Energy release processes during the 17 May 2013 M3.2 solar flare

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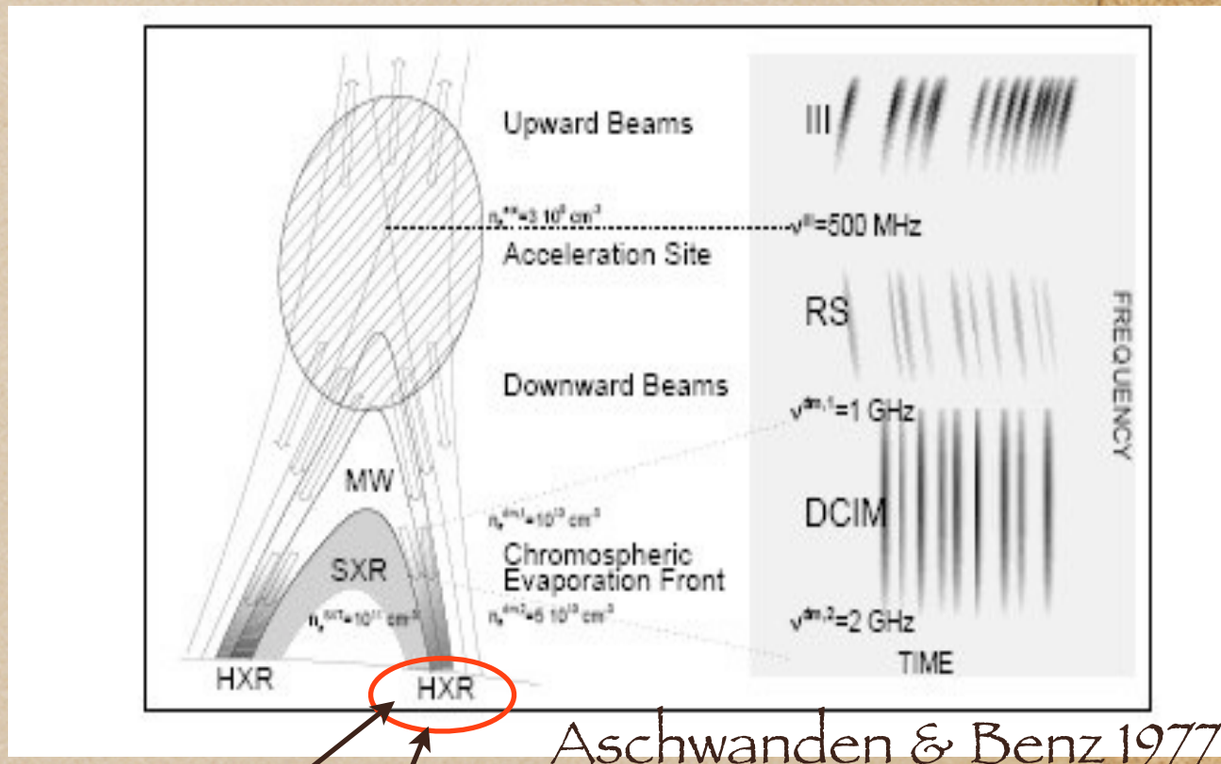
Motivations

- Flares with several peaks observed in HXR and MW temporal profiles What is it? Series of reconnection or development of single energy input process modulated by some osculations?

Why to use H-α data?



