

Comparing high-speed transition region jets in coronal holes and quiet sun regions



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Solar Wind

- Ionized particles bombard the Earth
- Acceleration mechanisms not well understood
 - Fast vs. slow solar wind
- Understanding necessary for predicting solar-terrestrial interactions

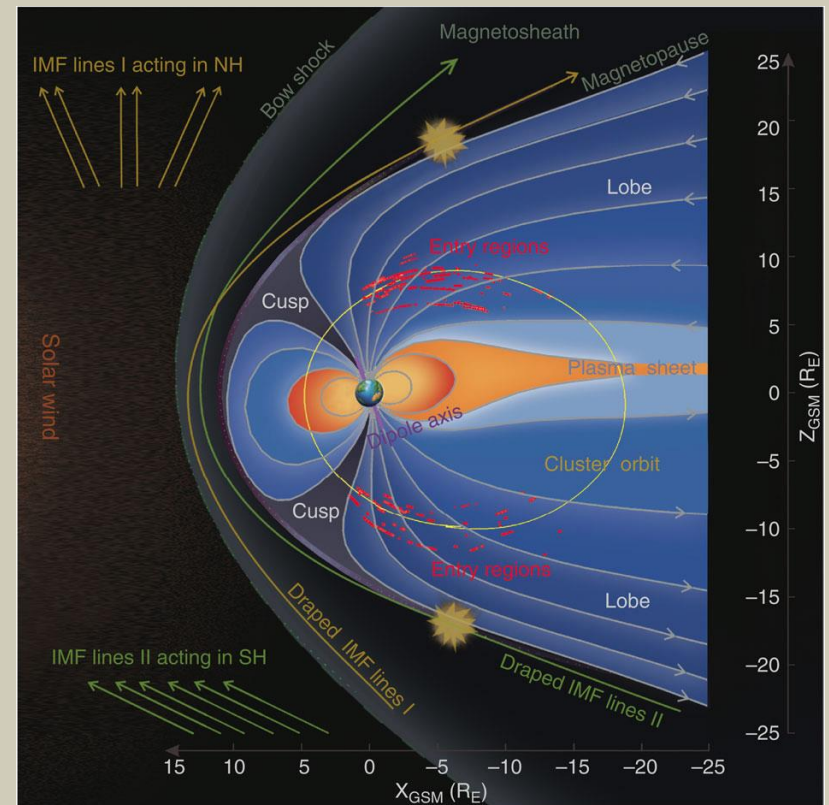
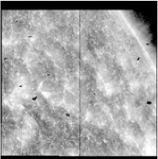


Image courtesy of NASA

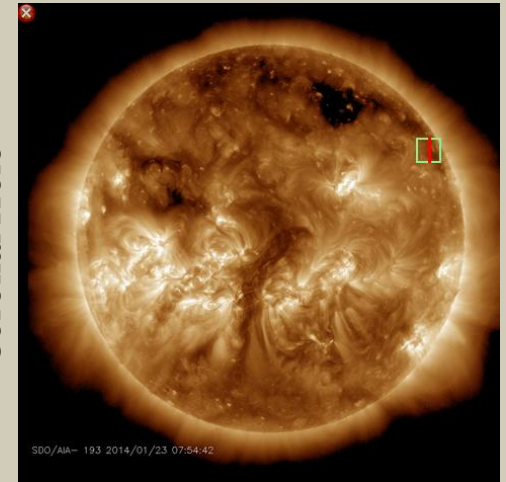
IRIS



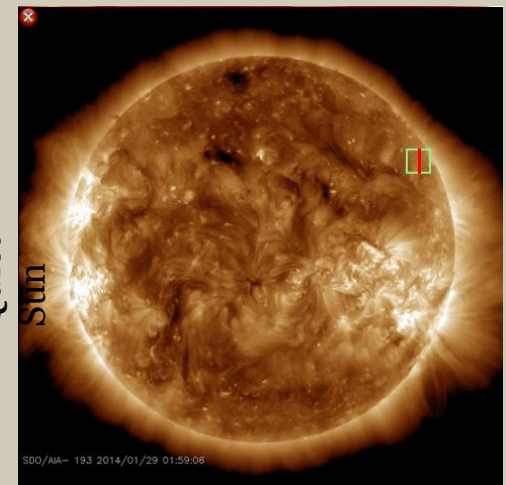
- High resolution imaging of transition region activity at 1330 Å (C II)
- Sit-and-stare raster scan using slit-jaw imaging
- Used only image data, not spectroscopy data

Overview	Where	Raster	SJI wavel: cadence, # images	Data Links
2014-01-23 07:10:31-08:02:13 	Coronal Hole Observation Near Limb OBS 3820007503: Large sit-and-stare			
	x,y: 804",447" Max FOV: 119"x119" Target: CH Nearby Events	FOV: 0"x119" Steps: 610x0" Step Cad: 5.1s Raster Cad: 5s, 1 ras Linelist: y38_01	FOV: 119"x119" 1330: 10s, 305 imgs	Raster 1041 MB 1330 157 MB

Coronal Hole



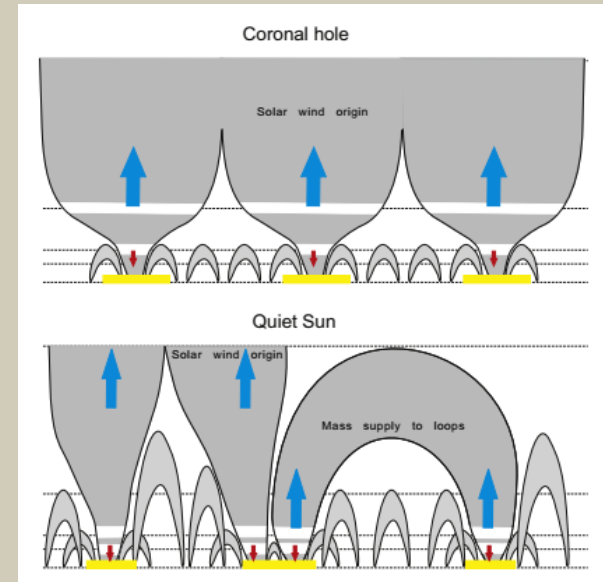
Quiet Sun



Transition Region



- Serves as boundary between cool chromosphere and hot corona
- Not fully ionized below, ionized above
- Coronal holes dominated by large, open field lines with small, low-lying loops
- Quiet sun is characterized by closed loops of varying sizes



