

Large Microwave Flare Sources with multi-loop Magnetic Reconnection observed by EOVSA Imaging Spectroscopy

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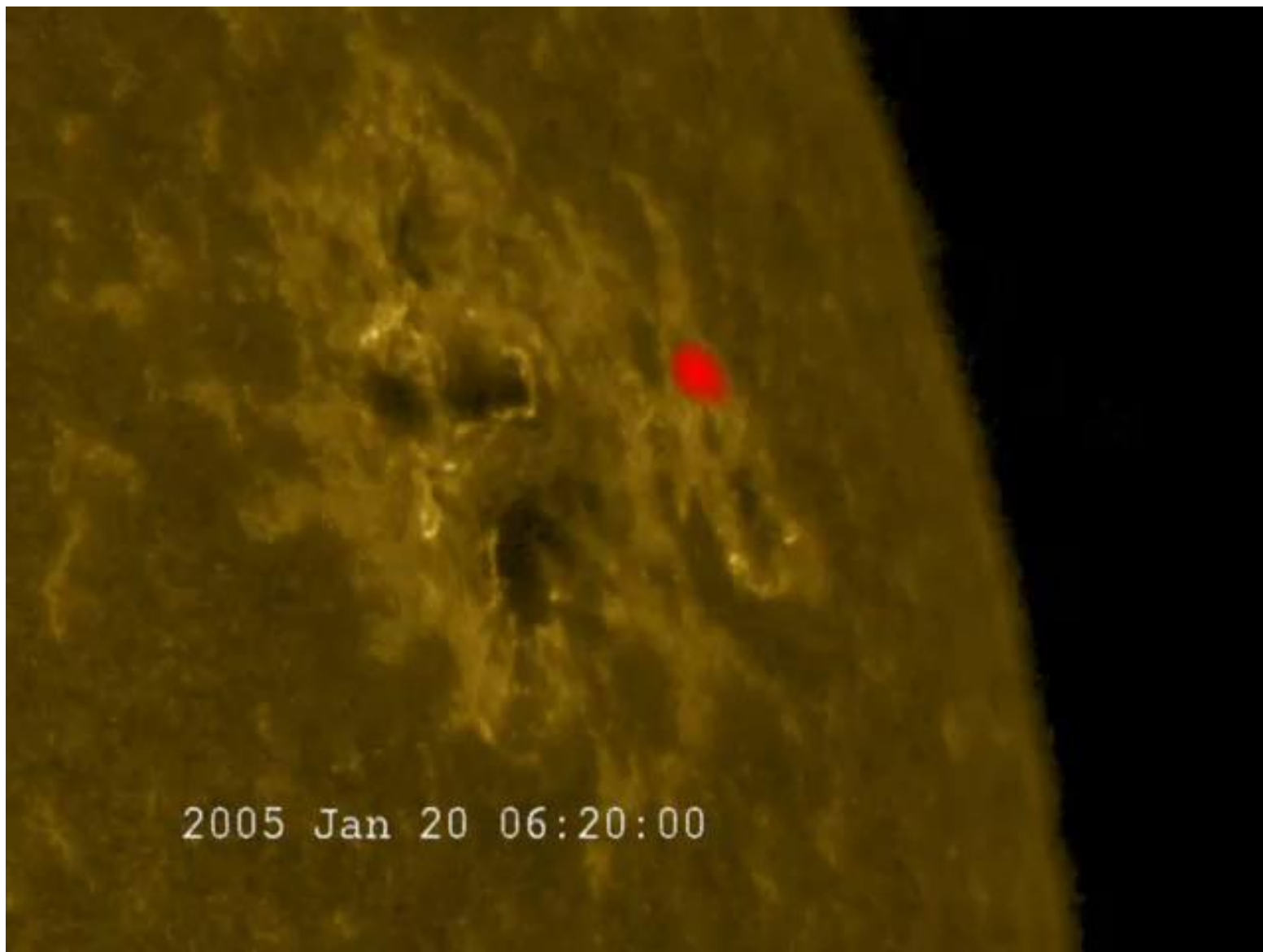
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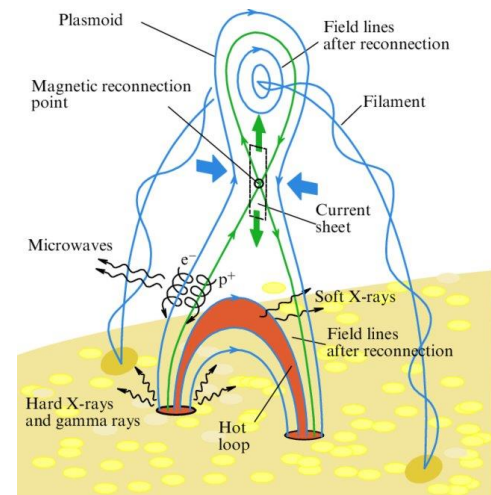
May 27, 2022

