

Investigating Dynamics of Coronal Hole Jets

Amanda Stricklan, Juie Shetye, PhD
New Mexico State University

Introduction

- Sun-Earth interactions not fully understood
- Outer layer of sun consists of solar wind¹
 - magnetized plasma of mostly protons and electrons
 - fast: higher velocity, less dense, photosphere-like composition, originates from coronal holes
 - slow: lower velocity, lower temperature, originates at the equator
- coronal holes
 - areas of corona that are colder/less dense
 - contain open field lines
 - dispense solar wind at double normal speeds
- solar atmospheric jets
 - Long plasma jets can reveal physical conditions in solar atmosphere¹
 - jets lay along coronal field edges
 - spicules: fine-scale structures along solar limb dynamic jet of plasma
 - show up flows and down flows of plasma
 - **can trigger/accelerate solar wind**
 - coronal plumes: long structures extending beyond limb for several solar radii³ occur at poles along coronal holes

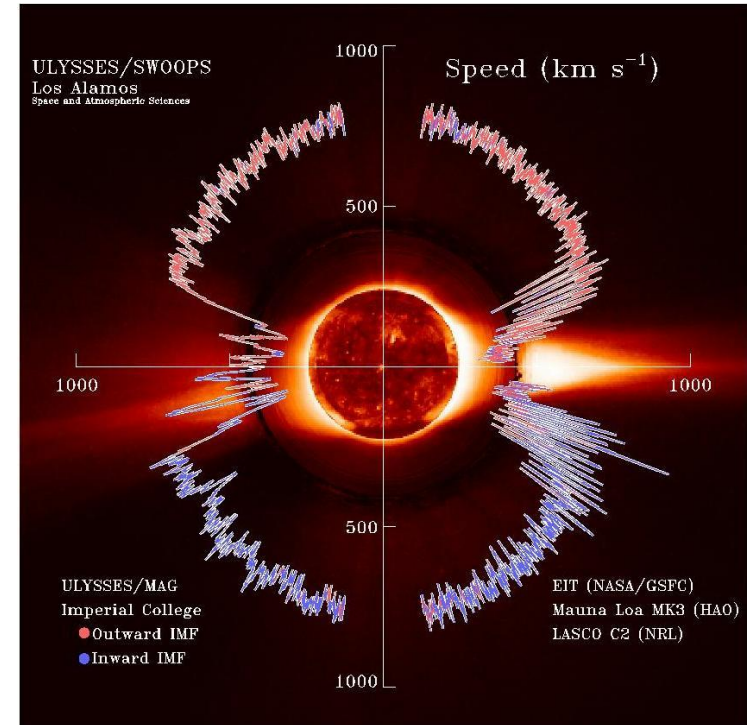


Figure 1: Ulysses' solar wind observations during solar minimum²

CRISP Data

- Data taken: June 6th, 2014
- Swedish Solar Telescope: CRisp Imaging SpectroPolarimeter (CRISP)⁴ H α 6563 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
- Swedish Solar Telescope: CRisp Imaging SpectroPolarimeter (CRISP)⁴ Ca II 8542 Å
 - Time: 08:28:14 - 09:16:55
 - Cadence: ~4s
 - 7 equidistant spectral positions centered at 8542 Å
 - 0.059 arcsec spatial resolution ~ 44.25 km