Tian et al, 2010

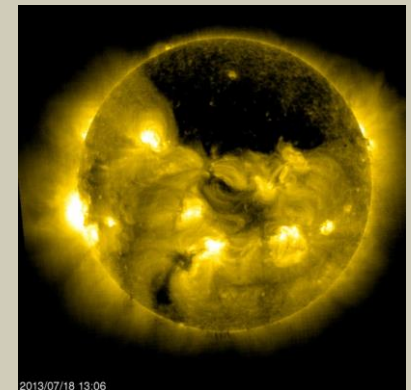
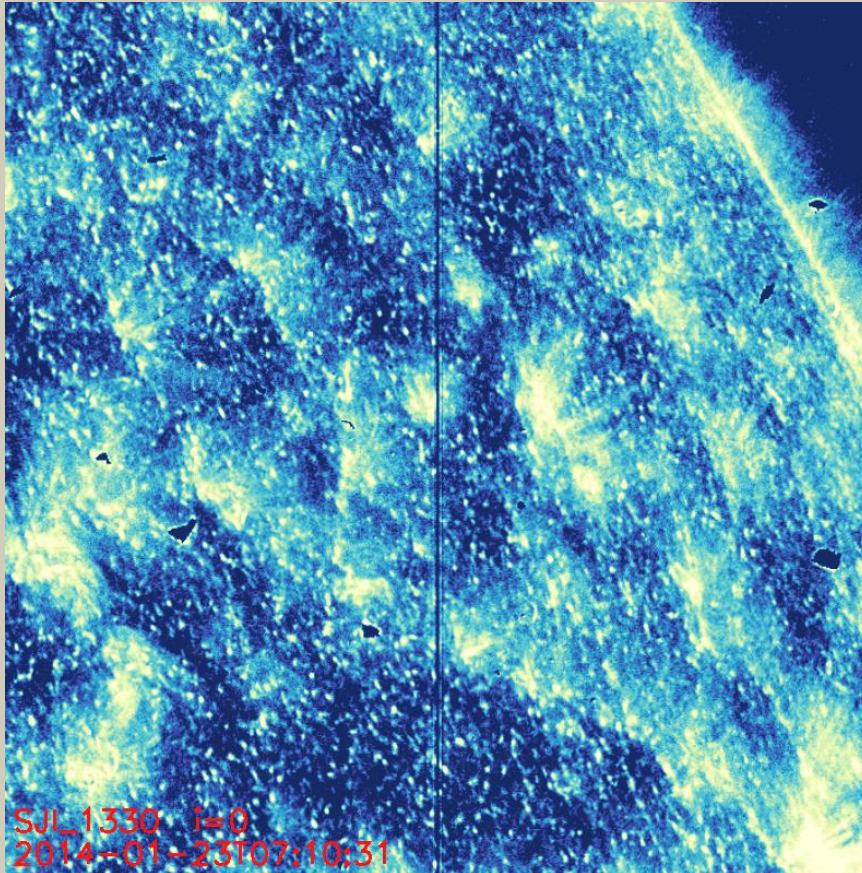