EGU Meeting

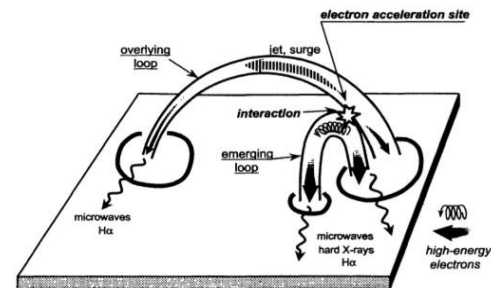
Flare Emission



Overview

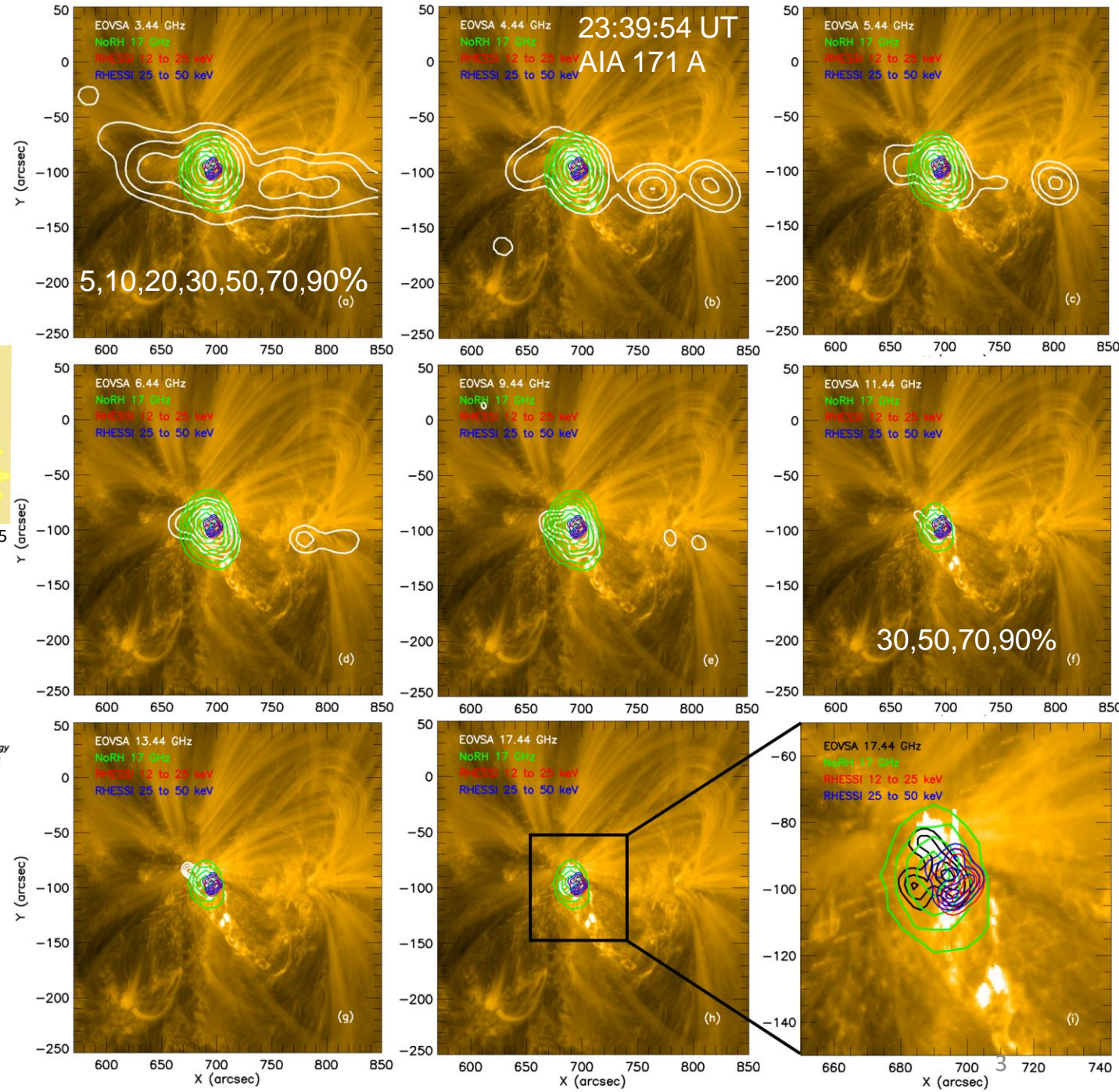


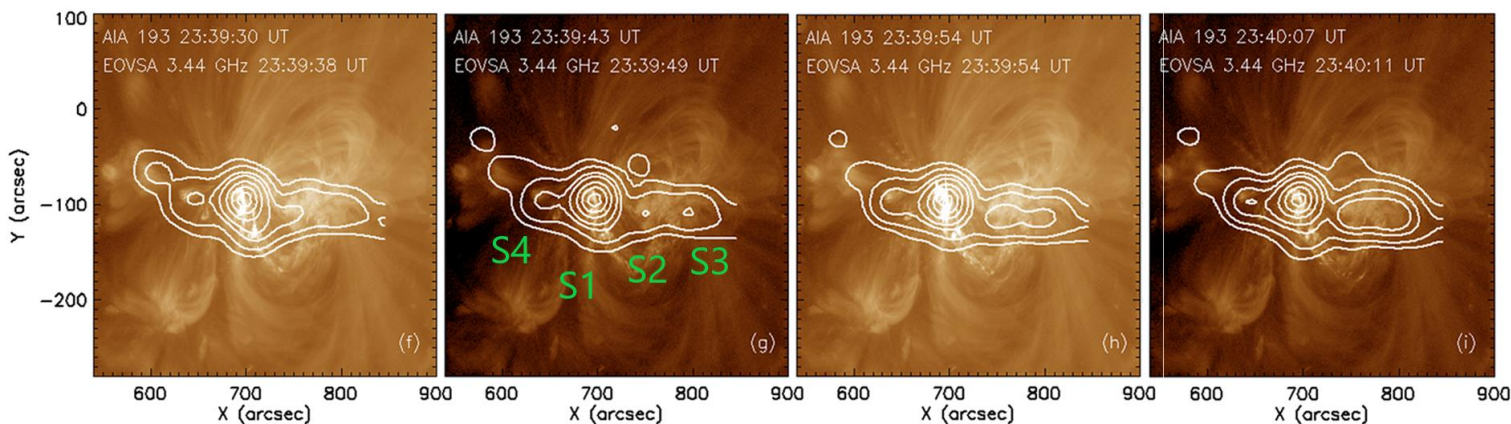
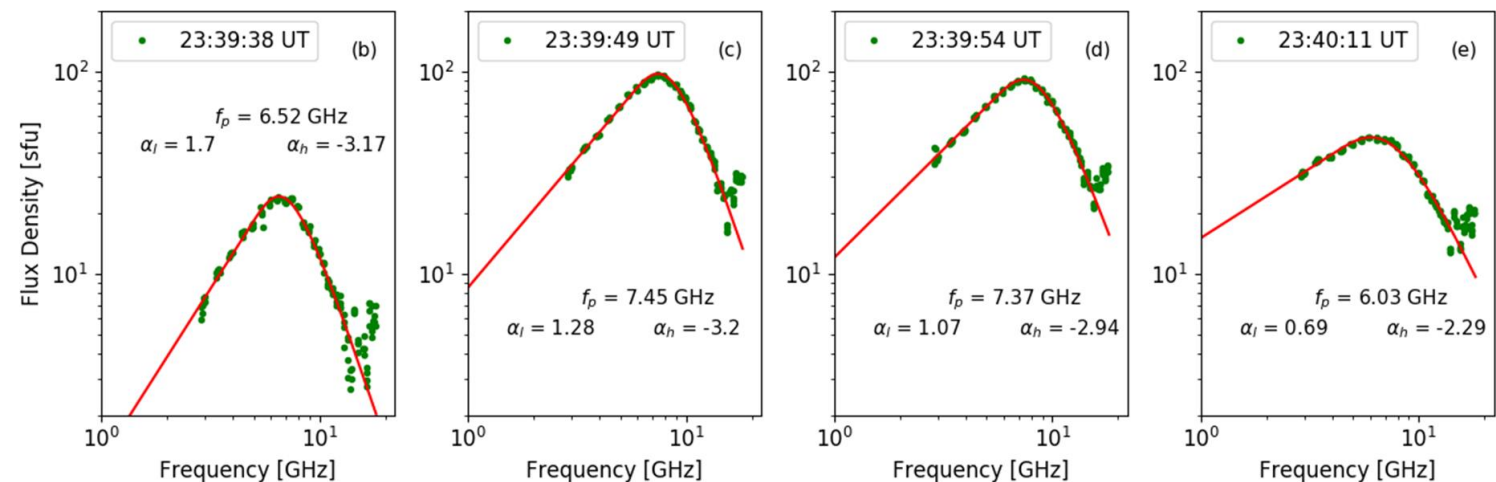
