The limb eruptive events as a signature of a flux-rope formation:

some results of analysis

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Outline

- Motivation
- SOL2003-Mar-19 event
- SOL2015-Apr-21 event
- Discussion
- Summary & future plans

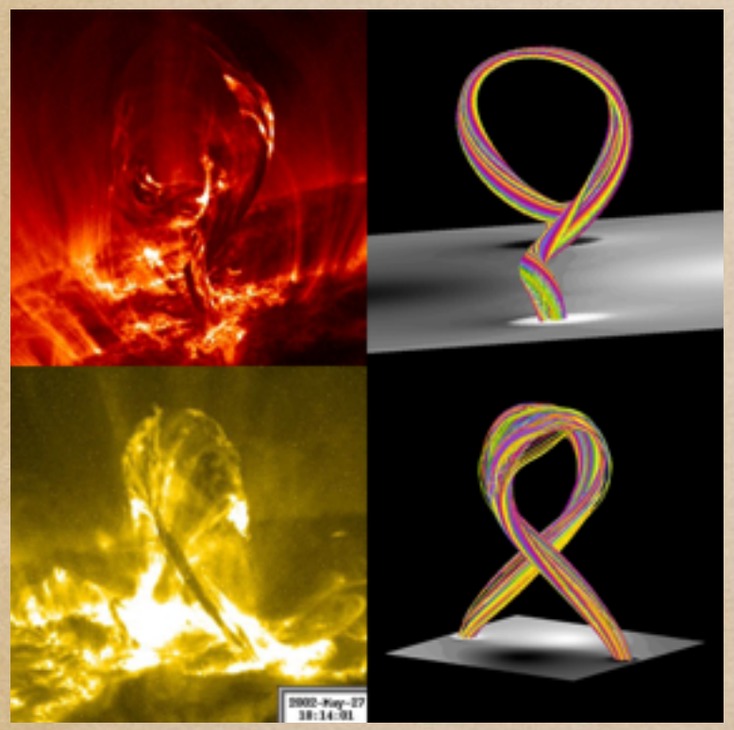
Motivation

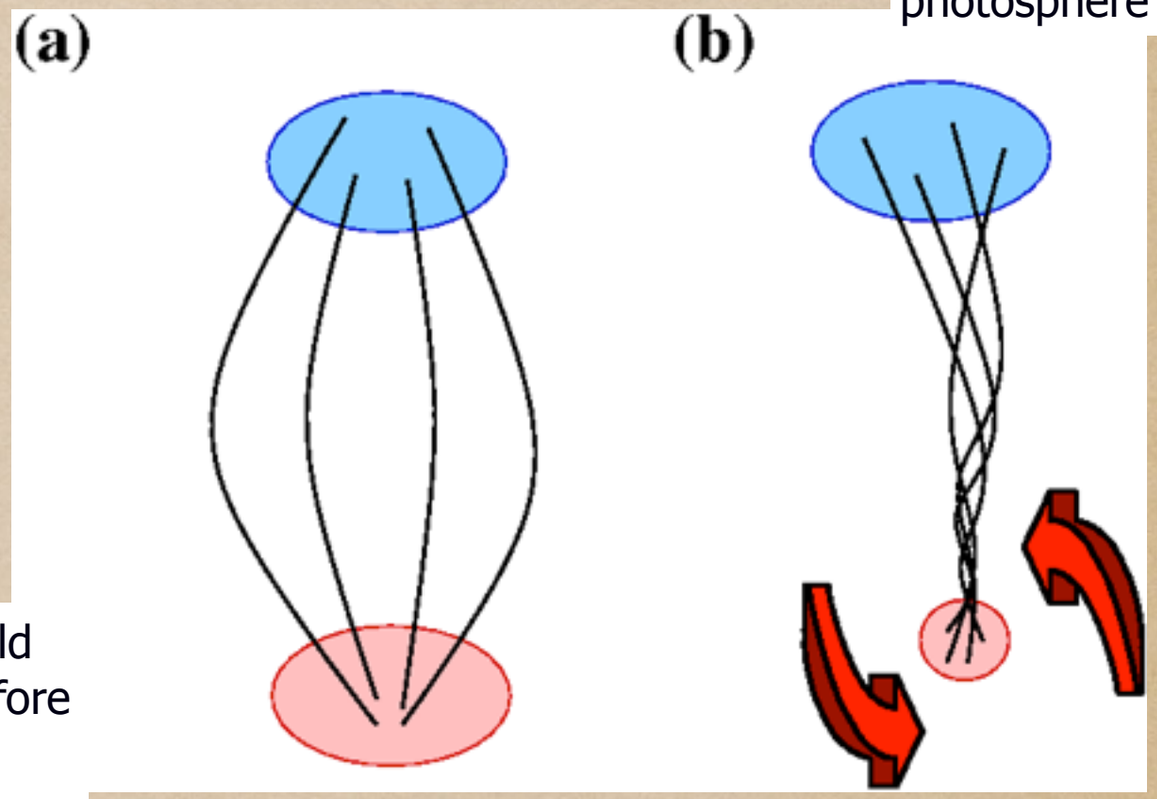
Lin & Forbes, 2000

Török & Kliem 2005; Kliem & Török 2006;

Williams et al. 2005; Kliem et al. 2010

Flux–rope/ filament creation as a result of rotation and convergent flows in photosphere





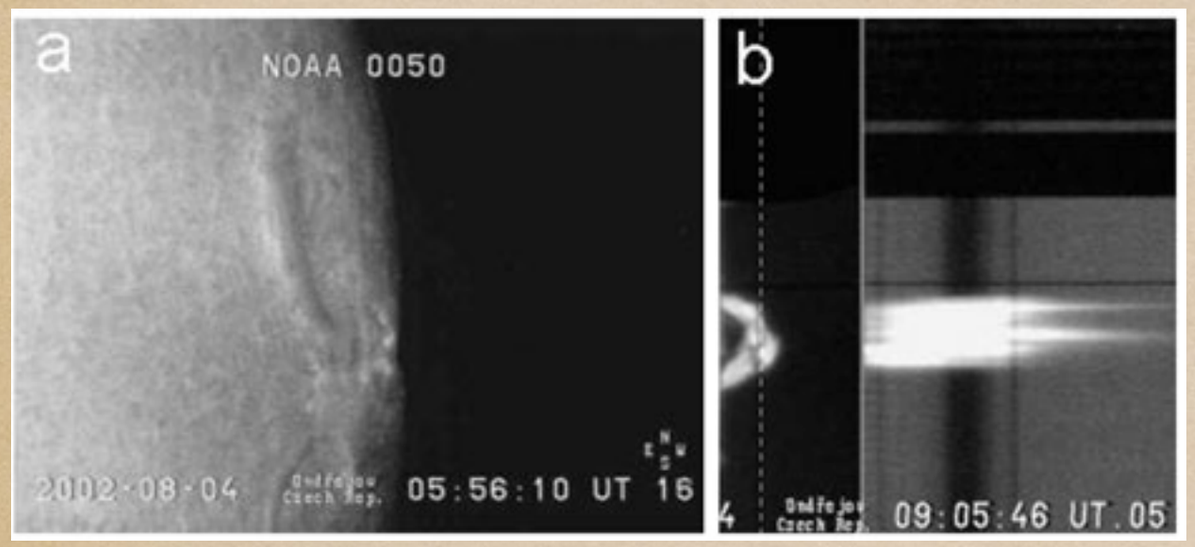
Magnetic field potential before onset of spinning motions in the future filament foot-point

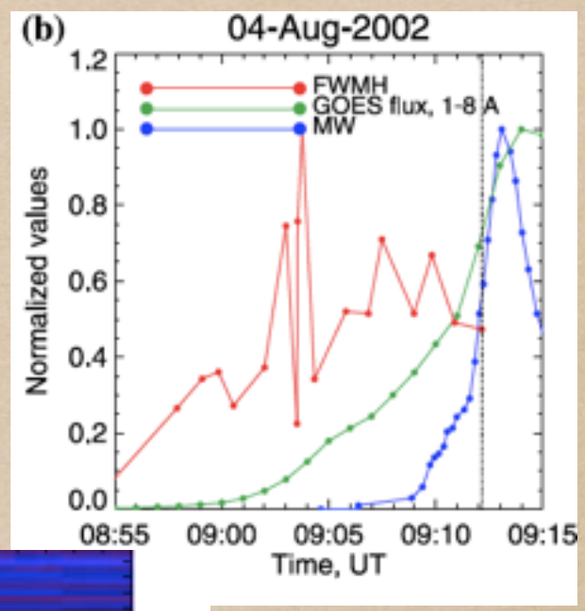
Observations

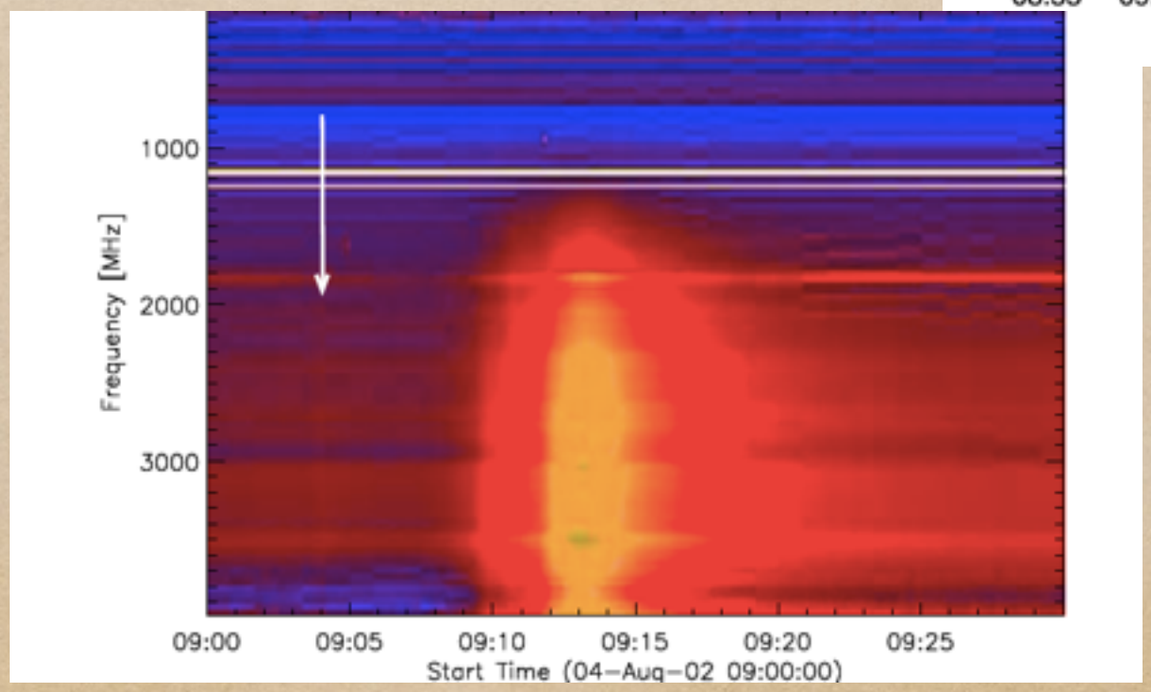
- Chromospheric observations : Ondrejov horizontal telescope and spectrograph & Ondrejov Multichannel flare spectrograph.
- EUV data: SOHO/EIT & SDO/AIA
- X-ray data: GOES & RHESSI