Image courtesy of NASA, from SOHO

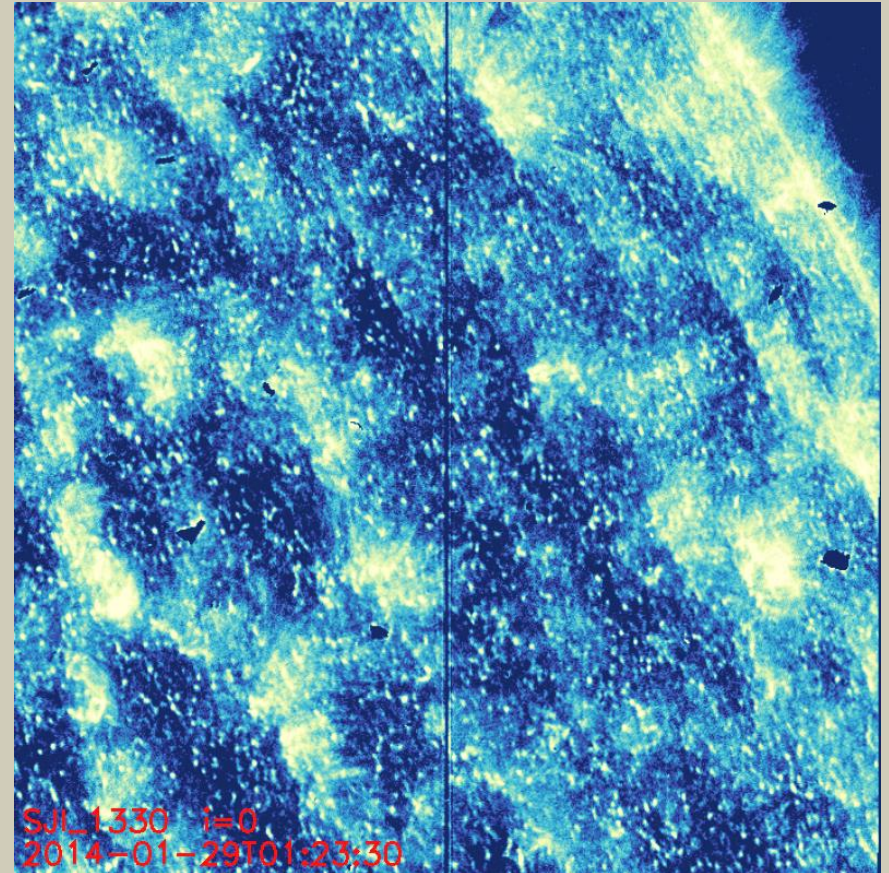
Regional Analysis



Coronal Hole



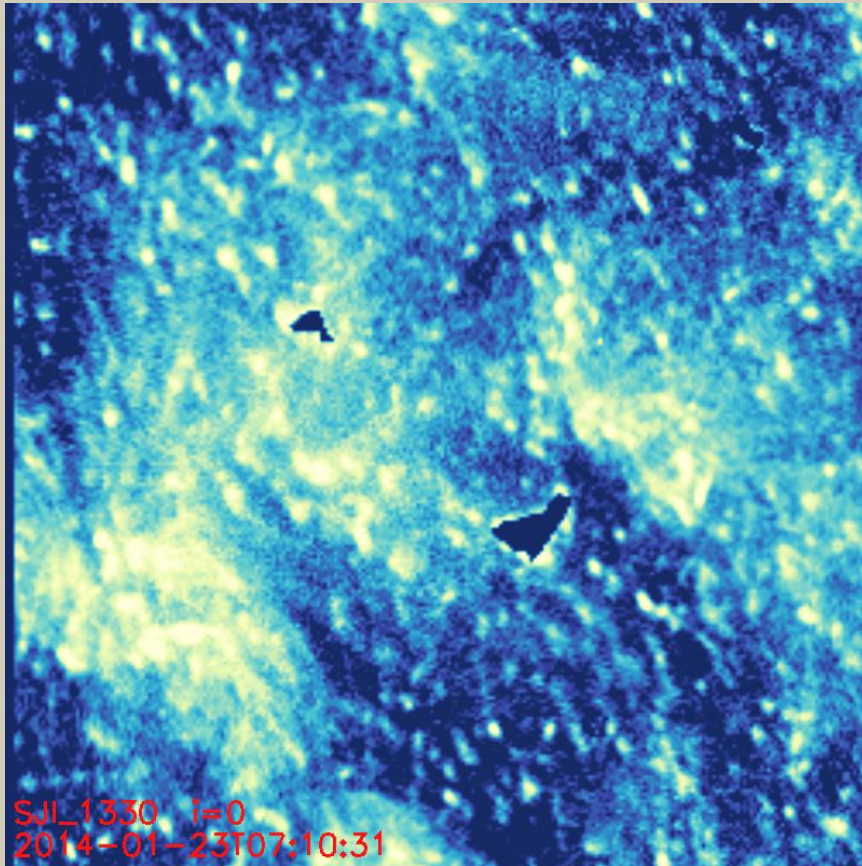
Quiet Sun



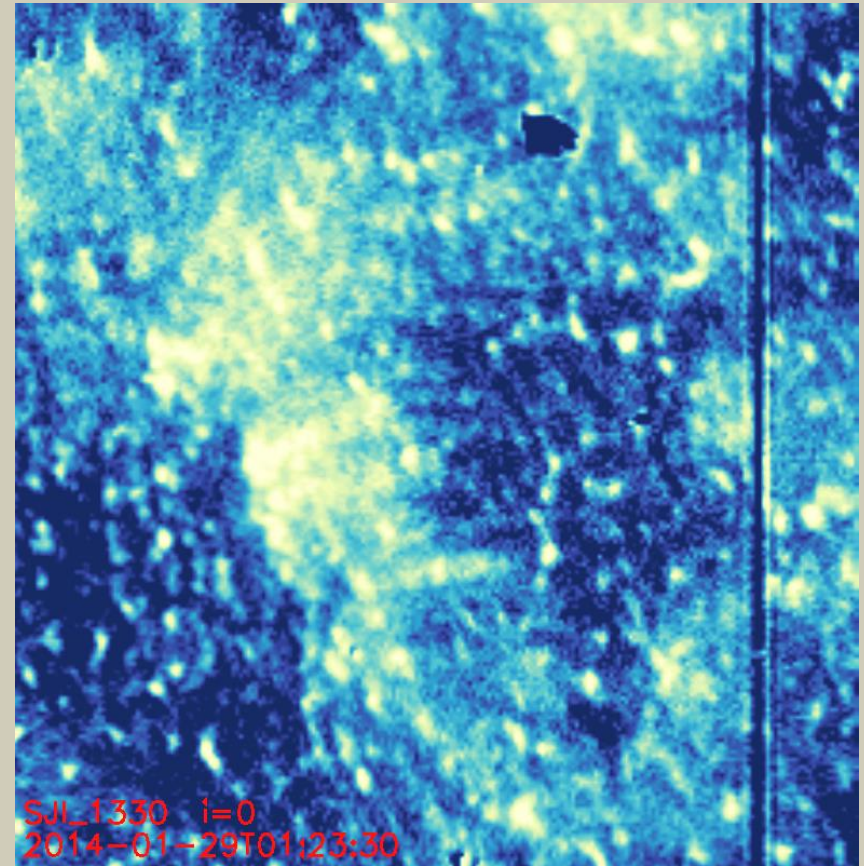
Tracing jets



Coronal Hole



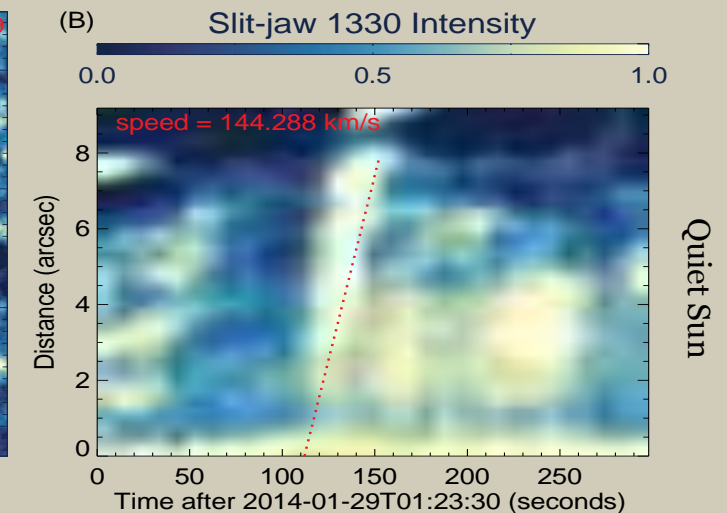
