Chromospheric jets above sunspots

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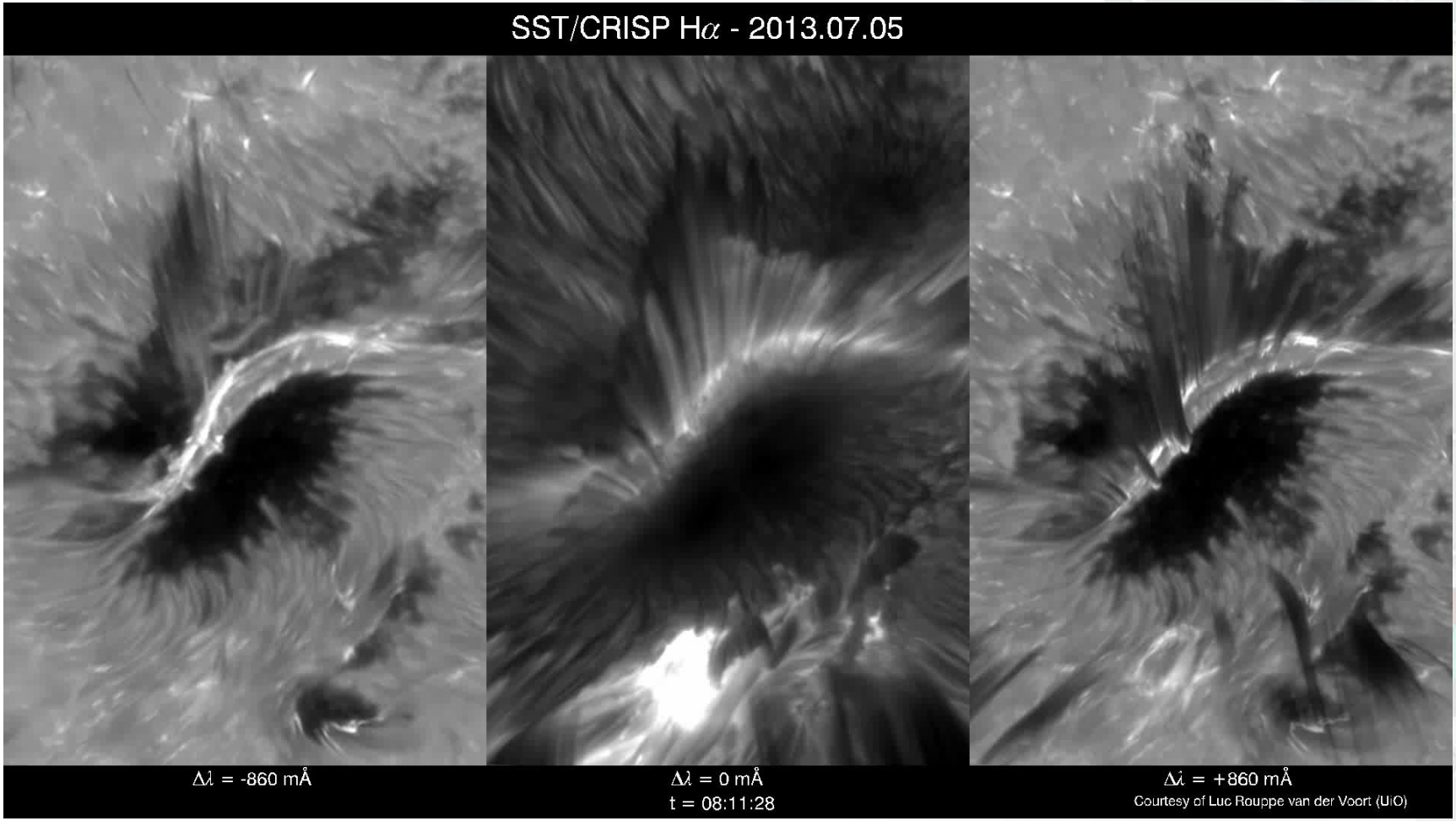

Robustini et al. 2016, A&A

"The PRE-EST project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 739500"

Large scales magnetic structures:
sunspots, prominences, and filaments

- Stability of the umbra
- Formation and decay of sunspot penumbrae
- Structure of cool sunspot umbrae

discussed by Nazaret Bello Gonzalez

- Relation between the moat flows, MMFs, and sunspot decay
- Umbral dots
- Evolution of an individual penumbral filament
- Umbral flashes as a probe of fine structure in the umbra chromosphere
- Penumbral and umbral microjets
- Light bridges

- Fine structure of prominences and filaments
- Are quiescent and active region prominences the same phenomenon?
- Magnetic field and dynamics of tornado prominences

