

## Abstract

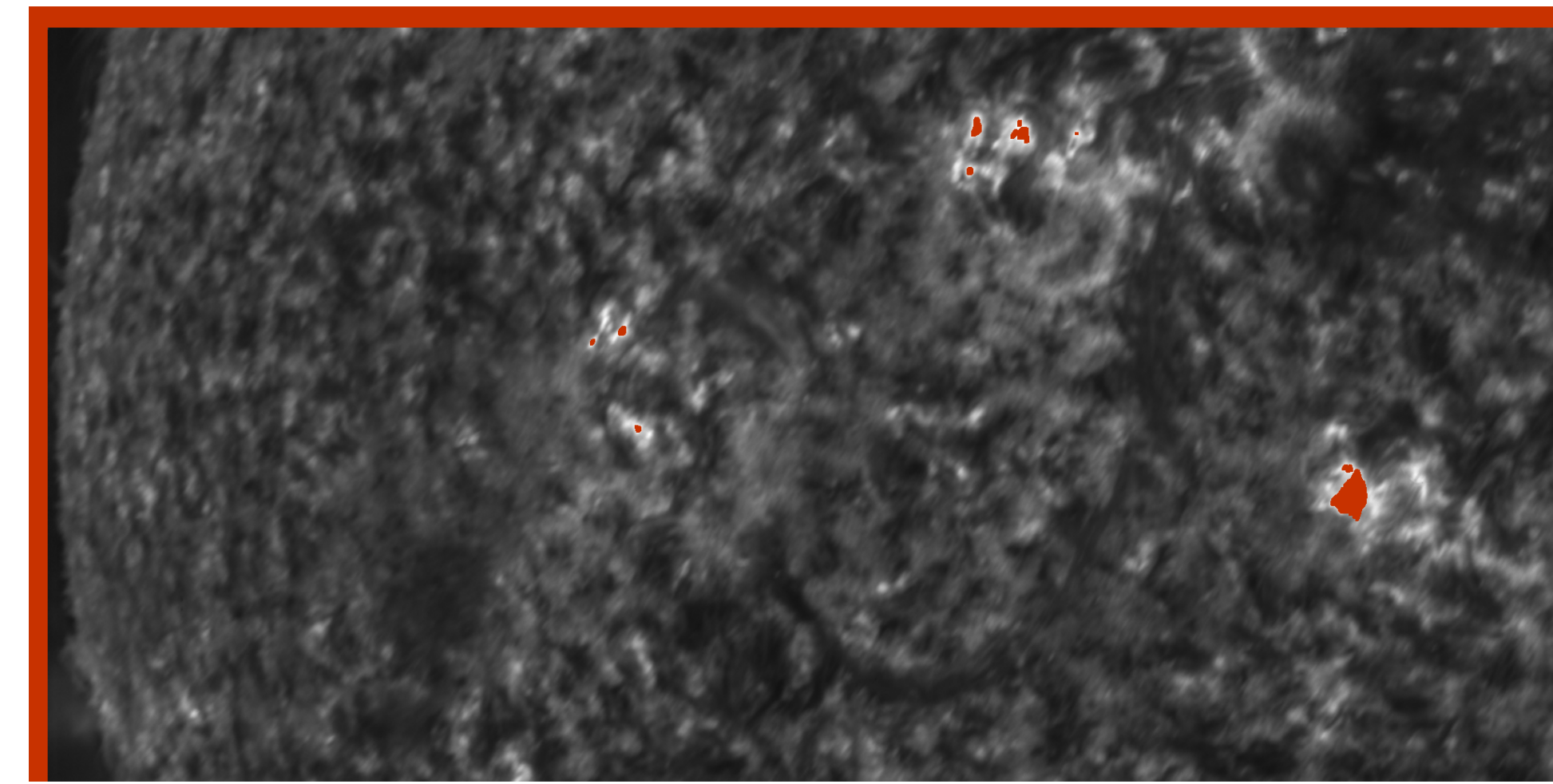
The Multi-Order Solar EUV Spectrograph (*MOSES*) obtains images dispersed at three spectral orders from an objective grating, with the goal of reconstructing EUV spectra of He II (30.38 nm) and Si XI (30.33 nm) simultaneously over a large 2D field of view. We present preliminary results from a new data inversion code, estimating the spectrum in every pixel. This capability opens a new window on the solar atmosphere.