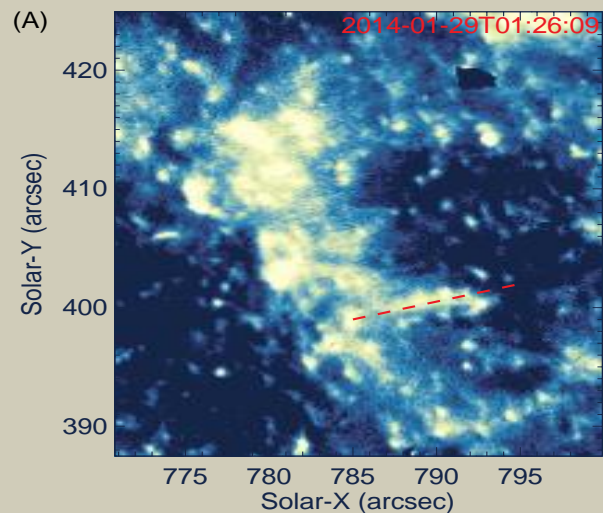
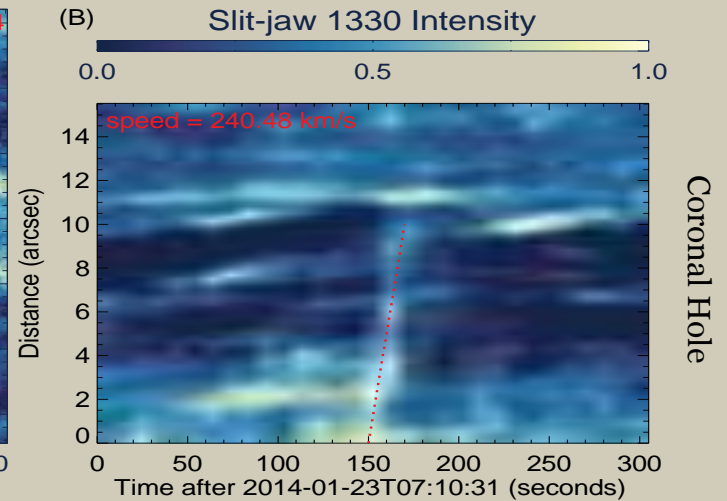
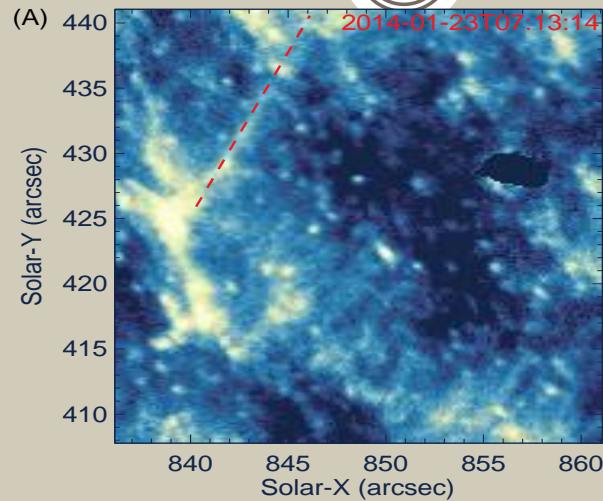
Quiet Sun



Parameter Calculation



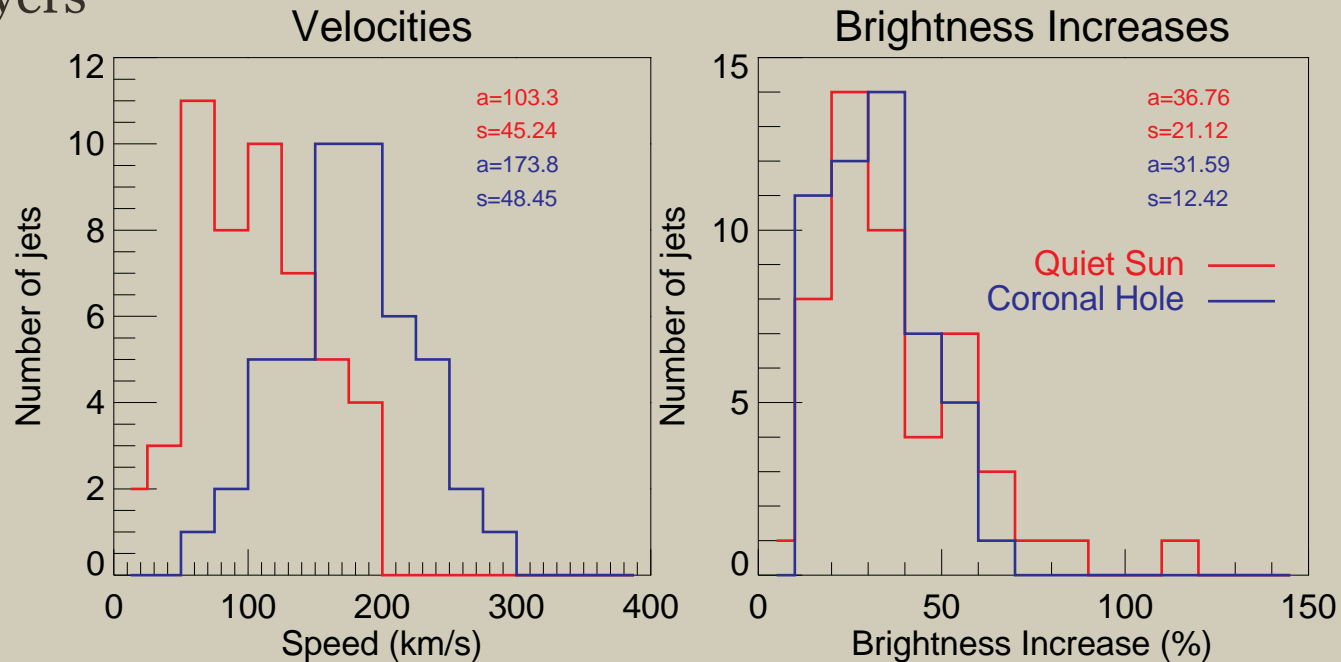
- Length
- Lifetime
- Velocity
- Brightness increase at footpoint