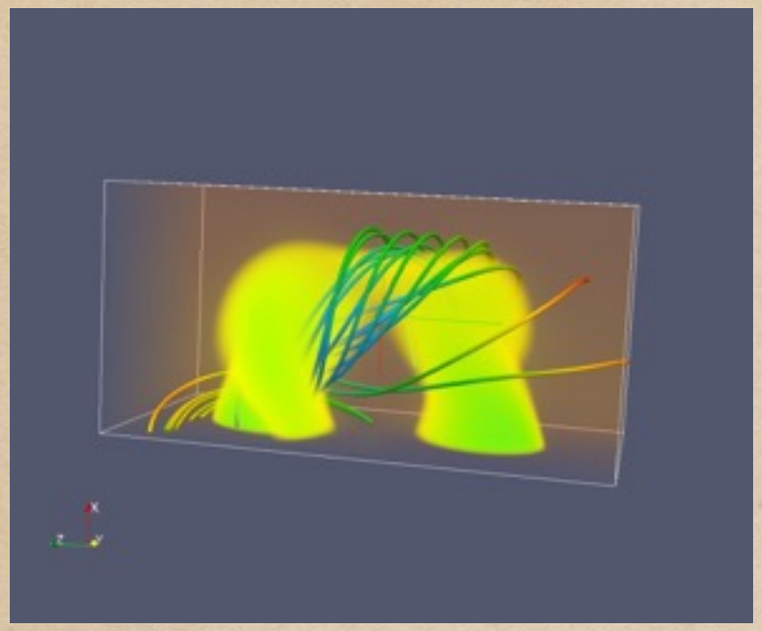
Onset of the study

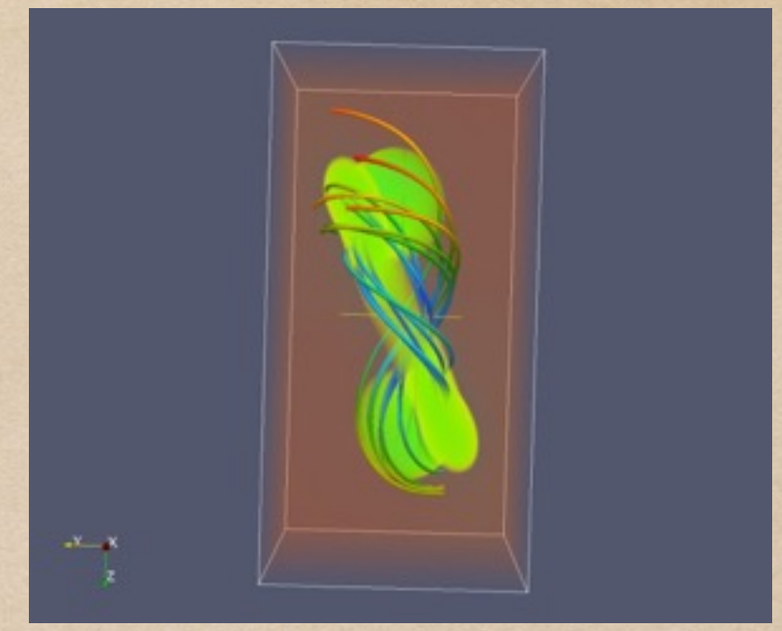
Kotrc et al (Solar Physics, 2013)

