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Fine structures of the electron current sheet in magnetotail guide-field reconnection

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The electron-scale current sheet forms a basic feature of the electron diffusion region of magnetic reconnection, in which various electron processes have been revealed by researchers. However, due to its small spatial scale, the fine structure of the electron current sheet has not been fully investigated. In this study, we present fine structures of the electron current sheet in magnetotail guide-field reconnection by using Magnetospheric Multiscale (MMS) observations. This current sheet, observed in the outer electron diffusion region of reconnection, is not only featured by clear bifurcation and deflection, but also has complicated fine sublayers. The formation of these sublayers is closely related with streaming and meandering electrons, which is facilitated by the reconnection guide field. Particularly, in the sublayer around the B_L reversal, the meandering electrons, which usually move along the out-of-plane (M) direction, are strongly distorted into the v_L-v_M plane due to the finite B_M component. Finally, the low frequency fluctuation of this current sheet is also presented, contributing ~3% of the reconnection electric field by the anomalous effect. We suggest that such current sheet fluctuations, possibly related to the magnetic double-gradient instability, can be characteristic in the outer electron diffusion region.

References

[1] Burch et al, Science, 352(6290), (2016)

[2] Erkaev et al., Phys. Rev. Lett., 99, 235003 (2007)

[3]Torbert et al., Science 10.1126/science.aat2998 (2018).

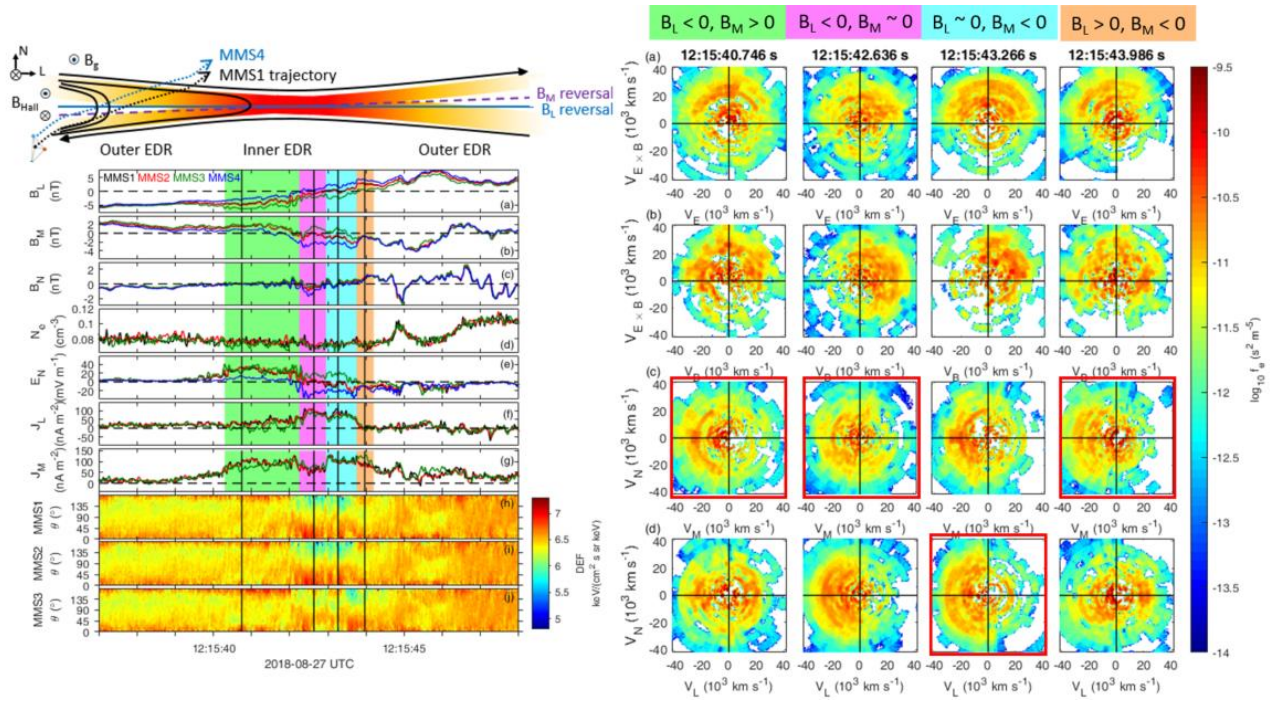

Figure. Fine structures of the electron current sheet observed by MMS. The right panels show the related reduced electron distributions indicated by the vertical black lines at different sublayers.