Findings



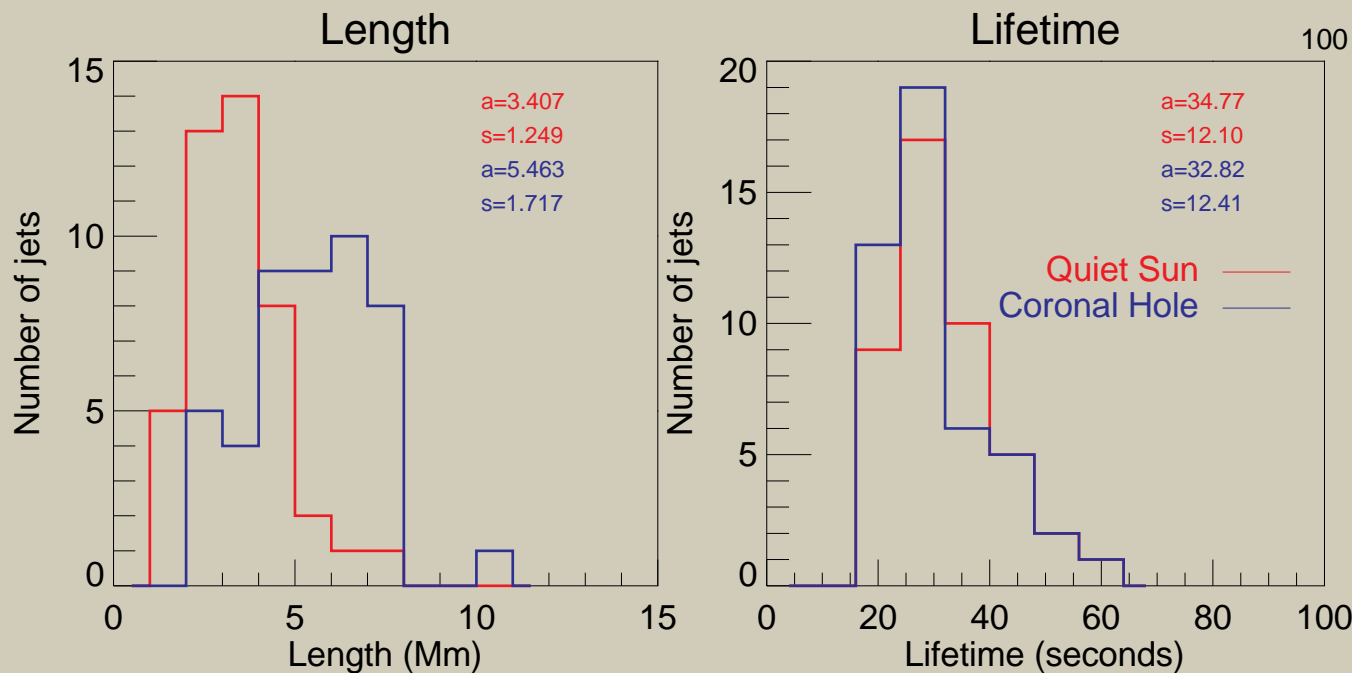
- Coronal hole jets significantly faster
 - Indicates that coronal hole jets are accelerated more efficiently
- Brightness increase differences negligible
 - Plausible if jets have similar generation mechanisms in lower layers



Findings



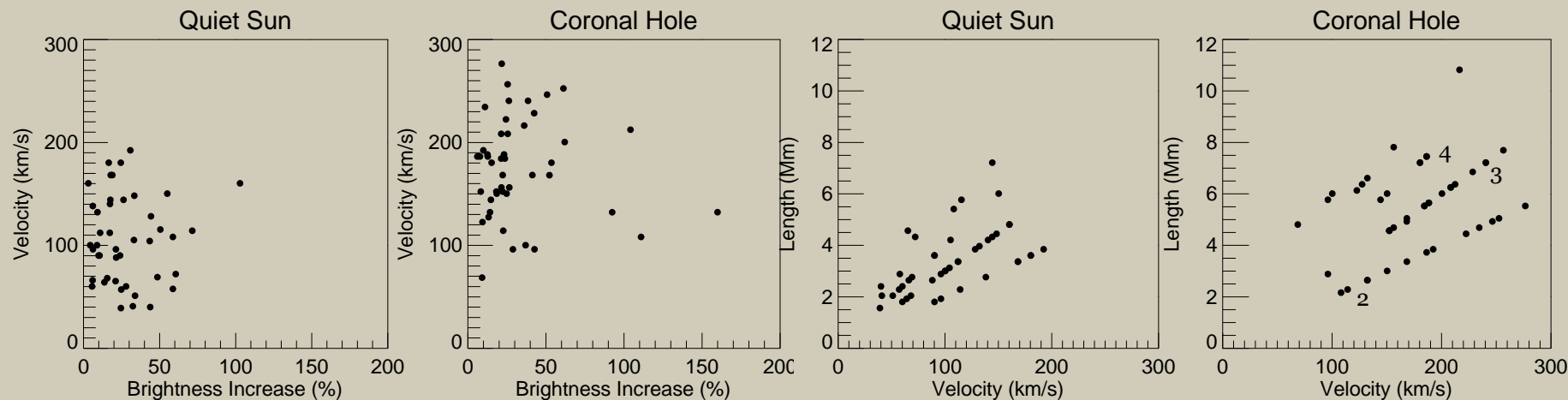
- Coronal holes exhibit longer jets
 - Likely due to open field lines in coronal holes as compared to constraining loops in quiet sun
- Similar lifetimes