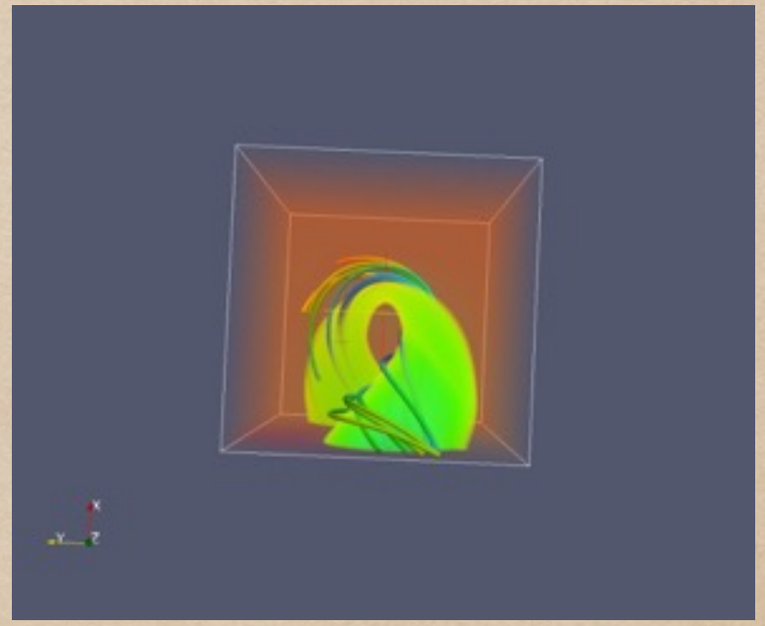


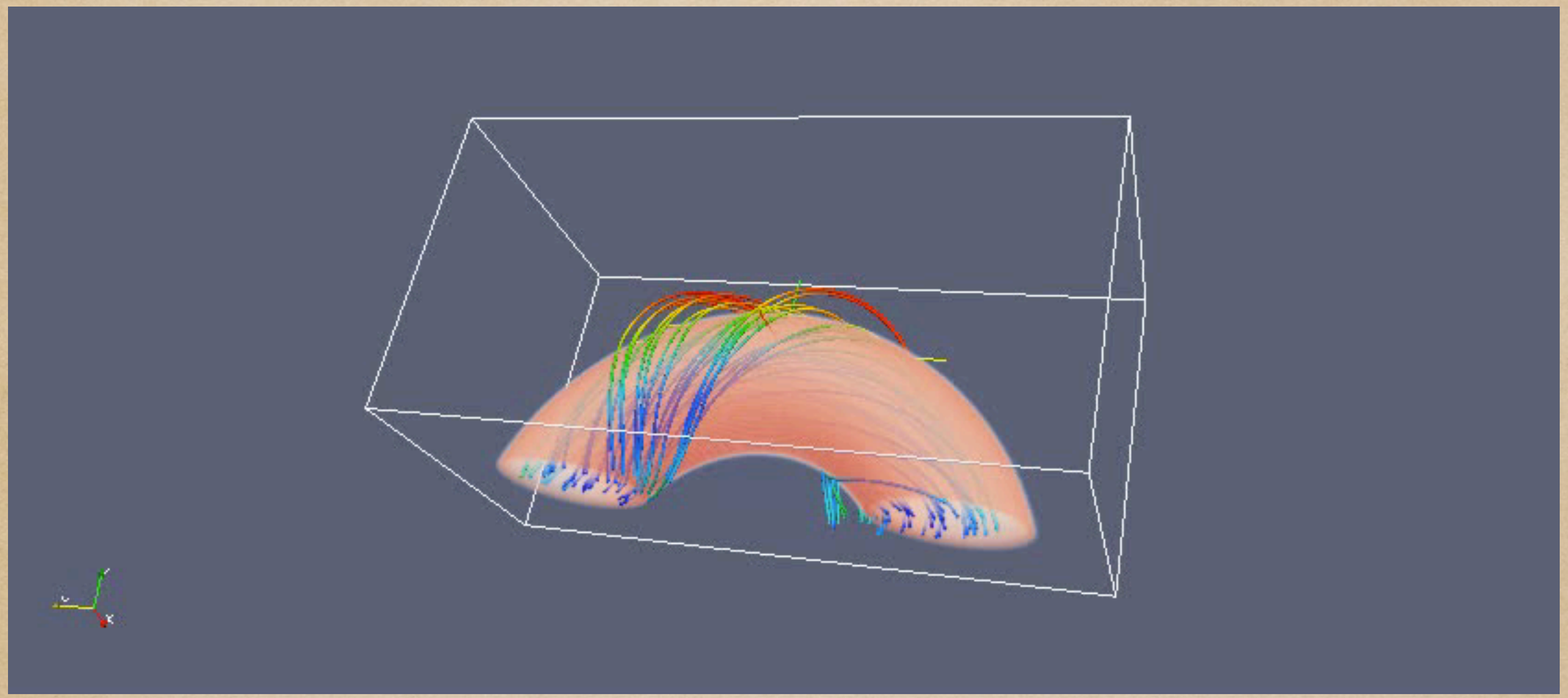


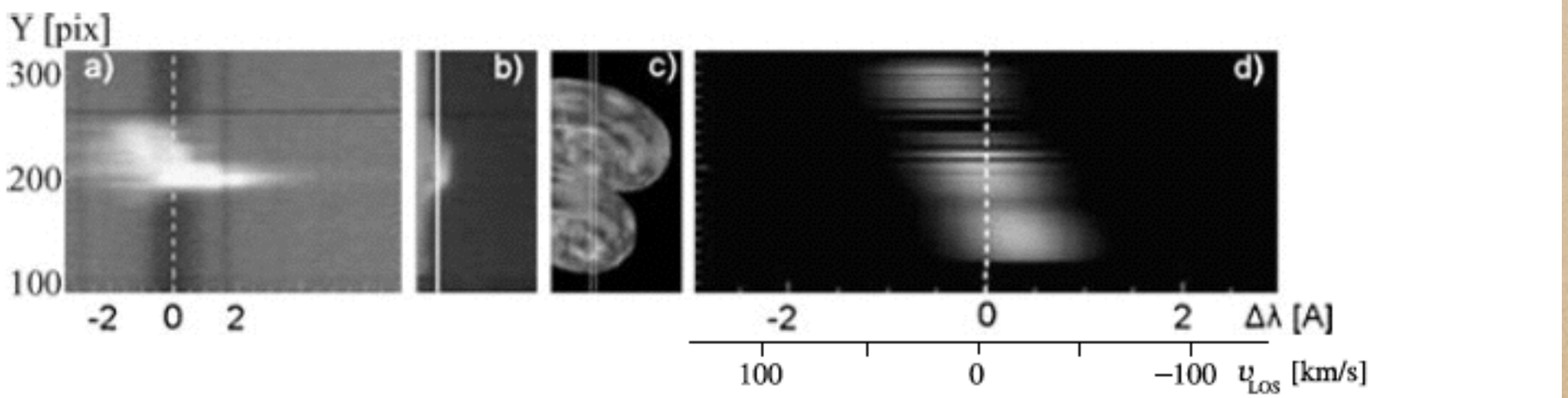








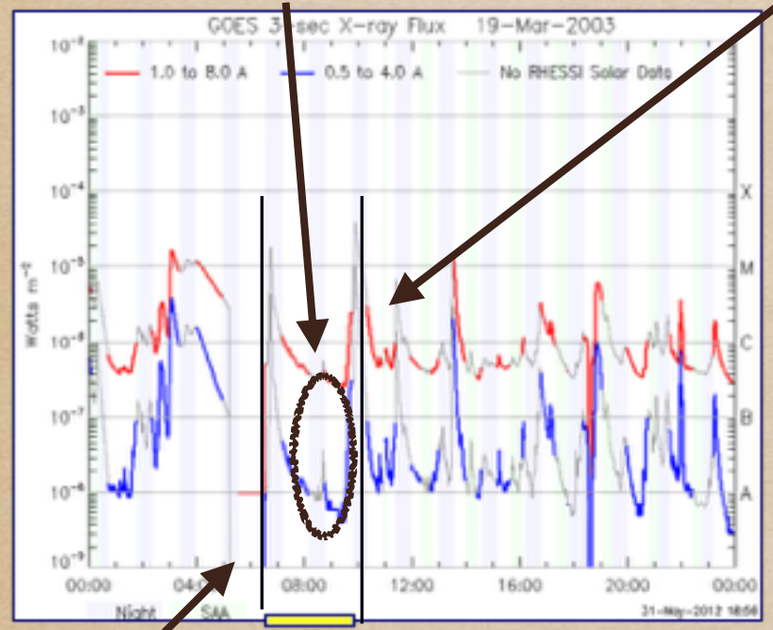



Y [pix]
300
200
100
a)
b)
c)
d)
-2
0
2
-2
0
2
Δλ [A]
100
0
−100
υLos [km/s]

