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The Rapid Filament Restructuring in AR 12975 on 28 March 2022 and its Connection to the Subsequent Eruption

We analyzed a rapid filament restructuring during a confined C2 flare that led to an eruptive M4 flare 1.5 h later. During the C2 flare, the filament's southern half disappeared, and the remaining plasma flowed into a new, longer channel, similar to an EUV hot channel seen during the flare.

We took advantage of the quasi-quadrature position (84°) between SDO and Solar Orbiter, during its first science perihelion, by combining close-up (0.33 AU) and side-on observations from the Solar Orbiter/STIX and EUVI instruments with on-disk observations from SDO/AIA and HMI, along with nonlinear force-free field extrapolations.

Our results suggest that loop-loop reconnection occurred in an essentially vertical current sheet at a polarity inversion line below the breakup region and involved field lines surrounding the filament channel. This scenario is supported by concentrated currents and free magnetic energy built up by antiparallel flows. It can explain the extended flare loop arcade, the EUV hot channel, and the filament restructuring as the reconnection progressed to involve the filament itself.

In addition, it provides a general mechanism for the formation of the long filament channel via tether cutting, which was active throughout the filament's continuous rise phase, beginning at least 30 min before the C2 flare and continuing until the eruption. These results demonstrate how rapid changes in a filament's topology can be driven by a confined flare due to loop-loop reconnection (Type I confined flare), and how this can contribute to a prolonged tether-cutting process leading to a full eruption.

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