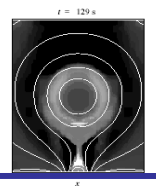

Application of the Kopp and Pneuman model to an M2.5 flare

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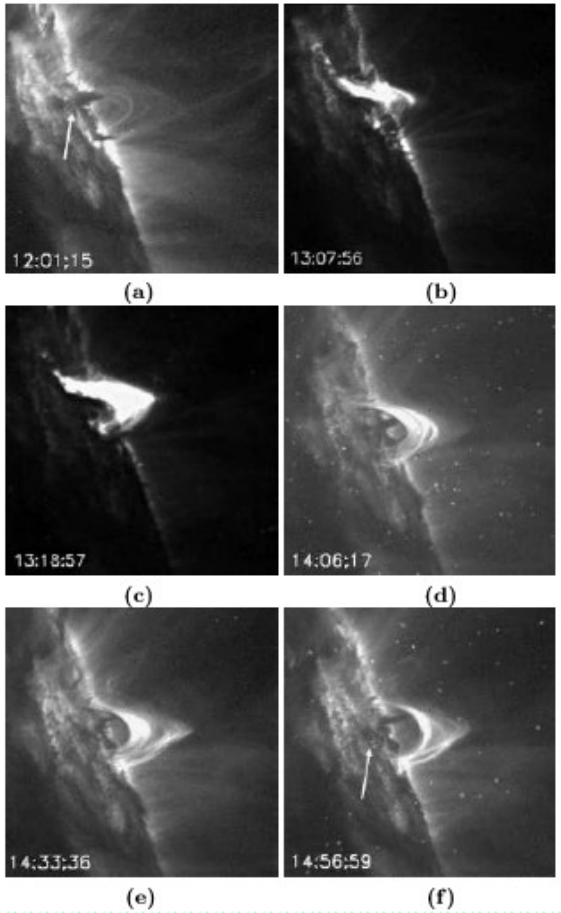
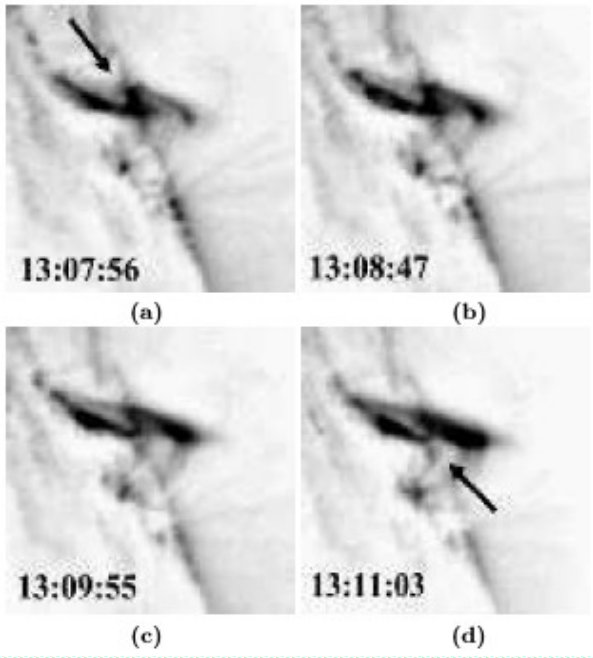
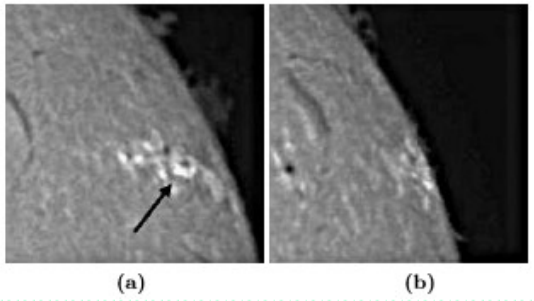
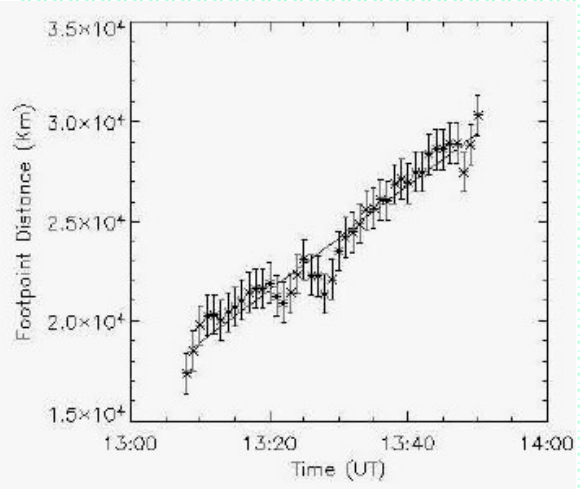
Current sheet formation in flaring loops

