Fachhochschule Nordwestschweiz

Multi-wavelength Observations of Electron Acceleration in a Series of Solar Microflares

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Executive Summary

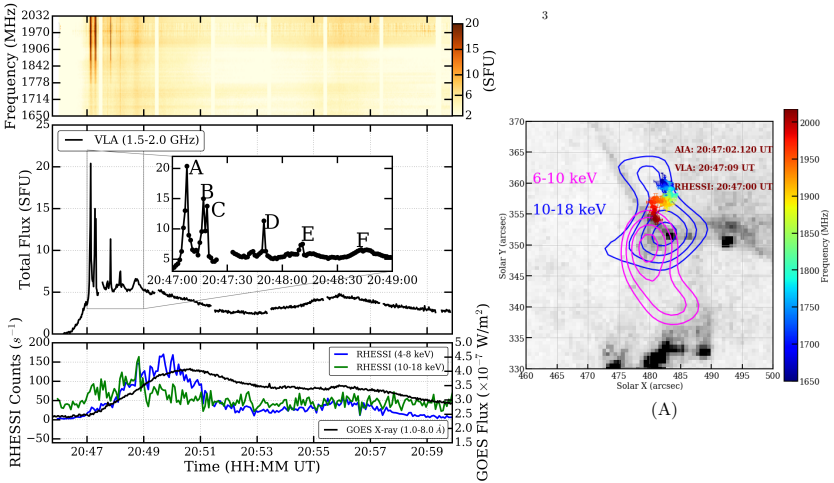
We observe a **series of X-ray microflares** with RHESSI from different locations within the same active region.

Coherent radio emission (short-lived bursts and spikes, broad-band continuum) was observed with the VLA. It was co-temporal, but not co-spatial with the flares.

Interpretation:

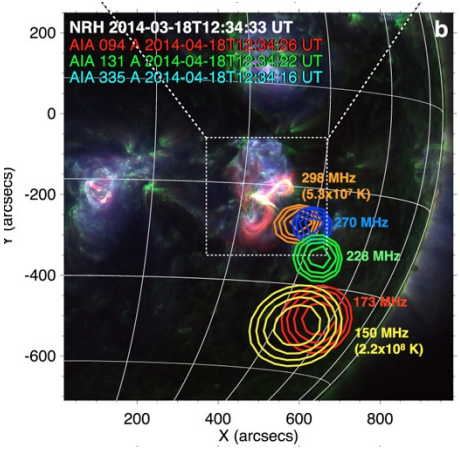
In some flares, electrons were accelerated near the main flare site and were transported far away. In other flares, the observations suggest secondary acceleration, possibly triggered by the main flare, but potentially completely independent of it.

Context: Multiple acceleration instances and sites in the literature

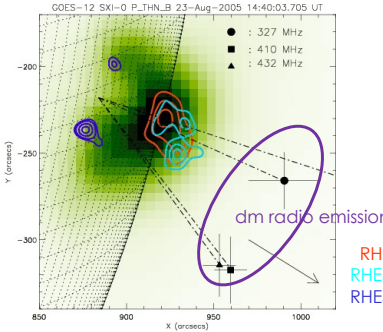


Two different, simultaneous electron populations during a small flare (Sharma et al. 2020)

