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Assessing the validity of the maximum magnetic shear model to predict the dayside reconnection location

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Reconnection at the Earth's magnetopause is the mechanism by which magnetic fields in different regions change topology to create open magnetic field lines that allow energy and momentum to flow into the magnetosphere. One of the long standing questions about magnetic reconnection is the location of the reconnection line. There are two reconnection scenarios discussed in the literature: a) anti-parallel reconnection where shear angles between the magnetospheric field and the interplanetary magnetic field (IMF) are near 180°, and b) component reconnection where a tilted reconnection line which crosses the magnetopause in the sub-solar region at shear angles not near 180°.
Early satellite observations were limited to the detection of accelerated ion beams in the magnetopause boundary layer to determine the general direction of the reconnection line location with respect to the satellite. An improved view of the reconnection location at the magnetopause was determined from ionospheric emissions observed by polar-orbiting imagers which revealed that both scenarios occur. The time-of-flight effect of precipitating ions in the cusp in connection with the low-velocity cutoff method pin-pointed reconnection locations and their dependency on IMF conditions. These results are summarized by the Maximum Magnetic Shear Model.
This study will discuss recent investigations to test the validity of the predictions from the Maximum Magnetic Shear model. Several multi-spacecraft studies at the magnetopause showed an excellent agreement between the predicted and observed location of the reconnection line, especially under dominant IMF BY conditions.