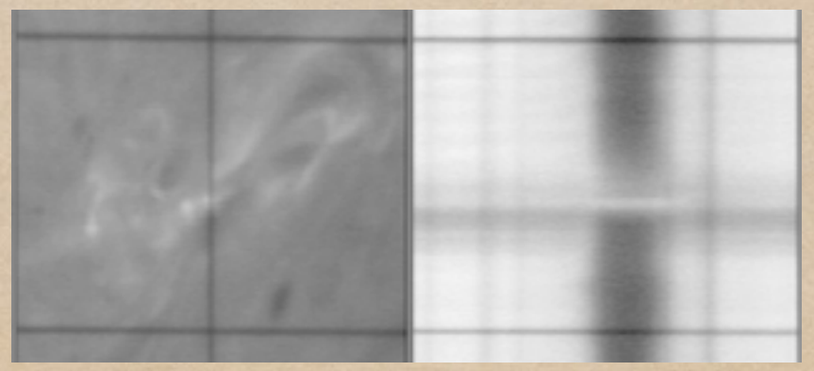
Pre-flare event 19 March 2003

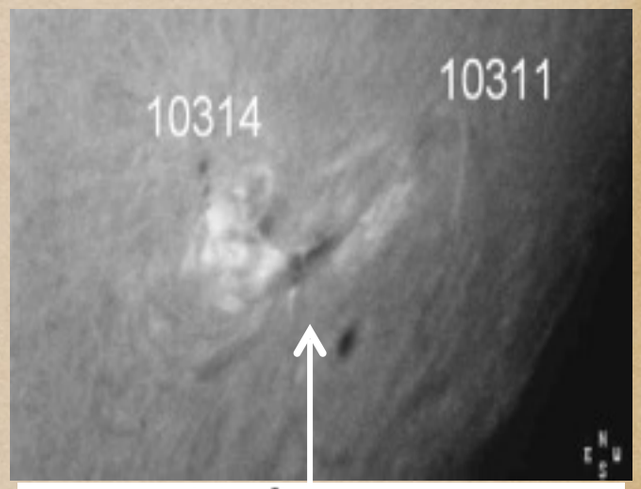
Sol19-Mar-2003T06:36

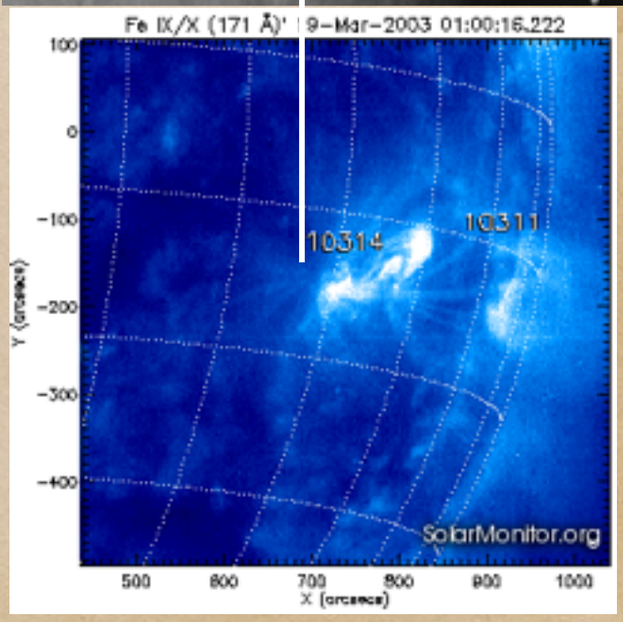
Sol19-Mar-2003T09:41

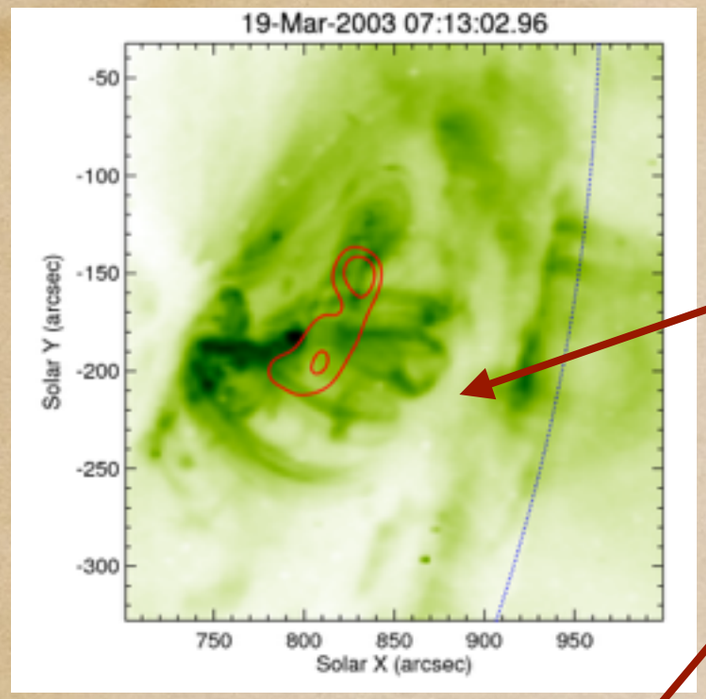


Sol19-Mar-2003T05:51



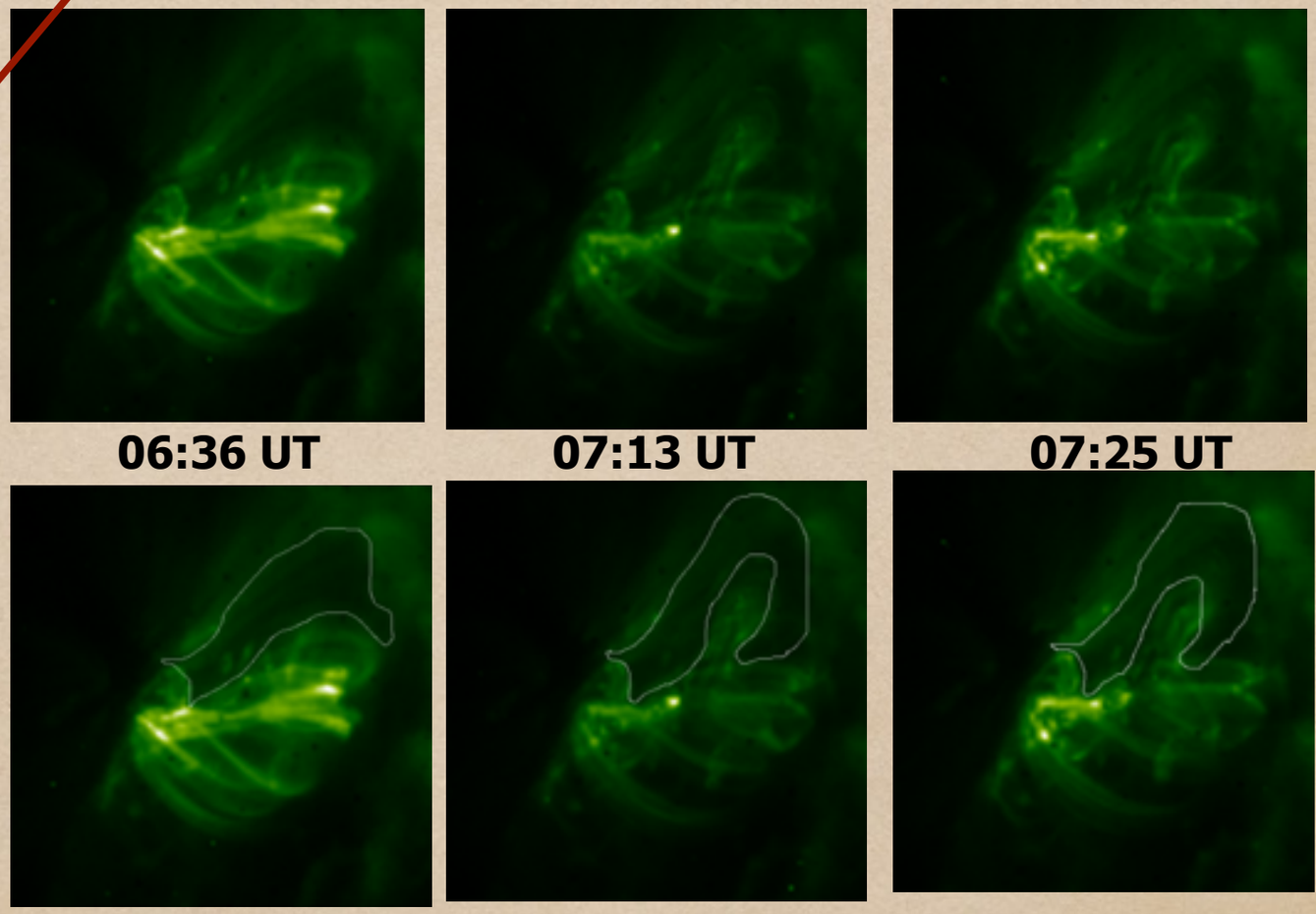


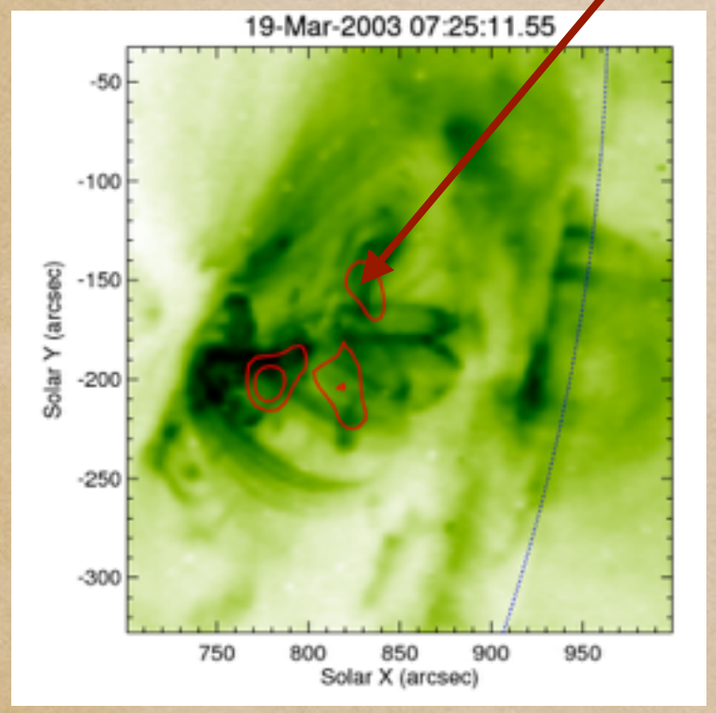




