



Investigating Dynamics of Coronal Hole Jets

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Introduction

Looking at the origin of solar wind

- Sun-Earth interactions not fully understood
- Outer layer of sun consists of solar wind¹
 - magnetized plasma of mostly protons and electrons
- coronal holes
 - areas of corona that are colder/less dense
 - coronal plumes³
- solar atmospheric jets
 - spicules: fine-scale structures along solar limb
 - dynamic jet of plasma
 - **can trigger/accelerate solar wind**

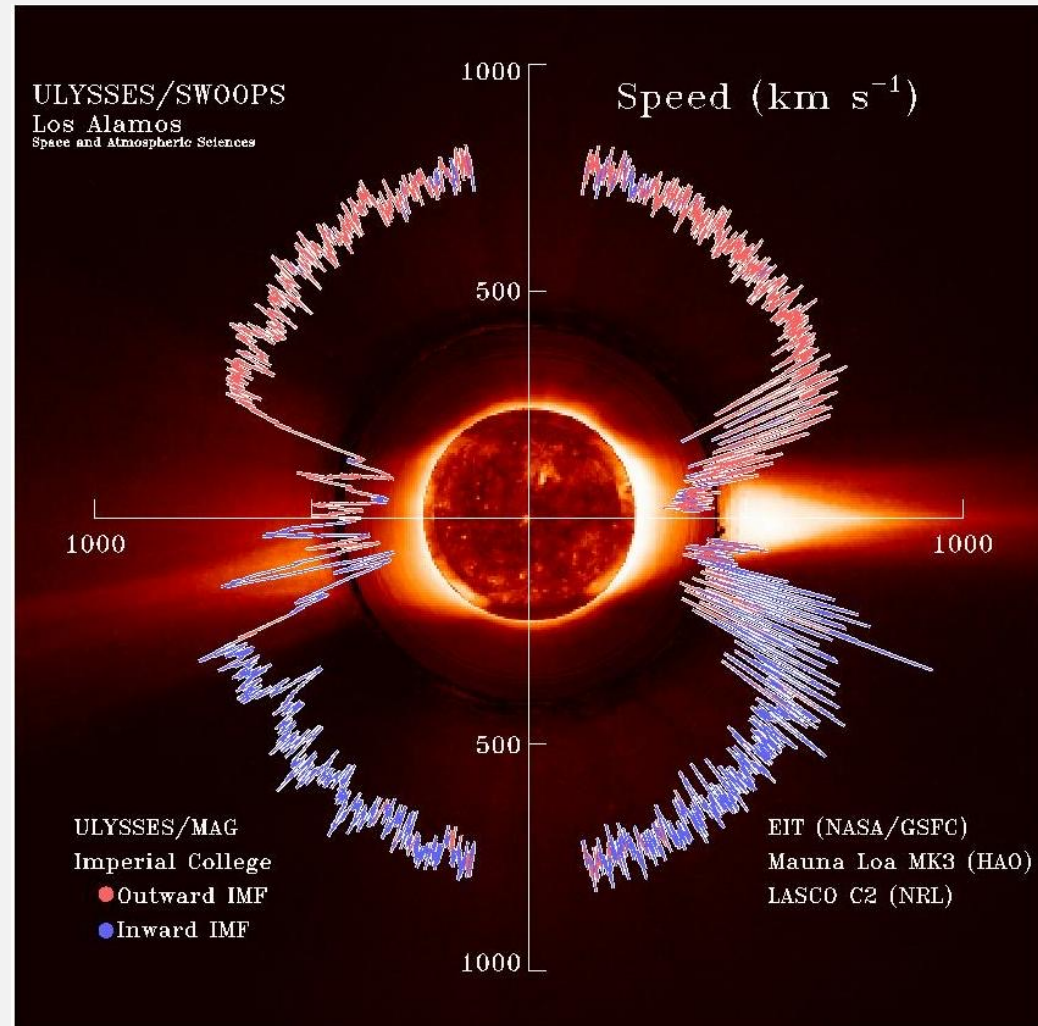


Figure 1: Ulysses' solar wind observations during solar minimum²

CRISP/IRIS Data

Getting a more complete picture with multiple data sets

- Swedish Solar Telescope: CRisp Imaging SpectroPolarimeter (CRISP)⁴ H α 6563 Å/Ca II 8542 Å
 - Time: 08:28:14 - 09:16:55
 - Cadence: ~4s
 - 7 equidistant spectral positions centered at 6563 Å
 - 0.059 arcsec spatial resolution ~ 44.25 km
- Interface Region Imaging Spectrograph (IRIS)⁵ Slit-jaw image, Si IV 1400 Å
 - Time: 07:29:34 - 09:21:04
 - Cadence: ~17s
 - 0.33 arcsec spatial resolution ~ 247.5 km

