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# Dynamics of a switchback-like magnetic deflection induced by a propagating coronal jet

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## Résumé

The Parker Solar Probe (PSP) mission has revealed the ubiquity of switchbacks (SBs), namely sharp and localised magnetic deflections, in the nascent solar wind. Rarely observed near Earth, these features have spurred investigations into their origin and the processes responsible for their formation. A prominent theory is that switchbacks originate in the lower corona through magnetic reconnection processes, linked to solar jet activity. Solar jets are collimated, impulsive and sharp-edged features associated with magnetic reconnection that generate an Alfvénic torsional wavefront propagating outward into the heliosphere.

In this work, we investigate whether a realistic spacecraft crossing the path of a propagating solar jet can generate synthetic in-situ signatures comparable to the SBs observed by PSP. We also characterise the three-dimensional (3D) magnetic topology of the underlying structure and assess how the magnitude of the magnetic deflection evolves with the surrounding environment.

To this end, we perform a 3D magnetohydrodynamic simulation of a solar jet propagating through the ambient solar wind. A virtual spacecraft trajectory, constructed from the actual PSP orbit during its 22nd perihelion, is embedded within the simulation to produce synthetic in-situ measurements.

The simulation reproduces SB-like magnetic signatures with durations and profiles consistent with PSP observations, confirming earlier results obtained with simplified trajectories. This demonstrates that the torsional Alfvénic wavefront of the propagating jet naturally reproduces SB-like structures. For the first time, we directly visualise the full 3D magnetic topology of a jet-induced SB region. Two distinct families of magnetic field lines are identified: one displaying a single magnetic deflection and another exhibiting two sequential deflections propagating along the same field line. We note that the evolution of the magnitude of the magnetic deflection is strongly modulated by the background plasma beta, suggesting that the magnetic reversals require longer residence times in low-beta environments.

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\*Intervenant

This provides strong support for a solar origin of at least a fraction of the SBs observed by PSP and sets new constraints for interpreting PSP measurements in terms of their underlying magnetic structure.