



Observational Evidence of Three-Dimensional Magnetic Reconnections Based on MUSER and SDO Observations

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1 Abstract

We present a comprehensive study of a solar eruption based on the observations of the Mingantu Spectral Radioheliograph (MUSER) and the Solar Dynamics Observatory (SDO). This eruption originates from the ongoing shearing motion of the lower coronal loops, which leads to the formation and ascending of the initial flux rope. This expansion is eventually impeded by the larger-scale coronal structures that encompass them. The interaction between these structures results in a half-circular flare ribbon, rapid narrow outflows, and ejected plasmoids, all of which are characteristic of null-point magnetic reconnections. Notably, a sequence of radio bursts with varying fine structures demonstrates a significant relationship with the different processes occurring during the eruption. The initial radio signature, which exhibits a high-frequency limit exceeding 2 GHz, correlates with the typical reconnection events of the inner overlying loops that are being stretched by the ascending flux rope. Furthermore, the source of the subsequent repeating radio emissions, which have a high-frequency limit of 1.4 GHz or even lower, is observed in advance of the narrow outflows and ejected plasmoids. These observations support the notion of three-dimensional reconnection associated with the spine or separator (or quasi-separator).