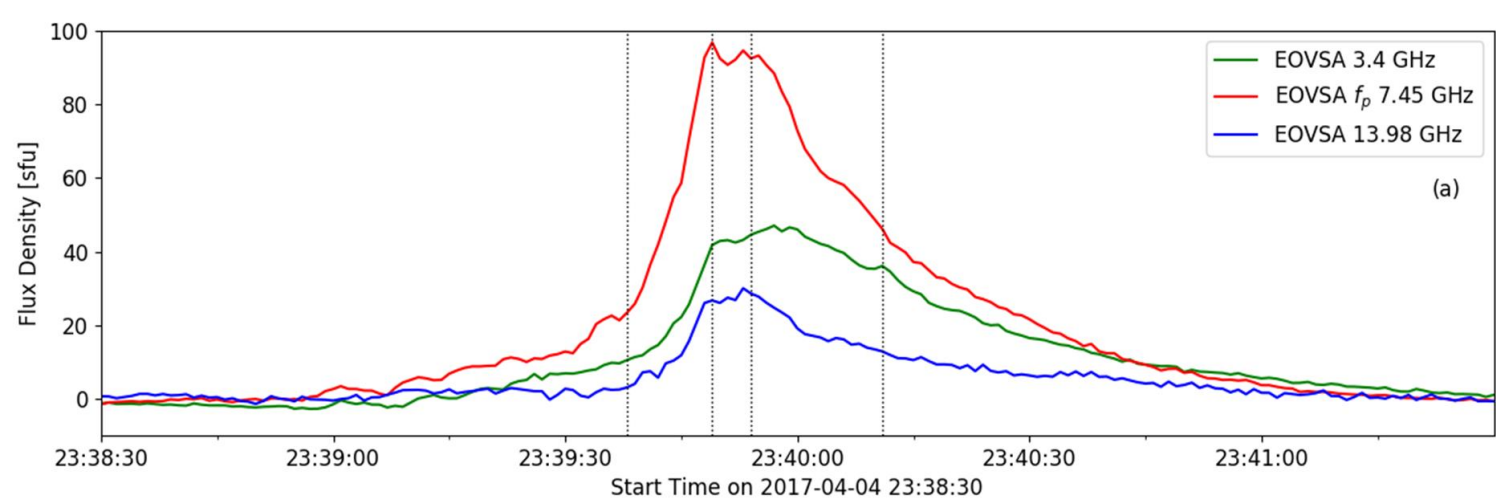
Lysenko et al., 2020, adapted from Shibata 1995



