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Magnetic Reconnection as a Dissipation Mechanism for Magnetic Switchbacks

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Context: Magnetic switchbacks are localised polarity reversals in the radial component of the heliospheric magnetic field. Observations from *Parker Solar Probe* (PSP) have shown that they are a prevalent feature of the near-Sun solar wind. However, observations of switchbacks at 1 au and beyond are less frequent, suggesting that these structures are dissipated by yet-to-be identified mechanisms as they propagate away from the Sun.

Aims: We estimate the timescales over which magnetic switchbacks may be dissipated by magnetic reconnection and evaluate the viability of reconnection as a dissipation mechanism for switchbacks.

Methods: We analyse magnetic field and plasma data from the magnetometer and Solar Wind Analyser instruments aboard *Solar Orbiter* between 10 August and 30 August 2021. During this period, the spacecraft was 0.6 – 0.7 au from the Sun.

Results: We identify three instances of reconnection occurring at the trailing edge of magnetic switchbacks. Using hodographs and Walen analysis methods, we find that the reconnection exhaust region for all three events are bound by rotational discontinuities in the magnetic field, consistent with existing models describing the properties of reconnection in the solar wind. Based on these observations, we propose a scenario through which reconnection can dissipate a switchback and we estimate the timescales over which this occurs. We find that for our events the dissipation timescales are much shorter than the expansion timescale and thus, the complete dissipation of all three observed switchbacks would occur well before they reach Earth. Furthermore, assuming the observed reconnection rate has remained constant, and extrapolating back to an origin close to the Sun, we find that the spatial scale of these switchbacks would be considerably larger than is typically seen in the inner heliosphere. Hence, it is implied that the onset of reconnection must occur during transport in the solar wind. If typical, these results suggest that reconnection can play a significant role in dissipating switchbacks and could help explain the relative rarity of switchback observations at 1 au.