Aschwanden & Benz 1977

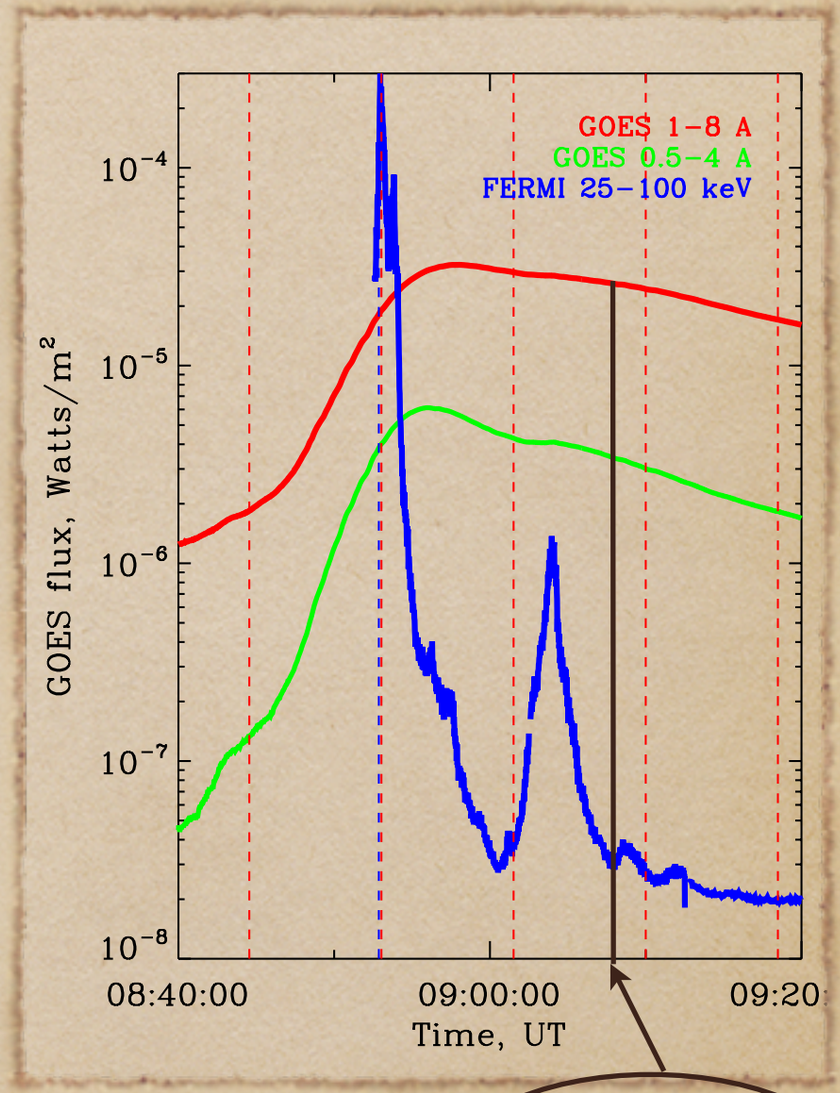
UV continuum

H-α emission

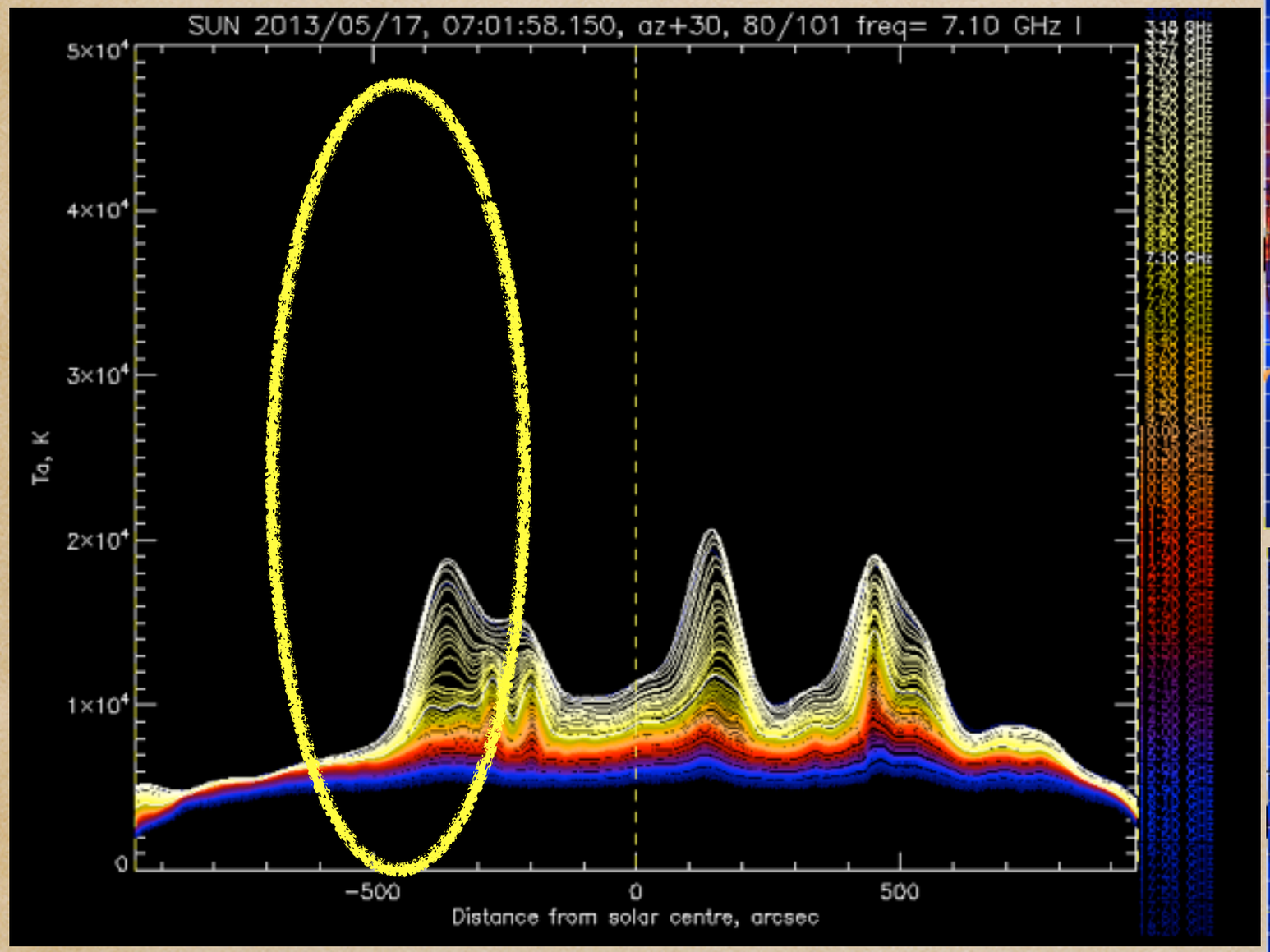
Event -M3.2 flare

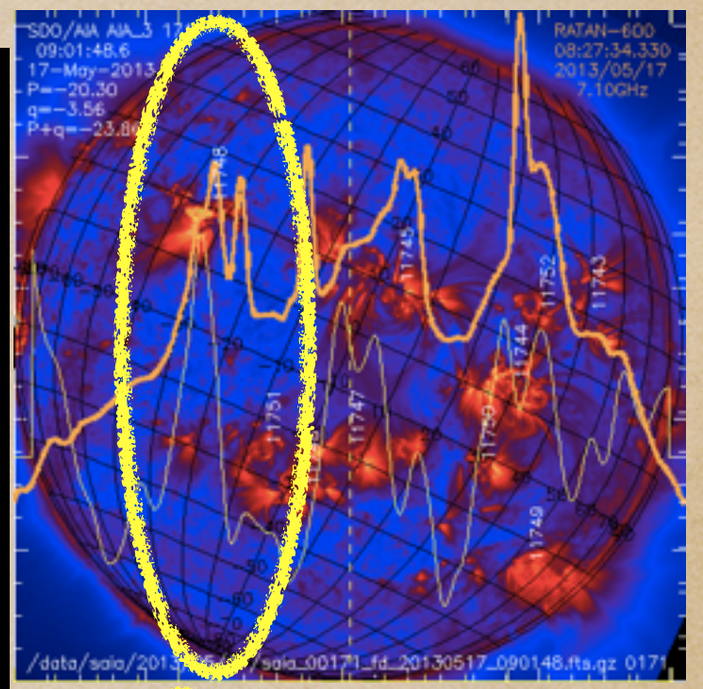
SOL2013-05-17T08:43

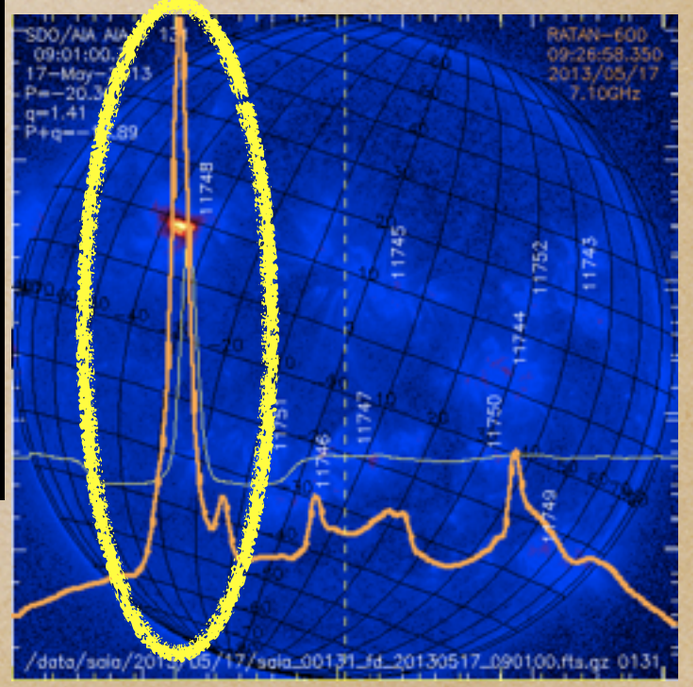
- HSFA-2 (Ondřejov) : H_α line
- RATAN-600 : MW data
- The Siberian Solar Radio Spectropolarimeters (2-24 GHz & 4-8GHz) : MW spectra
- RHESSI & FERMI : X-ray data
- AIA/SDO and HMI/SDO : EUV and magnetograms