Hanaoka 1999

- Can these large sources be explained by the standard flare model?

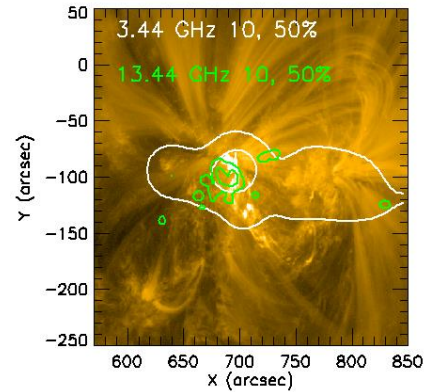




As discussed in
Shaik and Gary,
2021,

- a flat spectrum is an indication of a large and/or multiple centroid source emission
- Extreme flatness especially at the decay phase

Source Morphology with frequency



$$A_{FWHM} \propto f^{-2}$$

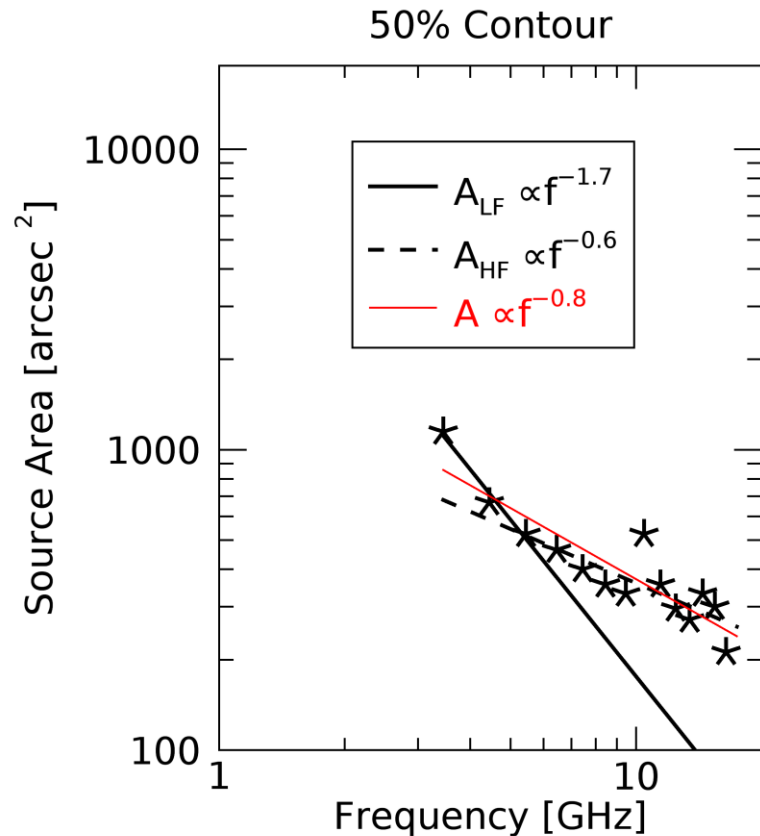
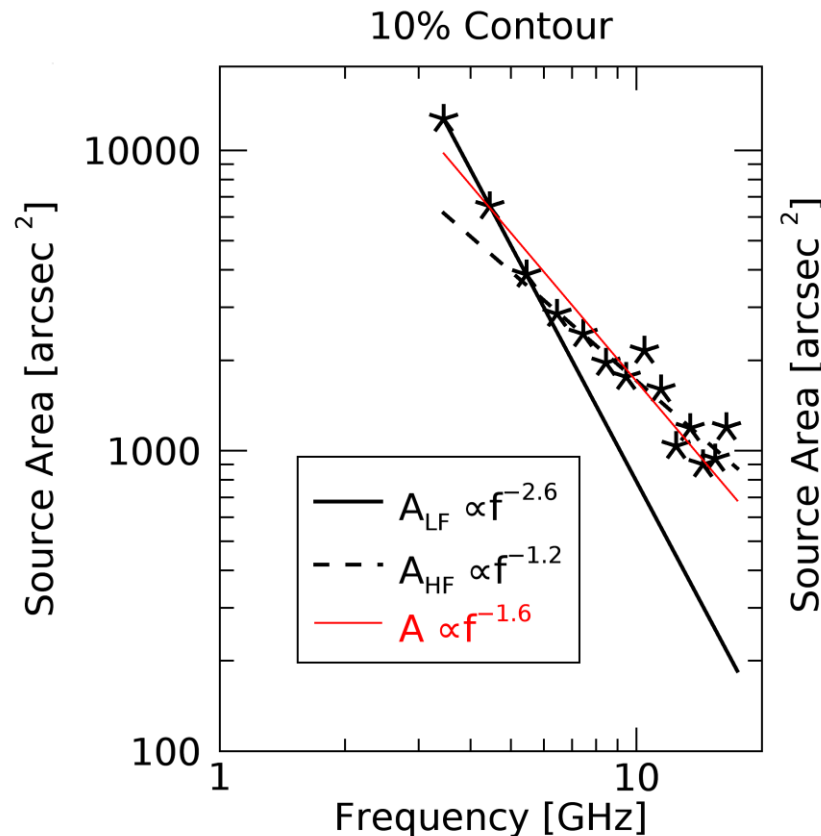
Bastian 1998