discussed by María Martínez González

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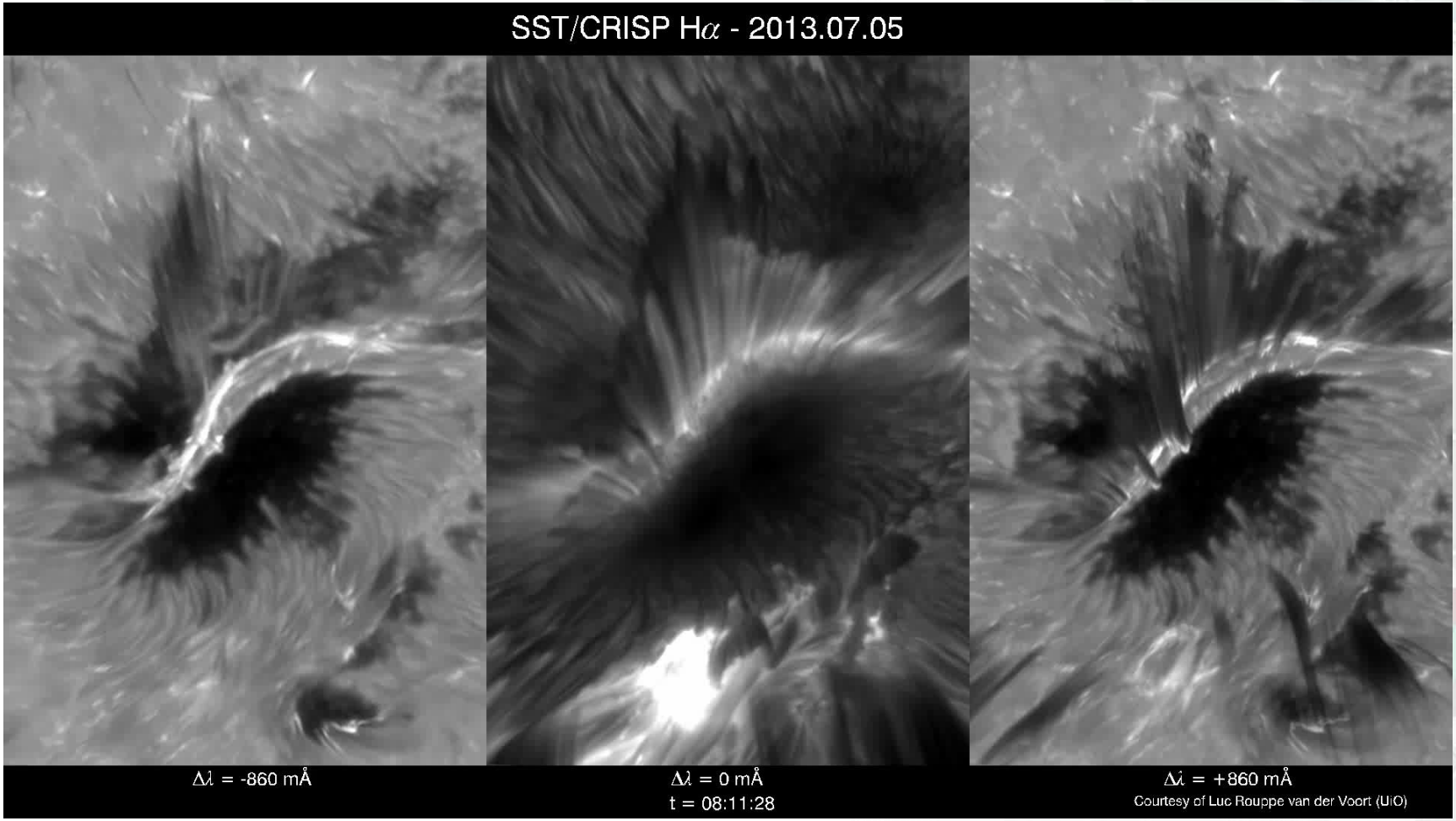

Robustini et al. 2016, A&A

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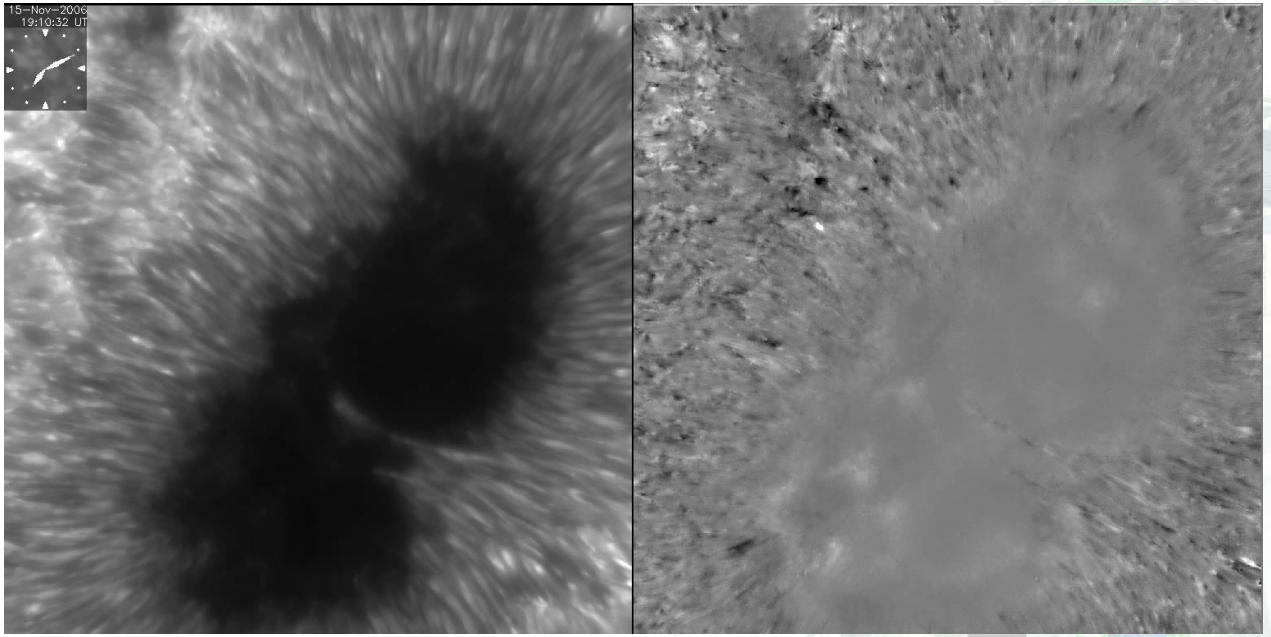
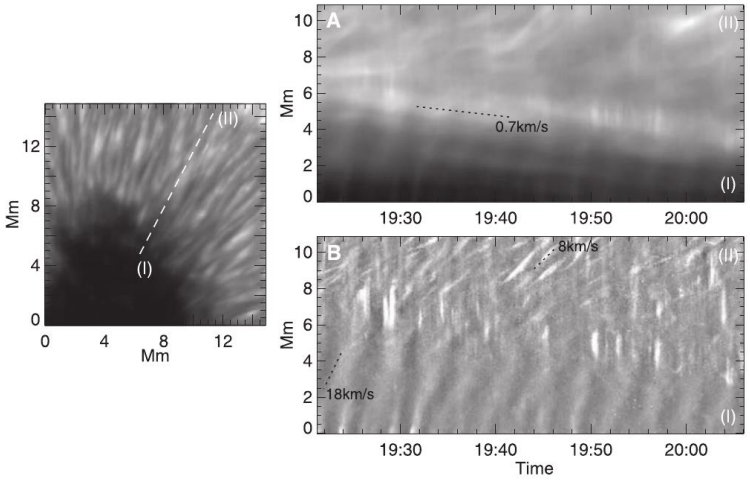
Penumbral microjets

