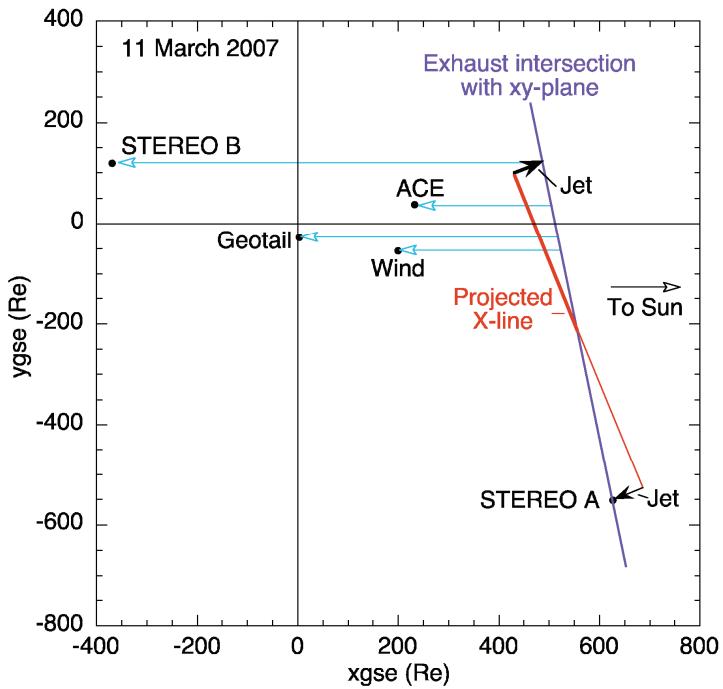


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An Extended Magnetic Reconnection X-line in the Solar Wind



Observations by a flotilla of five well-separated spacecraft of oppositely directed plasma jets within an extended, bifurcated current sheet in the solar wind have demonstrated the tremendous spatial scale over which magnetic reconnection can occur in a space plasma. Reconnection is an important plasma mechanism for converting magnetic energy to bulk flow energy and particle heating and often manifests itself in spectacular ways in space, solar, astrophysical and laboratory plasma. Measurements obtained in the solar wind by ACE, STEREO A and B, Wind, and Geotail on 11 March 2007 have revealed that reconnection occurred within an extensive current sheet along a line (the reconnection X-line) that extended at least 4.26×10^6 km = 668 Earth radii = 6.12 solar radii = 0.0284 AU, and persisted for more than 5.3 hours. These minimum values are the largest yet obtained from direct measurements in a space plasma (see also ACE News # 105). Determinations of X-line lengths and reconnection durations are important because, along with reconnection rates, those quantities determine how much magnetic flux was reconnected in an event. Both dynamic processes in the reconnection region and the spherical expansion of the solar wind probably contribute to the production of extended X-lines in the solar wind.

The figure above shows the positions of ACE, STEREO A and B, Wind, and Geotail on 11 March 2007 projected onto the gse xy-plane (Earth is located at the origin of the gse coordinate system). All of the spacecraft were positioned slightly below the xy-plane on this date. The violet line in the figure indicates the intersection of the current sheet with the xy plane at the time when STEREO A observed the anti-sunward-directed exhaust jet from the extended reconnection site. The red line shows the projection of the X-line onto the xy-plane at that time, the thick (thin) portion corresponding to that part of the X-line lying above (below) the xy-plane. Black arrows at the opposite ends of the X-line indicate projections of the oppositely directed jets observed by STEREO A and B, respectively. Blue arrows indicate the motion of the exhaust intersection as the X-line was carried anti-sunward by the nearly radial (from the Sun) flow of the solar wind (see ACE News #85). The lengths of the blue arrows are proportional to the predicted lags relative to STEREO A for the exhaust encounters at the other spacecraft. Those lags ranged from 105 to 320 minutes and were consistent with the exhaust intersection being nearly planar, as drawn.

Contributed by J. T. Gosling, University of Colorado (jack.gosling@lasp.colorado.edu). For details see Gosling et al., Geophys. Res. Lett., 34, L20108, doi:10.1029/2007GL031492, 2007. For an archive of earlier ACE News items see http://www.srl.caltech.edu/ACE/ACENews_Archives.html.