TRACE observation of flaring loops after a filament eruption





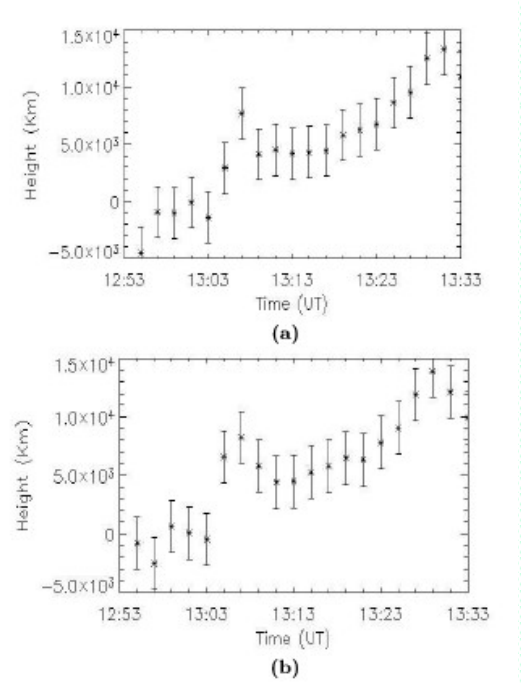




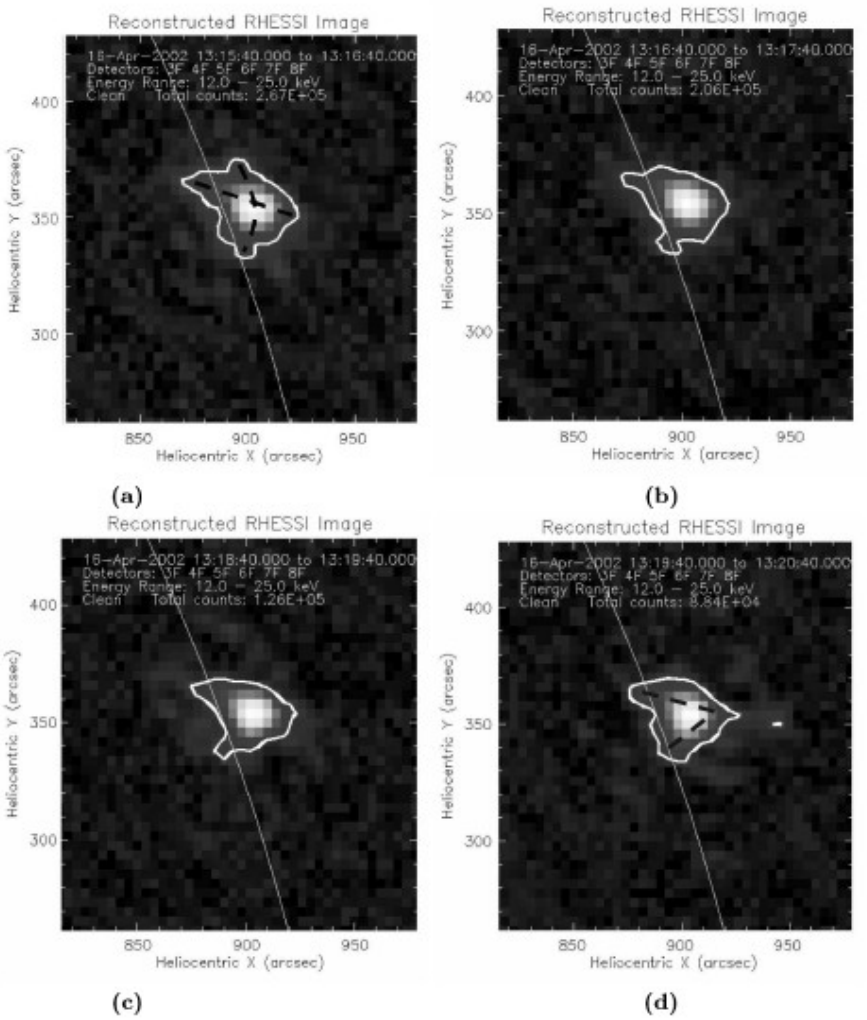
Increase of the foopoint distance as a function of time deduced by TRACE EUV images (5 km/s)

