X-ray solar flare loops: temporal variations in length, corpulence, position, temperature and pressure.

Natasha Jeffrey and Eduard Kontar University of Glasgow, Scotland, UK







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Flare X-ray (>3 keV) emission - corona to chromosphere



Flare X-ray (>3 keV) emission - coronal X-rays only



~3-25 keV



strong coronal emission

3-Aug-2005

Bulk of X-ray emission is produced in the coronal loop.

chromosphere

corona

weak or no footpoint X-rays

Spatial properties of coronal X-ray sources with energy Loop Length: $E_2 < E_1$



Spatial properties of coronal X-ray sources with energy Loop Width: $E_2 < E_1$



guiding B-field.

chromosphere



RHESSI and Visibility forward fitting (VIS FWDFIT)



X-ray visibilities - 2D Fourier components of the X-ray source (Hurford et al. 2002; Schmahl et al. 2007)

$$V(u, v; \epsilon) = \int_{x} \int_{y} I(x, y; \epsilon) e^{2\pi i (xu+yv)} dx dy,$$

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We studied 3 M-class events observed by Xu et al. (2008) and Kontar et al. (2011), concentrating on loop changes with **time** instead of energy:

1.23rd August 2005, 2.14th/15th April 2002 and 3.21st May 2004

Flare I - 23rd August 2005 event



23rd August 2005 event - Imaging results Peak 80 X-rays 23-August-2005 flare 10-12 keV 70 12-15 keV _ength [arcsec] 15-20 keV -20060 -21050 40 -22030 [arcsec] -230 20 Width [arcsec] 18 -240 16 14 -250 12 clean 10 -260 14:22 - 14:26vis fwdfit Radial distance [arcsec] 957 -270F956 900 920 930 940 880 890 910 950 955 X [arcsec] 954 953 The loop length and loop 952 width change with time. 95 I 14:36 14:24 14:28 14:32 14:40

Observation Time

23rd August 2005 event - Spectroscopy results



23rd August 2005 event - Inferred parameters

We see the <u>same results</u> for two other coronal X-ray events.

Clean

5 keV

-740

-750

-760

23:46-23:48

Possible explanations and future work?

- I. A reduction in B pressure? Liu et al. 2009, Gosain 2012 etc.
- 2. Thermal conduction -> chromospheric evaporation ?
- 3. Thermal pressure balances and overcomes the reduction in B pressure ?

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Future studies/common or different trends for all flares?

- New events with SDO data multiple loops interacting?
- An X-class event showed similar results using Clean (Caspi & Lin 2010).
- What about events with strong coronal emission and footpoints?

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