IRIS Data

- 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

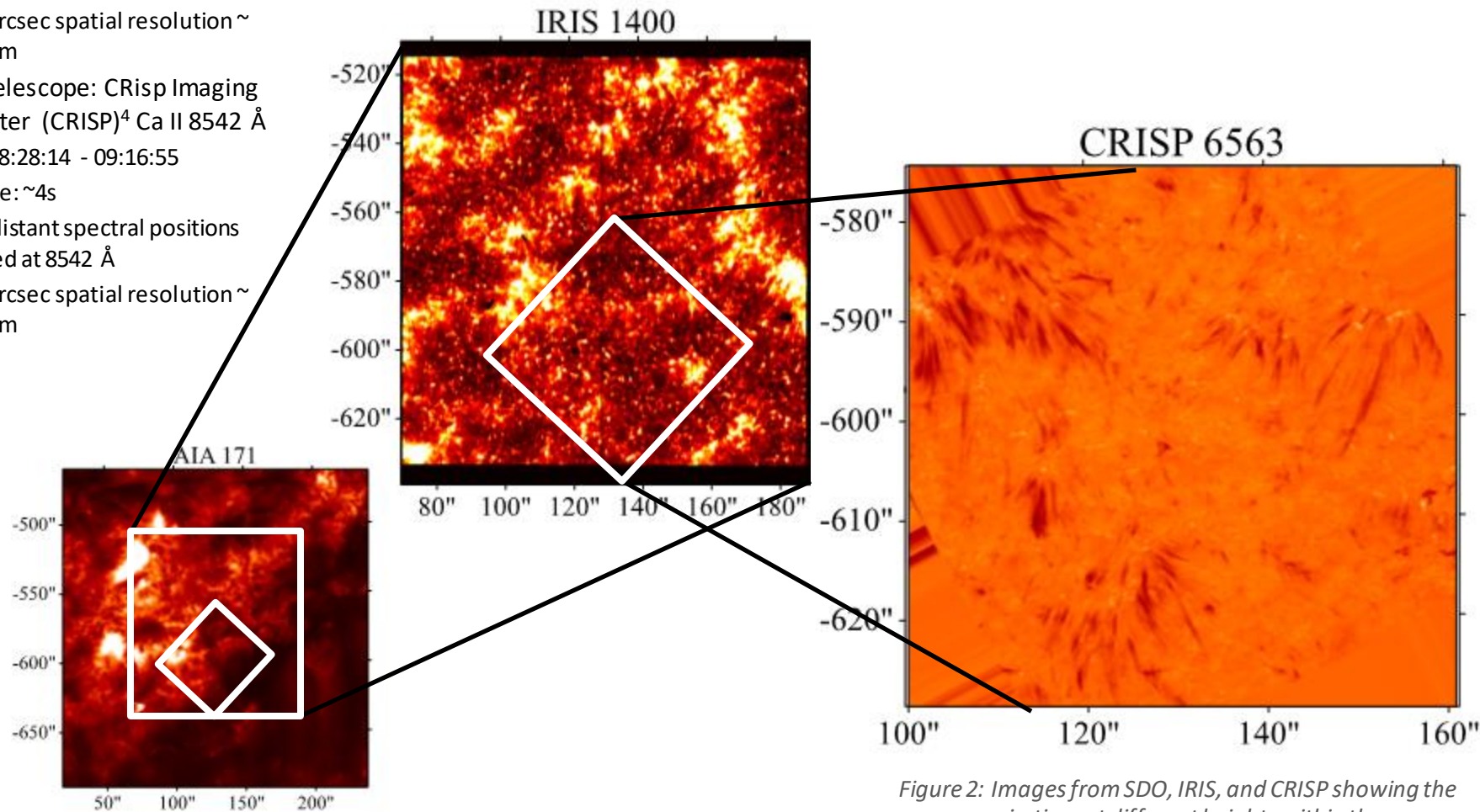


Figure 2: Images from SDO, IRIS, and CRISP showing the same area in time at different heights within the atmosphere.

STATISTICS IN CRISP AND IRIS

- Total of 76 events found in CRISP H α data
- Blue Wing: 50 events Red Wing: 26 events
12 events shared by both
- 7 events also found in IRIS
- Of these events
- 6 were type 1: expand and shrink
- 70 were type 2: expand and disappear¹