RATAN-600 data

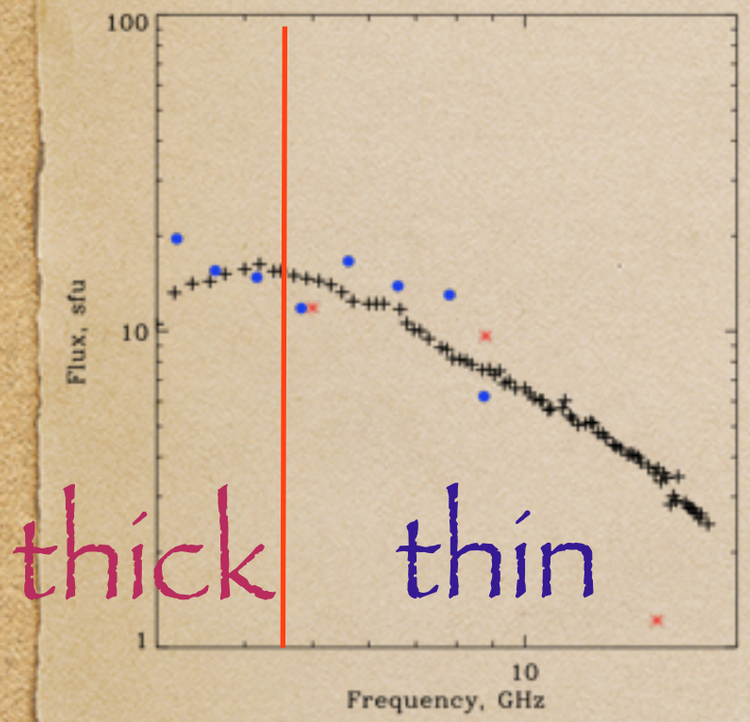






MW spectra

08:44 UT



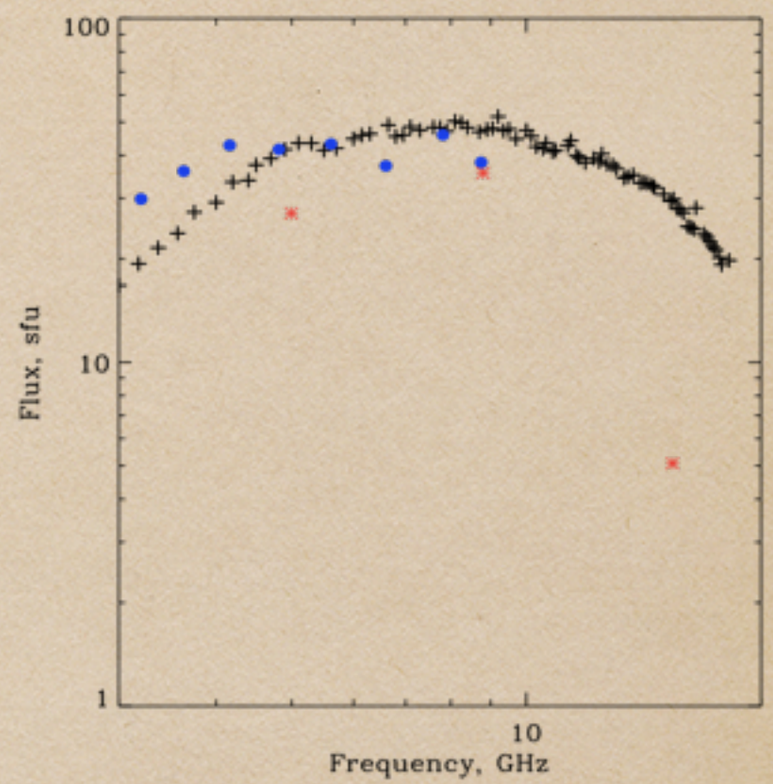
thick thin

RATAN-600

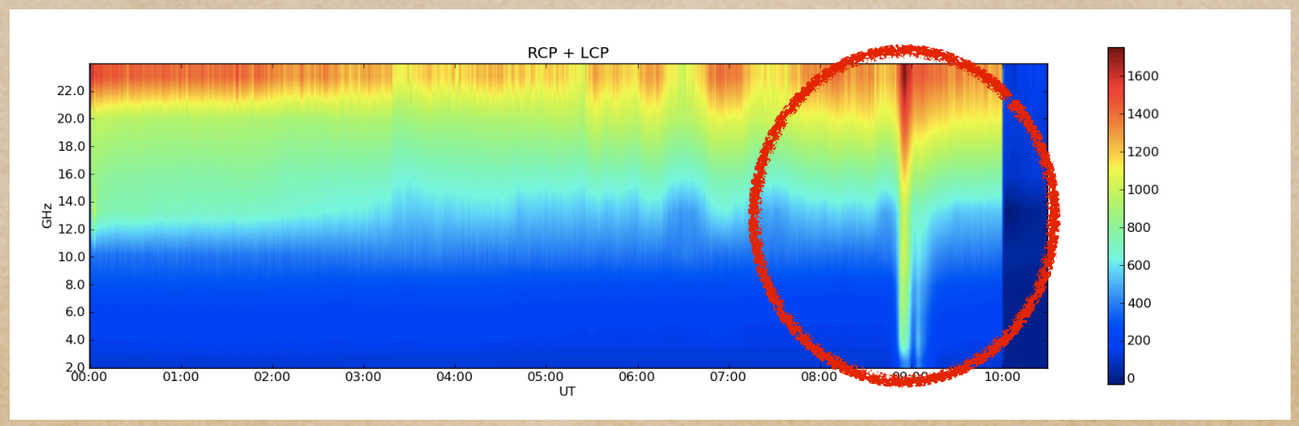
SSRS

RSTN

09:19 UT

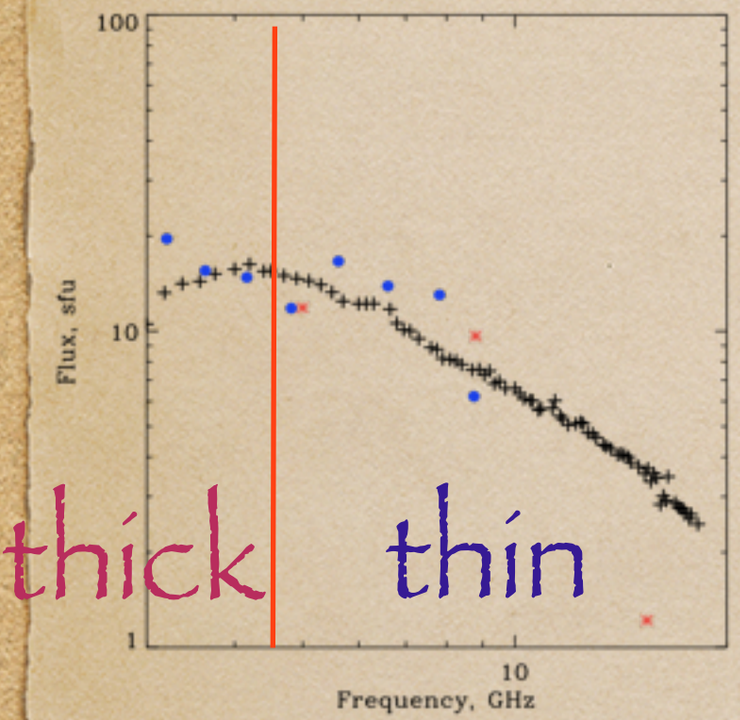


SSRS 2-24 GHz



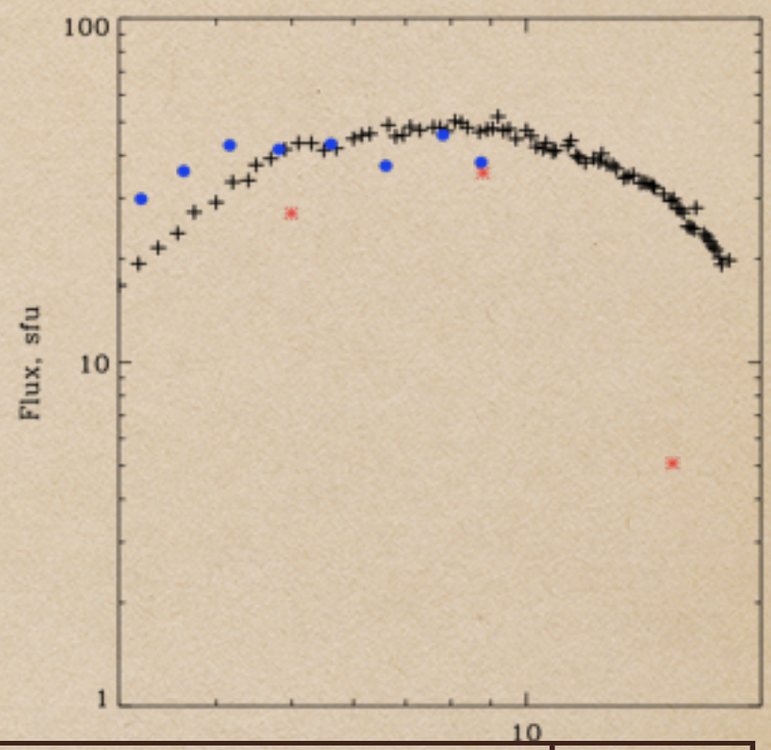
MW spectra

08:44 UT



RATAN-600
SSRS
RSTN

09:19 UT



Time, UT	Te, MK	ME, 10^{49} cm^{-3}	γ
08:53	21	0.14	3.3
09:04	21	0.09	3.0
9:08	20	0.08	4.1
09:12	19	0.07	-

