

DEM Temperature Analysis of Eruptive Events Using the

XRT on Hinode

K. K. Reeves, M. A. Weber, V. Kashyap & E. E. DeLuca (Harvard-Smithsonian CfA)

Abstract

The X-Ray Telescope (XRT) on Hinode has unprecedented temperature coverage with 9 X-Ray filters in the focal plane. This temperature coverage is especially useful in determining the temperatures of flaring plasma. In this work, we use DEM techniques to analyze the temperature structures in some small eruptive events.

Observations

On July 10, 2007 XRT observed a C8.2 flare in AR 10963 using the following seven filter combinations:

- Al-poly
- Ti-poly
- thin-Be
- med-Be
- Al-poly/Ti-poly
- thick-Al
- C-poly/thick-Al

The filter response functions for these filters are shown in Figure 1.

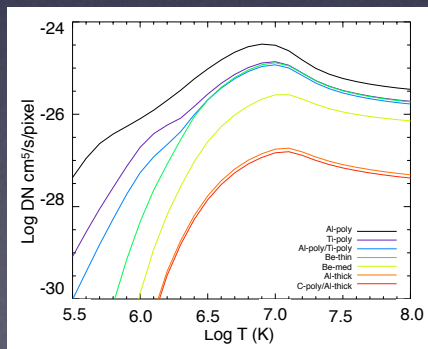


Figure 1: Filter response curves for the filters used in the observations.

Data Analysis

- Data was calibrated using `xrt_prep`
- Average of off-limb intensity was subtracted
- Data was spatially smoothed with a boxcar function with a width = 3
- Errors are assumed to be photon noise + 5 DN of CCD read noise.
- The routine `xrt_dem_iterative` is used to calculate DEMs in each pixel. It is a forward fitting routine - a solution is guessed and iterated upon until the χ^2 between the actual and model observations is minimized.
- Monte Carlo runs on the data using values varied normally by the sigma error gives an estimate of the error in the DEM.

Results

An image from the flare and a sample DEM curve are shown in Figure 2.

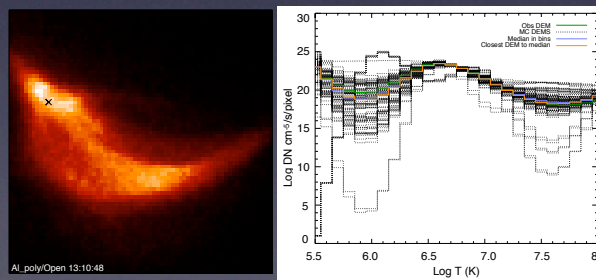


Figure 2: (Left) An Al-poly image from the post-flare loops taken at 13:10:48. (Right) Plots of the DEMs for the pixel marked in the image: the DEM from observed values (green), the Monte Carlo iterations (dotted lines), the median value of the MC iterations in each bin (blue) and the DEM closest to the median (orange).

Results, con't

Temperature maps were made for each pixel by integrating the DEM in specified temperature bins. Maps for two sets of images 10 minutes apart are shown in Figure 3.

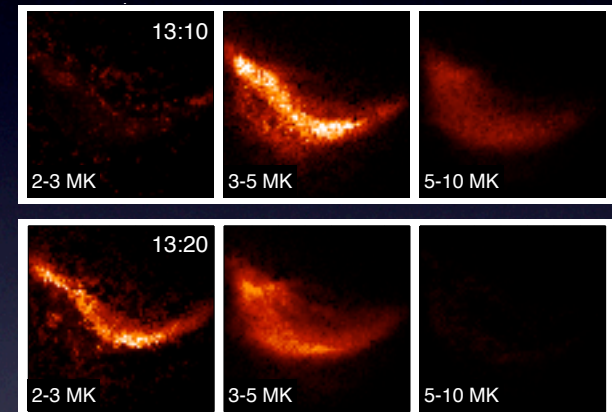


Figure 3: Temperature maps from 13:10 (top row) and 13:20 (bottom row).

Conclusions

Clear evidence of cooling is seen in the post flare loop system using this method of determining temperatures with XRT. In the temperature maps from 13:10, a prominent loop-like structure is seen in the 3-5 MK temperature map. Ten minutes later, this structure appears in the 2-3 MK temperature map.

Acknowledgments

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