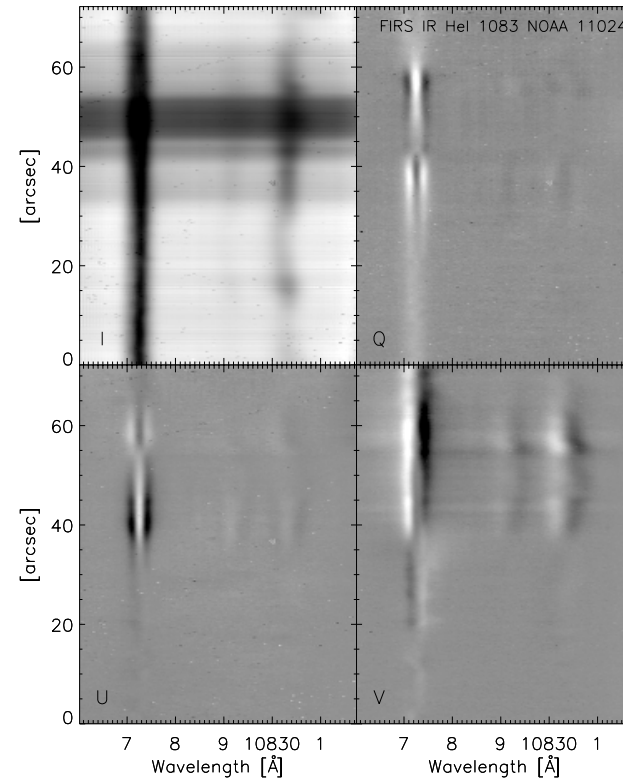
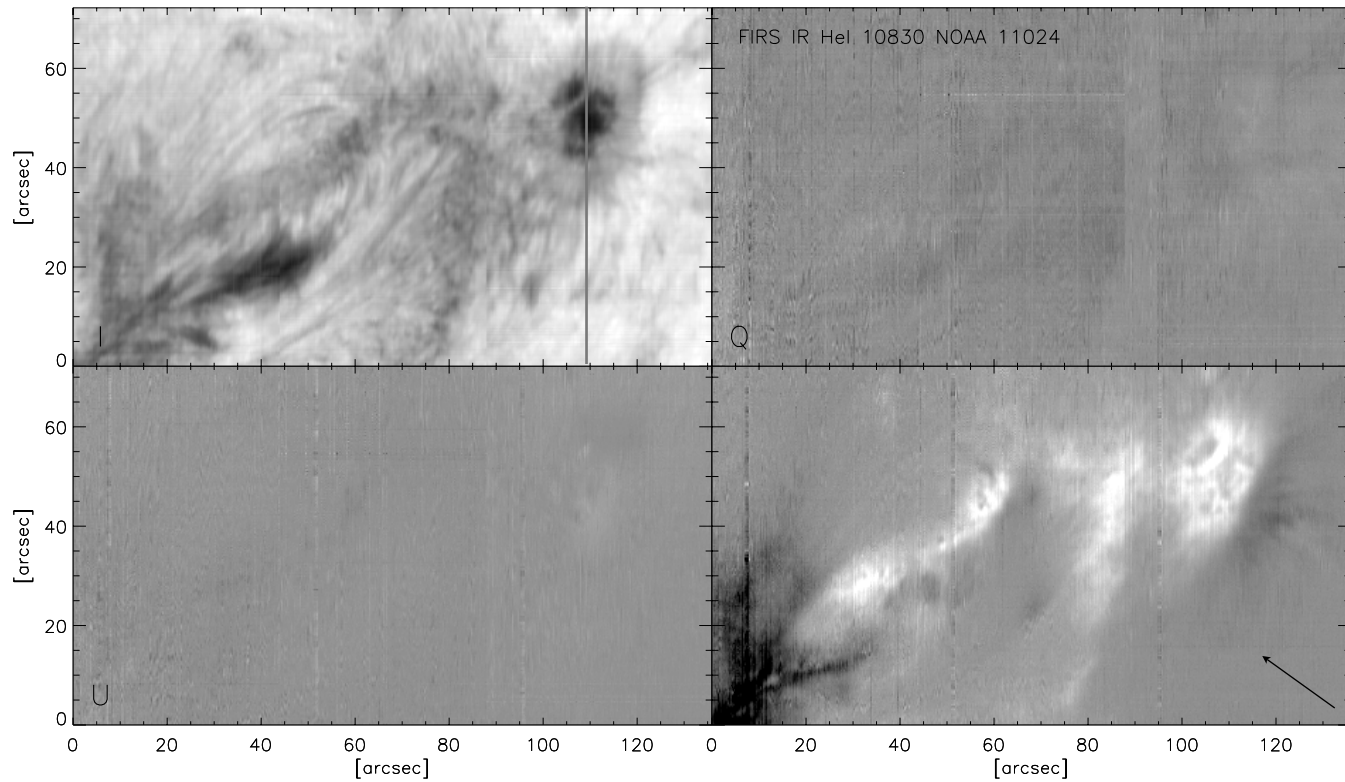
FIRS