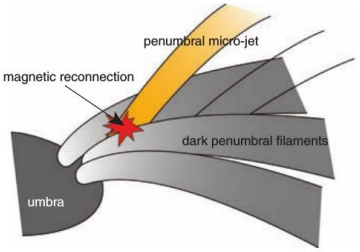
observations

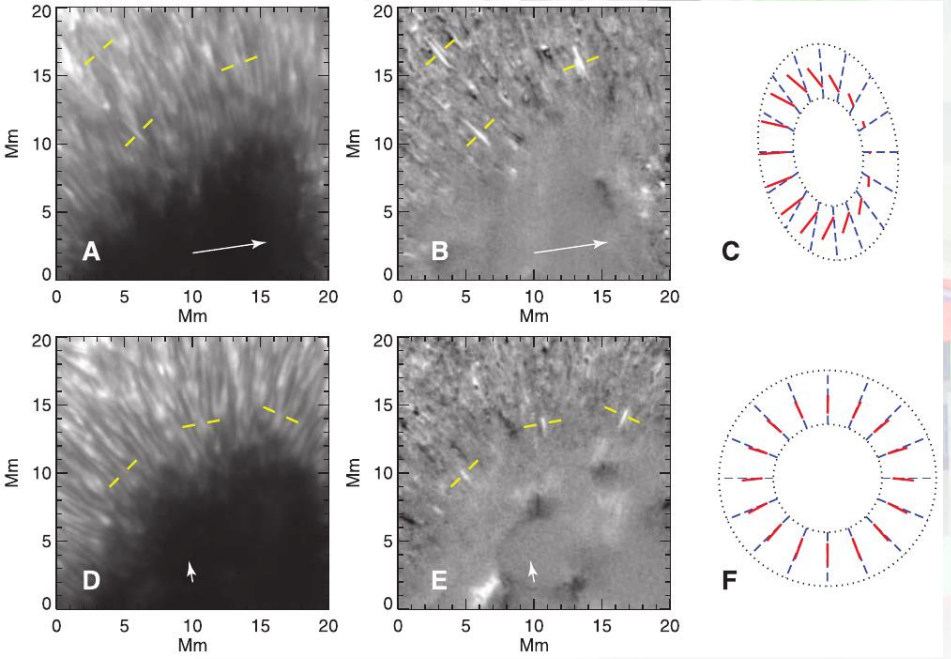
- discovered by Y. Katsukawa in Hinode data
- lifetimes around one minute
- widths of 400 km at maximum
- lengths around 1000 km
- inclined by 30° – 50° to the penumbral filaments