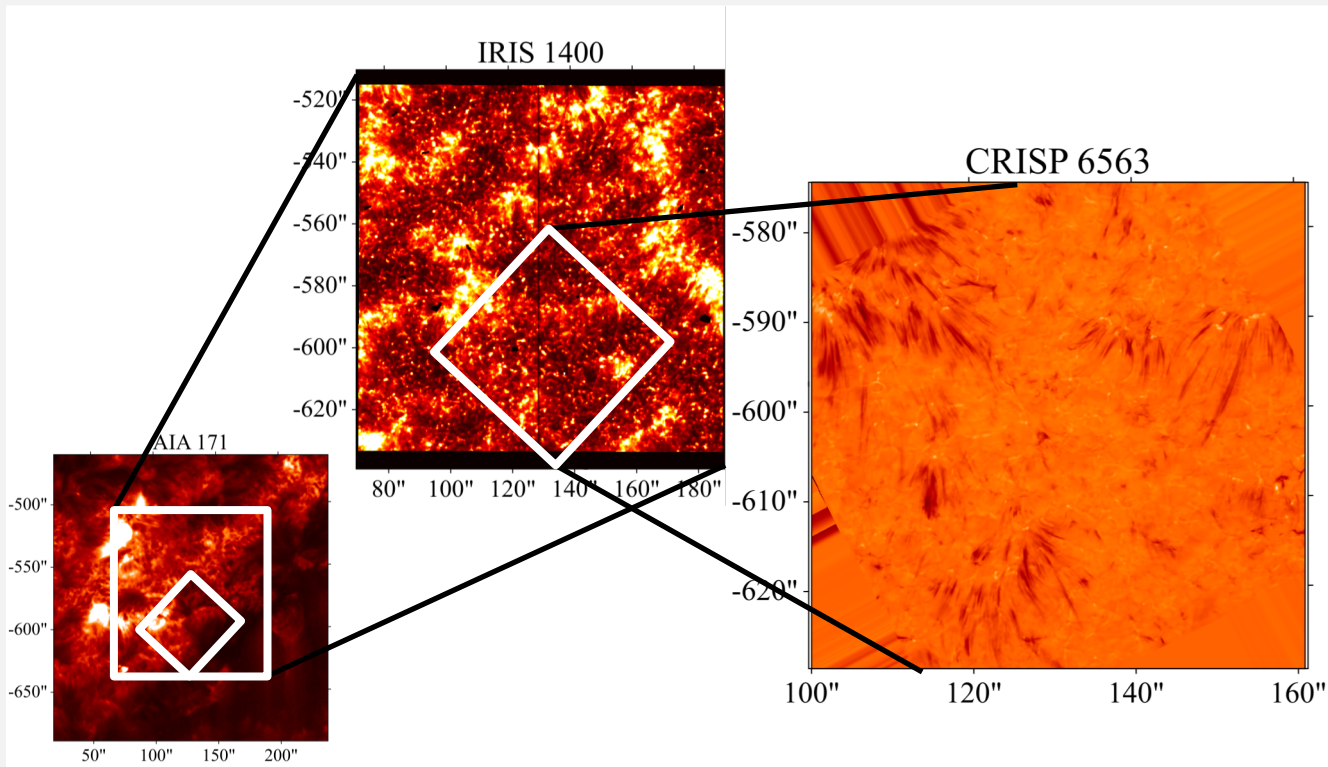


Figure 2: Images from SDO, IRIS, and CRISP showing the same area in time at different heights within the atmosphere.

Statistics in CRISP/IRIS

Wide range of spicule events

- Total of 74 events found in CRISP H α data
 - Blue Wing: 54 events
 - Red Wing: 24 events
 - 10 events shared by both
- 7 events also found in IRIS
- Of these events
 - 7 were type 1: expand and shrink
 - 67 were type 2: expand and disappear¹