Findings



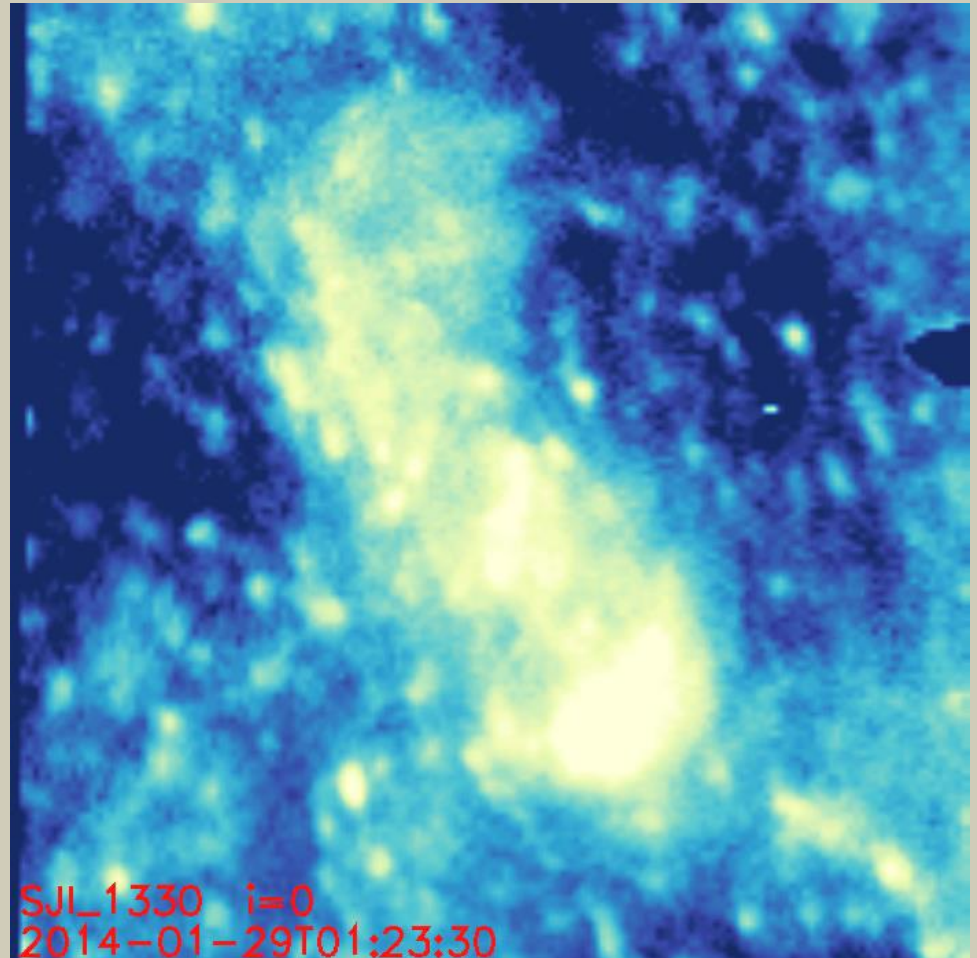
- No apparent relationship between velocity and brightness increase
 - Suggests similar generation mechanism, differences in propagation
- Length vs velocity impacted by lifetime constraints (10 second cadence)
- Positive correlation between length and velocity



Features Unique to Quiet Sun



- Bright areas contain fewer jets
- 5-10 arcsecond bright compact regions in some networks
- Flows follow curved field lines

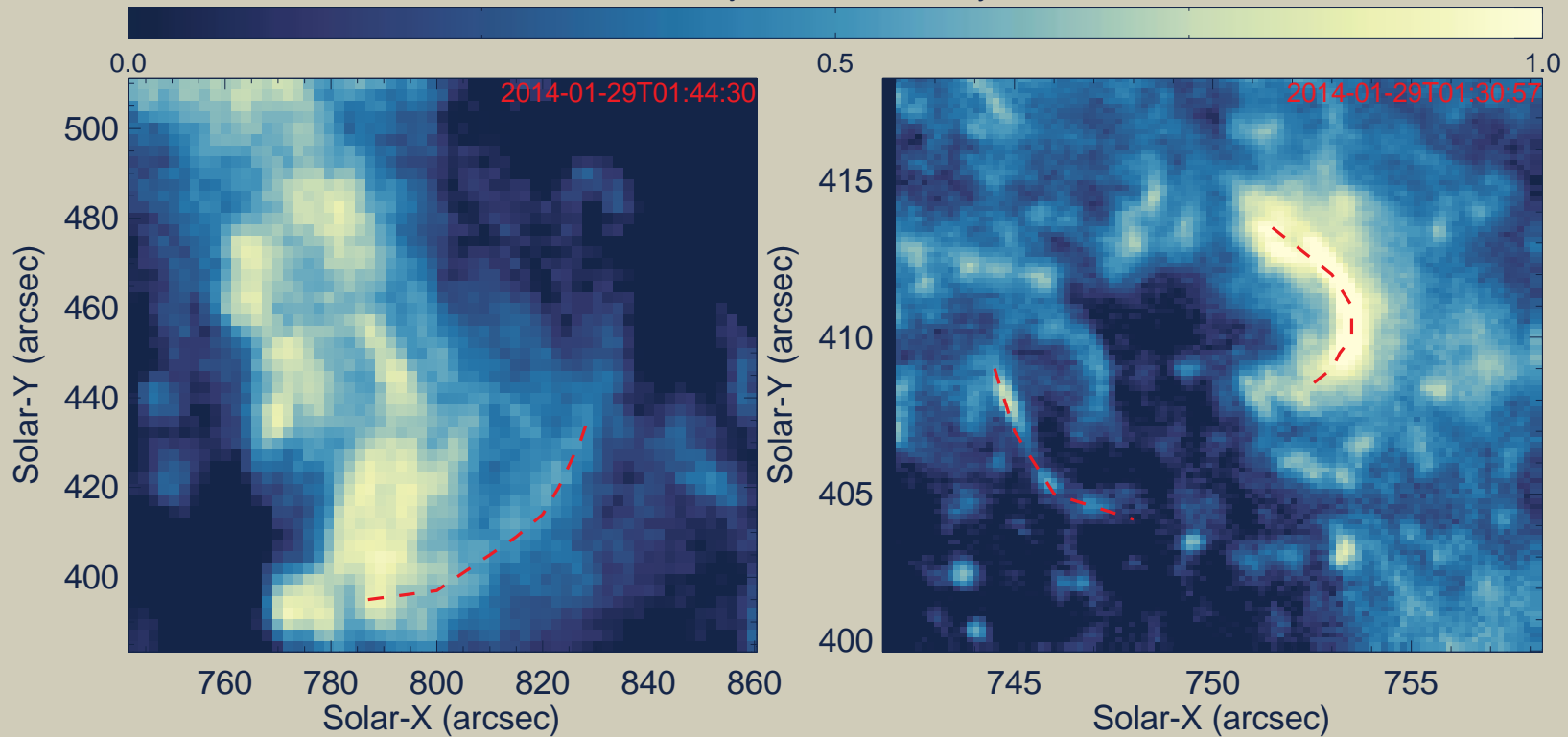


Features Unique to Quiet Sun



- Flows along curved field lines
 - Long, curved jets contribute mass to corona, some velocities considered
 - Small, bright flows keep mass below corona, velocities not considered