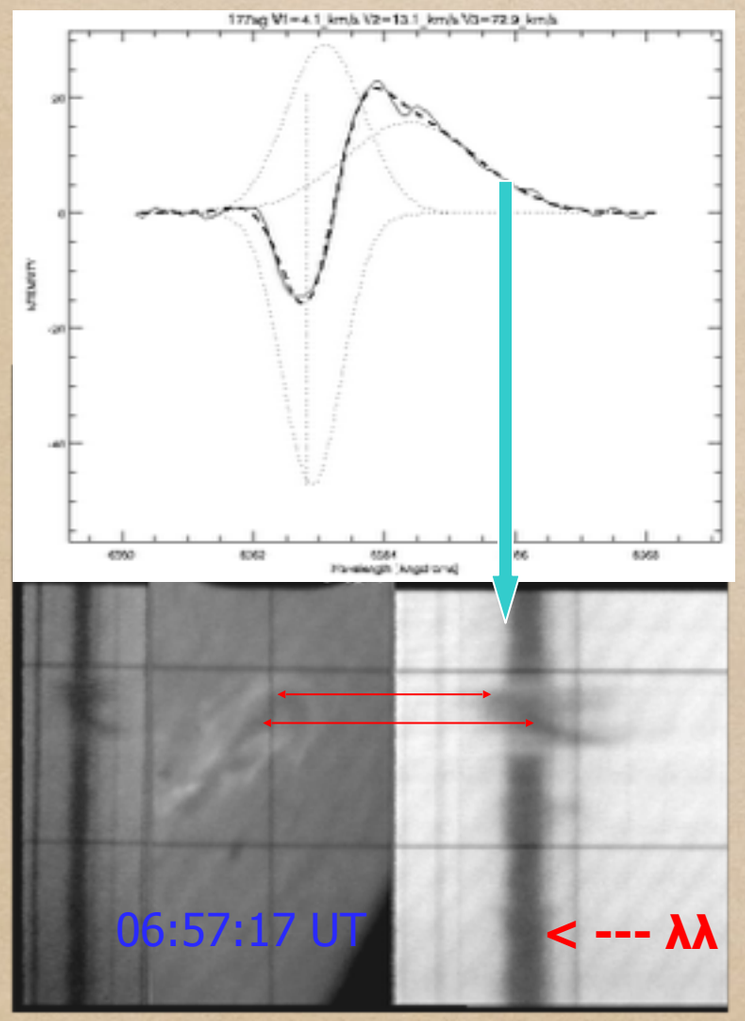
6-12 keV

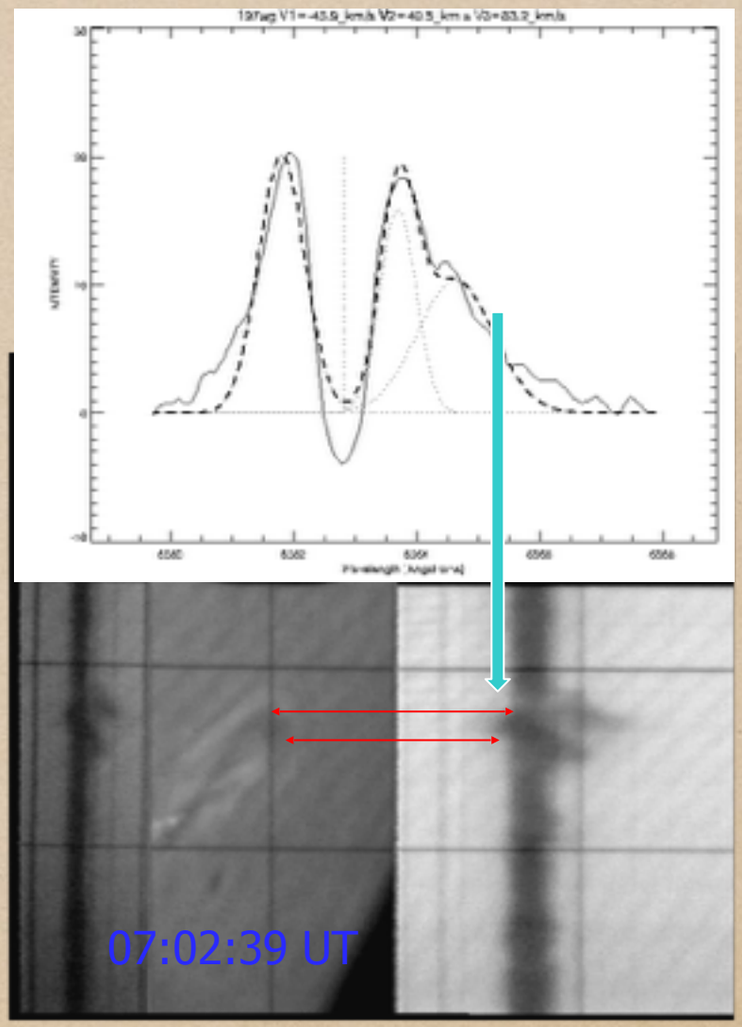
Te≈10 MK



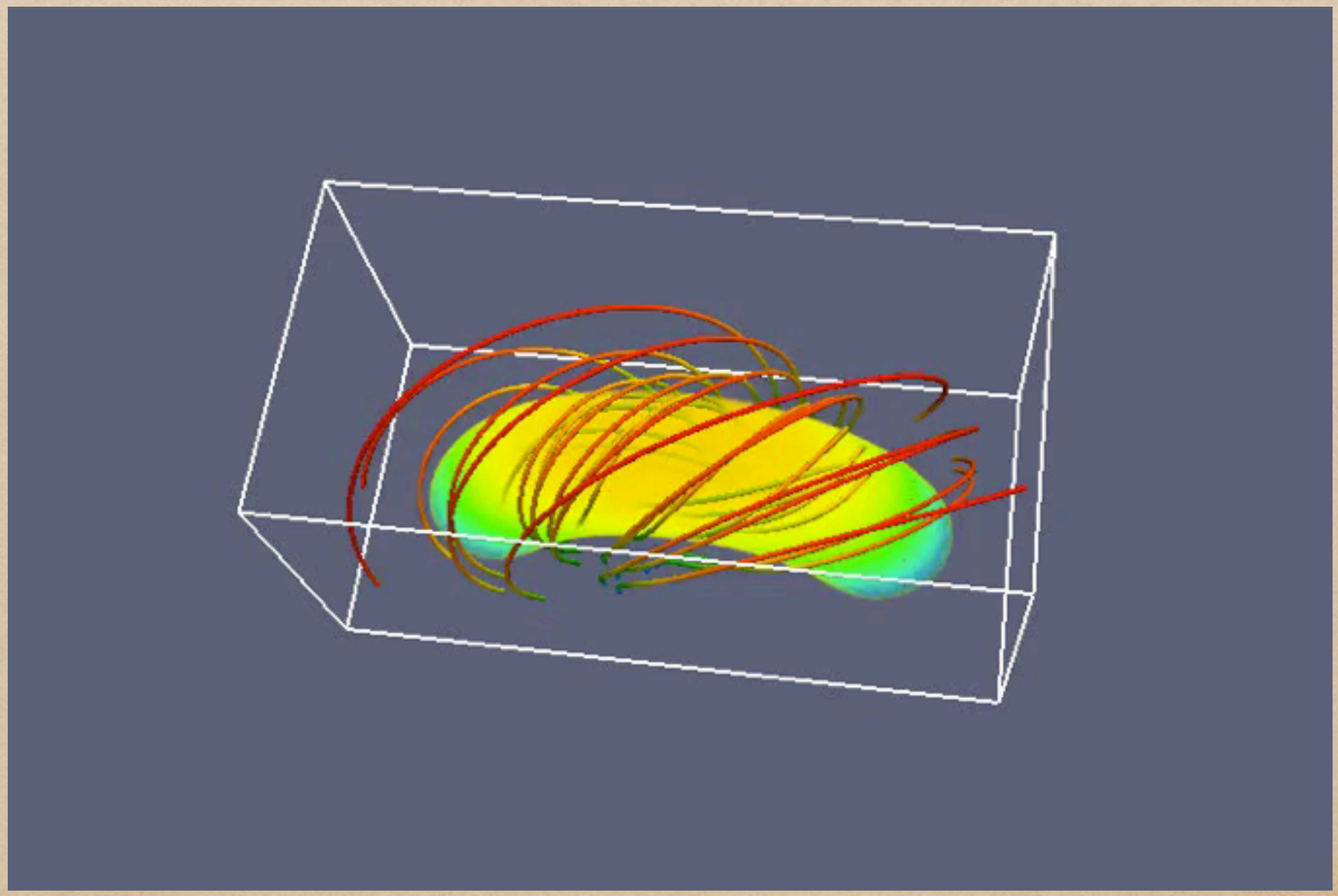


The filament started to rise in its center and to fall down on the edges.
Hα and Hβ spectra look similar, line profiles give the Doppler component velocities
Rise maximum -46 km/s, fall maximum 83 km/s. Both parts then evolved separately.

