The Confined Two-Ribbon Flare of 1991 October 24

The 1N/M9.9 flare of 1991 October 24 22:30 UT was simultaneously observed by the Yohkoh SXT and HXT instruments and by Mees Solar Observatory (U. Hawaii). This two-ribbon flare presents a challenge to the erupting-filament model, because the ribbons did not move apart and because neither Hz nor soft X-rays show any evidence for an ejected filament or disruption of the global magnetic field configuration.

These observations mean either that the "eruption" was able to drive the flare despite being confined by the overlying field or that a completely different mechanism is operating. The primary purpose of this paper is to address these two possibilities. We also describe other notable features of this event.

Flare Plasma Dynamics Observed with the Yohkoh Bragg Crystal Spectrometer
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Using data from the Bragg Crystal Spectrometer on the Yohkoh spacecraft, we have computed measures of the total intensity, centroid position, and line width for the resonance line of Ca XIX during the rise phase and after maximum for 219 solar flares. The difference between the centroid positions early and late in each flare yields a measure of the line-of-sight velocity shift of the line centroid. We find a trend in the average value of the centroid shift with distance from Sun center suggesting radial mass motions with a characteristic centroid shift of 38 km s⁻¹. There is also a correlation between rise-phase line widths and the centroid shift. We find no correlation between the centroid shift and the peak intensity, rise time, and total flare duration; and no correlation between the line width and the distance from Sun center, the peak intensity, rise time, and total flare duration. With very few exceptions, all the flares we have examined show a substantial rest component to the Ca XIX resonance line at the earliest times in the event.

Loop Interactions in Solar Active Regions Observed from SXT/Yohkoh
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We present observations of loop interactions observed in several solar active regions by the Soft X-ray Telescope (SXT) aboard the Yohkoh spacecraft in the period from February to April 1992. A variety of loop interaction morphologies is observed. Magnetograms when available are used to ascertain the magnetic structure of the loop morphology. The interaction between the loops results in transient brightenings lasting several minutes. In addition, simplification and reconfiguration of the loop morphology are often observed to be associated with the brightening, indicating the release of stressed magnetic energy. Whether the observed loop interaction and its ensuing morphological evolution is indicative of magnetic reconnection or other dynamic processes is an important question which will be addressed.

Coronal Arcade-like Structures Over Magnetic Inversion Lines
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We have been using the Yohkoh SXT images to study the changes of the coronal magnetic fields that occur over photospheric magnetic inversion lines. In particular we have examined a number of events associated with magnetic inversion lines outside of active regions in which arcade-like structures appear in soft X-rays. In several cases it seems possible that these arcade-like structures are not the result of the closing of an open field structure, as has been proposed in many of the models for the formation of arcades associated with Hz filament disappearances.

We will compare events in which an opening-up of the overlying field is likely to have occurred, with ones in which there is reason to believe that the magnetic field parallel to the inversion line rises but is in part, or wholly, continuing by the overlying magnetic structures. We will show some initial quantitative analysis of these arcade-like structures, including light-curves, growth-rates, shear-relaxation-rates, and foot-point motions.