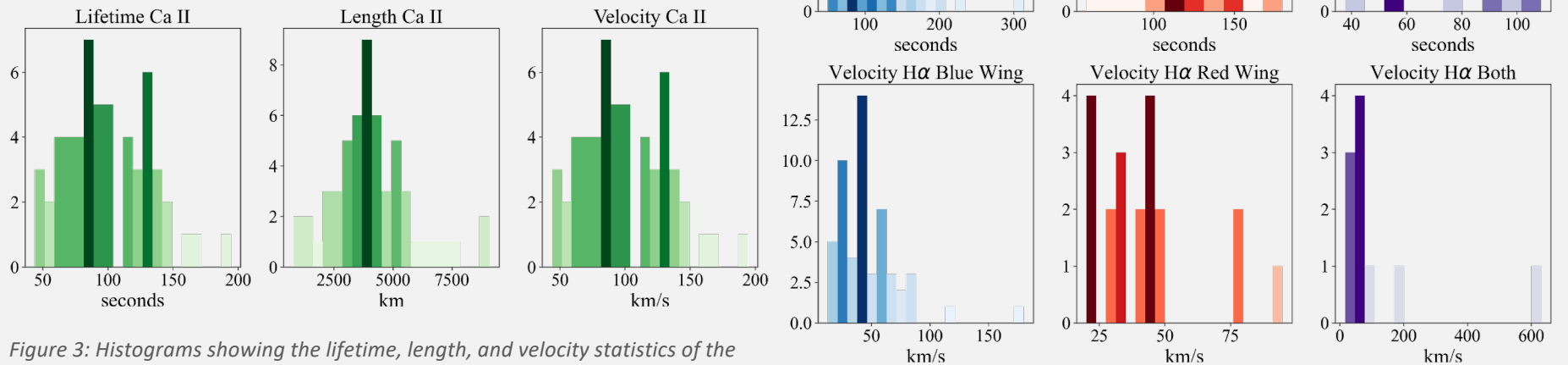


Figure 3: Histograms showing the lifetime, length, and velocity statistics of the CRISP data.