## 2006 Flight

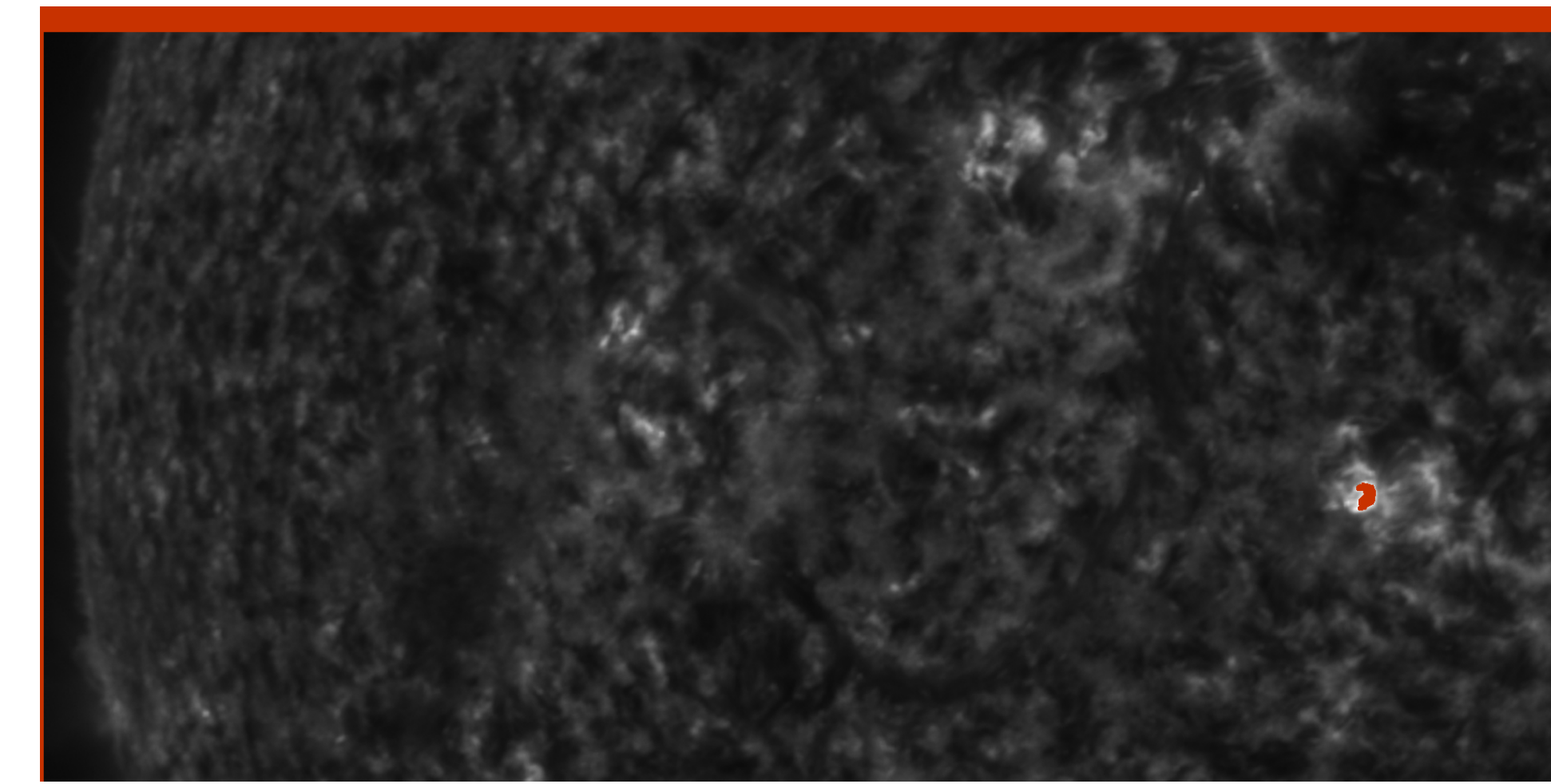
The *Multi-Order Solar EUV Spectrograph (MOSES)* was first launched on February 8, 2006 from White Sands Missile Range at 18:44:01 UT on a NASA Terrier Black Brant sounding rocket.



