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MMS Observations of Electron Diffusion Region in Earth's Magnetosphere

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Electron diffusion region (EDR) is an electron-scale region at the heart of reconnection where electrons finally decouple from magnetic field. Its structure and physical properties have not been well resolved until the launch of the magnetospheric multiscale (MMS) mission. Here we present some novel observations of EDR by using the unprecedented high-resolution data from MMS. We show EDRs in reconnections in two different contexts: one is the nominal reconnection with small guide field in the neutral sheet in Earth's magnetotail, and the other is the reconnection with large guide field at the boundary of magnetic flux ropes. The EDR in the neutral sheet was embedded within an ion diffusion region. The EDR was identified and characterized by flow reversal, intense energy dissipation and electron nongyrotropy. The energy dissipation was manly contributed by parallel electron current and parallel electric field. Electrons gained limited energy as they crossed the EDR from the immediate upstream to the downstream. The EDR at the flux rope boundary was between two coalescing flux ropes. It was also characterized by intense energy dissipation through parallel electric field and suprathermal electron acceleration. Although the thickness of this EDR is comparable to that of the EDR inside the neutral sheet, this EDR was in a reconnection without ion coupling, i.e., electron-only reconnection, which is similar to the reconnection in the magnetosheath turbulence.

References

1. Zhou, M., X. H. Deng, Z. H. Zhong, Y. Pang, R. X. Tang, et al., Observations of an Electron Diffusion Region in Symmetric Reconnection with Weak Guide Field, Astrophys. J., 870, 34, 2019.
2. Zhou, M., et al., Coalescence of Macroscopic Flux Ropes at the Subsolar Magnetopause: Magnetospheric Multiscale Observations, Phys. Rev. Lett., 119, 055101, DOI: 10.1103/PhysRevLett.119.055101, 2017.