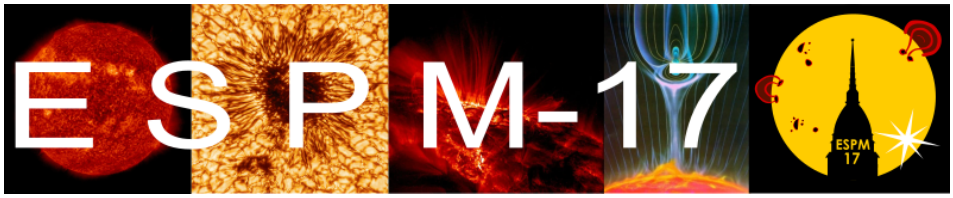


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# Are Switchbacks the Magnetohydrodynamic Equivalent of Smoke Rings?

*Tuesday 10 September 2024 14:30 (15 minutes)*

Switchbacks are large Alfvénic deflections , or even reversals, of the magnetic field in the solar wind. Many authors have suggested that switchbacks are linked to interchange reconnection in the solar corona, but the manner of this connection remains unclear. In our previous work we have shown that both the interchange reconnection process itself (Wyper et al. 22) as well as coronal jets and jetlets that involve interchange reconnection (Wyper et al. 18, Pariat et al. 09) launch Torsional Alfvén waves into the solar wind. Furthermore, photospheric swirls are also thought to be an abundant source of coronal Torsional Alfvén waves.

Here we present a new study of how such Torsional Alfvén waves can evolve into switchbacks in an superradially expanding solar wind. We find that through a combination of length contraction due to the reduction in Alfvén speed with height, and the onset of a Rayleigh-Taylor-like instability the waves evolve into a vortex ring configuration involving Alfvénic radial field reversals. We show that this evolution is relatively insensitive to the injection time or driving speed, provided a sufficient amount of twist is injected overall. We also find that the switchbacks within the vortex rings have a preferential deflection near helmet streamers that may explain observed RTN deflection biases. Overall, our findings support the idea that Torsional Alfvén waves launched into the solar corona can provide seed perturbations for the formation of switchback radial field reversals within the solar wind.

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