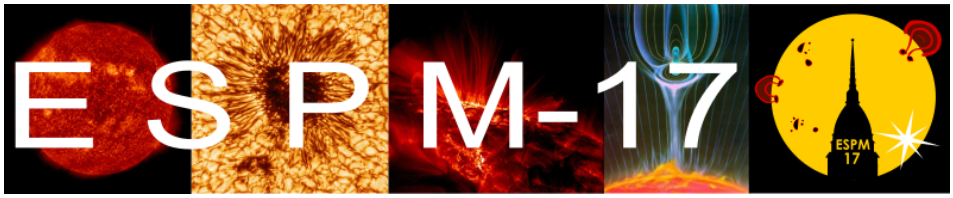

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Key Roles of External and Internal Reconnection in Small-Scale Solar Events

Small-scale solar events, such as microflares and mini-filament eruptions, are prevalent in the solar atmosphere. However, their eruption mechanisms are still not understood thoroughly. With a combination of 174 Å images of high spatio-temporal resolution taken by the Extreme Ultraviolet Imager on board Solar Orbiter and images of the Atmospheric Imaging Assembly on board Solar Dynamics Observatory, we investigate in detail an erupting mini-filament over a weak magnetic field region. The eruption exhibited two separating bright ribbons and small-scale blobs of 1–2 Mm, suggesting a sequence of internal followed by external reconnection, which transfers magnetic flux to the ambient corona. Additionally, magnetohydrodynamic simulations reveal that magnetic reconnection plays a crucial role in heating localized chromospheric plasma to coronal temperatures, leading to microflares. The magnetic topology analysis discloses that the reconnection region is located near quasi-separators where both current density and squashing factors are maximal with the specific topology varying from a tether-cutting to fan-spine-like structure. High-resolution magnetograms from the Polarimetric and Helioseismic Imager support MHD simulations suggesting that external reconnection generates jets and transfers mass and magnetic twist to the corona. These findings highlight the critical roles of internal and external reconnection in driving small-scale solar events. External reconnection, in particular, transfers mass to the corona, potentially contributing to the solar wind.

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