Katsukawa et al. 2007, Science



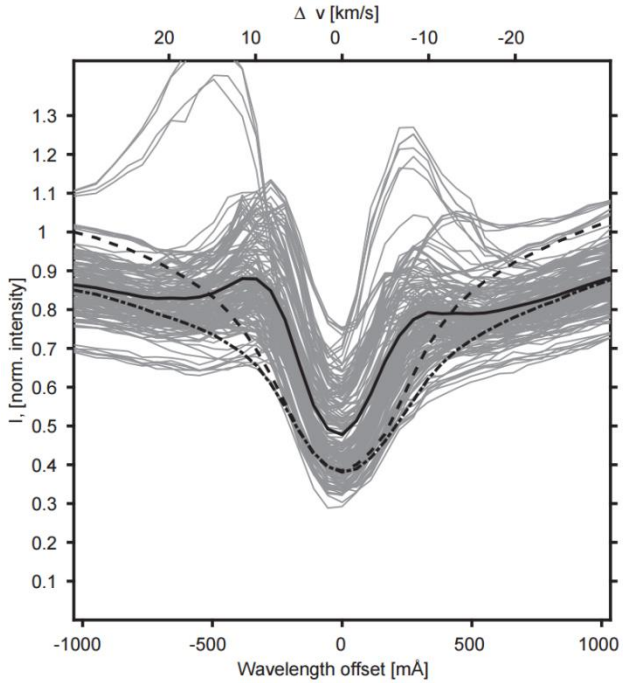




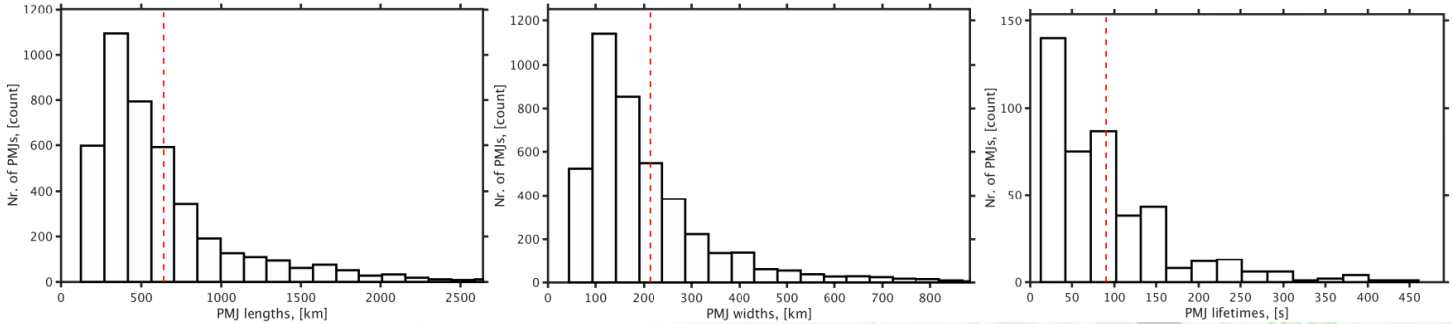
Penumbral microjets

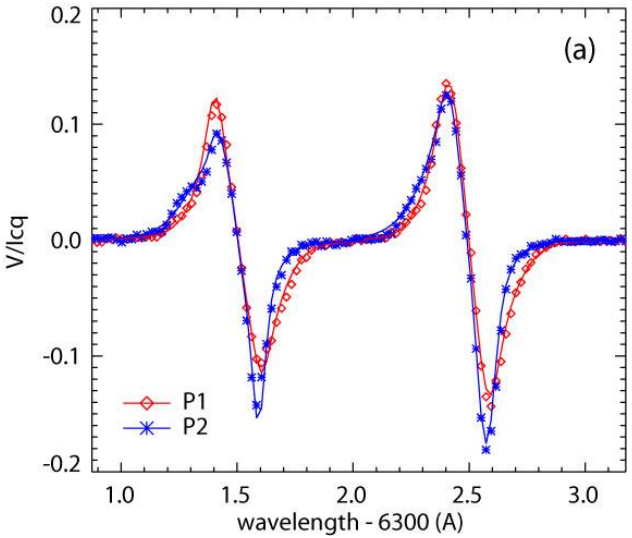
observations

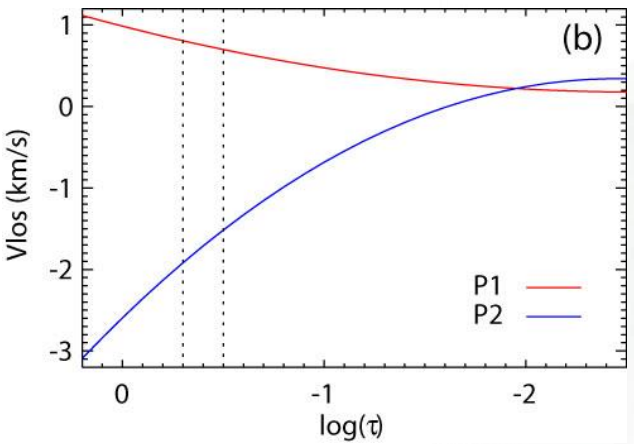
- line profiles observed in the PMJs in the photosphere and in the chromosphere imply (along with other indications) that reconnection is the driving mechanism of these jets



