Title: Energetic particle behavior in near-Sun magnetic field switchbacks from Parker Solar Probe

Abstract:

Context— The observation of numerous magnetic switchbacks and associated plasma jets in Parker Solar Probe (PSP) during its first five orbits, particularly near the Sun, has attracted considerable attention. Switchbacks have been found to be systematically associated with correlated reversals in the direction of the propagation of Alfvénic fluctuations, as well as similar reversals of the electron strahl.

Aims— Here we aim to see whether the energetic particles change direction at the magnetic field switchbacks.

Methods— We use magnetic field data from the MAG suite's fluxgate magnetometer (MAG) instrument to identify switchback regions. We examine the radial anisotropy of the energetic particles measured by the EPI-Lo instrument of the IS⊙IS suite (energy range 80-200 keV/nuc).

Results— We find that energetic particles measured by EPI-Lo generally do not preferentially change their directionality from that of the background magnetic field to that of the switchbacks.

Conclusions— This result provides the possibility of setting a constraint on the radius of the curvature of the magnetic field in switchbacks, a property not otherwise observed by PSP. A reasonable hypothesis is that particles with smaller gyroradii, such as strahl electrons, can reverse direction by following the magnetic field in switchbacks, but that larger gyroradii particles cannot. This provides the possibility of setting a constraint on the radius of the curvature of the magnetic field in switchbacks, a property not otherwise observed by PSP. We expect that particles at higher energies than those detectable by EPI-Lo will also not respond to switchbacks. The observed reversals of radial energetic particle flux are separate phenomena, likely associated with source locations or other propagation effects occurring at greater radial distances.

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