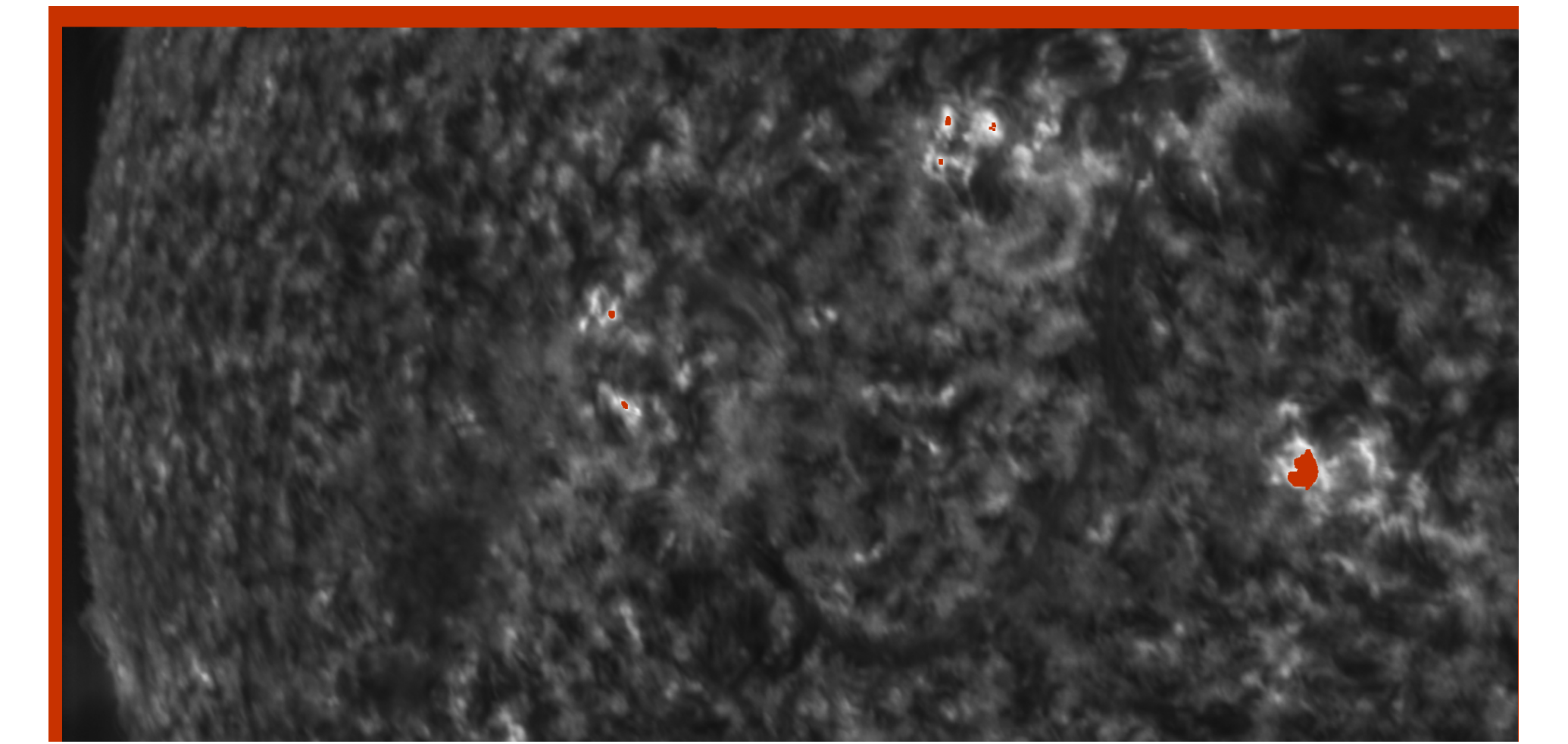
## Data (FOV 20' × 10')



*MOSES* 304 Å image in spectral order  $m = -1$ .



Spectral order  $m = 0$ .



Spectral order  $m = +1$ .

