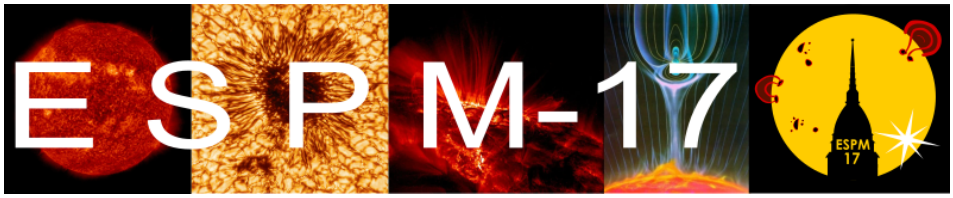

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Unveiling the Dynamics and Genesis of Small-scale Fine Structure Loops in the Lower Solar Atmosphere

Recent high-resolution solar observations have unveiled the presence of small-scale loop-like structures in the lower solar atmosphere, often referred to as unresolved fine structures, low-lying loops, and miniature hot loops. These structures undergo rapid changes within minutes, and their formation mechanism has remained elusive. In this study, we conducted a comprehensive analysis utilizing data from the Interface Region Imaging Spectrograph (IRIS) and the Goode Solar Telescope (GST) at the Big Bear Solar Observatory, aiming to elucidate the underlying process behind their formation. The GST observations revealed that these loops, with lengths of ~3.5 Mm and heights of ~1 Mm, manifest as bright emission structures in Hα wing images, particularly prominent in the red wing. IRIS observations showcased these loops in 1330 Å slit-jaw images. TR and chromospheric spectral lines exhibited significant enhancement and broadening above the loops, indicative of plasmoid-mediated reconnection during their formation. Additionally, we observed inverse Y-shaped configurations at their base and jet eruptions above these loops. Furthermore, differential emission measurement analysis reveals that these loops are heated to temperatures exceeding a million degrees. Based on our observations, we propose that these loops and associated jets align with the mini-filament eruption model. Our findings suggest a unified mechanism governing the formation of small-scale loops and jets akin to larger-scale X-ray jets.

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