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# Polar conic current sheets as sources and channels of energetic particles in the high-latitude heliosphere

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The existence of a large-scale magnetically separated conic region inside the polar coronal hole has been predicted by the Fisk-Parker hybrid heliospheric magnetic field model in the modification of Burger and co-workers (Burger et al., ApJ, 2008). Recently, long-lived conic (or cylindrical) current sheets (CCSs) have been found from Ulysses observations at high heliolatitudes (Khabarova et al., ApJ, 2017). The characteristic scale of these structures is several times lesser than the typical width of coronal holes, and the CCSs can be observed at 2-3 AU for several months. CCS crossings in 1994 and 2007 are characterized by sharp decreases in the solar wind speed and plasma beta typical for predicted profiles of CCSs. In 2007, a CCS was detected directly over the South Pole and strongly highlighted by the interaction with comet McNaught.
The finding is confirmed by restorations of solar coronal magnetic field lines that reveal the occurrence of conic-like magnetic separators over the solar poles both in 1994 and 2007. Interplanetary scintillation data analysis also confirms the existence of long-lived low-speed regions surrounded by the typical polar high-speed solar wind in solar minima.
The occurrence of long-lived CCSs in the high-latitude solar wind could shed light on how energetic particles reach high latitudes. Energetic particle enhancements up to tens MeV were observed by Ulysses at edges of CCSs both in 1994 and 2007. In 1994 this effect was clearer, probably due to technical reasons.
Accelerated particles could be produced either by magnetic reconnection at the edges of a CCS in the solar corona or in the solar wind. We discuss the role of high-latitude CCSs in propagation of energetic particles in the heliosphere and revisit previous studies of energetic particle enhancements at high heliolatitudes.
We also suggest that the existence of a CCS can modify the distribution of the solar wind as a function of heliolatitude and consequently impact ionization rates of heliospheric particles such as neutral interstellar gas atoms, pick-up ions or energetic neutral atoms
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