MMS Observations of FTE-Type Structures with Internal Magnetic Reconnection

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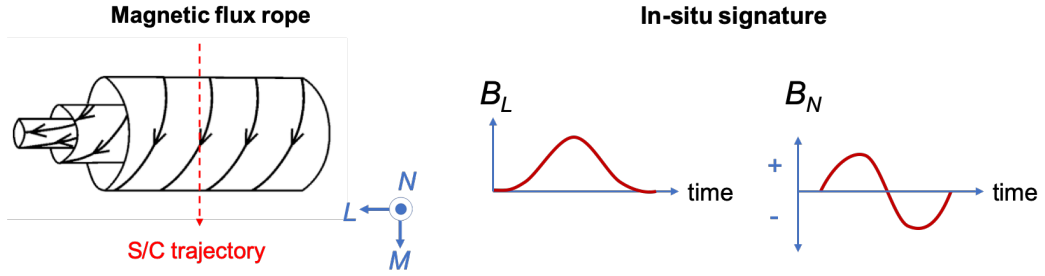
(1) FTE-Type Structures

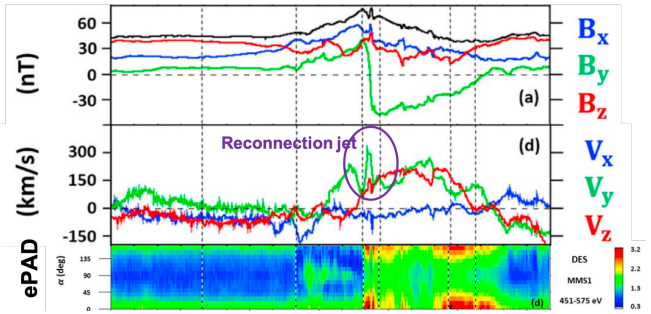
A bipolar magnetic variation B_N with enhanced core and total fields in spacecraft data are recognized as a Flux Transfer Event (FTE) signature, which corresponds to the passage of a magnetic flux rope structure.



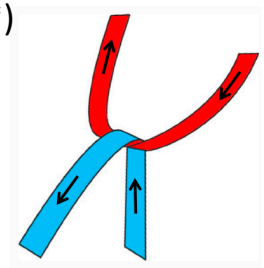
These signatures are observed at dayside magnetopause. They are believed to form in between two reconnection sites.

(2) MMS Observations of FTE-Type Structures

Signatures of magnetic reconnection are observed in the middle of the structures by Kacem et al. (2018) and Øieroset et al. (2019).



(*)



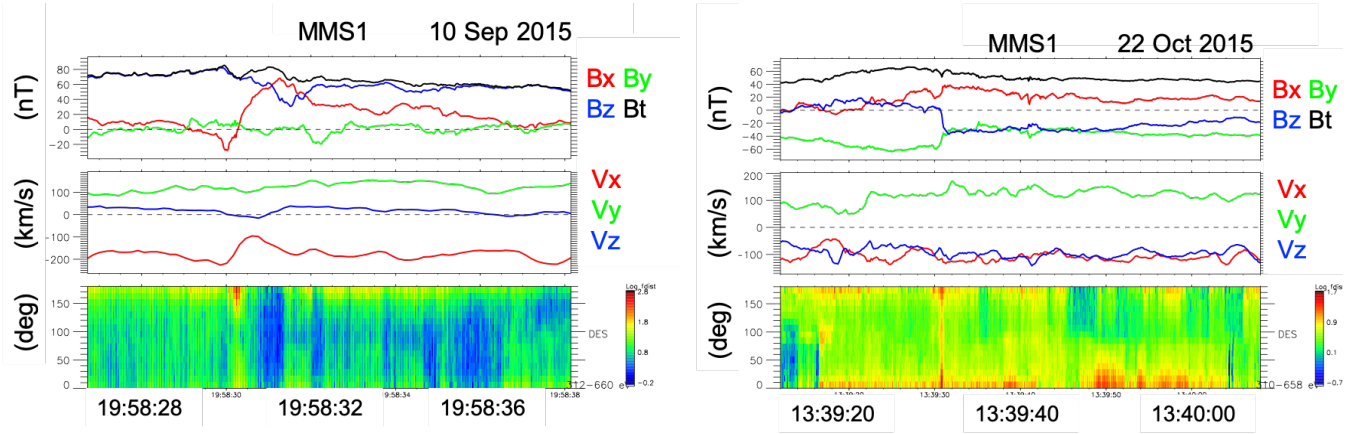
However, the electron pitch angle distributions (ePAD) in suprathermal energy range show distinct features on either side of current sheet, indicating different magnetic connectivities. This scenario is interpreted as interlinked flux tubes (IFTs) (*).

(3) FTE-Type Structures with Reconnection (FTER)

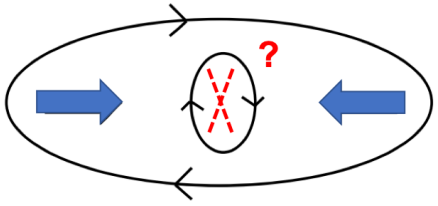
Ubiquity of FTE-type structures with reconnection at the central current sheet (CS) has been surveyed by Fargette et al. (2020) using MMS. It is found that 19% of FTEs at the dayside magnetopause of total 229 cases have reconnection signatures at the CSs. These structures are found under southward IMF with significant B_Y component.

(4) FTER: Detailed suprathermal ePAD Observations

Variations of ePAD of suprathermal electrons are indicative of magnetic topology. By surveying the ePAD of FTEs with reconnection cases reported by Fargette et al. (2020), we find different variations of ePAD across the structures. Particularly, we find homogeneous ePAD despite the reconnection, inconsistent with the IFT model.



(5) FTER with homogeneous ePAD: reconnection inside a single flux rope structure?



Adapted from Øieroset et al. (2019)

Homogeneous ePAD across the FTEs indicate that they are rather single flux ropes, not IFTs. A possible scenario is that the reconnection is due to compression due to converging jets. However, why is there reconnection at all? Is there any relation to IFT evolution? Comments and discussion are very welcome!