On resolving the dynamics and Oxygen and Iron ion abundance variations in coronal microjet modelling

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Résumé

Magnetic inversions known as switchbacks and velocity spikes have been ubiquitously observed in solar wind observations from the Parker Solar Probe and Solar Orbiter. Previous studies have suggested that they are formed due to interchange reconnection in the solar corona, from jetlets originating from small bipoles located at the base of coronal plumes. Remote sensing observations also show variations in the ion abundances of the solar wind that appear to be linked to the wind speed, but the underlying reason remains unclear. In this study, we present 2D MHD numerical modelling results using the IDEFIX code of a magnetic bipole emergence leading to microjets. We solve the ion-charge state ratio in the tracer variables of the code to obtain the Oxygen and Iron ion abundances in the structure. From the results, we find that the reconnection events and the resulting velocity jets can produce small-scale variations in the ion abundances, where the dominant effects from the jets push the lower ionisation states along the jet, potentially travelling into the outer corona. Combined with forward modelling of the microjets in the AIA, Solar Orbiter EUI/HRI, and MUSE passbands and resolutions, the results highlight the need for high spatial and temporal resolution observations to clearly resolve such structures visually and its resulting transient ion composition variation. If these signatures survive to the heliosphere, they may pinpoint the origins of the solar wind variation.

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