$$A_{FWHM} \propto f^{-0.5 \text{ to } -3.5}$$

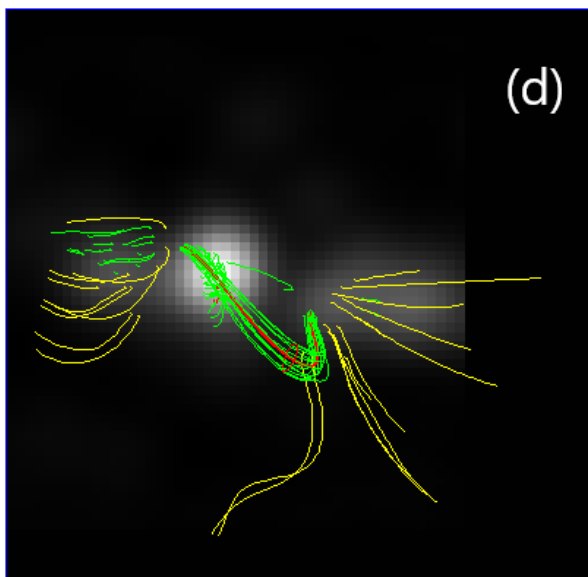
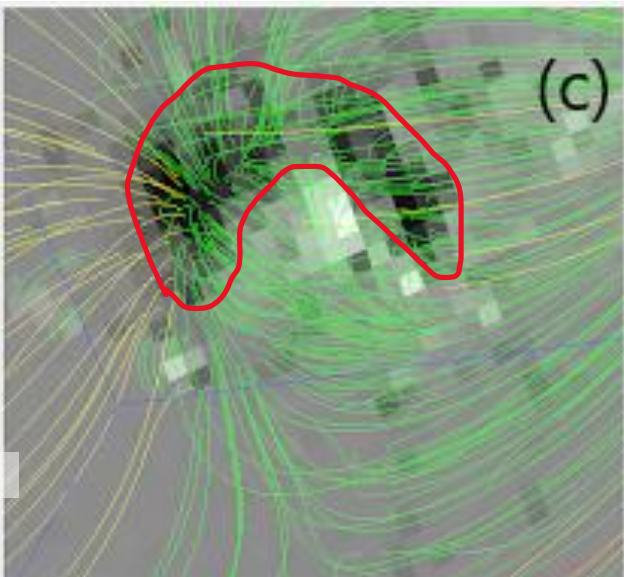
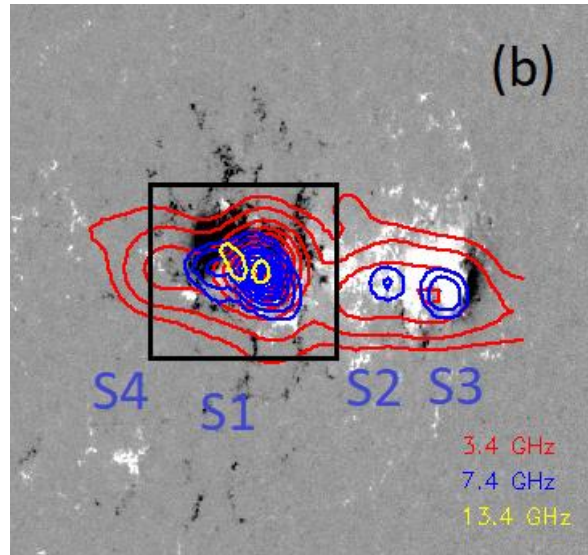
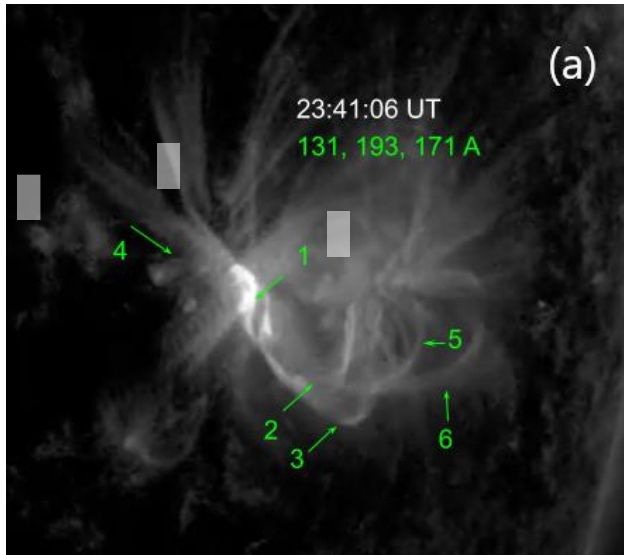
Fleishman et al 2018

For a power-law relationship between the area of the source and frequency, especially for the low frequency sources