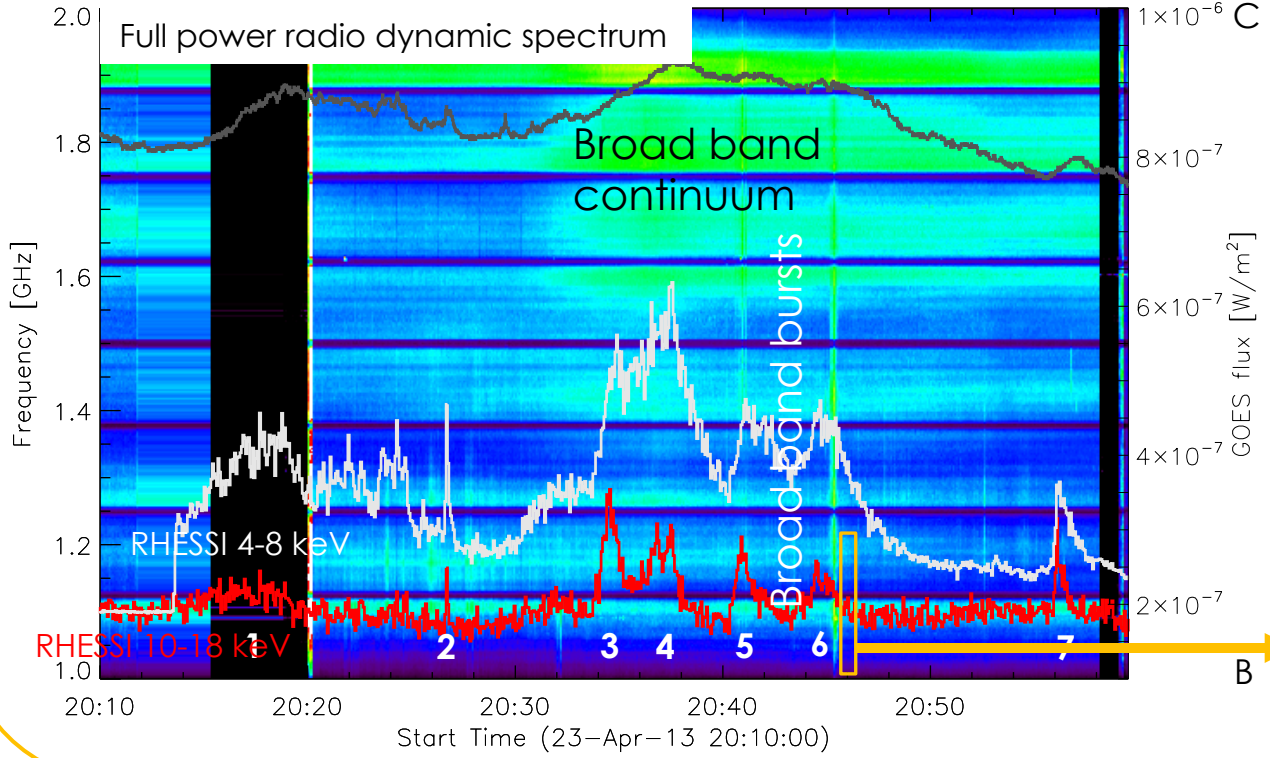
Secondary acceleration associated with an erupting flux rope (Carley et al. 2016)



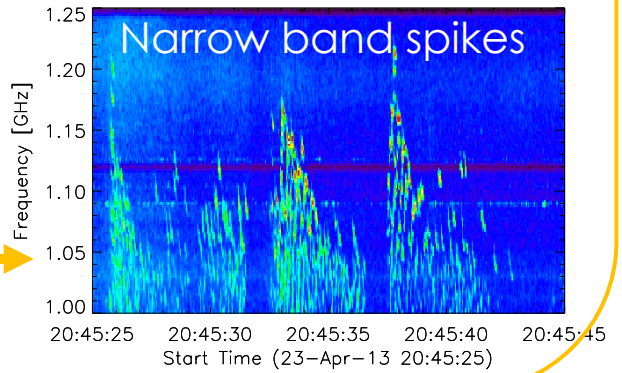
Secondary acceleration associated with CME (Battaglia et al. 2009)