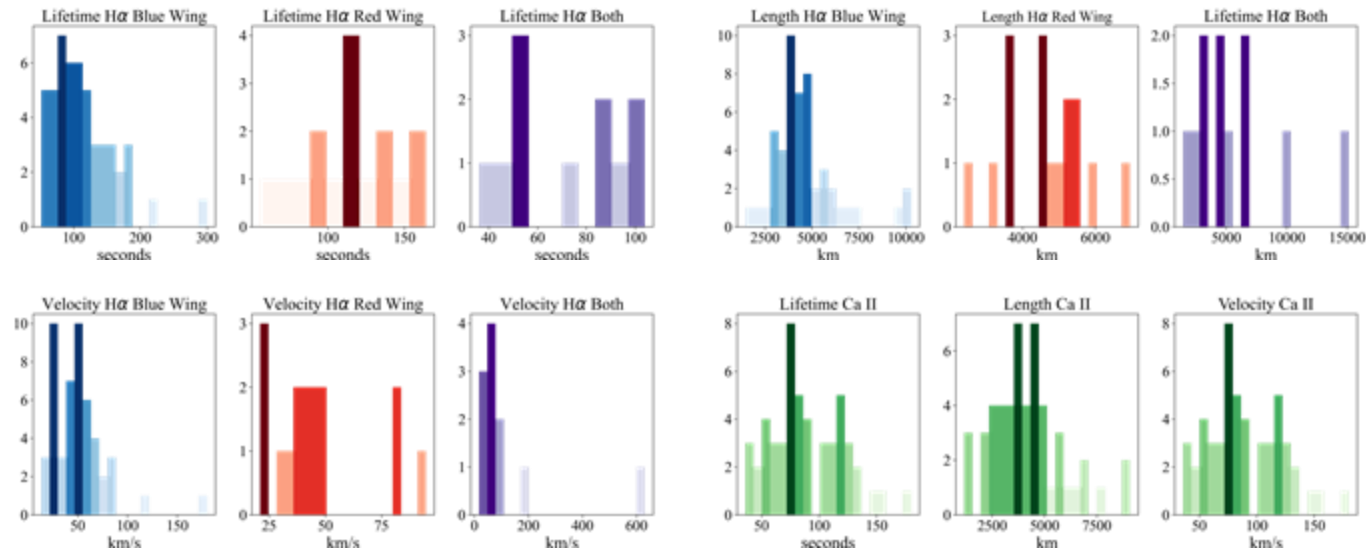
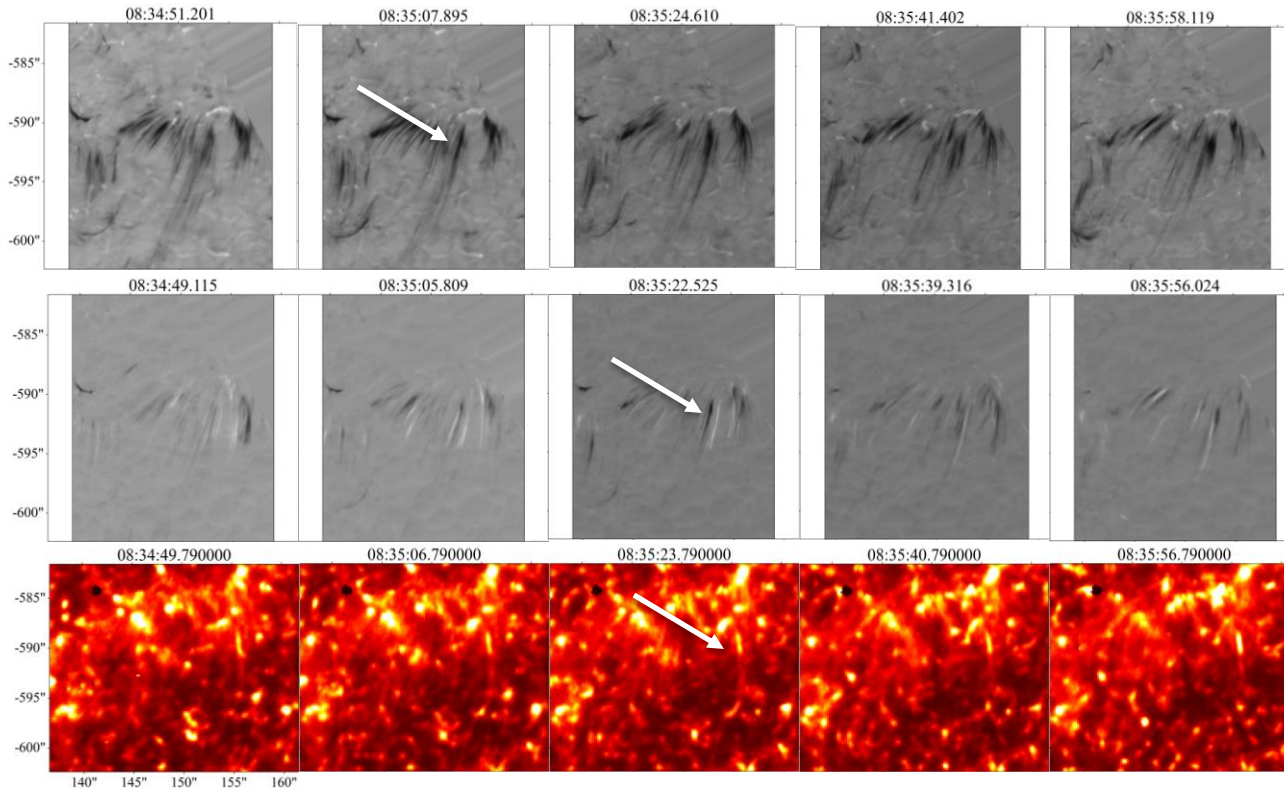


Figure 3: Histograms showing the lifetime, length, and velocity statistics of the CRISP data.

