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The location of the reconnection line for southward IMF

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One of the major outstanding questions about magnetic reconnection is where reconnection will occur at the magnetopause. There are two scenarios discussed in the literature, a) anti-parallel reconnection where shear angles between the magnetospheric field and the IMF are near 180 degrees, and b) component reconnection where shear angles are as low as 50 degrees. One popular component reconnection model is the tilted neutral line model. Both reconnection scenarios have a profound impact on the location of the X-line and plasma transfer into the magnetosphere.

We have analyzed about 80 northern cusp crossings by the Polar satellite during southward IMF conditions. Measurements from the Toroidal Imaging Mass-Angle Spectrograph (TIMAS) onboard the Polar spacecraft are used to estimate the distance to the reconnection line by using the low-velocity cutoffs of the precipitating and mirrored magnetosheath populations in the cusp. Our analysis revealed that the occurrence of anti-parallel or tilted X-line (component) reconnection depends on the clock angle of the IMF. The reconnection lines are located at the anti-parallel reconnection sites for southward IMF conditions and small angles of the IMF By component. However, an increase in the By component increases the probability to encountner a tilted X-line.