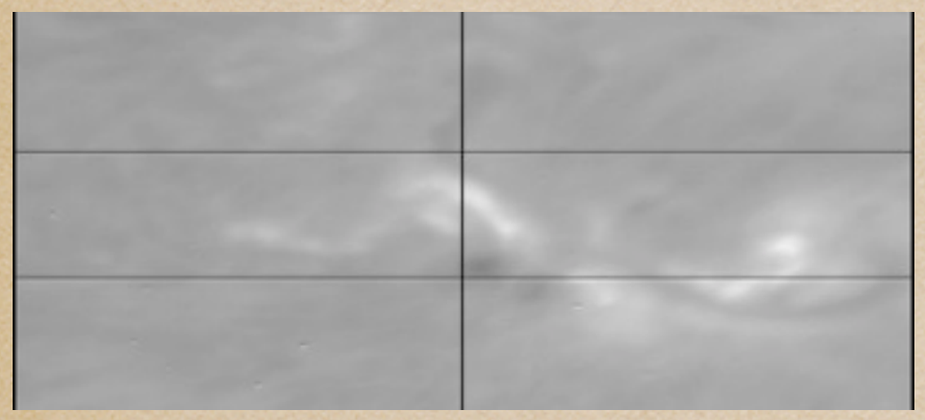
Hα -image processing method

Hα slit-jaw images (halfwidth - 0.5 A)

→ Spatial evolution

→ Hα intensity evolution

08:43:37 UT



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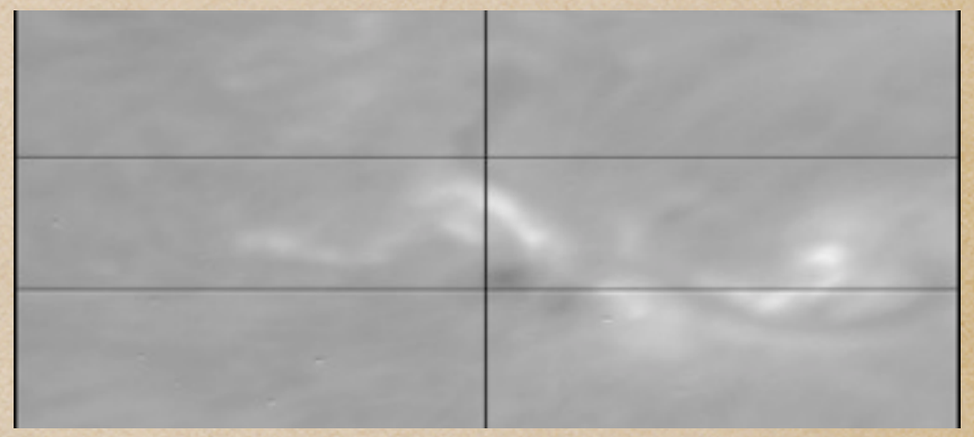
08:43:36 UT



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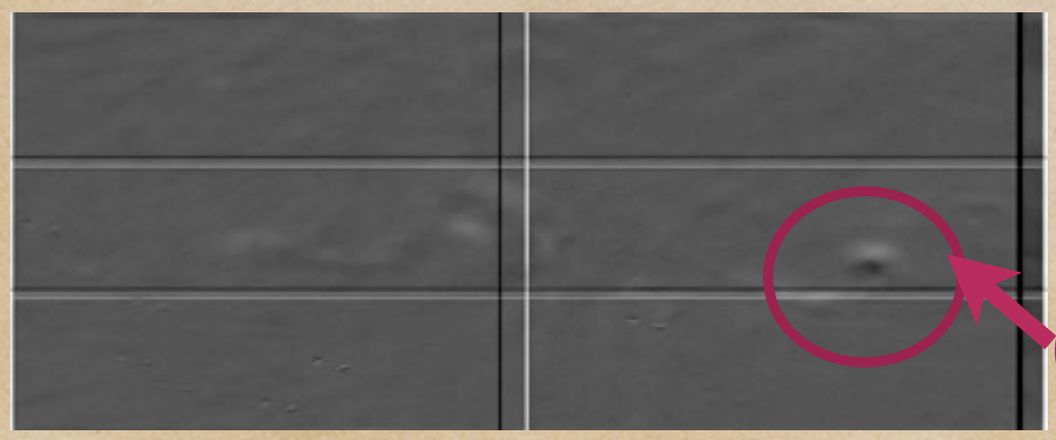
08:43:37 -08:43:36 UT



Kernel 1

The method was tested in Zharkova et al MNRAS,2011

Hα -image processing method

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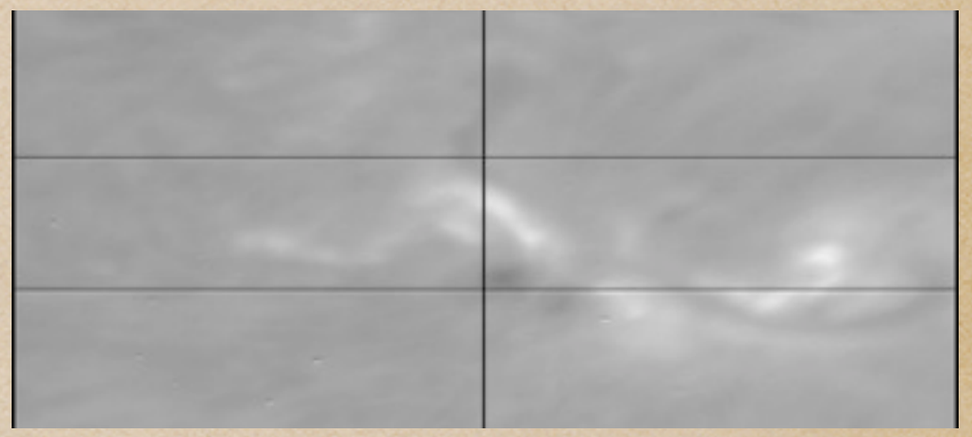
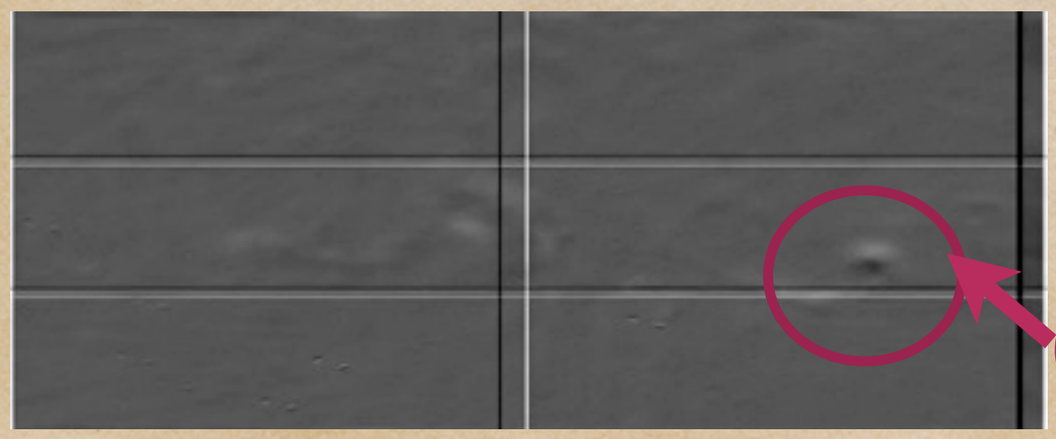
08:43:37 UT