1. Right contours levels than the FWHM size are important
2. Fitting over the full frequency range is not reasonable



Flaring Region Configuration

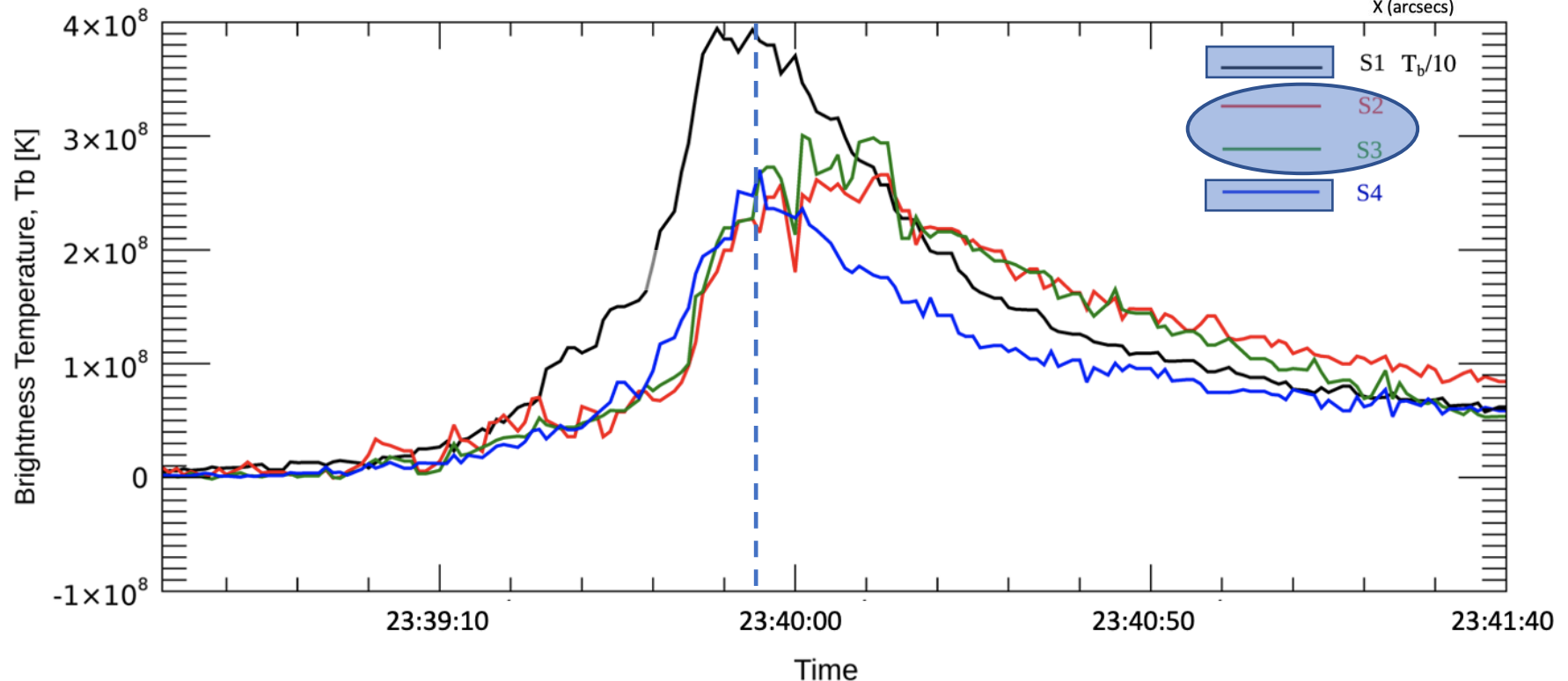
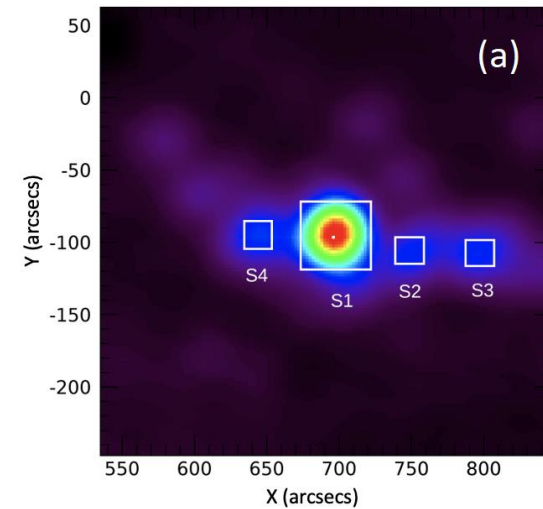