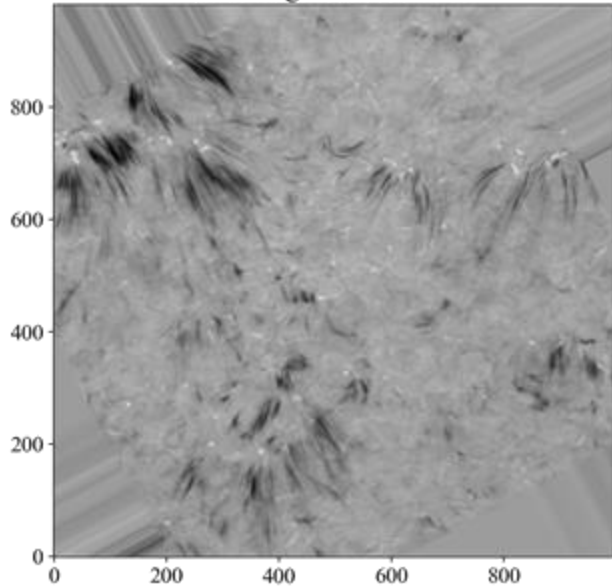


Examples of Events in CRISP/IRIS

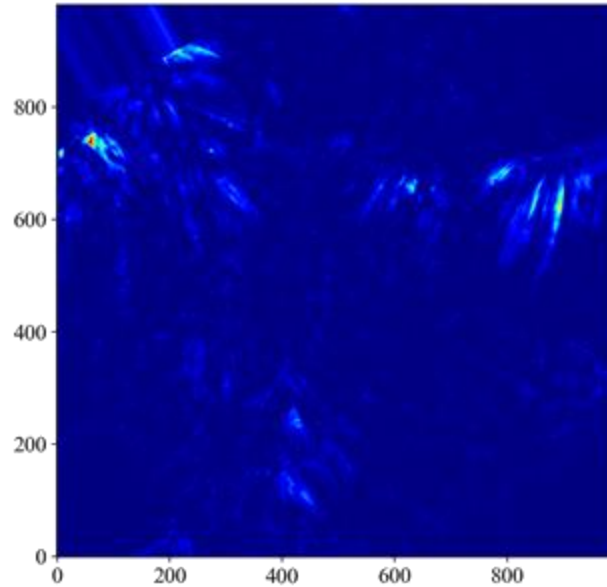
- Of 76 events in CRISP data, 7 are also found in IRIS
- 5 CRISP blue wing 1 CRISP red wing 1 both wings

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

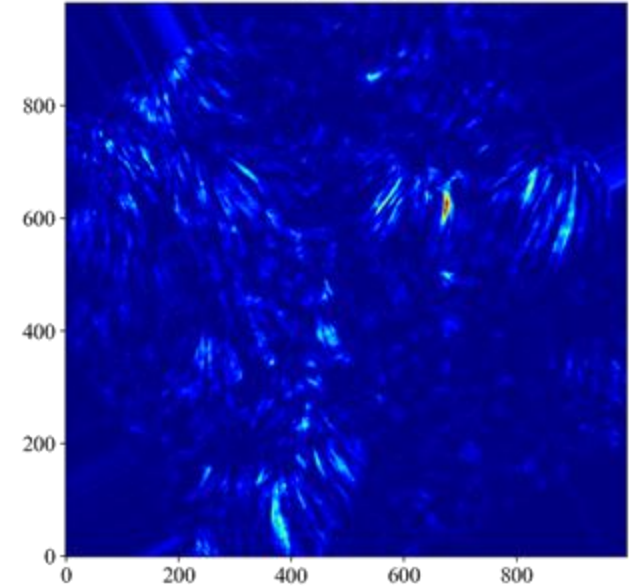
H α Image 08:28:14.109



H α Power Spectrum
Period = 350



H α Power Spectrum
Period = 125



FUTURE WORK

- investigate oscillations using power spectra of CRISP data classify as high or low frequency
investigate different waves around jets
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