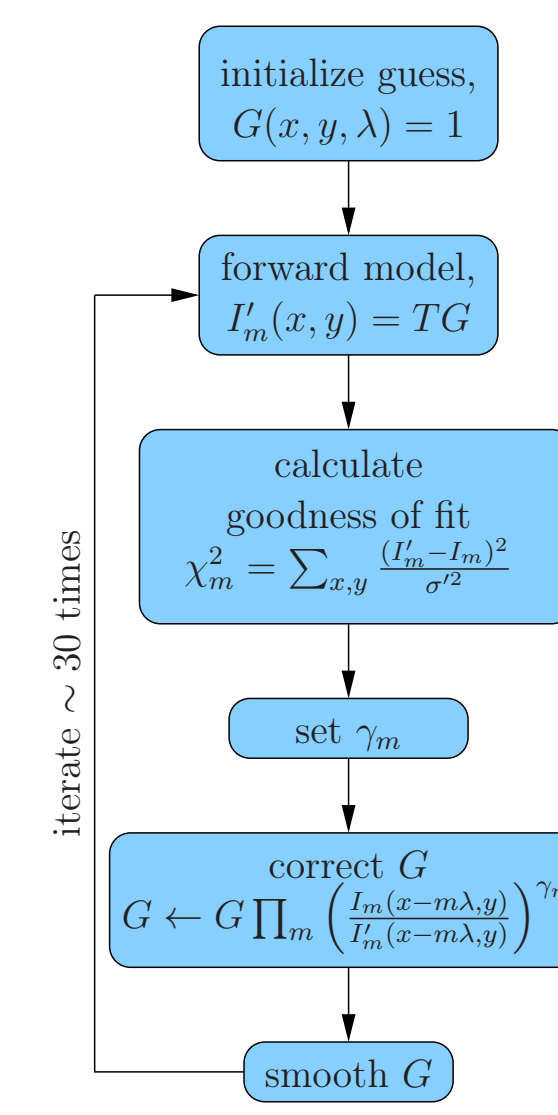
## Inversion Algorithm

We wish to infer spatially resolved spectra  $G(x, y, \lambda)$  given images  $I_m$  at spectral orders  $m = -1, 0, +1$ :

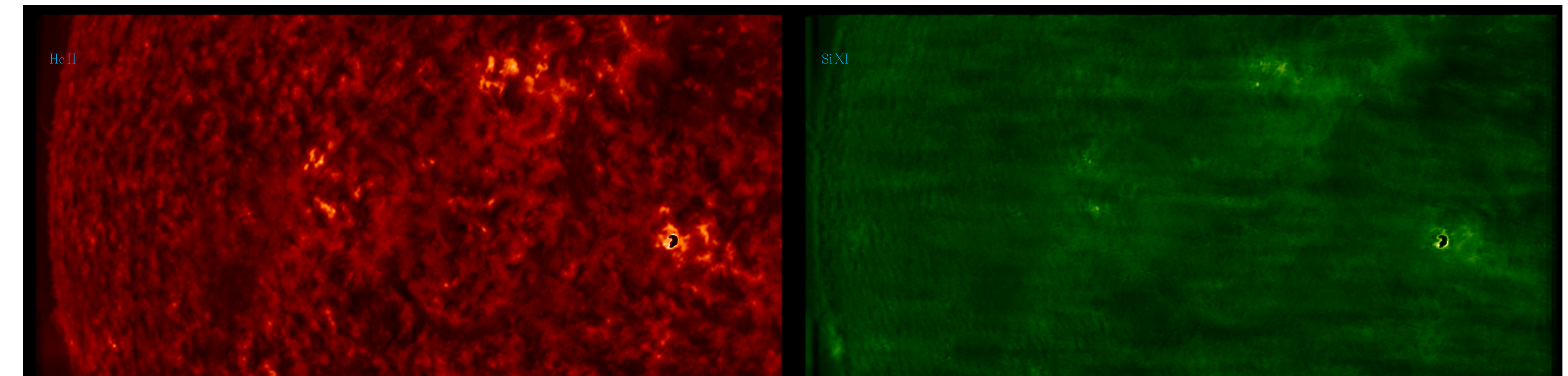
$$I_m(x, y) = \int_{\mathfrak{P}} G(x + m\lambda, y, \lambda) d\lambda$$

$$I_\infty(\lambda) = \iint_{\mathfrak{F}} G(x, y, \lambda) dx dy$$

Our assumed mean spectrum,  $I_\infty$ , is based on SERTS-95 measurements (Brosius et al., 1998 ApJ 119:255).