08:43:36 UT



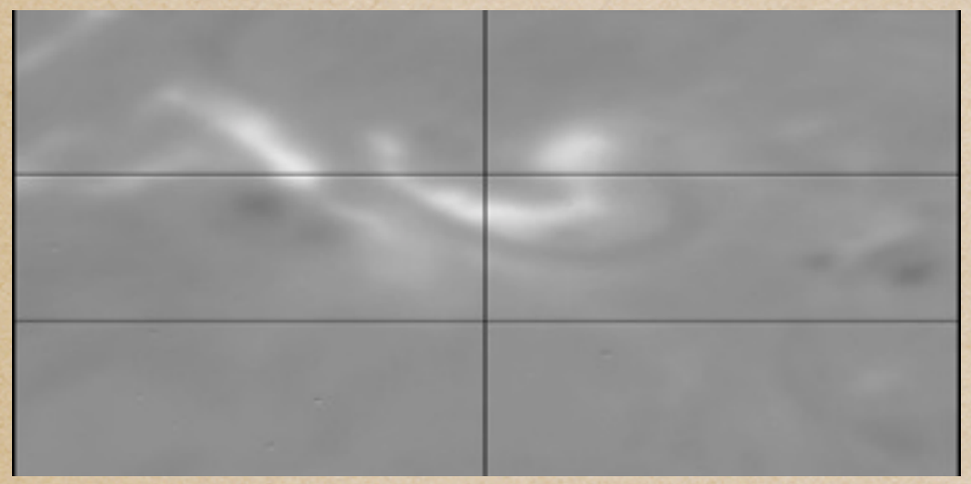
08:43:37 -08:43:36 UT



The method was tested in Zharkova et al MNRAS,2011

Temporal evolution of Hα emission

08:47:58 UT



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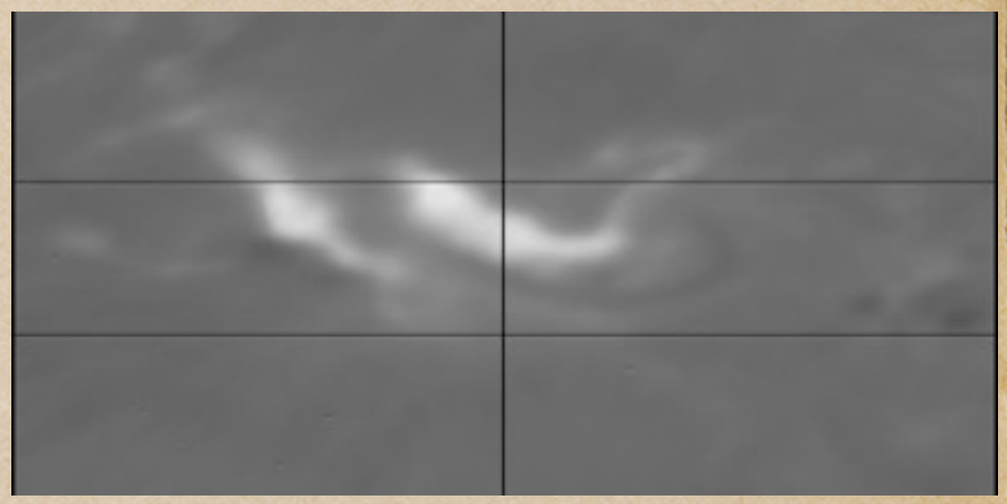
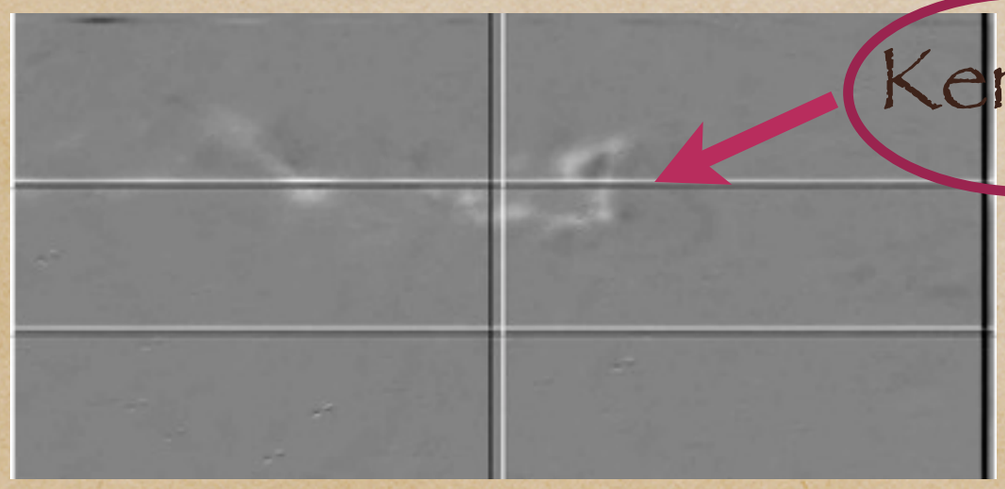
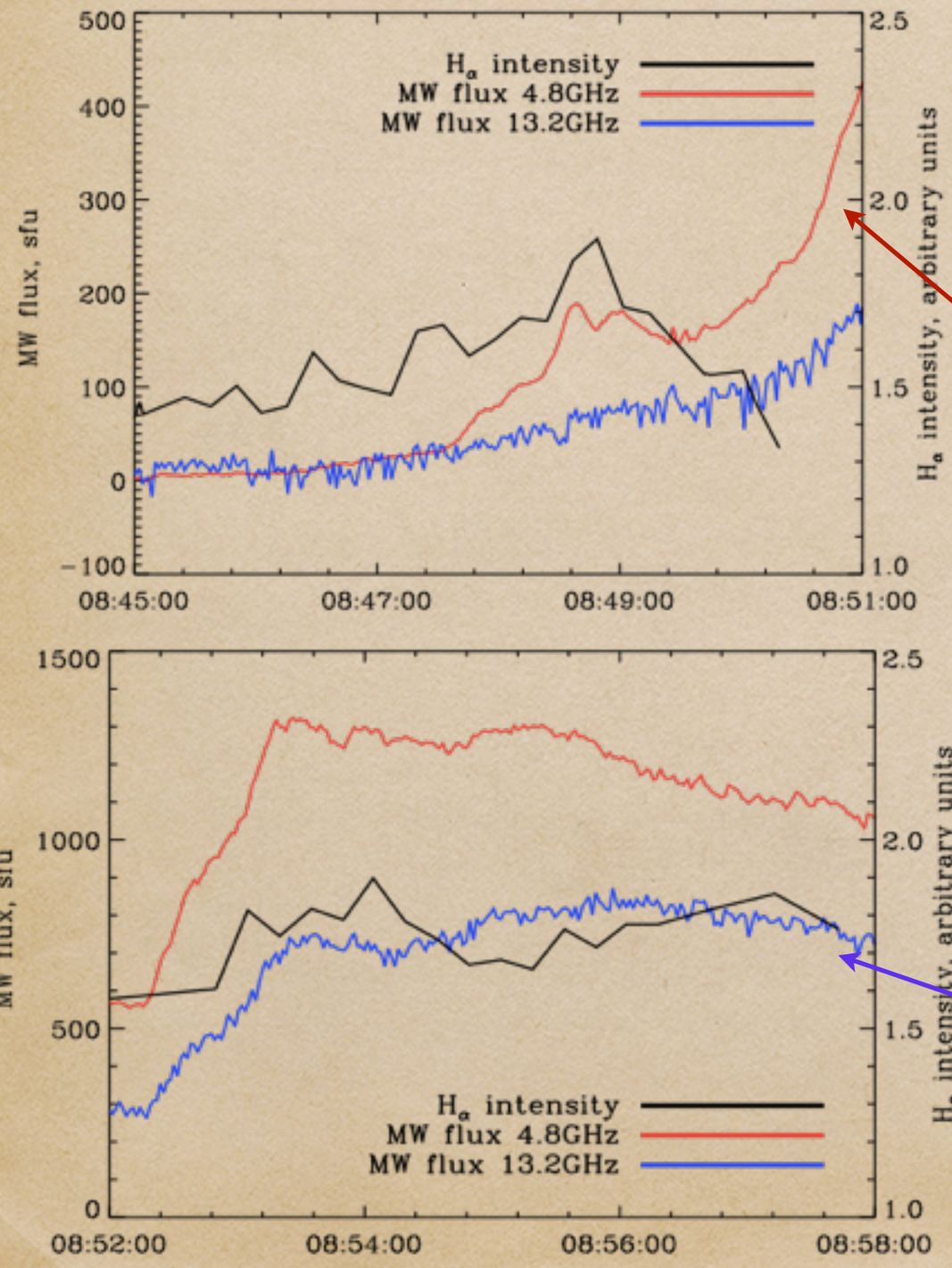
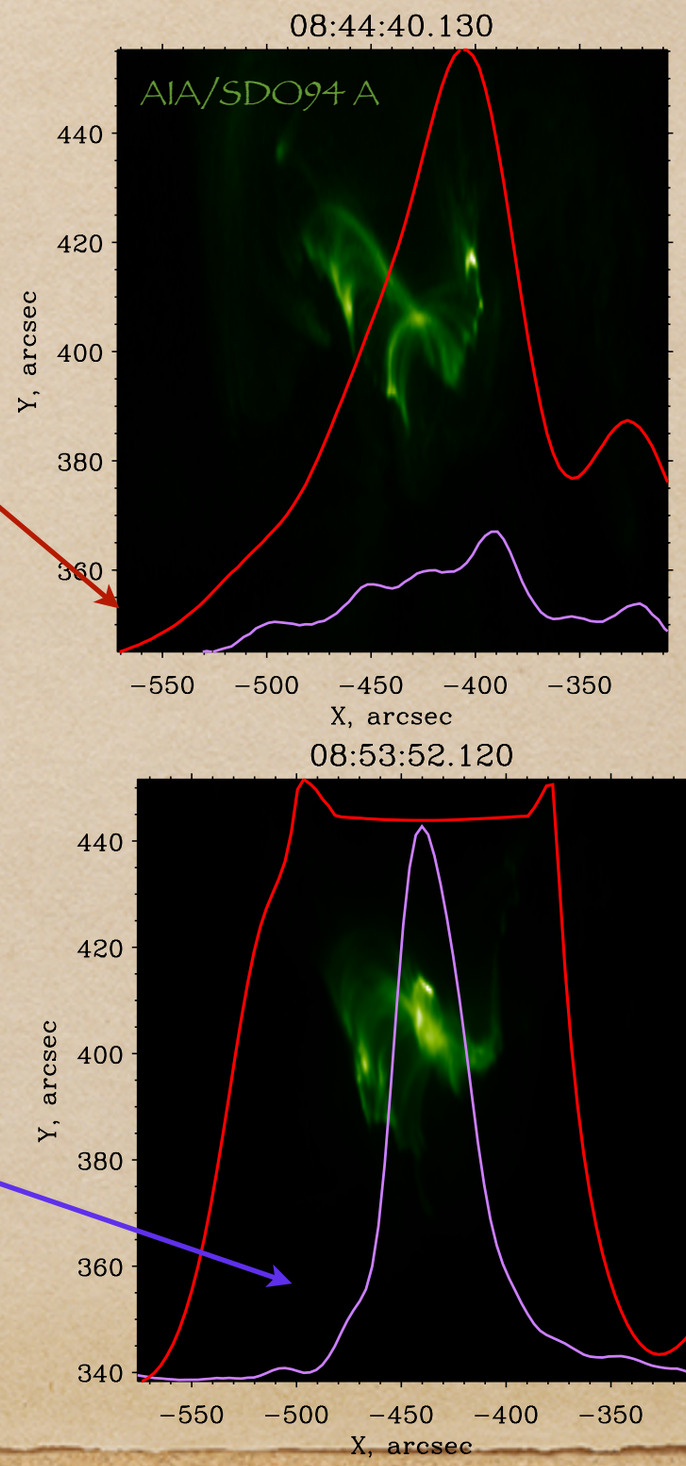