The secondary/extended emission can provide information on the

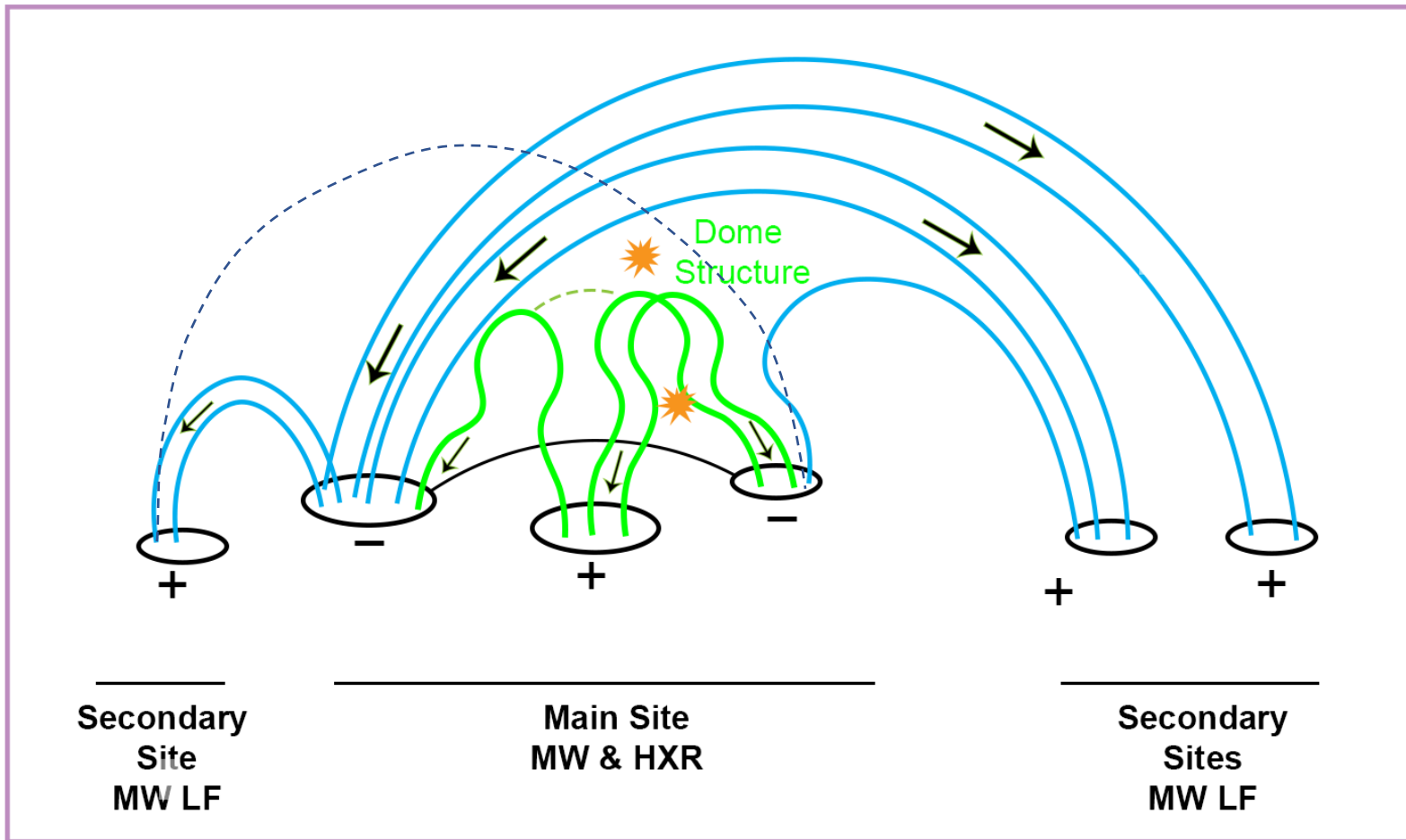
- **timing** of the particle acceleration,
- **transport** of the accelerated particles,
- **physical conditions** in the acceleration or propagation region.

Main and Secondary sources

- Time delay between the main and secondary sources – indicating particle transport with injection and trapping processes



Possible scenario of a flare model



- Sequential reconnection between system of loops
- Transport of accelerated particles to the farther end
- Other wavelengths have no signatures of the secondary emission

Conclusion

- **Can these sources still be explained entirely by the standard 2D flare model? If not, why? And what can we infer from them?**
 - No
 - Contribution of multiple loops with different sized magnetic flux tubes and their interaction which results in the flare eruption
 - Need a revised 3D perspective and additional improvements over 2D model
 - Leads as an observational evidence of a more realistic flare model consisting of a multi-polar magnetic field configuration
- **Acceleration and transport of high-energy electrons**
 - The accelerated particles in this kind of flare show large access to multiple locations of the flaring region
 - Can this hidden population in a large flare explain the SEP and non-SEP occurrence?



*Thank you for your
attention*