Sympathetic Partial and Full Filament Eruptions Observed in One Solar Breakout Event

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Abstract

We report two sympathetic solar eruptions including a partial and a full flux rope eruption in a quadrupolar magnetic region where a large and a small filament resided above the middle and the east neutral lines, respectively. The large filament first rose slowly at a speed of 8 km s–1 for 23 minutes; it then accelerated to 102 km s–1 . Finally, this filament erupted successfully and caused a coronal mass ejection. During the slow rising phase, various evidence for breakout-like external reconnection has been identified at high and low temperature lines. The eruption of the small filament started around the end of the large filament's slow rising. This filament erupted partially, and no associated coronal mass ejection could be detected. Based on a potential field extrapolation, we find that the topology of the three-dimensional coronal field above the source region is composed of three low-lying lobes and a large overlying flux system, and a null point located between the middle lobe and the overlying antiparallel flux system.We propose a possible mechanism within the framework of the magnetic breakout model to interpret the sympathetic filament eruptions, in which the magnetic implosion mechanism is thought to be a possible link between the sympathetic eruptions, and the external reconnection at the null point transfers field lines from the middle lobe to the lateral lobes and thereby leads to the full (partial) eruption of the observed large (small) filament. Other possible mechanisms are also discussed briefly. We conclude that the structural properties of coronal fields are important for producing sympathetic eruptions.

Keywords: Sun: activity, Sun: coronal mass ejections (CMEs), Sun: filaments, prominences, Sun: flares, Sun: magnetic topology

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