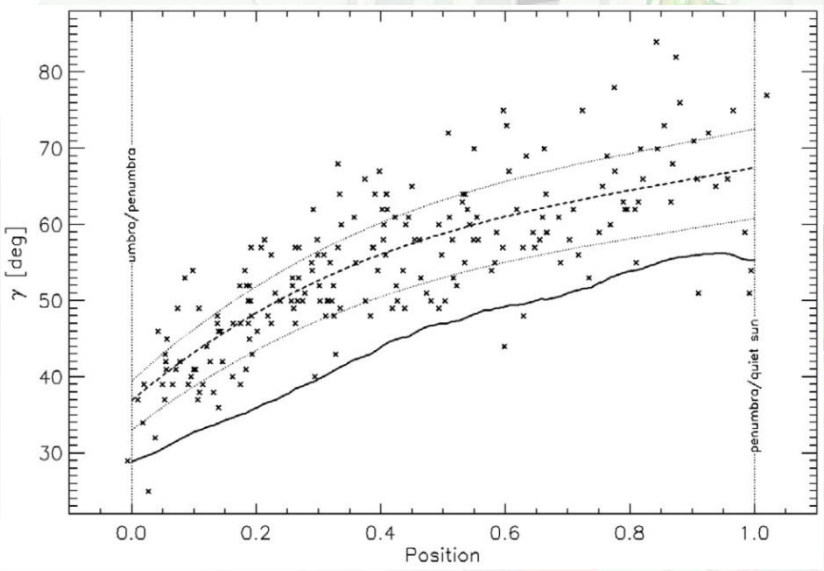
Drews & Rouppe van der Voort. 2017, A&A





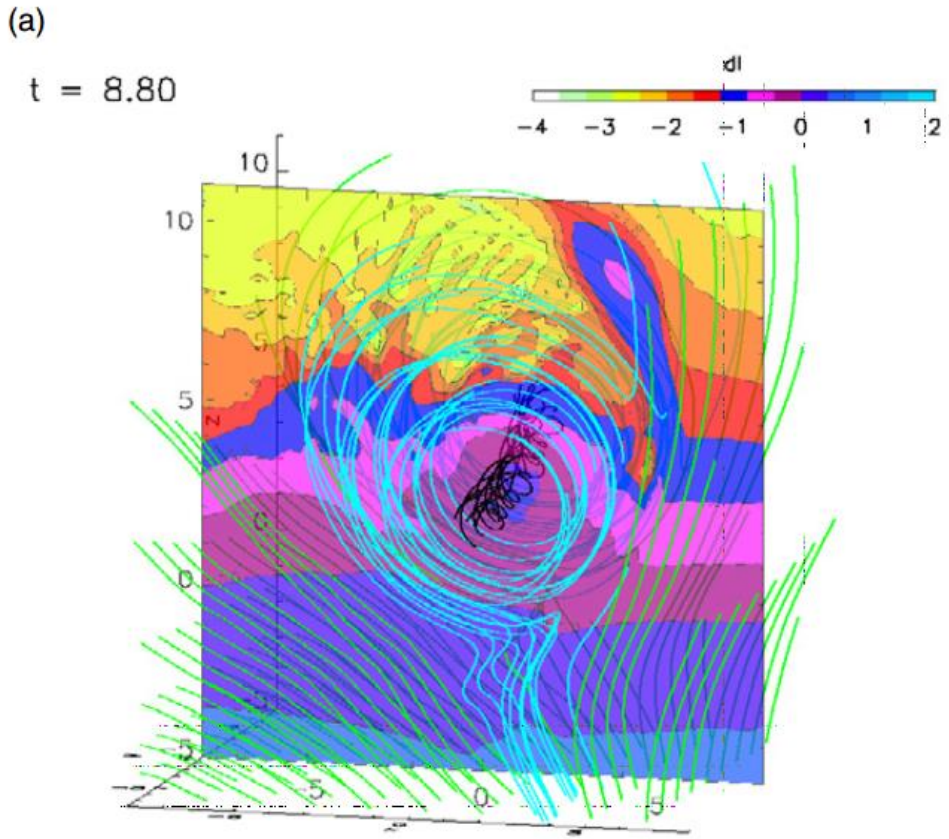


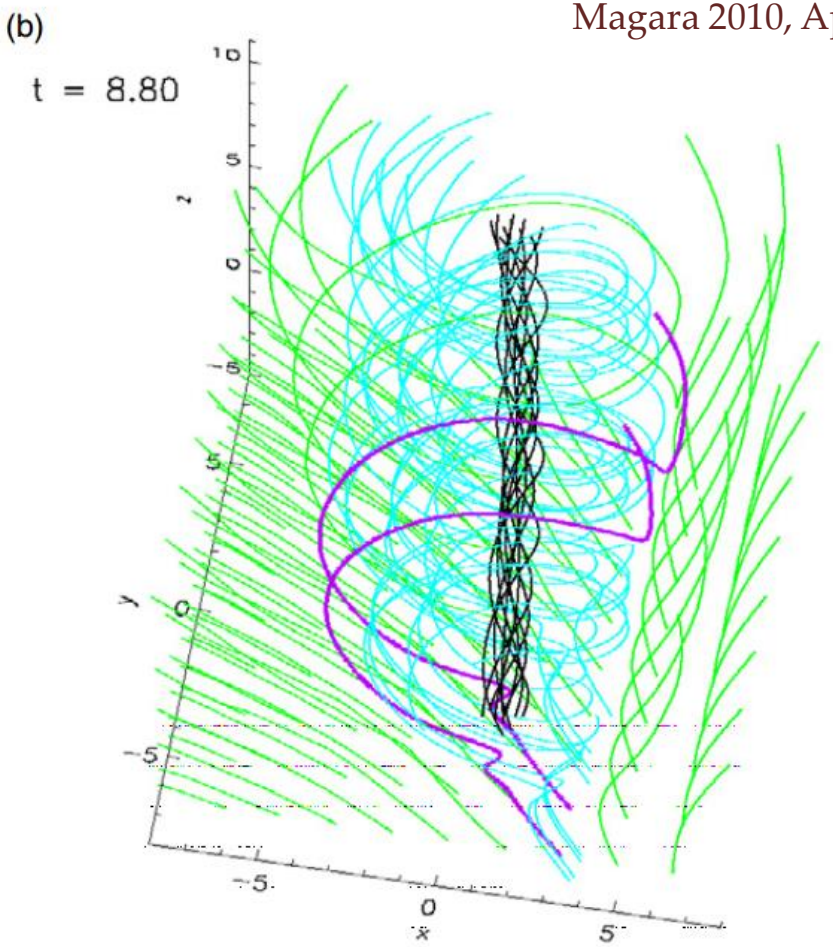
Katsukawa & Jurcak 2010, A&A
Jurcak & Katsukawa 2010, A&A



Jurcak & Katsukawa 2008, A&A

Penumbral microjets
simulations





Magara 2010, ApJ

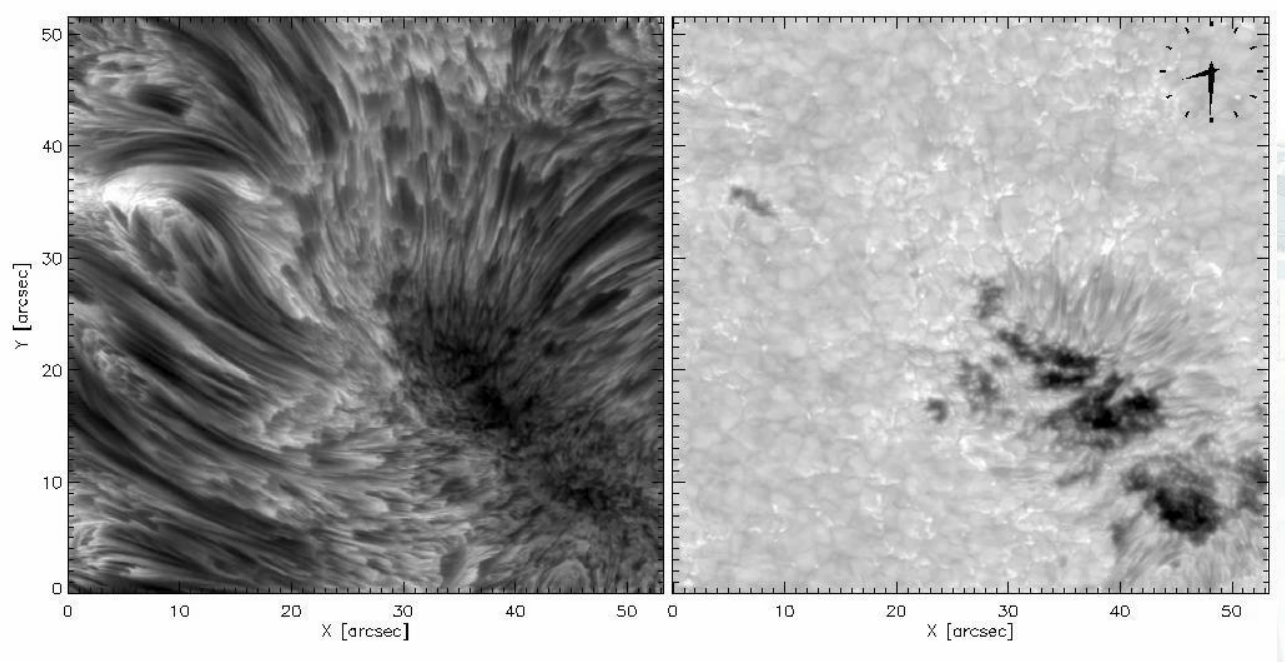
- basic properties of the observed PMJs are successfully reproduced by numerical simulations of reconnection between magnetic field lines of penumbral filaments and surrounding background field

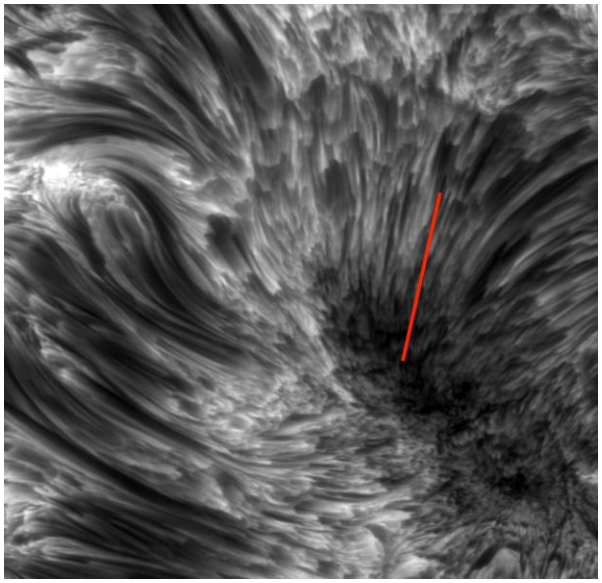
  Sakai & Smith 2008, ApJ; Sakai & Smith 2009, ApJ; Magara 2010, ApJ; Nakamura et al. 2012, ApJ