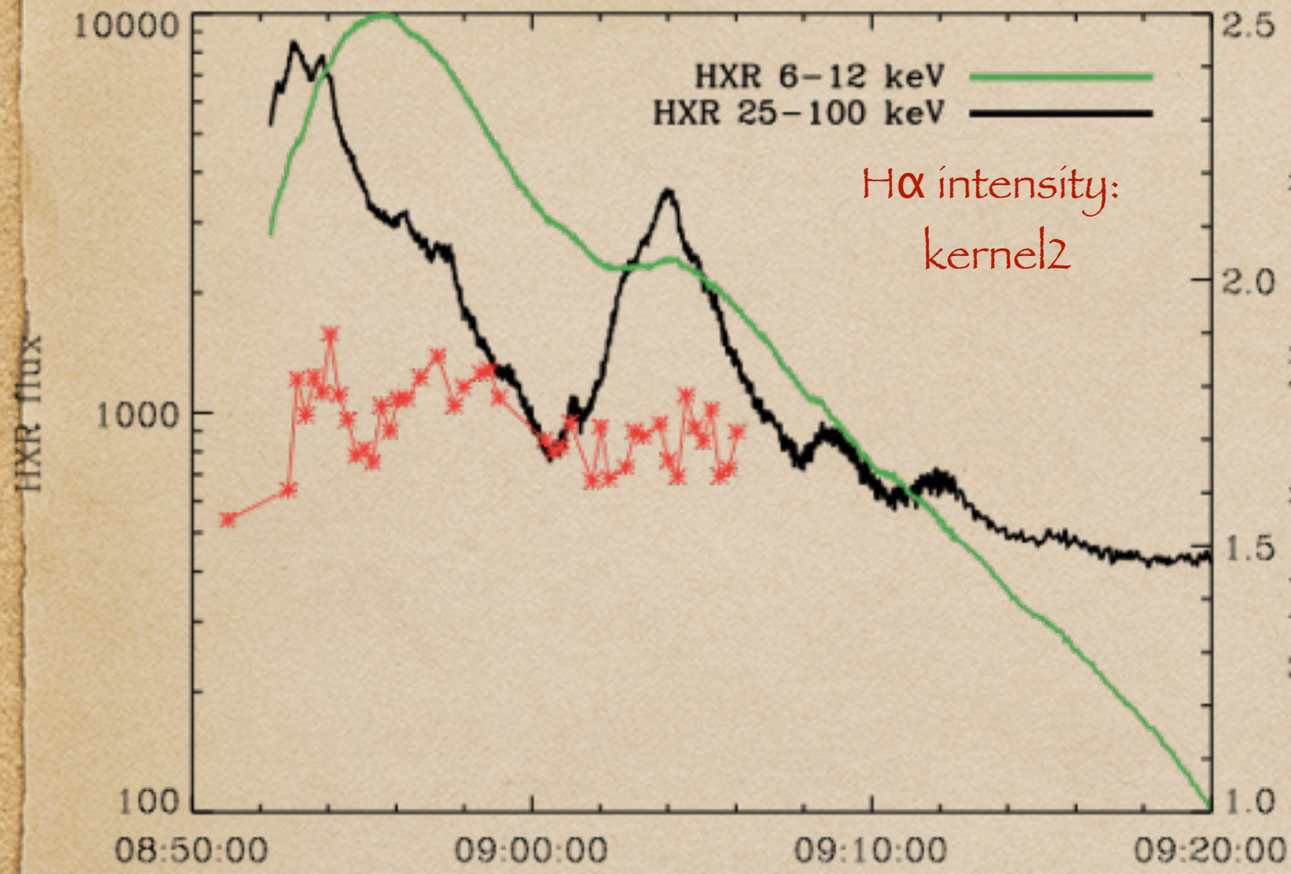


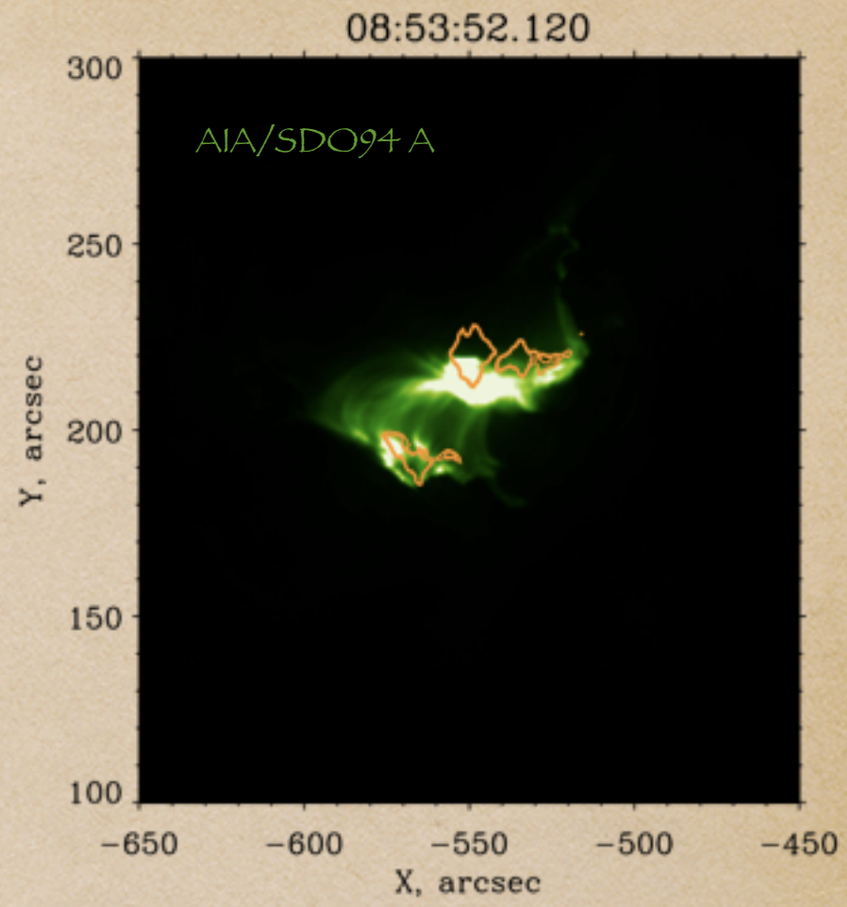
Hα vs MW: thermal or not-thermal?





Hα kernels vs HXR





