

A Possible Generation Mechanism for “Switchbacks” Observed in the Solar Wind by the Parker Solar Probe (PSP)

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The Parker Solar Probe (PSP) has observed copious rapid magnetic field direction changes in the near-Sun solar wind. These features have been called "switchbacks," and their origin is a mystery. But their widespread nature suggests that they may be generated by a frequently occurring process in the Sun's atmosphere. We examine the possibility that the switchbacks originate from coronal jets. Recent work suggests that many coronal jets result when photospheric magnetic flux cancels, and forms a small-scale "minifilament" flux rope that erupts and reconnects with coronal field. We argue that the reconnected erupting-minifilament flux rope can manifest as an outward propagating Alfvénic fluctuation that steepens into an increasingly compact disturbance as it moves through the solar wind. Using previous observed properties of coronal jets that connect to coronagraph-observed white-light jets (a.k.a. "narrow CMEs"), along with typical solar wind speed values, we expect the coronal-jet-produced disturbances to traverse near-perihelion PSP in less than about 25 minutes, with a velocity of ~ 400 km/s. To consider further the plausibility of this idea, we show that a previously studied series of equatorial latitude coronal jets, originating from the periphery of an active region, generate white-light jets in the outer corona (seen in STEREO/COR2 coronagraph images; 2.5-15 solar radii), and into the inner heliosphere (seen in Solar-Terrestrial Relations Observatory (STEREO)/Hi1 heliospheric imager images; 15-84 solar radii). Thus it is tenable that disturbances put onto open coronal magnetic field lines by coronal-jet-producing erupting-minifilament flux ropes can propagate out to PSP space and appear as switchbacks. This work was supported through funding from NASA's Heliophysics Division.

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