
Is Reconnection Suppressed by Diamagnetic Drifts at the Magnetopause?

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Abstract

The occurrence of magnetic reconnection is usually of pivotal importance regarding the evolution of magnetized astrophysical systems.

Among others, diamagnetic suppression is a mechanism that can prevent reconnection from developing.

Over the last decade, many studies have suggested that diamagnetic suppression is the dominant mechanism controlling whether reconnection occurs or not, in many space plasma environments, from planetary magnetospheres to the solar wind and heliopause. This conclusion was drawn from the reasonable agreement between the classification of current sheets observed in situ as being reconnecting or not, and their separation by theoretical predictions of diamagnetic suppression. Here, we show that an observational bias leads to a similar statistical separation simply because outflow speeds expected from reconnection strongly depend on both the magnetic shear and plasma beta, and low velocity jets become increasingly hard to observe when they become comparable to the surrounding flow fluctuation level, preventing the conclusion that reconnection is suppressed in those conditions. We furthermore show that well detected jets are found in conditions where, in contrast, reconnection should be suppressed, and conclude that the role of diamagnetic suppression at the Earth’s magnetopause remains unclear. Finally, we derive the condition for the diamagnetic suppression of magnetic reconnection in asymmetric current sheets and show that is entirely determined by the magnetic field amplitude asymmetry and shear angle but not on the plasma beta.

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