



Observations of Ion Heating in Inverted-V Structures in the High-Latitude Plasma Sheet Boundary Layer

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Ion beams of H^+ , He^+ and O^+ were observed escaping the Earth's ionosphere by Cluster when the satellites crossed the high latitude plasma sheet boundary layer (PSBL) in the southern hemisphere. These beams appear as inverted-V structures in the energy flux spectrograms. The pitch angles of the beams are ~ 0 to 30° , hence these are ions streaming out of the ionosphere. These beams in the inverted-V structures occur with another ion population of ring-shaped distribution. These beams show the parallel temperature (T_{\parallel}) increases as the streaming velocity of the beam increases indicating the beams are being heated as they are accelerated by the field-aligned negative U-shaped potentials in the auroral acceleration region (AAR). The streaming velocity ranges from a few tens of km/s to several hundred km/s indicating a potential drop of $\sim 10^2$ to 10^4 volts. Ions are heated more in the central U-shaped region than on the sides. These results provide important new information to modelers and theorists about how the escaping ions are heated.