

Retreat and reformation of X-line during quasi-continuous magnetic reconnection at the high-latitude magnetopause

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It is known that magnetic reconnection can persist for hours, e.g., at the high-latitude magnetopause. However, it remains unknown in what manner reconnection can be continuous in regions where the flow tangential to the current sheet is significant on one side of the current sheet, as at the high-latitude or flank magnetopause; whether a single X-line sits still and remains active for an extended period of time, or an X-line retreats with the tangential flow and then a new X-line reforms at or near the original reconnection site. Here we present observations on 19-20 November 2006 by the Cluster spacecraft that were skimming the high-latitude dusk-flank magnetopause, which are consistent with more than one reconnection X-line present on the tailward side of the polar cusp under northward interplanetary magnetic field. Evidence of quasi-continuous reconnection over 16 hours exists in the form of Alfvénic acceleration of magnetosheath ions found almost always when either of the satellites traversed the magnetopause current layer. The data indicate that for most of the time, a dominant X-line was between Cluster and the cusp (sunward of Cluster), but ion velocity distributions consisting of two magnetosheath (shocked-solar-wind) populations demonstrate that for part of the time, more than one X-line existed. Further, the motion of reconnected field lines shows that some X-line(s) retreated tailward and was anti-sunward of Cluster. It is inferred that following the X-line retreat, another X-line reformed sunward of Cluster, leading to multiple X-lines.