Current sheet formation in flaring loops

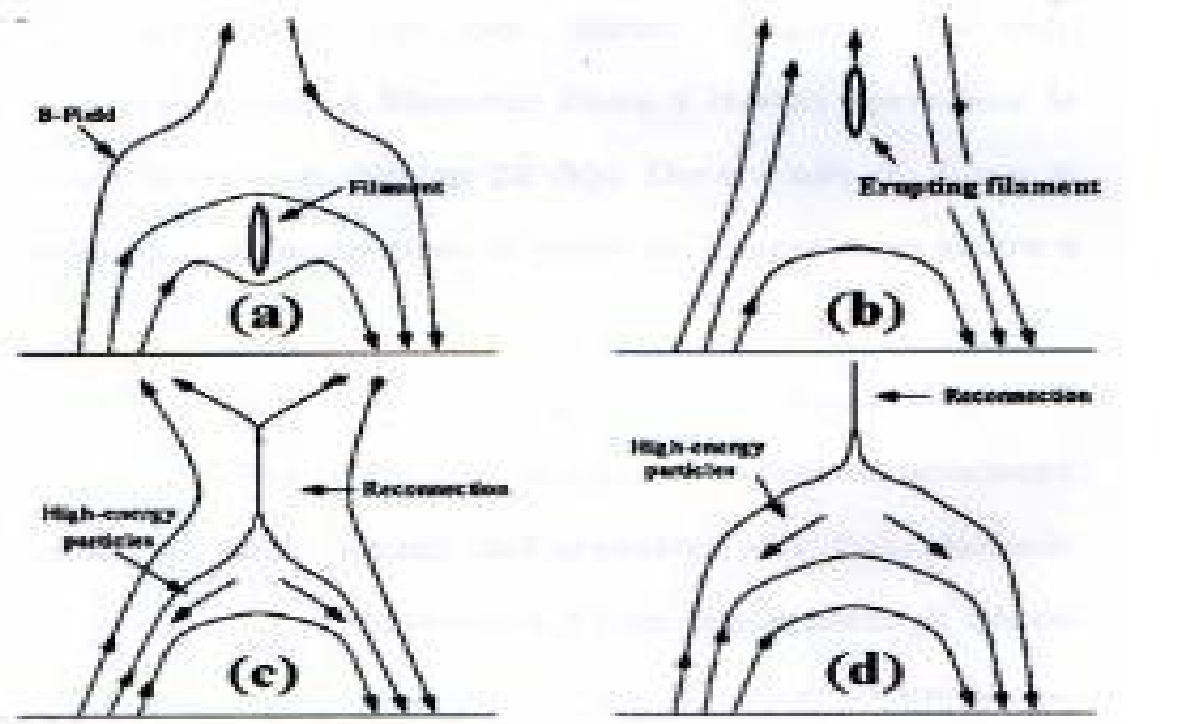
Analysis of RHESSI data in the X-ray range:
The shape of the loops changes from a X-type configuration to a Y-type configuration



Increase in the loop top height as a function of time, calculated in two different RHESSI energy channels



