ON THE FINE STRUCTURE OF DIPOLARIZATION FRONTS

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Measurements from the closely spaced Cluster spacecraft are used to study the structure of the magnetic and electric fields within the magnetic ramp of dipolarisation fronts (DF) observed close to the neutral sheet and the midnight meridian ($Y_{GSM} < 3$ R_E). The spacecraft separation was small enough (< 300 km) to treat the magnetic ramp of the DF front as a planar structure as indicated from variance analysis. The finite value of the magnetic field along the minimum variance direction for the events studied indicates that the dipolarisation front structure was distinct from a tangential discontinuity. In addition to the main increase of the magnetic field in the maximum variance component, strong oscillations were observed in the intermediate component. The presence of this oscillatory structure results in an expansion of the region in which a change of magnetic pressure occurs, the size of which is typically an ion Larmor radius or greater. This widening is important in maintaining the pressure balance at the edge of the DF. This phenomenon resembles observations of intense current sheets in the magnetotail and also laboratory experiments of current sheet formation, in which a similar widening of the ramp region has been observed. In this paper we argue against the idea that an electron temperature anisotropy, resulting in electron curvature currents, can explain the formation of the oscillatory structures observed at DFs. Alternative explanations are investigated.