2025 Workshop: Fundamental physics in reconnection

Long title
Toward a better understanding of the fundamental physics in magnetic reconnection: energy conversion mechanisms and reconnection-turbulence interaction
GEM-only session
Conveners
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Description

With advancements in computational capabilities and continuous measurements of the Earth's magnetosphere by MMS, now is an opportune time to leverage state-of-the-art numerical simulations and satellite data to address key questions in magnetic reconnection. This session welcomes contributions on the fundamental physics of magnetic reconnection, with a focus on (1) the mechanisms governing the conversion of electromagnetic energy into plasma internal energy, (2) the interplay between reconnection and plasma turbulence, including the impact of intermittent current sheets on turbulence properties and the development of turbulence within reconnecting current sheets, and (3) cutting-edge techniques that advance reconnection research, such as innovative simulation methods and novel data analysis approaches.

Agenda

Zoom link: https://cuboulder.zoom.us/j/92875278306

- Katherine Davidson: *magnetotail reconnection leading to PBIs, using new high resolution SuperDARN data*

- Yu Lin: *TRACERS modeling*
- George Hospodarsky: *TRACERS statuts/summary*
- Jason Beedle: *MMS observations during the 2024 Mother’s Day/Gannon Storm*
- Xinmin Li: *Observation of a Knotted Electron Diffusion Region in Earth's Magnetotail Reconnection*
- Kristina Pritchard: *Dynamic Reconnection Rate*

Justification

Over the past decade, MMS has provided deep insights into the detailed physical processes occurring at sub-ion scales in magnetic reconnection. It is widely recognized that the diffusion region is highly complex, involving various waves and particle acceleration mechanisms that convert electromagnetic energy into plasma kinetic and thermal energy. However, a comprehensive understanding of the energy conversion process—from ion to electron scales—remains elusive. In addition, it is believed that reconnection plays a crucial role in the energy cascade process in plasma turbulence and turbulence developed within reconnecting current sheets may accelerate the electromagnetic energy release and particle energization. Despite its significance, the interaction between turbulence and reconnection has only recently gained substantial attention. Therefore, this session is timely by bringing together contributions that address key open questions in reconnection research. By emphasizing both simulations and satellite data analysis, this session will also foster collaborations between researchers with different expertise.

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reconnection, space plasma, turbulence
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