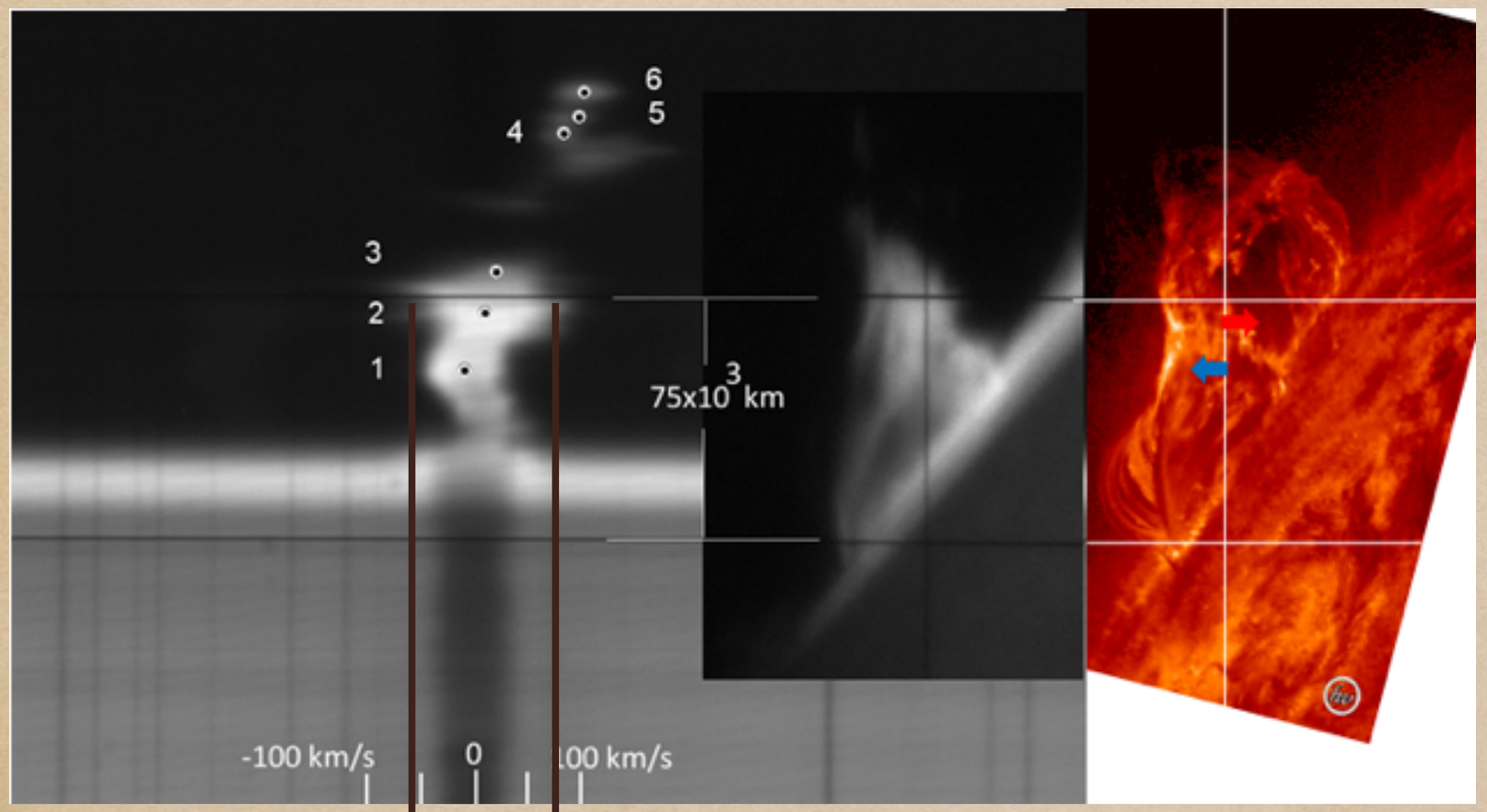




Simulations

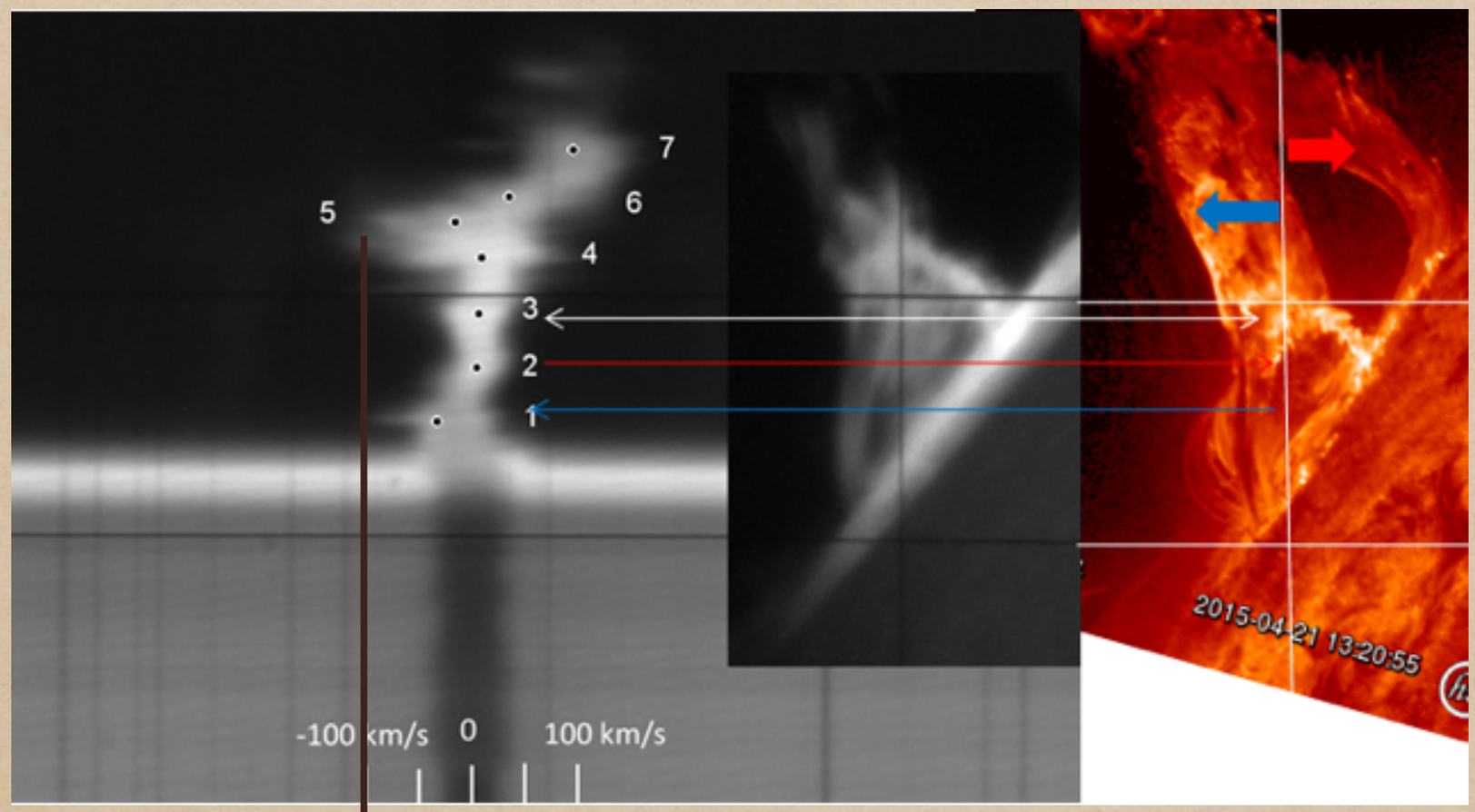


2015-APR-21 13:14:32 UT

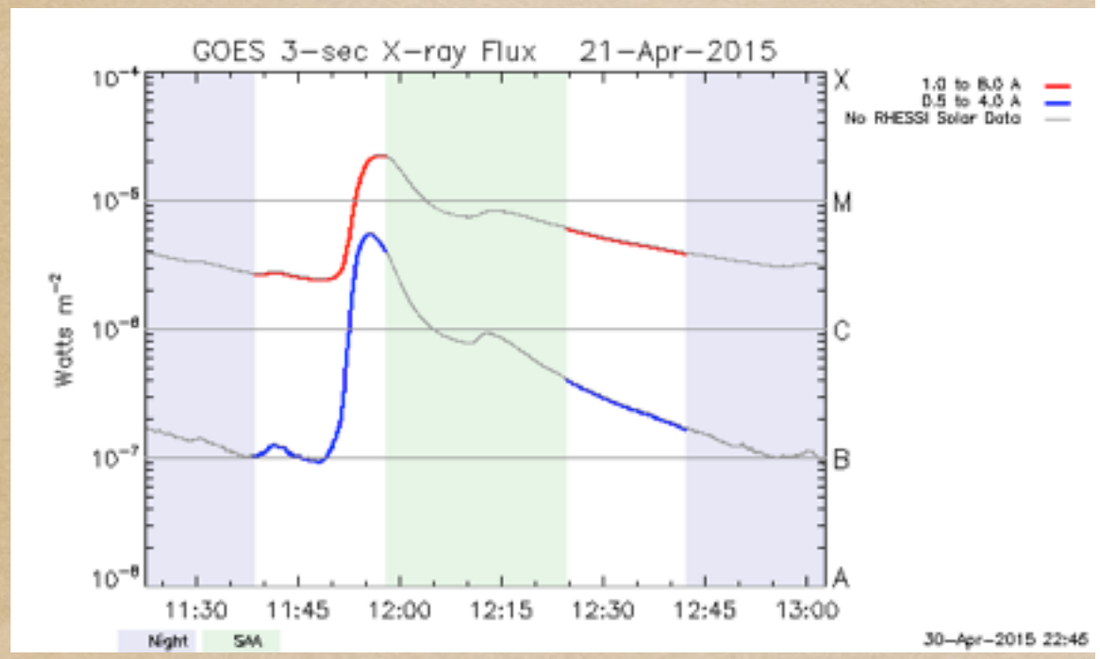


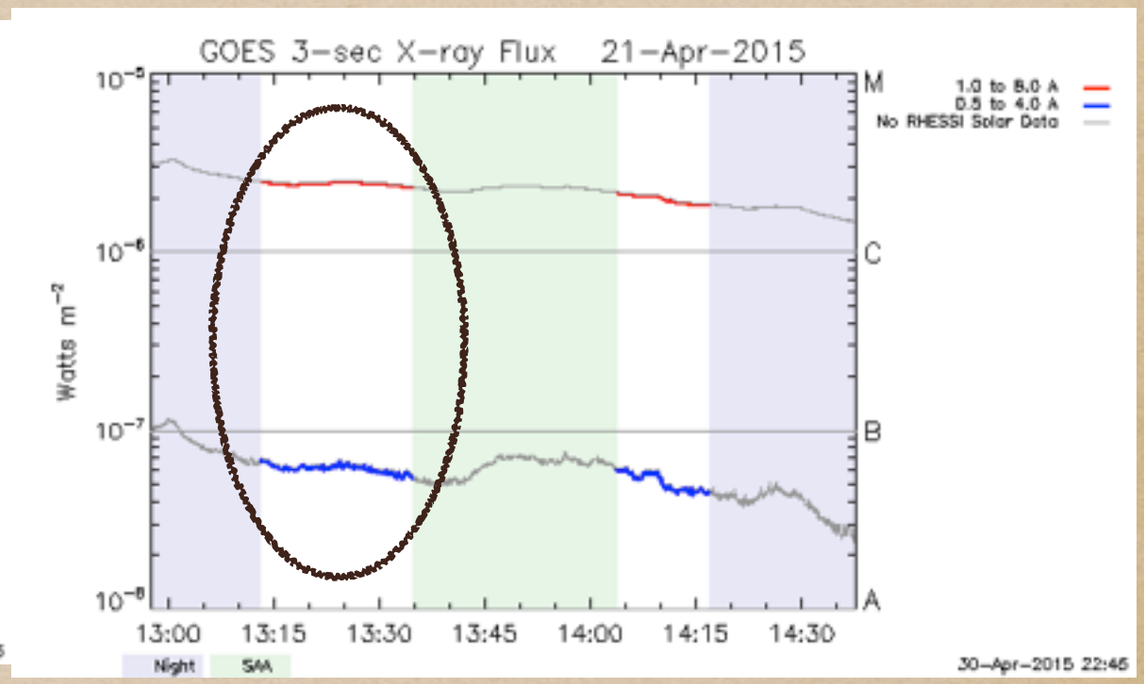
about 50-70 km/s

2015-APR-21 - 13:21:11 UT

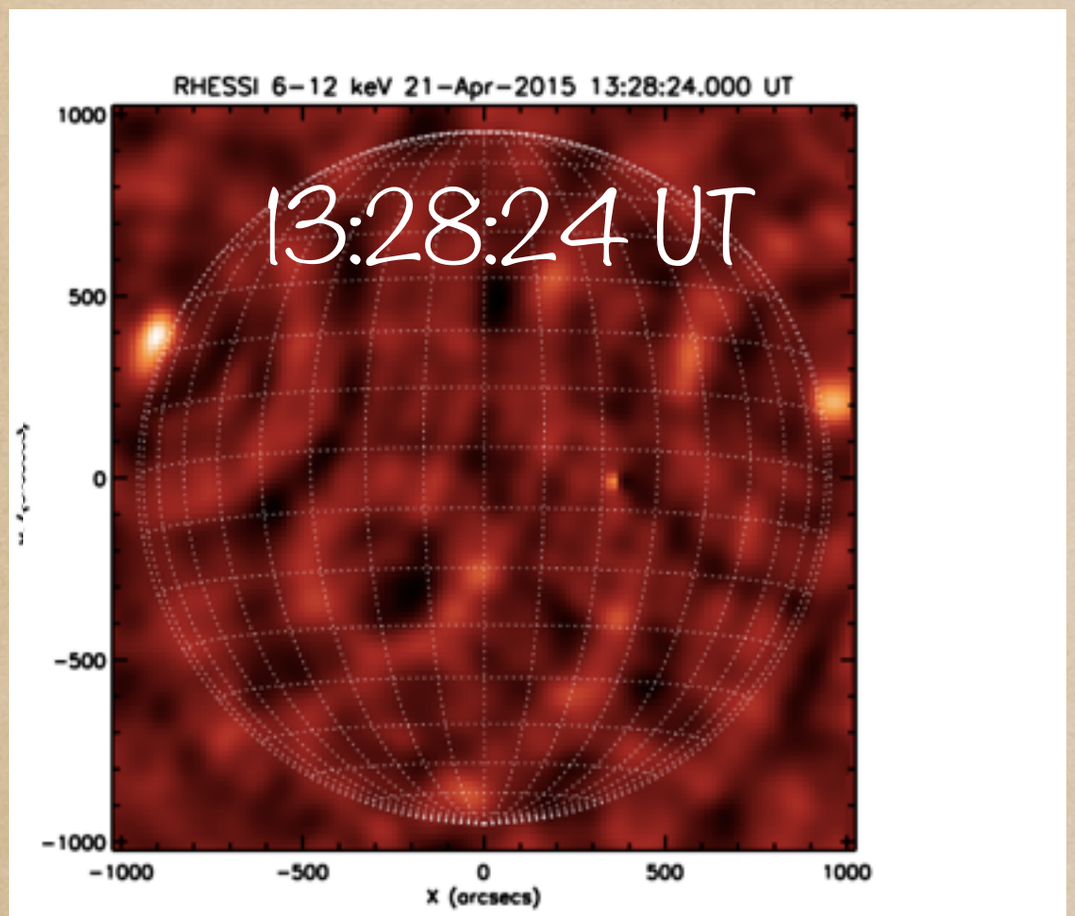


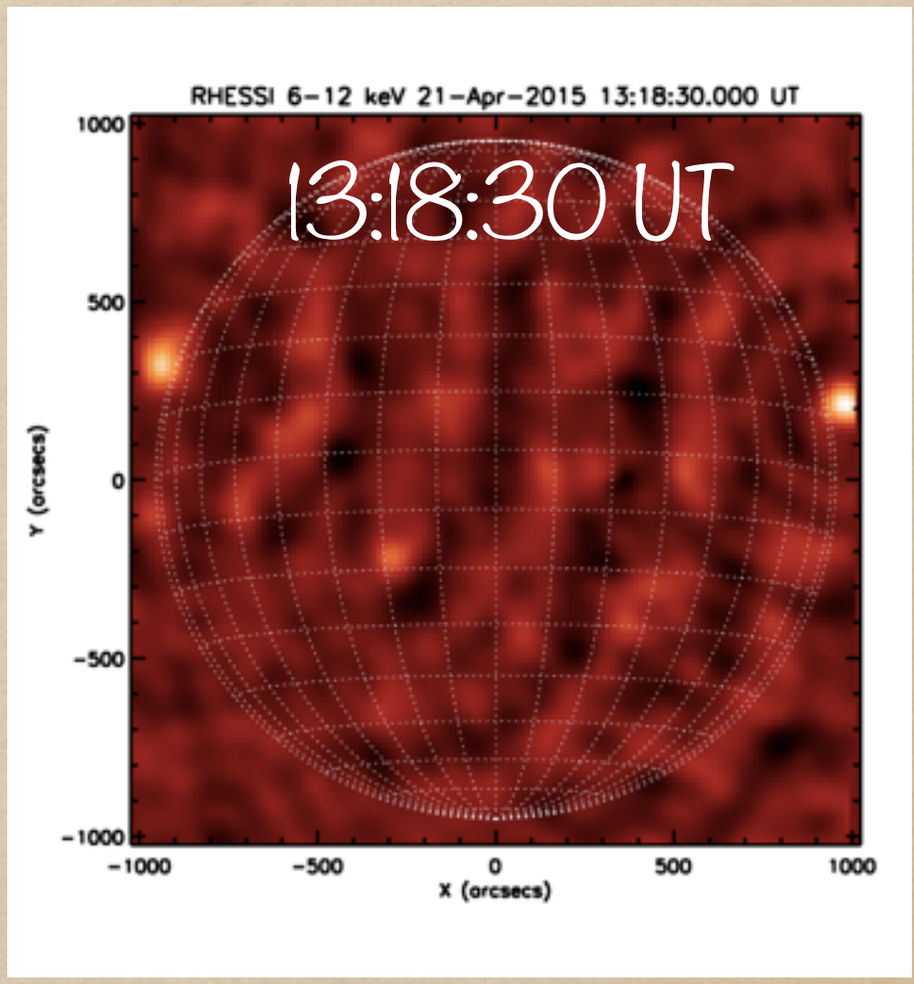
X-ray emission evolution





