Cluster observations of magnetospheric cusp

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Cluster data from the FGM, CIS, PEACE, EFW, WHISPER and STAFF instruments are used to study the magnetospheric cusp at different altitudes under normal and extreme solar wind conditions. On 18 April 2002 the Cluster spacecraft crossed through a high altitude cusp during the period 16:25-17:55 UT when the solar wind dynamic pressure was rather low ($<$ 2 nPa). The data reveal that the cusp is structured with three anti-sunward ion flow events of durations $\approx$ 1.5, 17.5 and 19.0 min, with bulk plasma flow roughly parallel to the magnetopause in a northerly direction. The ion and electron densities observed within these events are much greater than those outside. The zonal electric field in the ion flow events turns eastward as expected from the $\mathbf{V}\times\mathbf{B}$ effect. The sharp boundaries of the ion flow events cross the four spacecraft in a nested sequence suggesting global motion of the boundary rather than a convecting structure. The observations studied using magnetosphere and magnetopause models suggest that the structured cusp arises due to three inward and outward movements of the magnetopause due to the changes in the solar wind dynamic pressure. The solar wind pressure changes mainly due to the changes in the solar wind density.