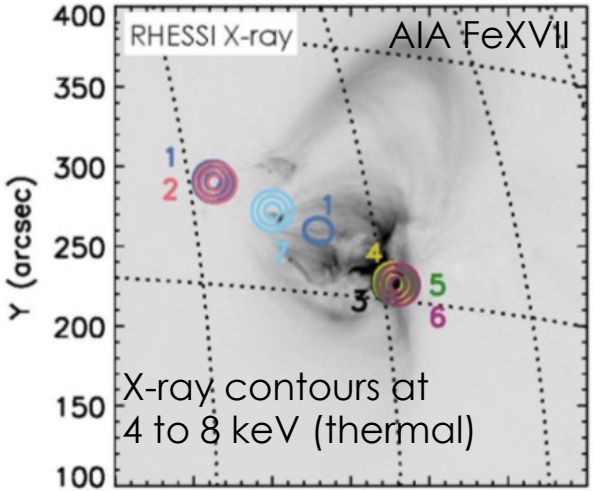


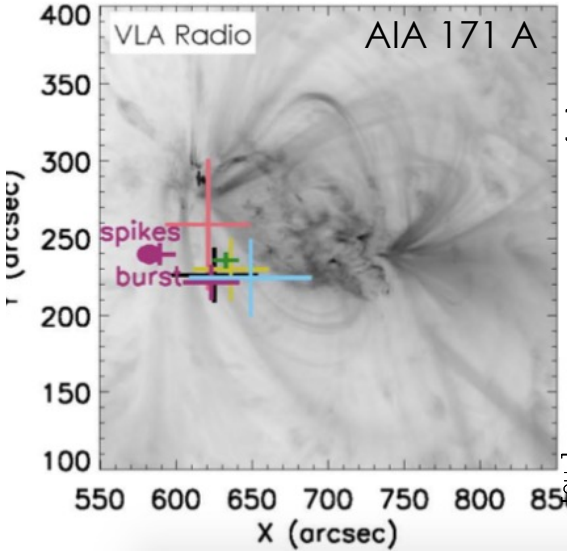
Observations

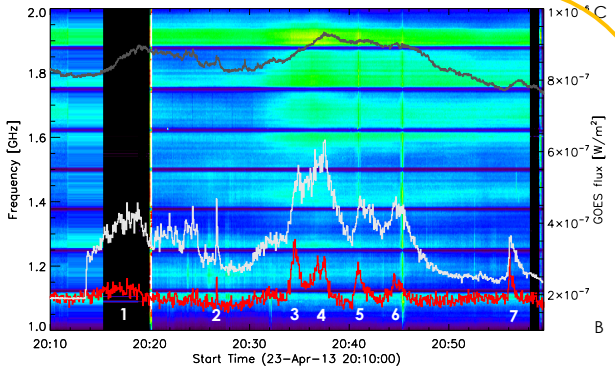


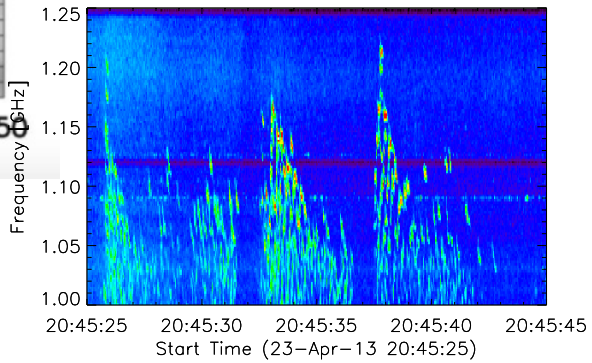
23 April 2013
50 minutes
7 X-ray flares
Multiple associated radio features







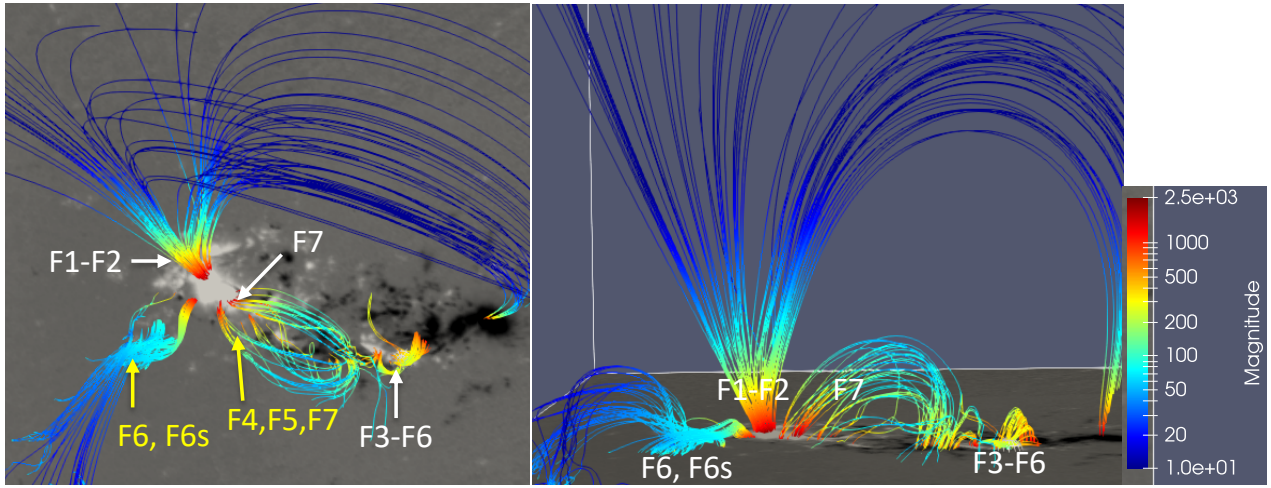


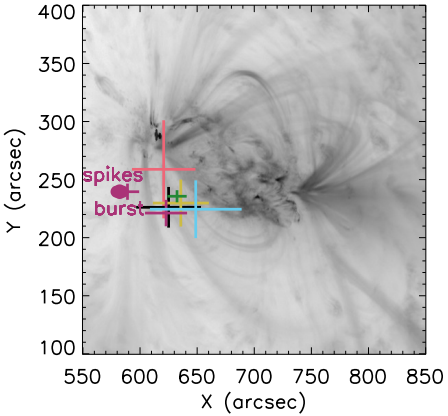


Flares originated at three different locations

Radio sources far displaced from X-ray sources

Discussion





white: approximate location of X-ray flares
yellow: approximate location of radio bursts

Conclusions

Even microflares can be surprisingly complex with multiple acceleration sites and complex loops systems along which electrons are transported.

Three scenarios

Electrons are accelerated at a secondary acceleration site, triggered by primary flare

Electrons are accelerated at flare site and transported away
to where we observe their signatures
(flare no. 7, possibly 4 and 5)

Coincidence!