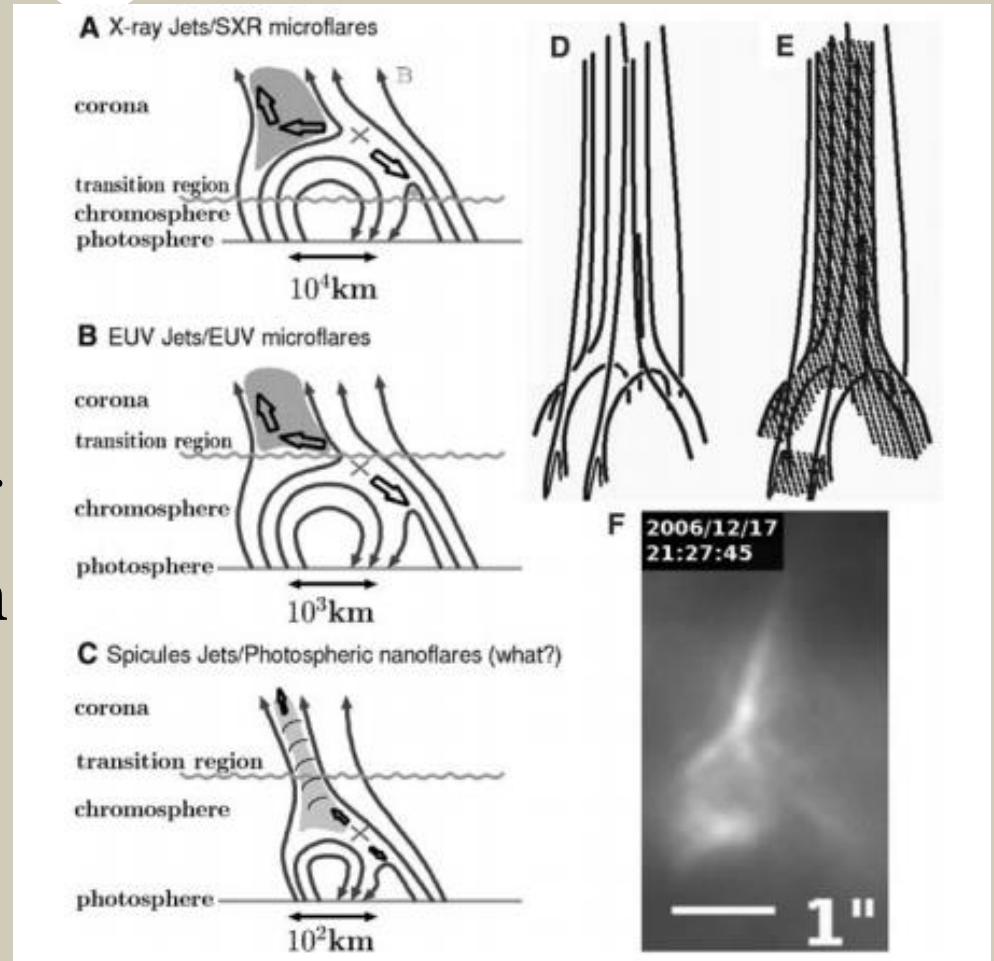
Slit-jaw 1330 Intensity



Reconnection



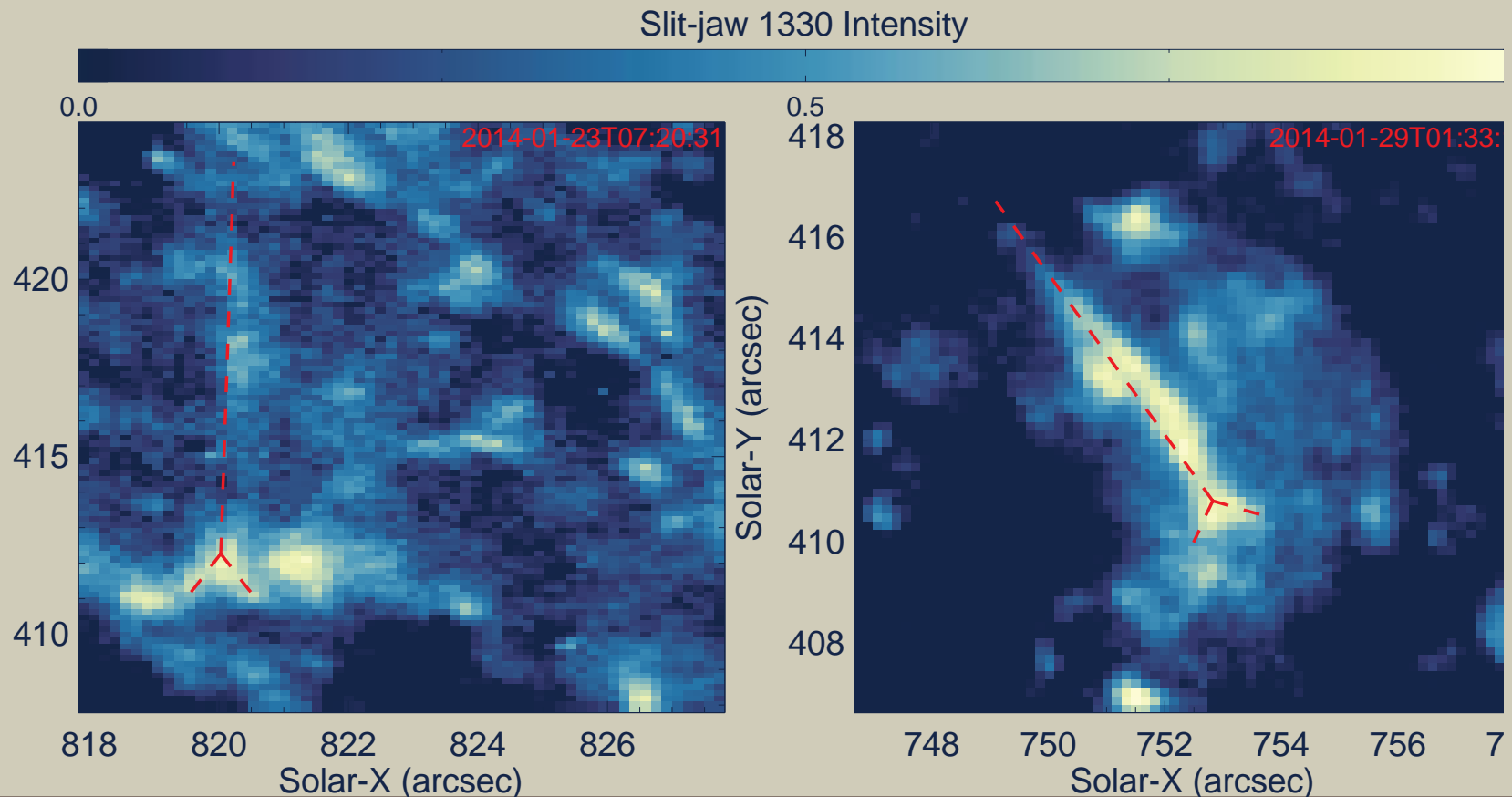
- Y structures as evidence of reconnection (Shibata et al, 2007)
- Reconnection is possible mechanism of solar wind acceleration
- Size of loop affects Y structure