Comparison with the K-P model

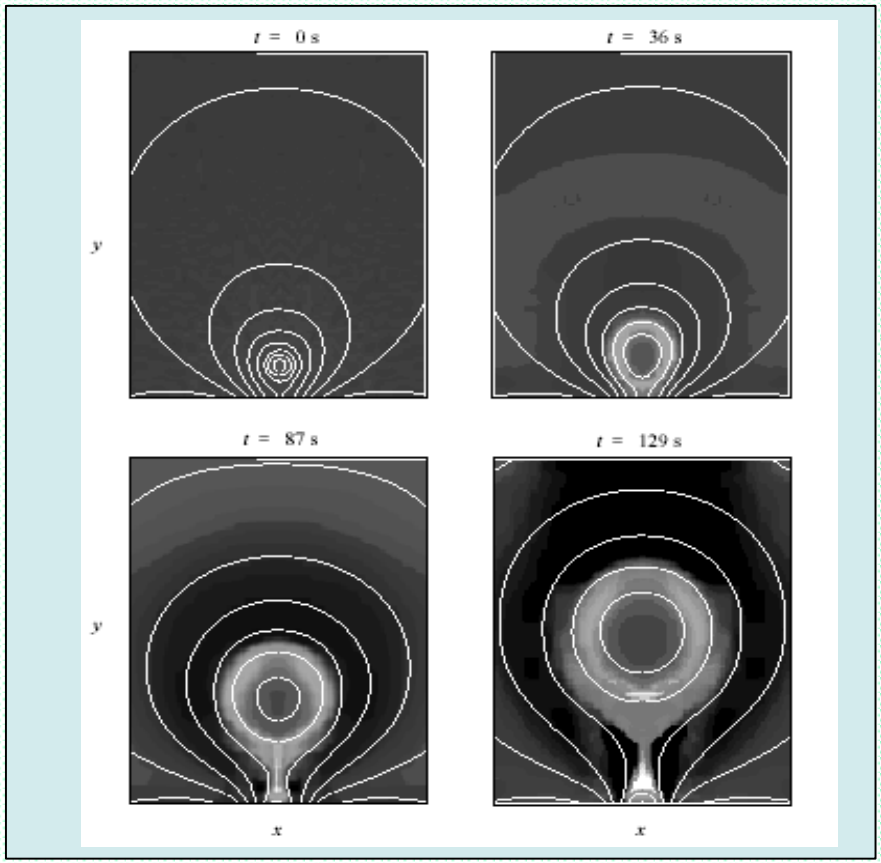


Kopp and Pneuman scenario: (a) a filament is initially confined between the inner field lines of a magnetic arcade; (b) the filament starts to erupt and opens the overlying field lines; (c) the arcade assumes an X configuration and a current sheet forms; (d) the current sheet rises towards higher levels and the arcade shows a cusp shape

Arcade with erupting flux rope

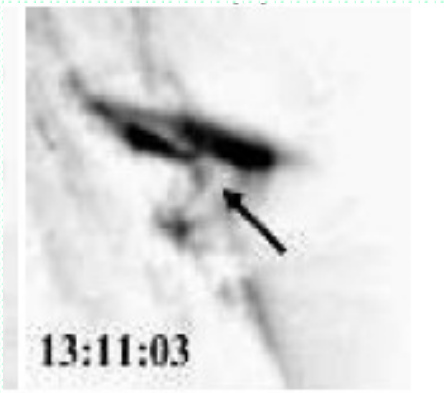
Resistive MHD simulation based on a 2D flux rope model.

White curves are magnetic field lines, while grey scale corresponds to temperature variations. White regions have the higher temperatures (Forbes, 1991).



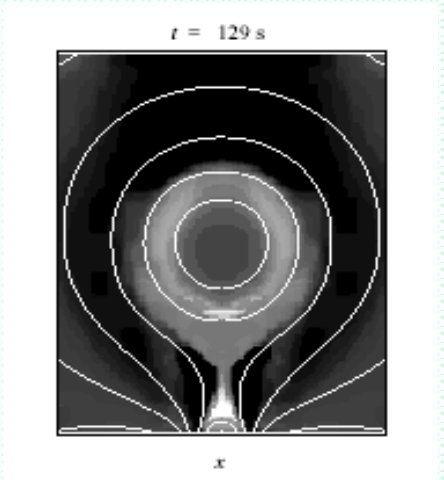
Current sheet formation in flaring loops

Working hypothesis: the filamentary structure indicates the presence of a current sheet.
The values of its parameters are:



Length: $L_{CS} \sim 5 \times 10^3$ km

Width: $l_{CS} \sim 10^{-2}$ km



Summary of the results

- TRACE EUV images acquired during the pre-flare phase show initially the presence of an *X* configuration and, after few minutes, a filamentary feature, apparently connecting the lower and the higher loops, which resembles the formation of a vertical current sheet following he collapse of an X neutral point (compare with the 2D simulation);
- RHESSI data indicate a change of the top-loop X-ray emission source from an *X* configuration, during the pre-flare phase, to a *Y* configuration, after the flare peak. The loop structures assume the canonical cusp-shape foreseen in several solar flare models;
- The centroid of the X-ray emission, assumed coincident with the top of the loop, shows a continuous increase of height with time, with a steeper increase ten minutes before the flare peak. The loop growth speed is about 17 km s^{-1}, in agreement with the Kopp-Pneuman model; moreover, the 12-25 keV source is always higher than the 6-12 keV one;
- The separation between EUV loop footpoints increases during the flare with a growth speed of about 5 km s-1.

Conclusions

The observations fit very well with the Kopp - Pneuman model of current sheet formation and magnetic reconnection in a magnetic arcade hosting an eruptive filament