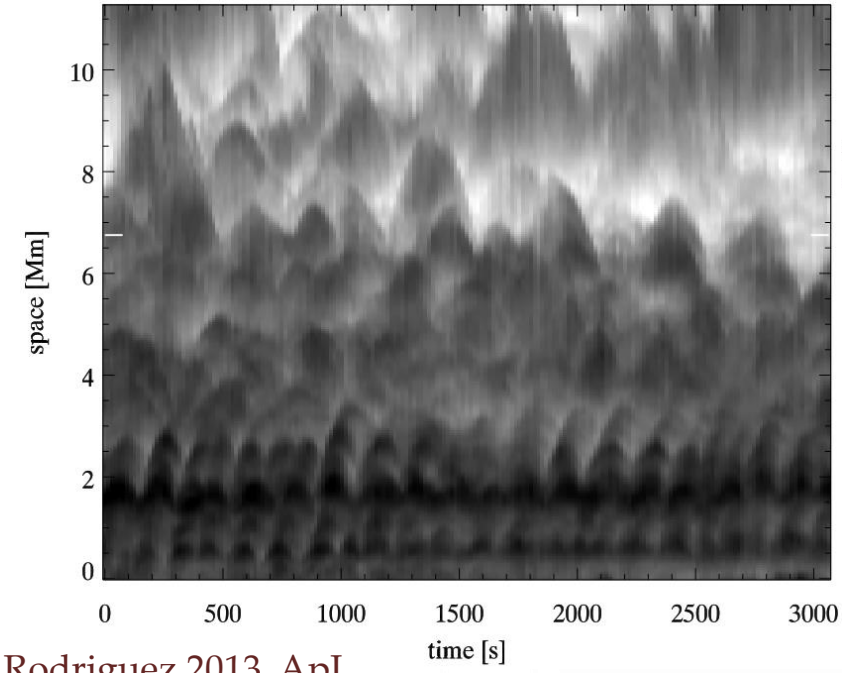
Dynamic fibrils in sunspots

observations

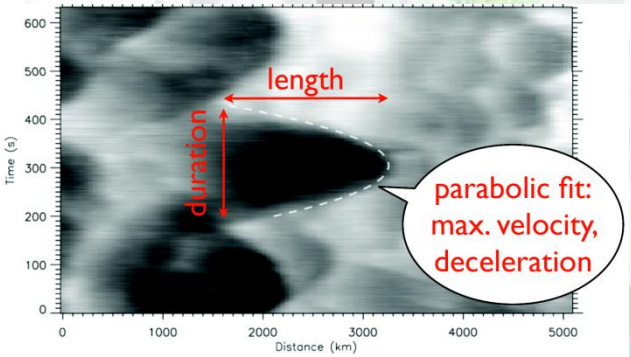
- periodic jets in the sunspot chromosphere
- analogous to dynamic fibrils observed in plages
- Socas-Navarro et al. 2000, ApJ
  Socas-Navarro et al. 2000, Science
  Socas-Navarro et al. 2009, ApJ
  Henriques & Kiselman 2013, A&A







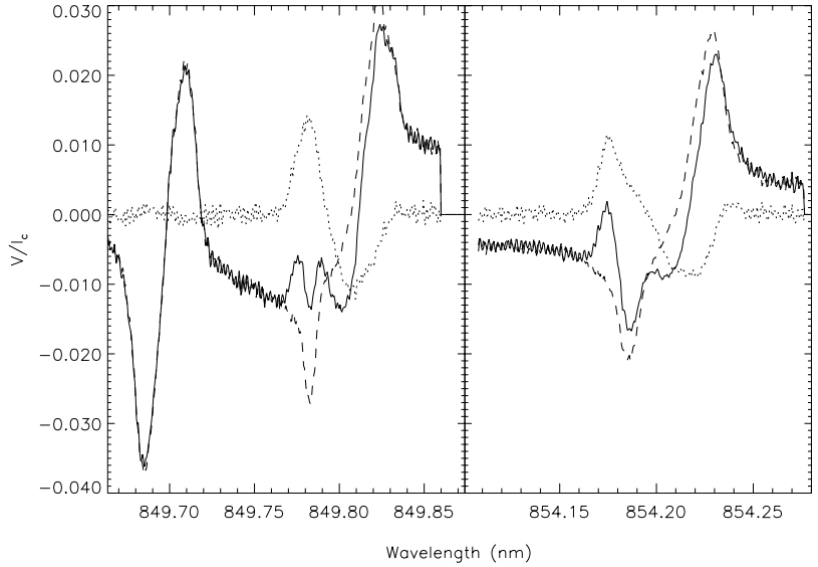
Rouppe van der Voort & de la Cruz Rodriguez 2013, ApJ