Examples of Events in CRISP/IRIS

Same event occurs at range of depths

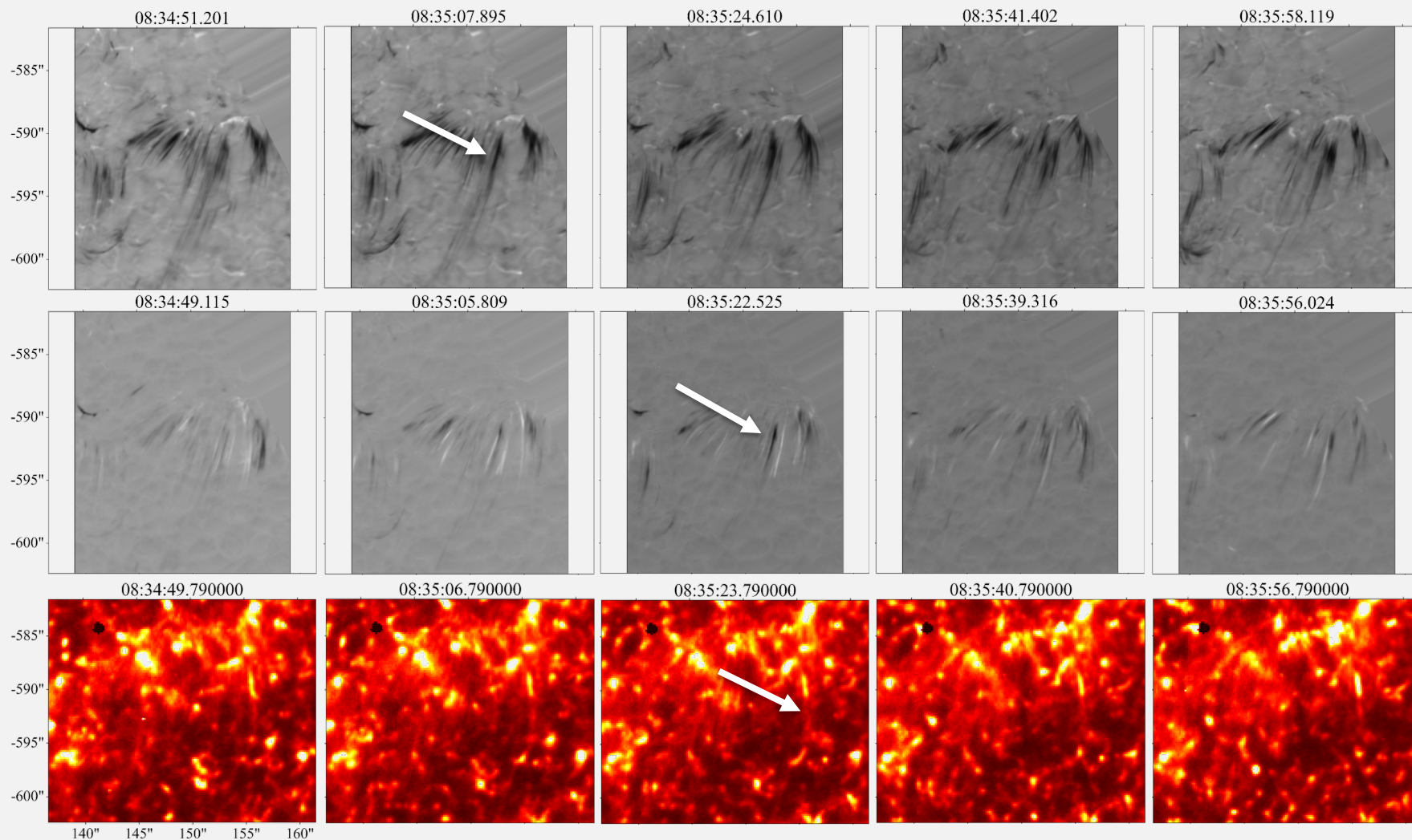


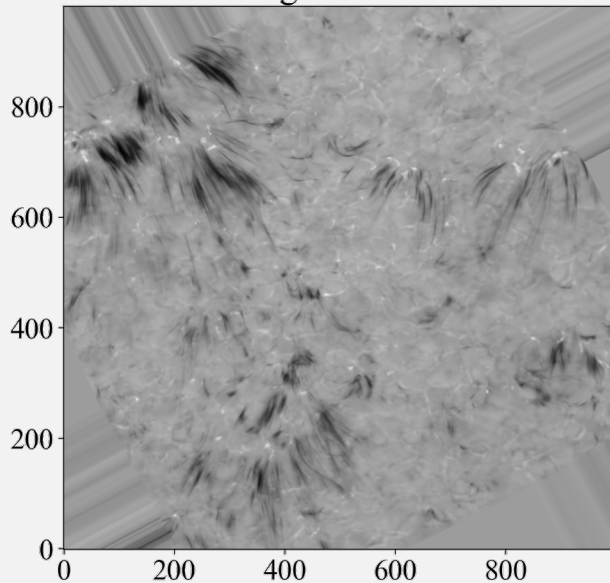
Figure 4: (Top) CRISP H α images, (Middle) CRISP Ca II images, and (Bottom) IRIS images all showing the same event.

Future Work

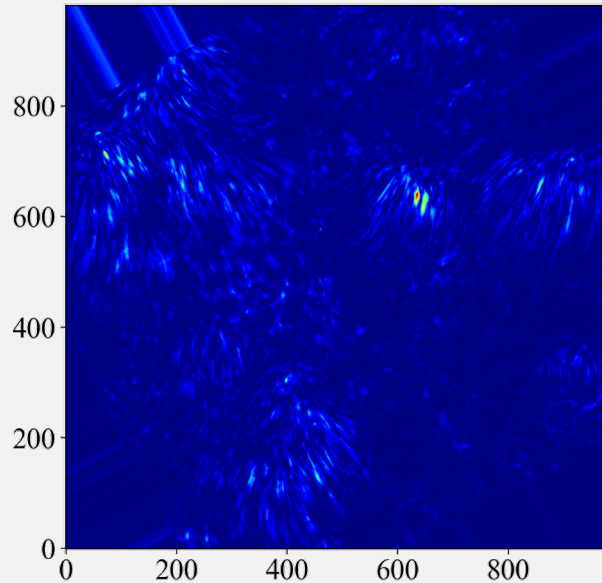
Classifying jets to determine frequency

- investigate oscillations using power spectra of CRISP data classify as high or low frequency
- classify jets and waves using periodograms
- compare with SDO data
- we want to be able to answer:
 1. How many of these events can reach higher temperature?
 2. If they harbor waves, how can we track waves?
 3. Can they trigger switch-backs in solar atmosphere

H α Image 08:28:14.109



H α Power Spectrum
Period = 62s



H α Power Spectrum
Period = 125s

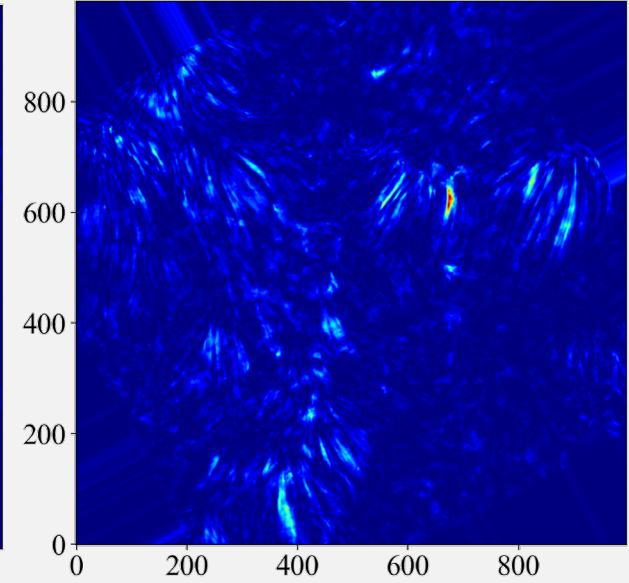


Figure 4: (Left) H-alpha image, (Middle) H-alpha power spectra at period of 62 s and (Right) 125 s.

References

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3. Poletto, G. Solar Coronal Plumes. Living Rev. Sol. Phys. 12, 7 (2015). <https://doi.org/10.1007/lrsp-2015-7>
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