

An Overview of the XRT Observations for the September 10 2017 X Flare

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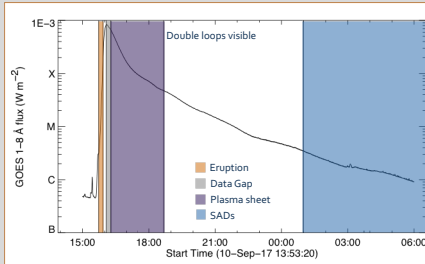
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Abstract

The September 10 2017 X8 flare was one of the biggest of the current solar cycle, and it was also incredibly well observed. This presentation will review the available XRT data for this flare. XRT observed the initial flux rope eruption, which was also well observed by AIA and SUIVI. XRT data is missing for some of the impulsive phase of the flare, but the late phase shows some very interesting features. There is some nice XRT imaging of a plasma sheet above cusp-shaped loops between 16:47 and 18:39 UT. After 18:40 UT, a double loop structure becomes apparent, with a more rounded loop nested within a larger, cusp-shaped structure. The flare loops continue to grow, and at around 1 UT on September 11, supra-arcade down flows and shrinking loops become visible. There is also interesting data in the late phase of this flare from RHESSI and the Expanded Owens Valley Solar Array (EOVSA).

Overview

Figure 1: GOES plot showing the Sept 10, 2017 X flare. Annotations show the times that various features were visible in the XRT data.



Initial Flux Rope Eruption 15:54 UT

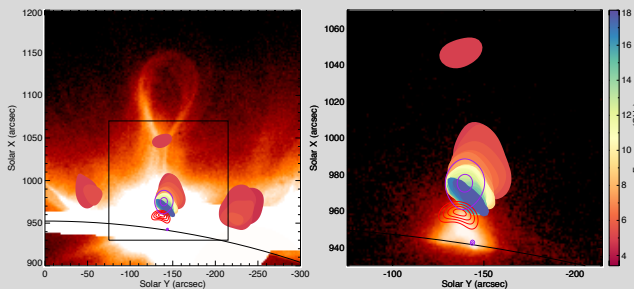


Figure 1. Left panel: XRT Al_poly + EOVSA (filled color contours) + RHESSI HXR (purple contours; 30-100 keV) + RHESSI SXR (red contours; 12-18 keV). Right panel (zoomed from black box in left): XRT Be_med + EOVSA (filled color contours) + RHESSI HXR (purple contours; 30-100 keV) + RHESSI SXR (red contours; 12-18 keV). Note the microwave source at the bottom of the erupting loop, which is probably due to the reconnection outflow. There are also radio sources off to the sides of the flare loops in the left panel. These sources may be due to particle acceleration in the erupting flux rope.

Plasma sheet and loops 17:31 UT

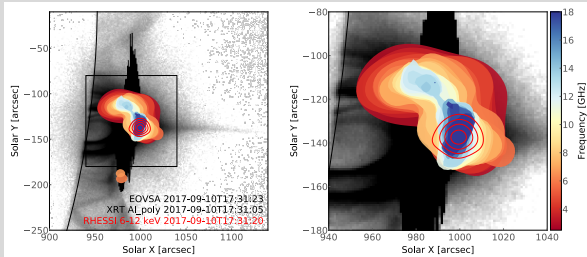


Figure 2. Left panel: XRT Al_poly + EOVSA (filled color contours) + RHESSI SXR (red contours; 6-12 keV). Right panel is the same, zoomed in to the black box on the left. Note that there is also a small microwave source to the south of the cusp shaped loops, indicating that there may be particle acceleration in this part of the arcade as well.

Double loops 18:40 UT

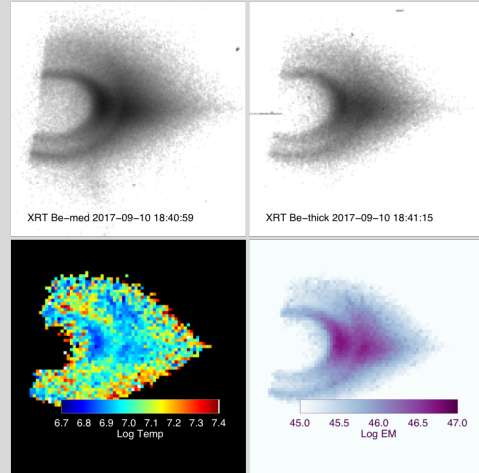


Figure 3. Top: XRT Be-med and Be-Thick filters. Bottom: Temperature and emission measure maps from a filter ratio of the top two filters. An interesting double loop structure appears in the XRT images at around 18:40 UT. There is a bright inner loop, and then a gap, and then a cusp-shaped outer loop. A temperature map constructed from the XRT filter ratio shows that the temperature is **hotter** in the gap between the bright loops.

Supra-arcade downflows 01:00 – 06:00 UT

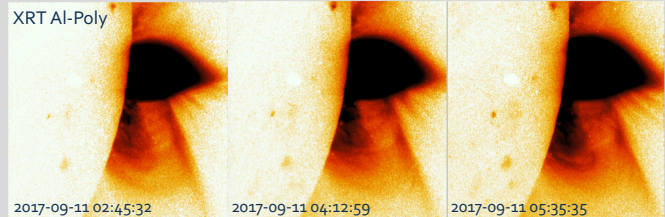


Figure 4. XRT Al-poly images scaled to show supra-arcade downflows. Very late in the decay phase of the flare, supra-arcade downflows are seen predominantly on the southern side of the cuspy loop structure. Shrinking loops are also seen in the cusp region. The SADs appear to be impinging on the arcade from the side, but this observation is probably due to a projection effect from the arcade curving around behind the cusp-shaped loops.

Conclusions

There is an unfortunate data gap in the XRT data around the peak of the flare due to an SAA crossing and a misfire of the flare trigger. Nevertheless, there are lots of interesting XRT data for the Sept 10 2017 flare. The Al-poly and Be-med filters show the initial flux rope eruption very well. Combined with the EOVSA data, there is some evidence for particle acceleration at the bottom of the erupting flux rope, and to the sides of the flare loops, where the flux rope might connect back to the Sun. There is a long, thin plasma sheet visible for several hours in the XRT images. There is a looptop RHESSI source at the bottom of the current sheet, and the EOVSA data shows a microwave source that fills the cusp-shaped loops. There is also a small microwave source to the south of the cusp-shaped loops, indicating another possible location for particle acceleration. At about 18:40 UT, an interesting double loop feature is observed in XRT. A temperature map from the XRT filter ratio indicates that the emission gap between the two bright loops is the hottest feature. Finally, many shrinking loops and supra-arcade downflows were observed late in the decay phase of this flare.

Acknowledgements

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