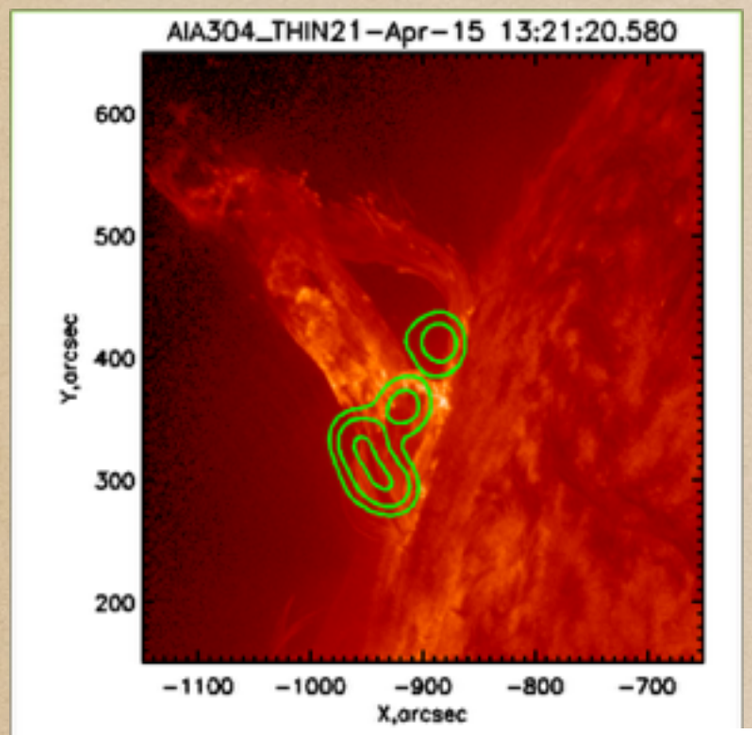
X-ray emission evolution

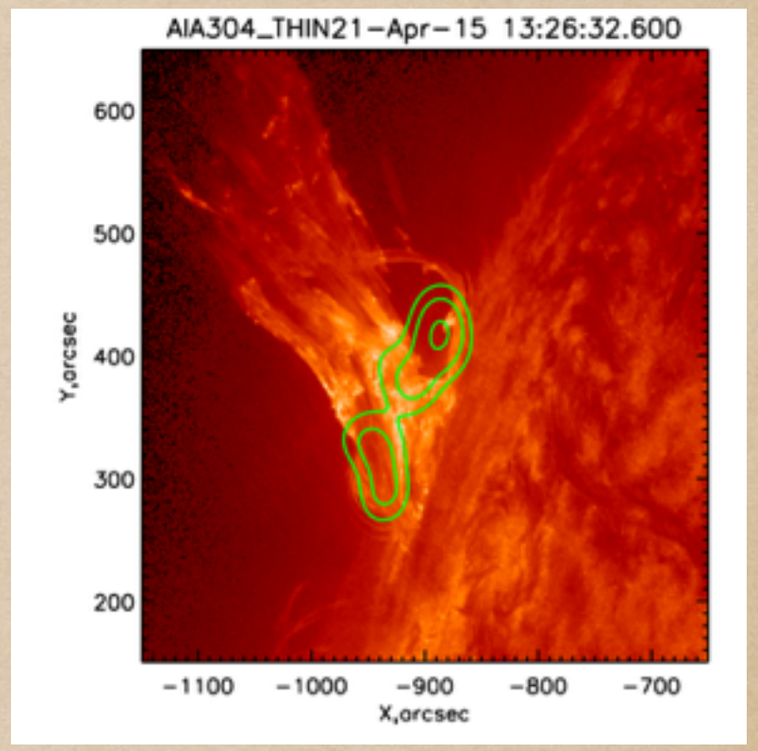


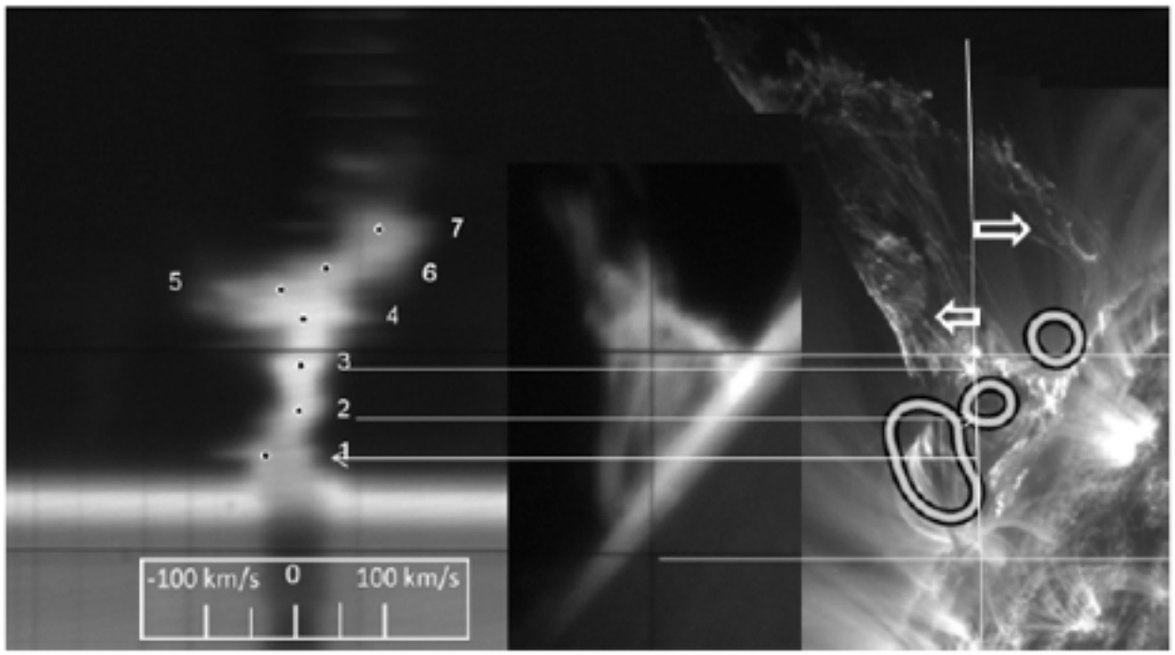


SXR via EUV (304Å)

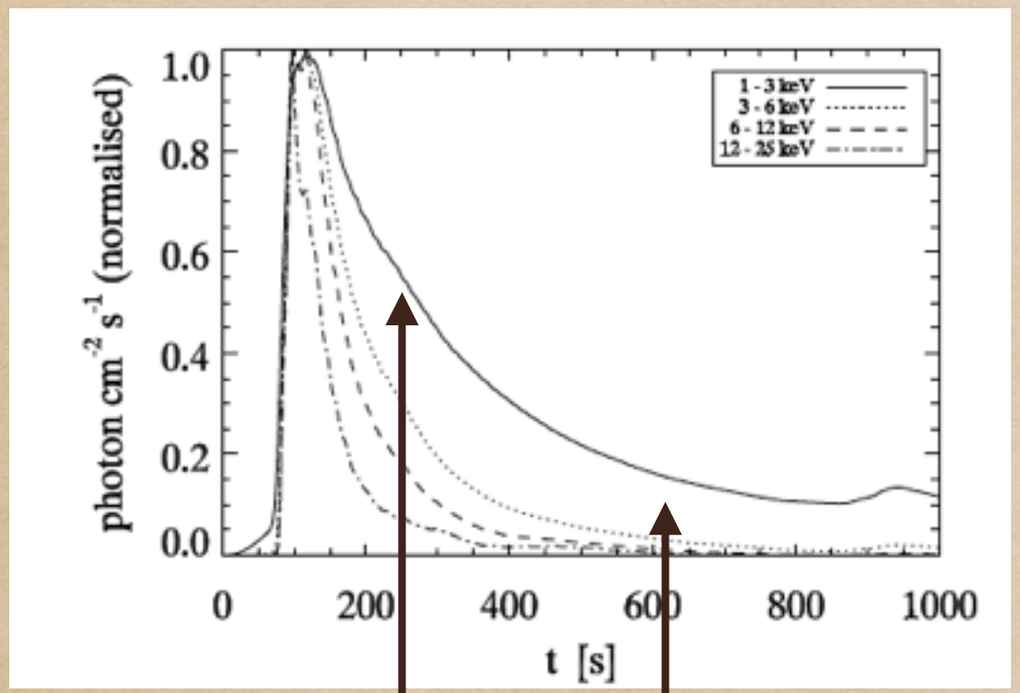
Te≈11 MK







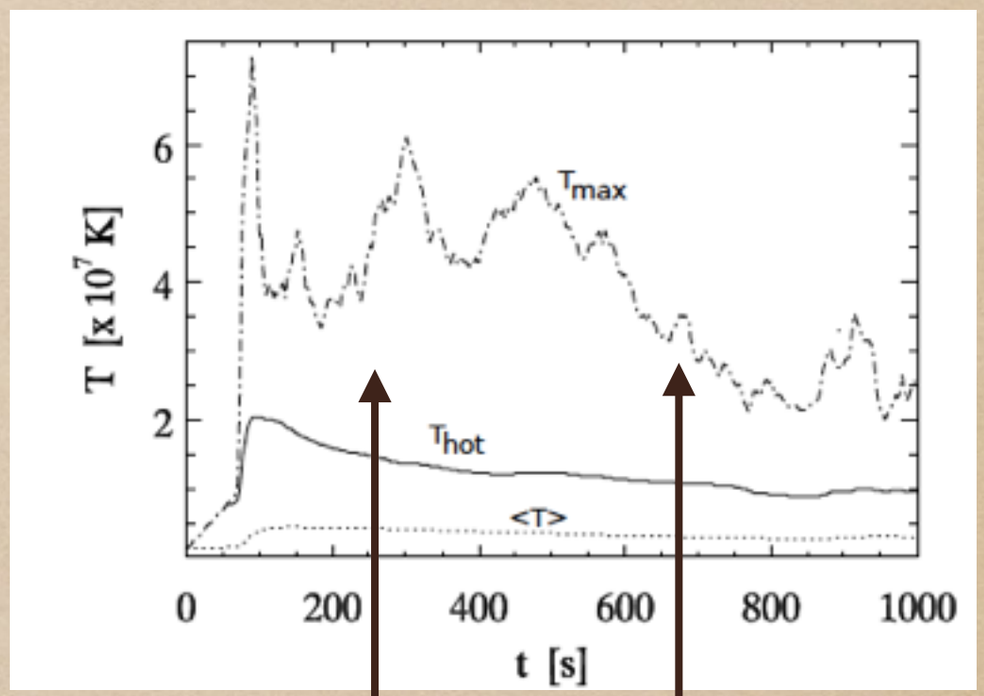
Soft X-ray emission in kink-unstable coronal loops (Pinto et al, A&A 2015)



