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Identification and analysis of in-situ observations of magnetic reconnection in the magnetosphere

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Magnetic reconnection in planetary magnetospheres plays a pivotal role in the transfer of solar wind mass and energy to the magnetosphere and rapid release of magnetic energy from the magnetotail during the course of magnetospheric substorms or explosive auroral activity. It is, however, a nontrivial task to identify, visualize, and elucidate the physical processes at work in reconnection regions from in-situ measurements of plasma particles and electromagnetic fields. Here, an overview is given of how reconnection effects or regions at global, magnetohydrodynamic-, ion-, and electron-scales can be identified and analyzed by use of in-situ measurements by space probes in and around Earth's magnetosphere. A particular emphasis is placed on recent advances in the era of NASA's Magnetospheric Multiscale mission, which has made, since the launch in 2015, electron-scale, multi-point measurements in the near-Earth space of magnetic reconnection in the collisionless regime. The methodology for the identification and analysis includes a variety of single- and multi-spacecraft data analysis techniques that are key to revealing the context of in-situ observations of magnetic reconnection in space and for detecting and analyzing the diffusion regions where ions and/or electrons are demagnetized and magnetic energy is converted to plasma energy. The presentation will be based on an outcome of the ISSI international team workshop on "Magnetic Reconnection: Explosive Energy Conversion in Space Plasmas",[1] a review article entitled "Advanced Methods for Analyzing In-Situ Observations of Magnetic Reconnection", which is currently under consideration for publication in Space Science Reviews.

References

[1] https://www.issibern.ch/workshops/magnetgeospace/