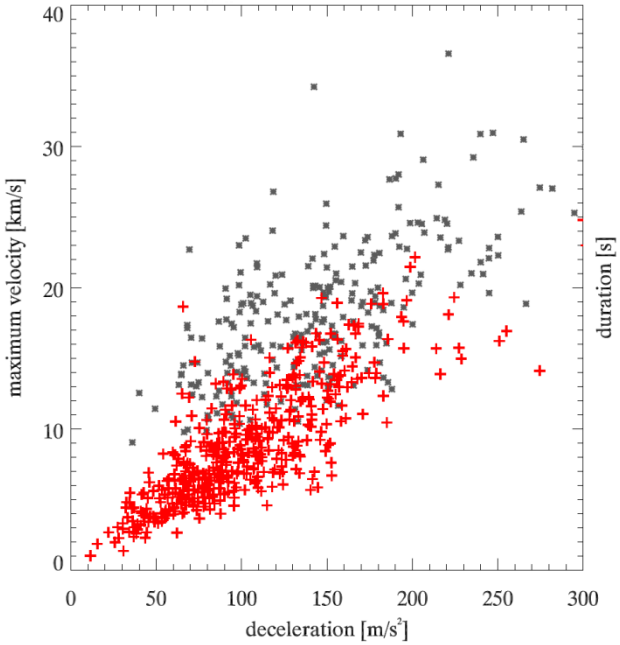
De Pontieu et al. 2007, ApJ

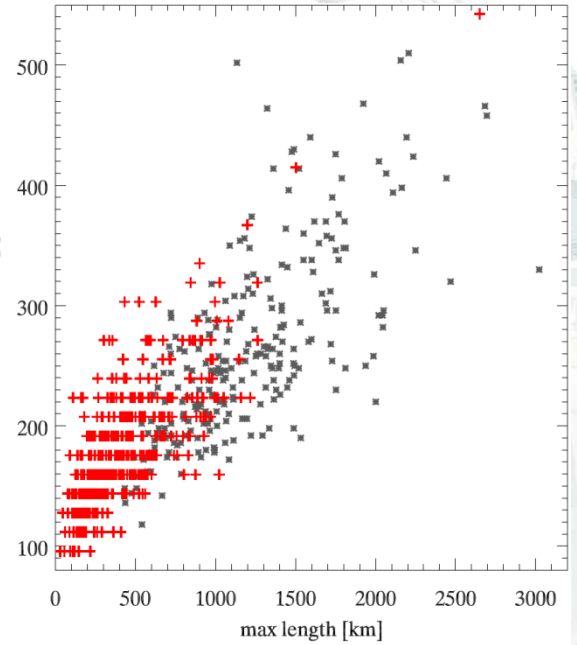
Dynamic fibrils in sunspots

observations



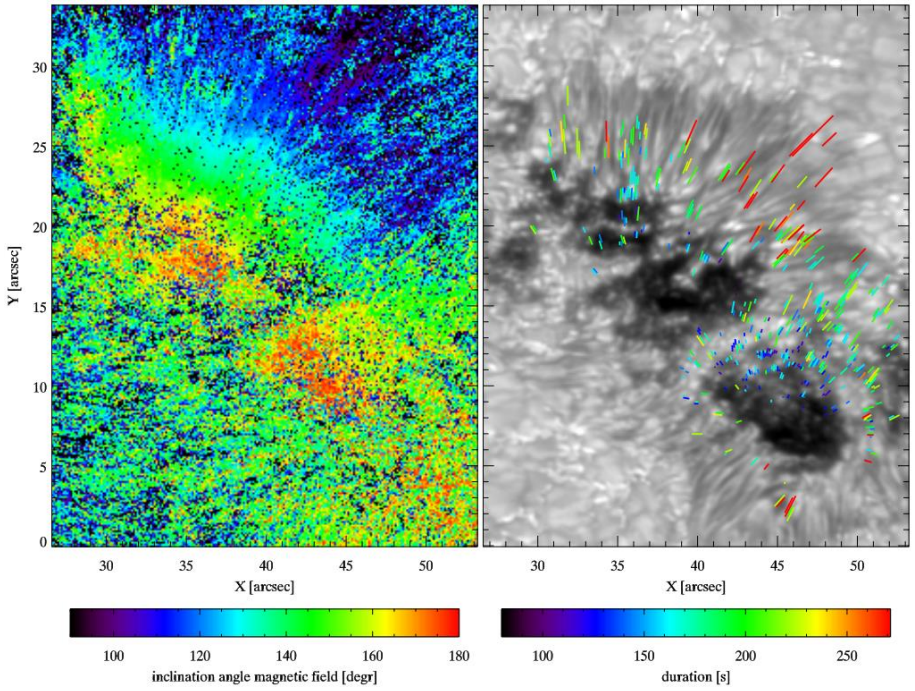
Socas-Navarro et al. 2000, ApJ



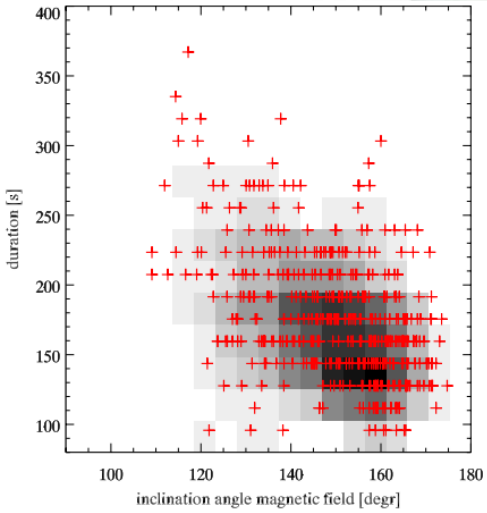


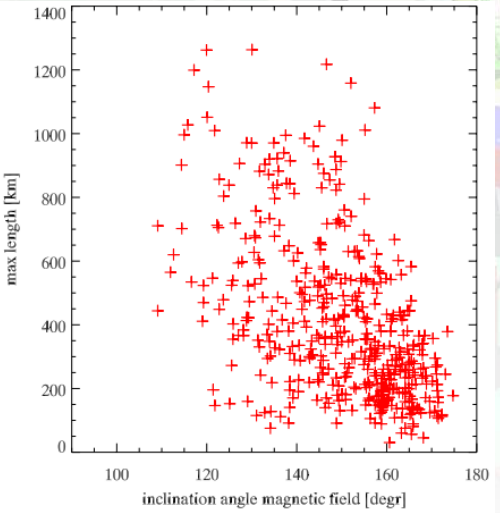
+ sunspot Rouppe van der Voort & de la Cruz Rodriguez 2013, ApJ

∗ plage De Pontieu et al. 2007, ApJ



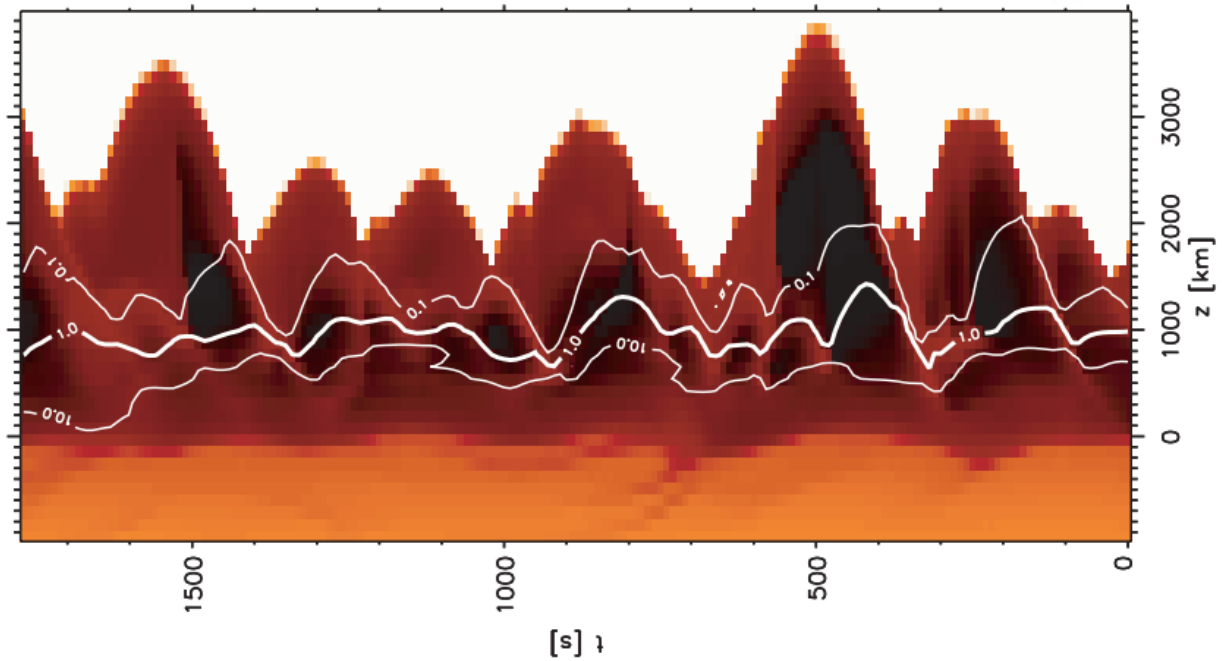
Rouppe van der Voort & de la Cruz Rodriguez 2013, ApJ