21-Apr-15

19-Mar-03

T_{hot} -> Te>9 MK

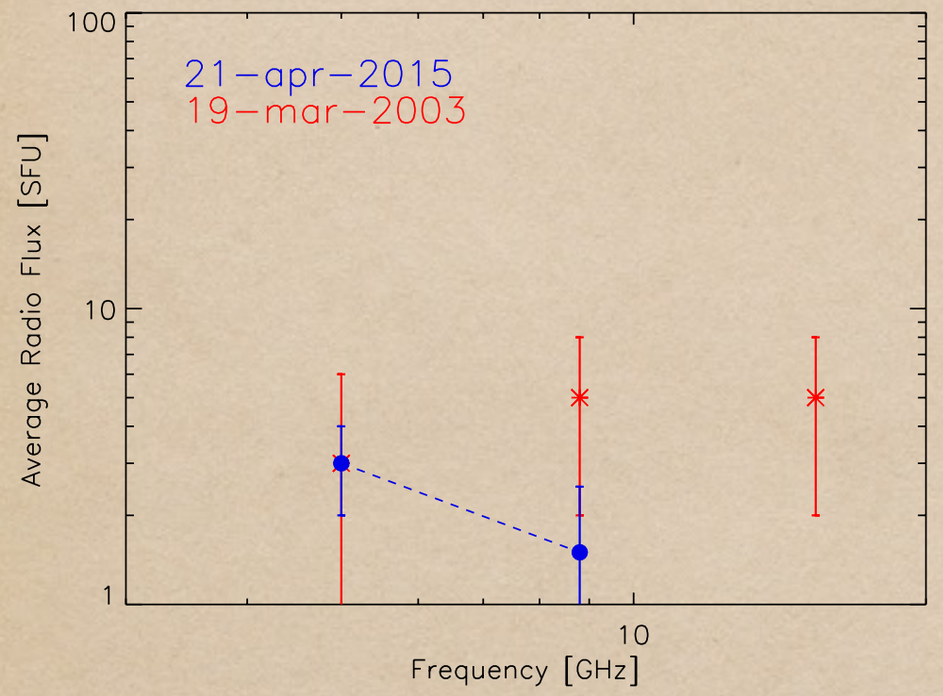


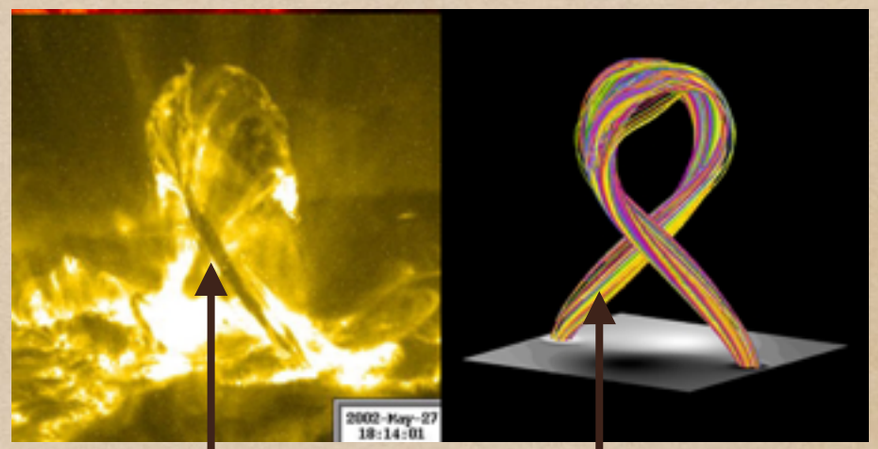
21-Apr-15

19-Mar-03

What about magnetic field?

Raw estimation of the high level of MW spectra



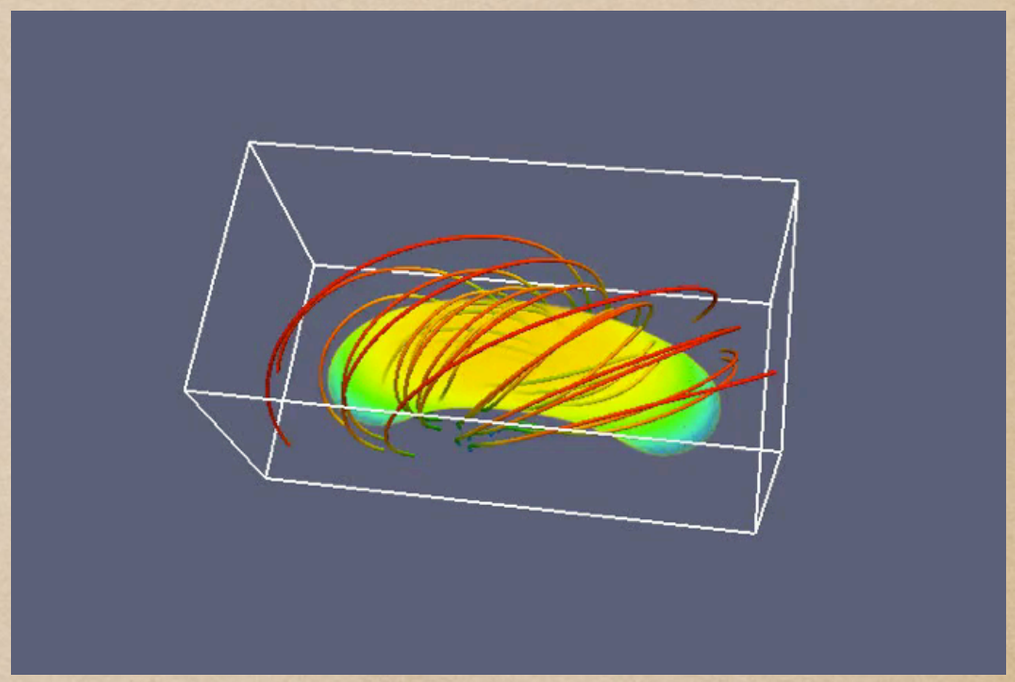


~10 G (??)

Summary

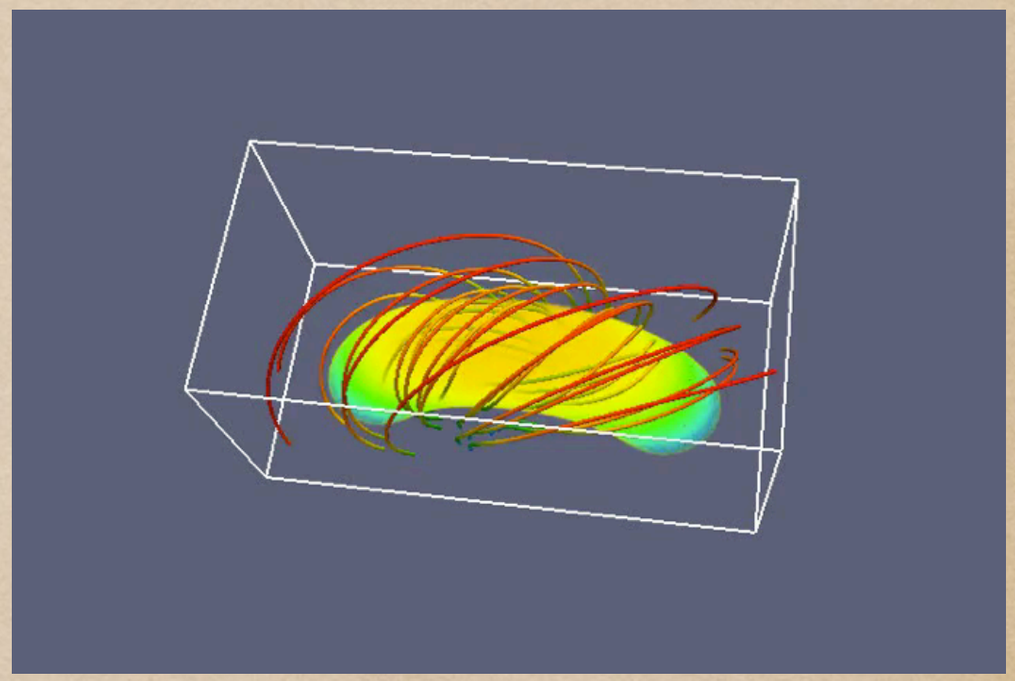
- The timing and observed characteristics (e.g. LOS velocities) of the both events correspond well to predictions of the model based on the twisting of the ropes and the kink instability.

- There are two phases corresponding to two values of LOS velocities - about 50km/sec and about 100 km/sec.



Summary

- However interaction of the newly erupting filament with an exiting arcade of post-flare loops via break-through reconnection likely led to the strong heating which is demonstrated by strong emission seen in EUV data and the collocated SXR sources.



Future plans

- Simulation with using observed parameters (LOS velocities, magnetic field)
- New multi frequency observation in MW