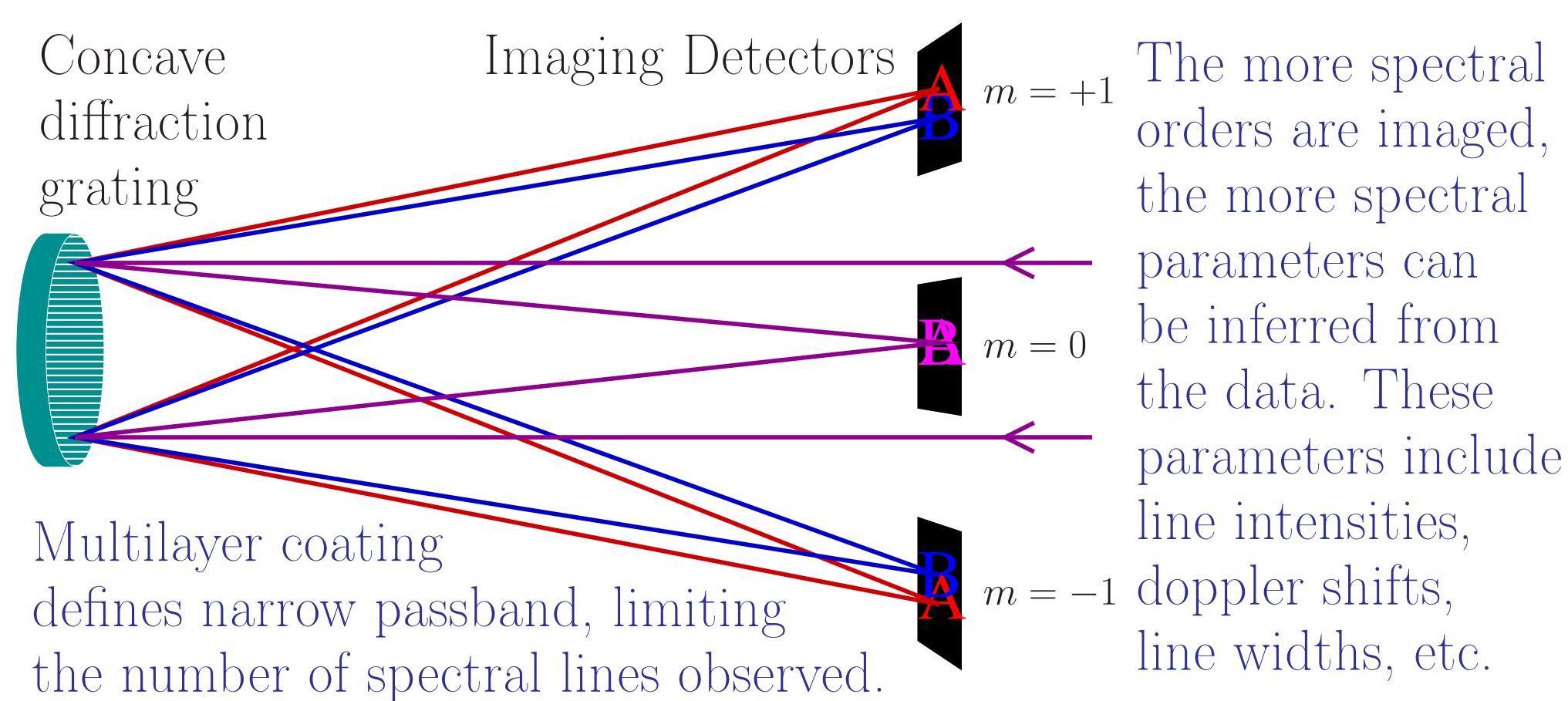
## Line Intensities



We find little Si XI at solar minimum, but its morphology is distinctly coronal: limb brightening, loops, a coronal hole, and diffuse quiet sun.