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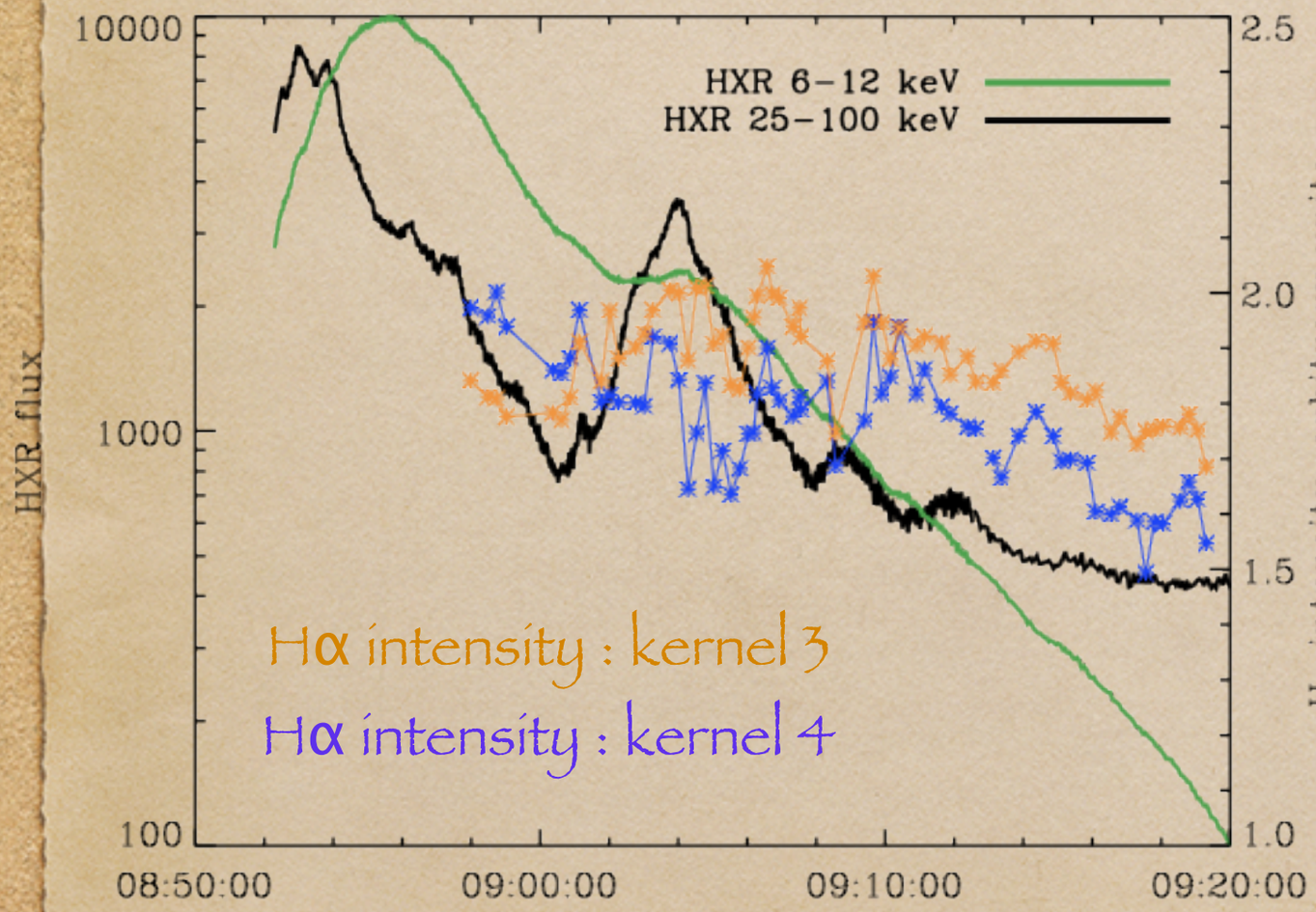
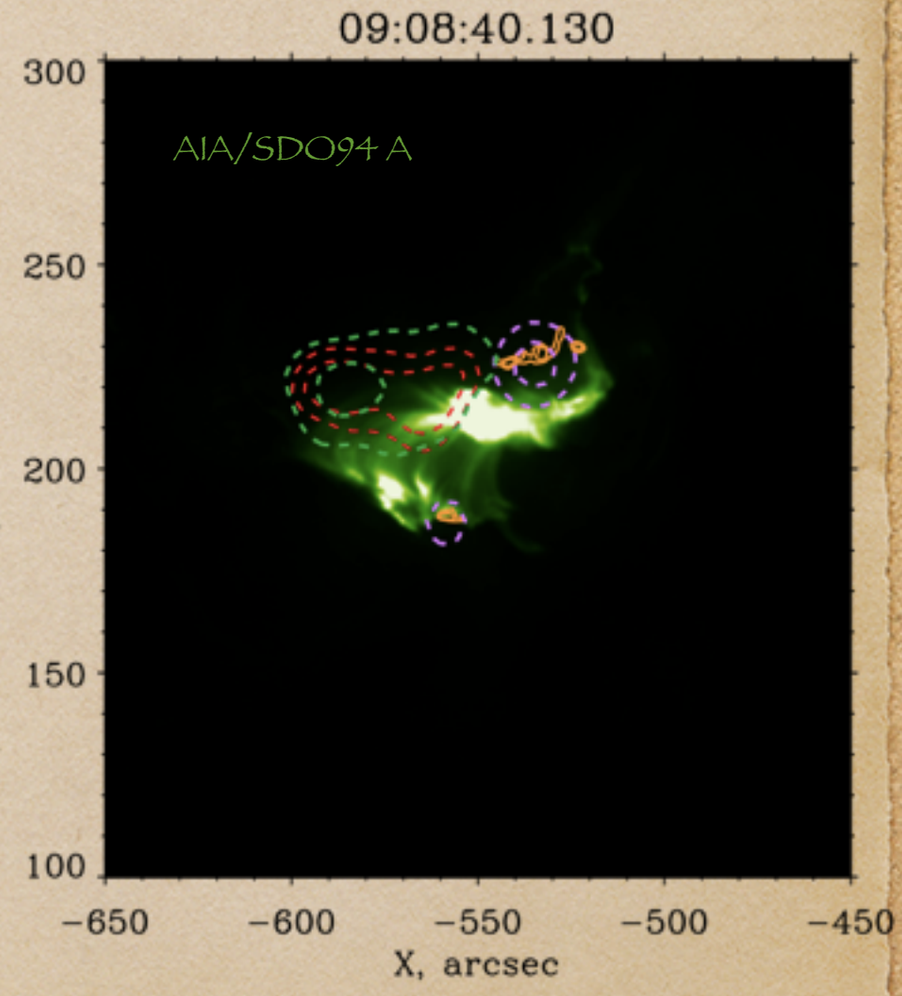
Hα kernels vs HXR