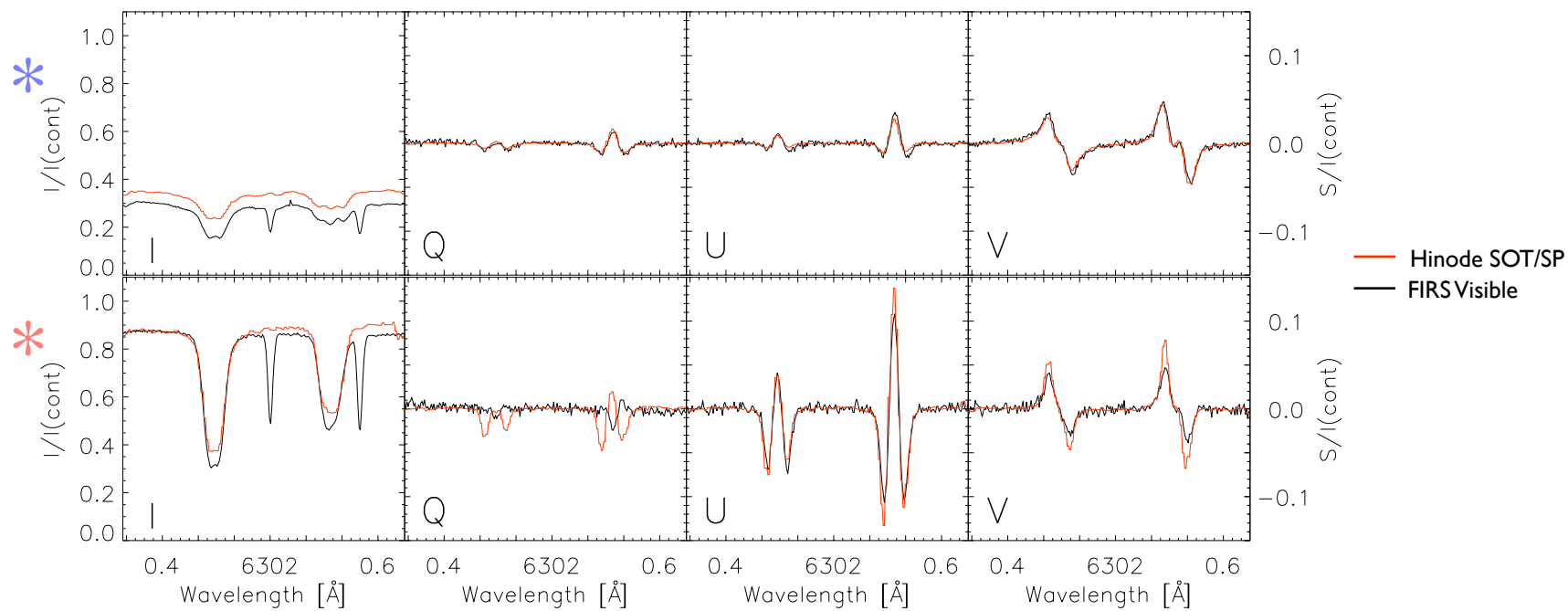
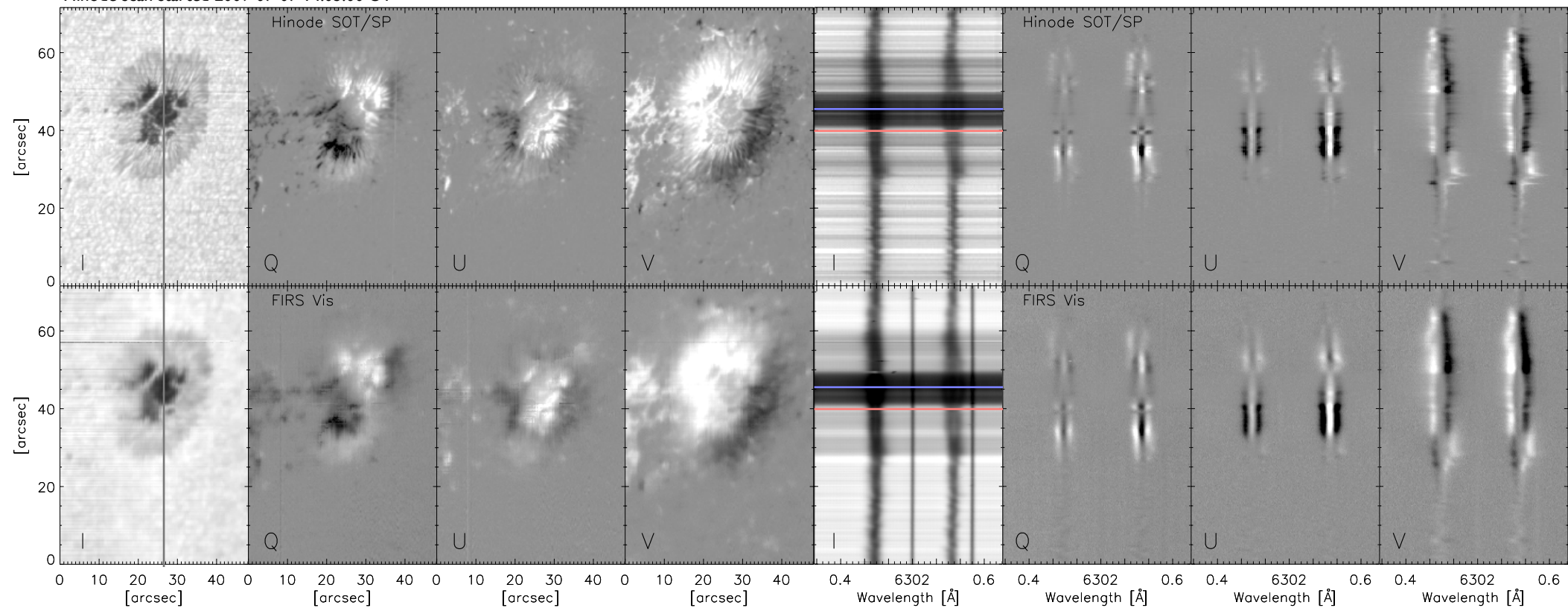
2009-07-07 14:31:00 UT



2009-07-07 18:02:00 UT



Hinode scan started 2009-07-07 14:03:00 UT



Current Status

FIRS standard configuration is complete!

- Observer training July, September 2009
- Released for NSO use 4th quarter 2009
- Released for general use 1st quarter 2010

For the Future

Extended Capabilities:

- Additional visible and IR detectors for simultaneous 6302-8542-10830-15650
- Maybe super-achromatic dual-waveplate modulator for synchronized exposures
- New pair of Wollaston prisms for smaller beam deviation and larger FOV
- More narrow-band filters for extended wavelength coverage

Thank You!

Ask us for a tour

for more information visit:
<http://kopiko.ifa.hawaii.edu/firs/>

or contact us:
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lin@ifa.hawaii.edu



FIRS