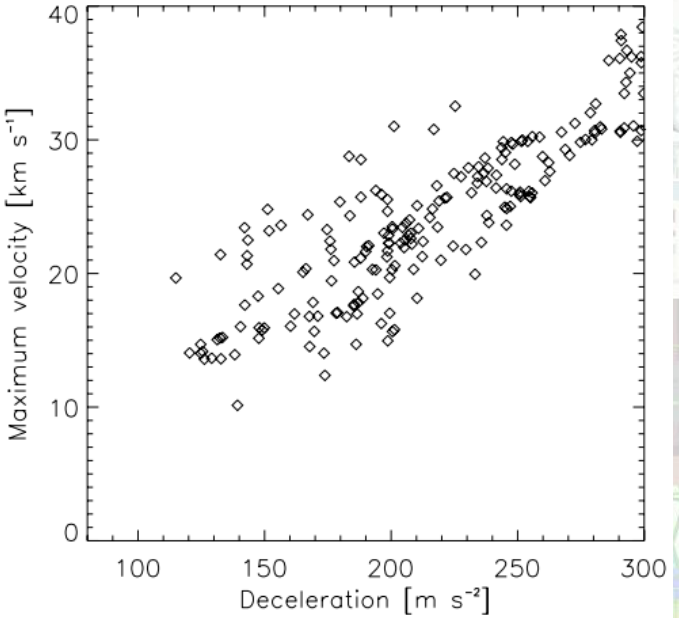




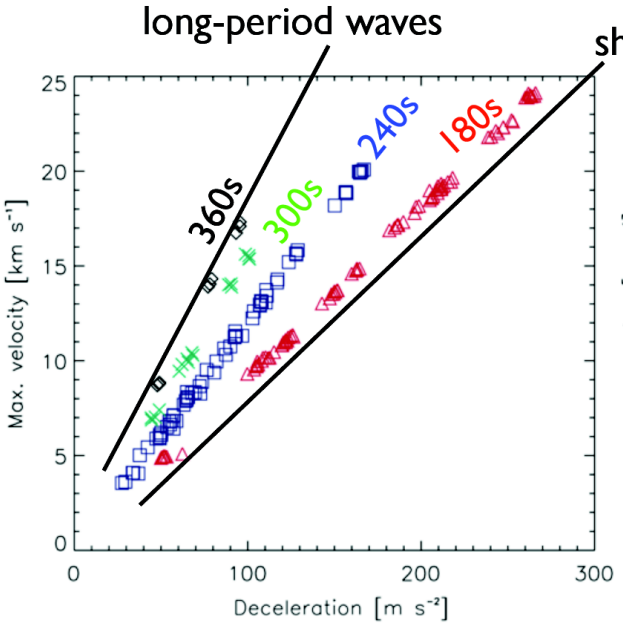
Dynamic fibrils (in sunspots)

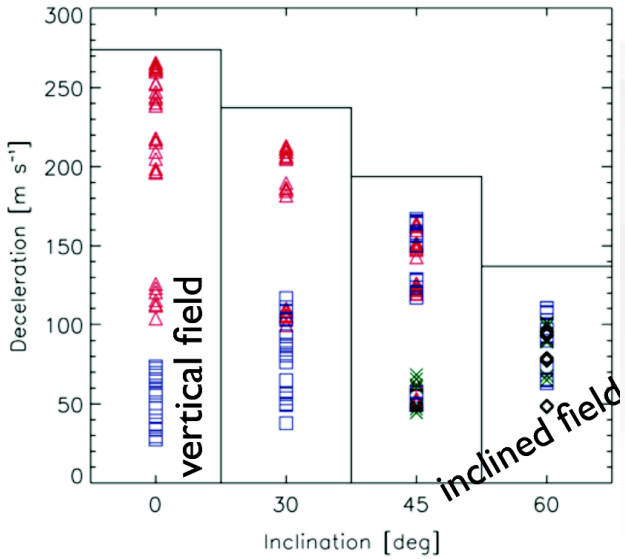
simulations





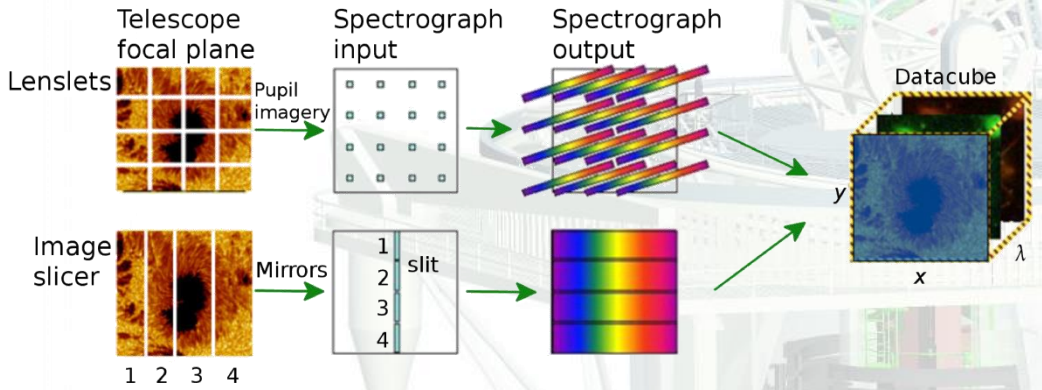
De Pontieu et al. 2007, ApJ





Heggland et al. 2007, ApJ

How can EST help us
integral field spectroscopy



Instrument 1	Integral field units	
Goal	Determine the magnetic topology in and around micro-jets. High-cadence spectropolarimetric observations of a small FOV.	
	Requirement	Goal
Spectral lines	Fe I 630.15 nm; Ca II 854 nm	
FOV	$10'' \times 10''$	as large as possible
Spatial resolution	$0\farcs06$	as good as possible
Spectral resolution R	80000	
Spectral range	as much as possible	
SNR	1000	2000
Cadence	10 s	5 s
Notes	Core of this OP.	