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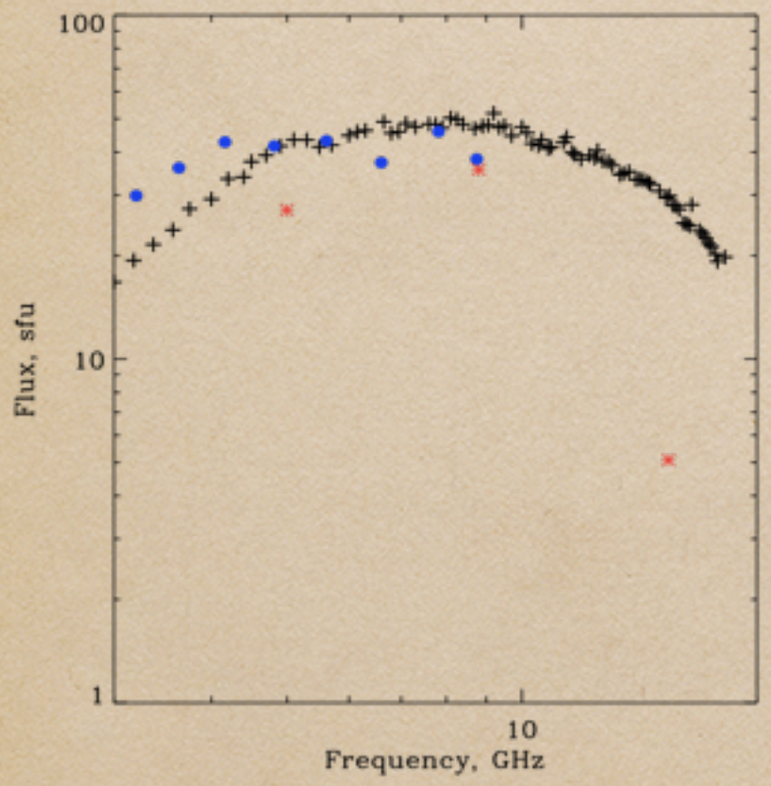
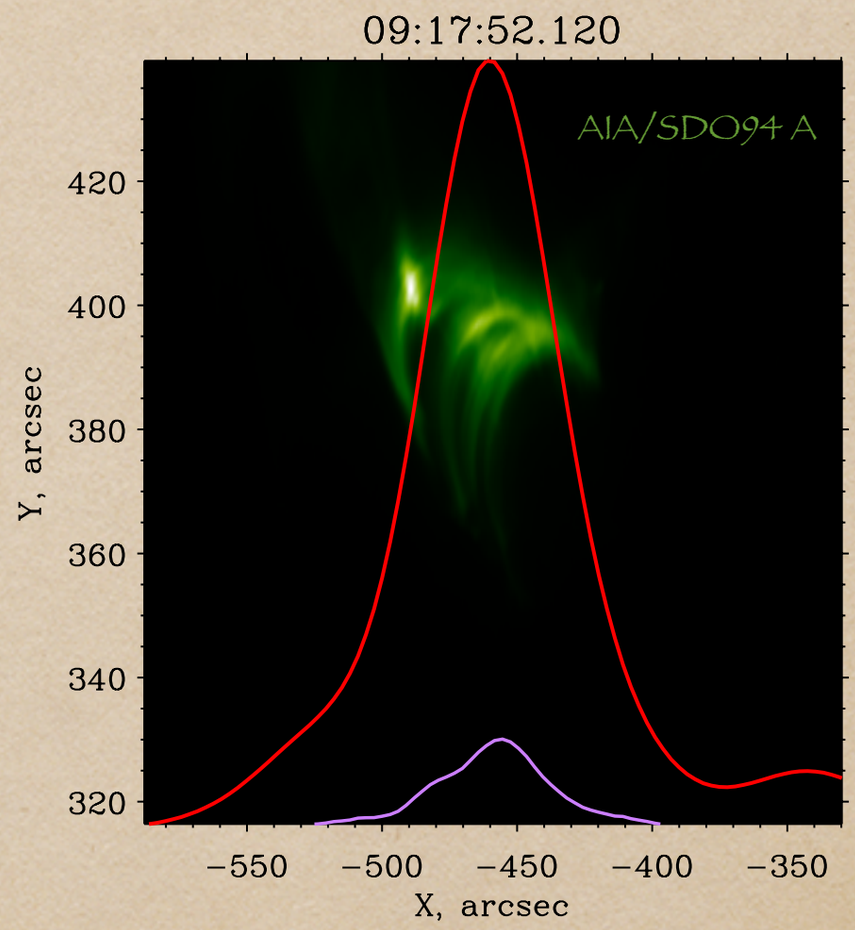

100
10
1
Flux, sfu
10
Frequency, GHz


09:17:52.120
AIA/SDO94 A
420
400
380
360
340
320
Y, arcsec
−550
−500
−450
−400
−350
X, arcsec

Summary

- It was revealed that the individual flare Hα kernels that arose in different moments of the flare were dominated by different mechanisms.

- Mainly they arose as a result of accelerated electrons precipitation into lower layers of solar atmosphere. Further development these kernels could be described by different thermal processes.

Summary II

- The MW spectra observed after maximum of the flare was a result of superposition of at least two MW sources or flare loops.

Thank you for attention!