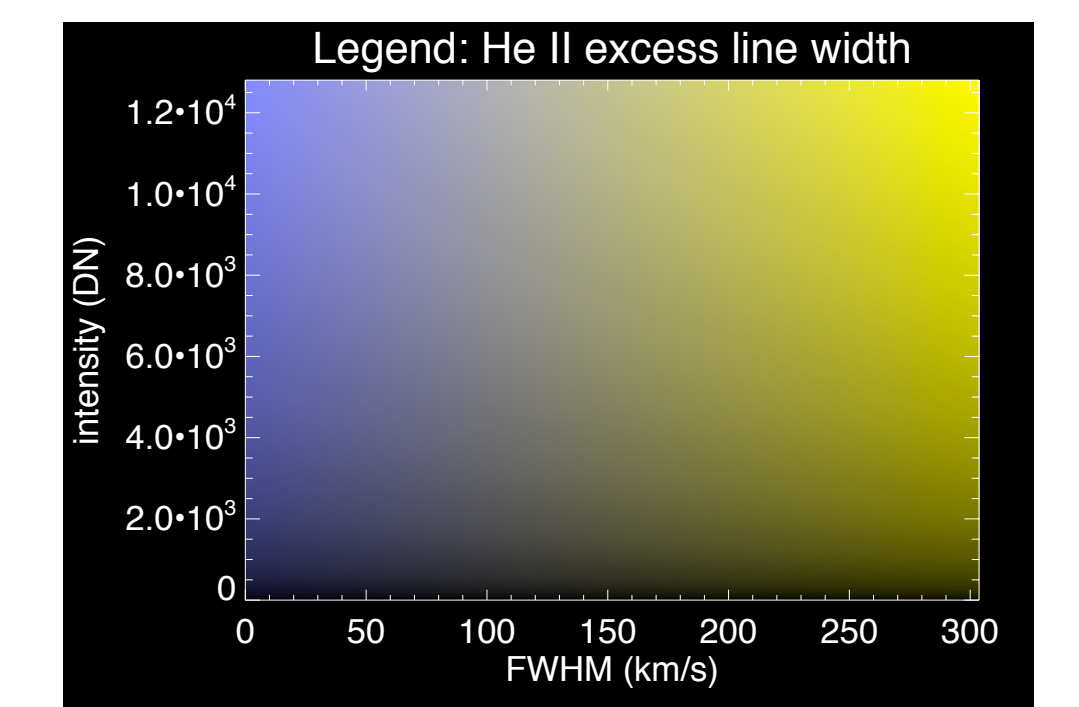
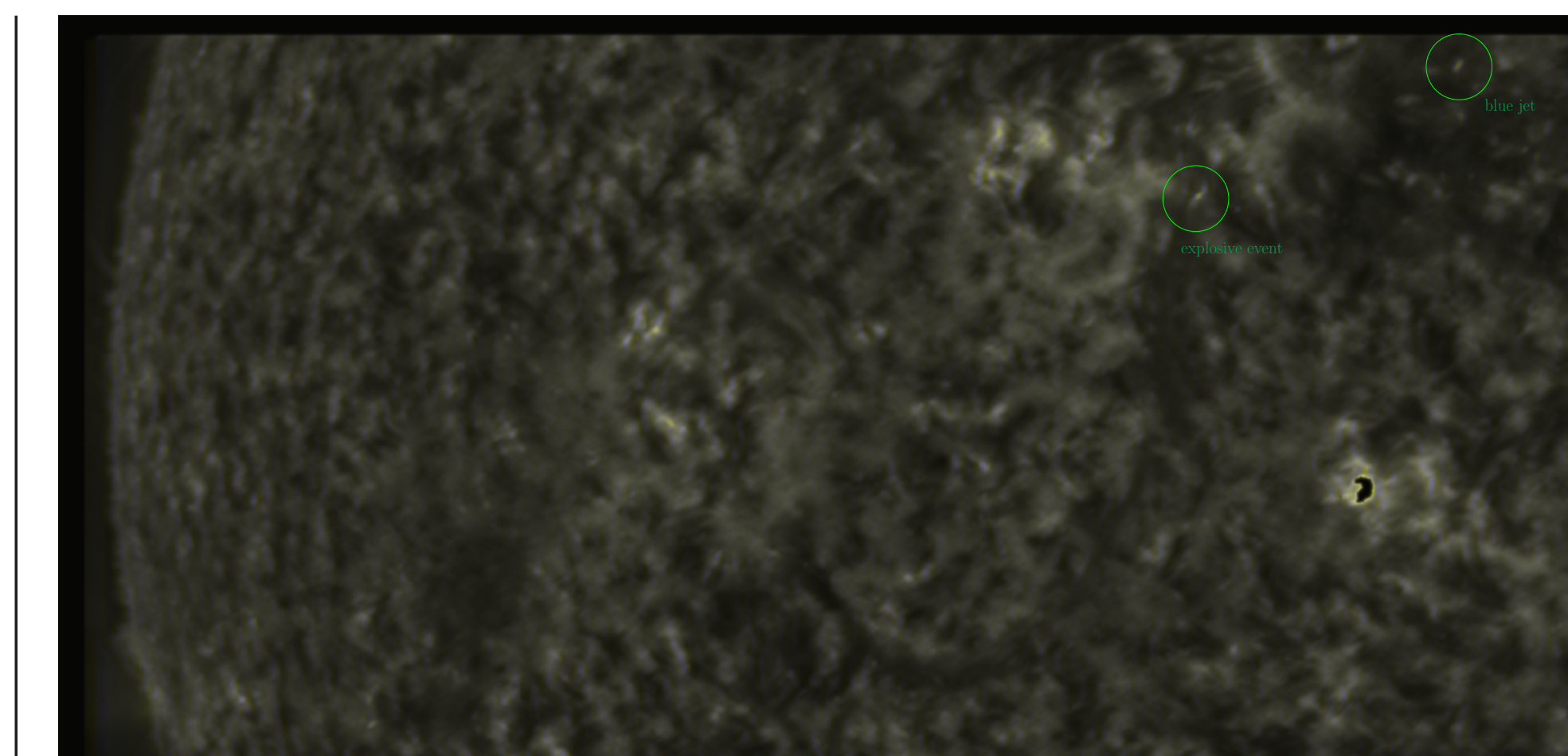
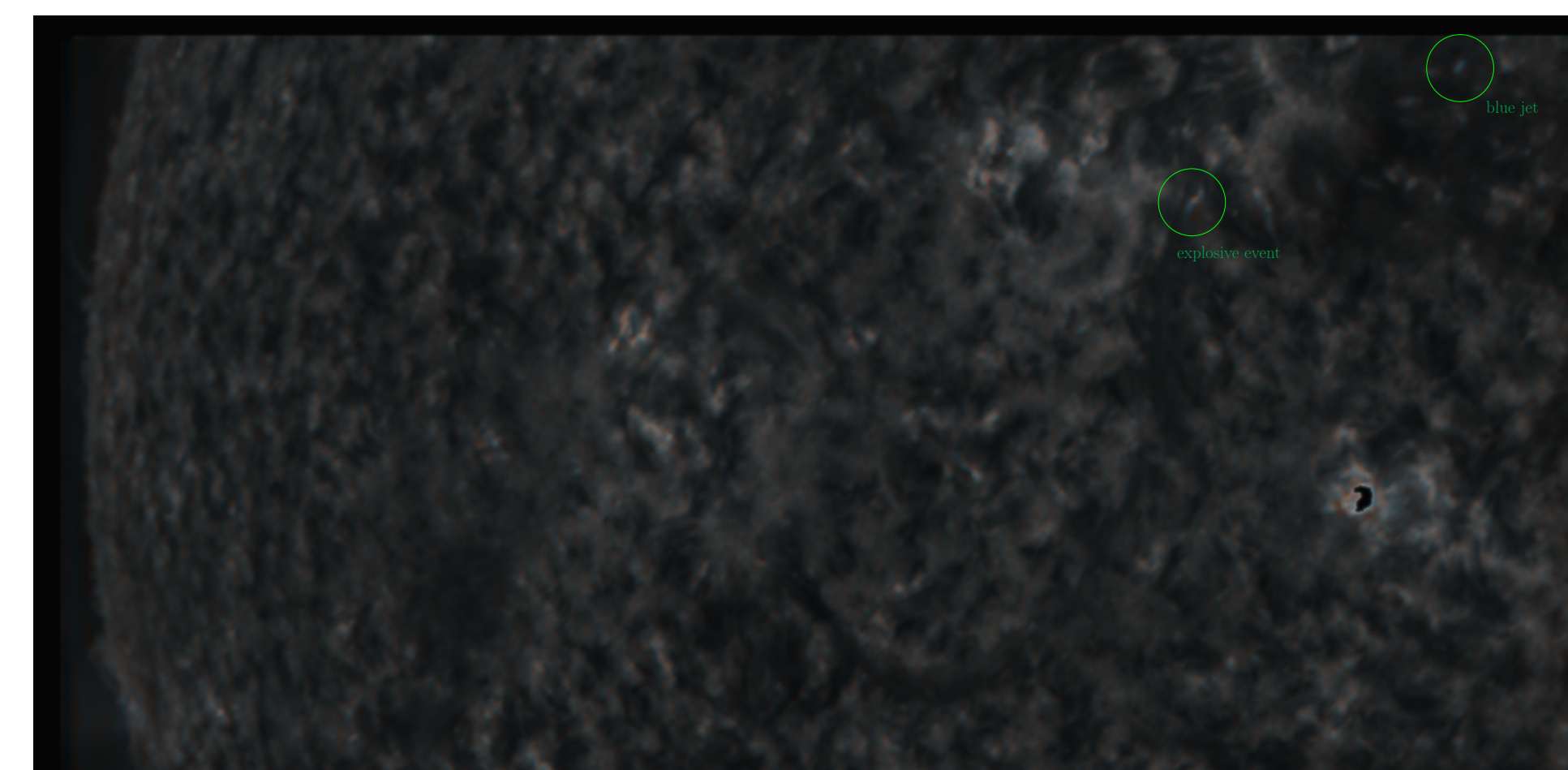
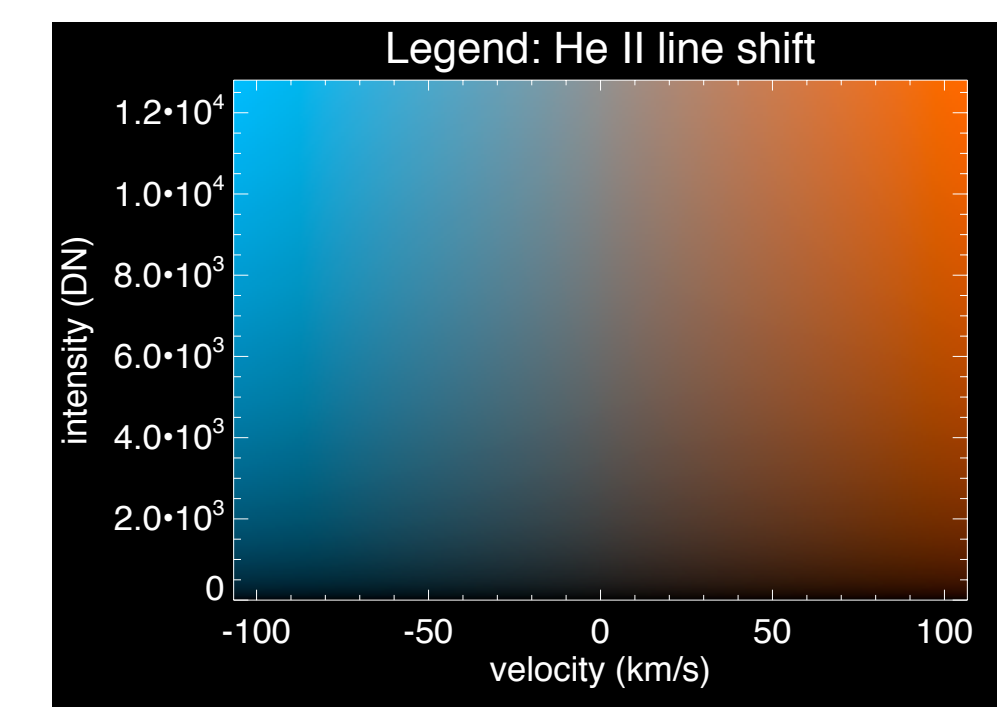
## Multi-Order Imaging Spectroscopy

A concave reflection grating forms images at several spectral orders simultaneously. Each spectral order presents a different combination of spectral and spatial information.



The configuration we flew in 2006 used a multilayer coated grating and secondary mirror for He II 303.8 Å and Si XI 303.3 Å. Our 2013 flight will be optimized for Ne VII 465 Å.

## Line Shifts and Widths



## Conclusions

*MOSES* allows us to obtain spectral information over a large field of view at high spatial and temporal resolution.

- Si XI is distinguishable from He II.
- Doppler shift and line width in He II are recovered, revealing dynamics of explosive events and jets.
- We find similar results from exposures of 1.5-24 s.

## Next Steps

- The PSF is different in each spectral order, resulting in faint, ubiquitous “velocity dipole” artifacts (red on top, blue on bottom). We have a correction algorithm under development.
- Our summer 2013 flight will investigate dynamics of the upper transition region in Ne VII.

## Acknowledgments

The *MOSES* investigation is supported by NASA Solar and Heliospheric Physics Low Cost Access to Space program, grant NNX07AG76G.