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The STEREO Electron Spikes and the Interplanetary Magnetic Field

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Klassen, etal discussed observations of a spike event of 55-65 keV electrons which occurred very nearly simultaneously at STEREO A and STEREO B, which at the time were separated in longitude by 38 degrees. The authors associated the spikes with a flare at the Sun near the footpoint of the nominal Archimedean spiral magnetic field line passing through STEREO A. The spike at STEREO A was delayed by 2.2 minutes from that at STEREOB. We discuss the observations in terms of a model in which the electrons, accelerated at the flare, propagate without significant scattering along magnetic field lines which separate or diverge as a function of radial distance from the Sun. The near simultaneity of the spikes at the two spacecraft is a natural consequence of this model. We interpret the divergence of the magnetic field lines as a consequence of field-line random walk and flux-tube expansion. We show that the field-line random walk in the absence of flux-tube expansion produces an rms spread of field lines significantly less than that which is required to produce to observed divergence. We find that observations of the solar wind and its source region at the time of the event can account for the observations in terms of propagation along interplanetary magnetic field-lines.

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