Difficulty in Identifying Y Structures



- Absence of Y structures due to other acceleration mechanisms or small scale structures below resolution limits



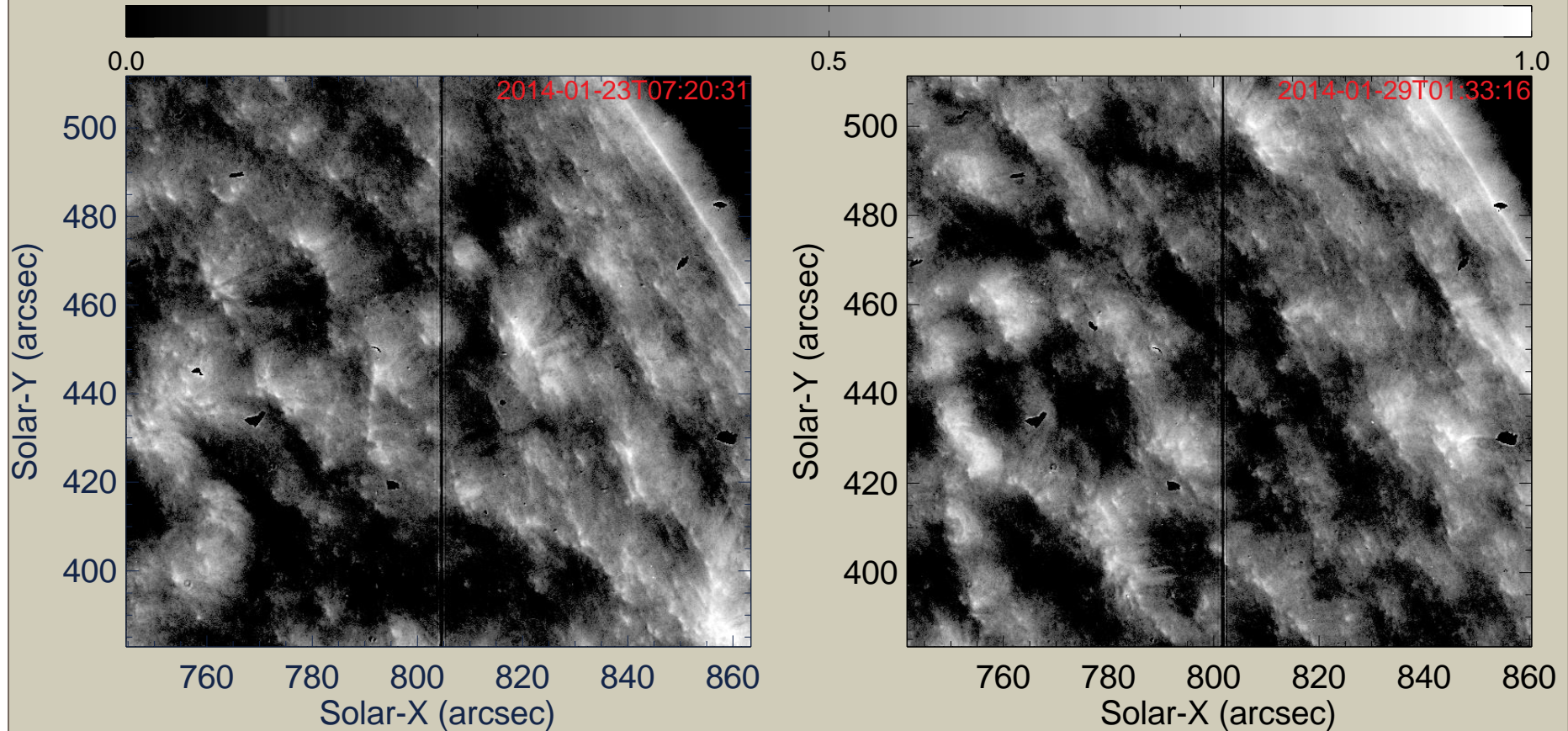
Recurrence Frequency



Coronal Hole Minimums

Quiet Sun Minimums

Slit-jaw 1330 Intensity



Summary



- Faster, longer jets from coronal hole regions
- Similar lifetimes and brightness increases
- Recurrence frequency larger in coronal hole regions
- Quiet sun exhibits some network regions dominated by loops, 5-10 arcseconds in size
- Few jets exhibit distinguishable Y structures
- Differences between coronal hole and quiet sun activity align with dominant magnetic structures in each respective region
 - Open field lines in coronal holes
 - Closed loops of varying sizes in quiet sun

Acknowledgements



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- Lauren for providing excellent guidance and conversation
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