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On the nature and statistical properties of transport barriers in magnetospheric and laboratory plasma

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The transport barriers near magnetospheric cusp have a dualistic feature: being very effective in limitation of the momentum transfer, they display the super-diffusive statistical properties.
We show an example from Interball-1 with a rare case of extremely quiet solar wind. The inbound magnetopause crossing, being inherently turbulent in this equilibrium case, is best seen from changes of the magnetic field component signs. The ion heating starts namely in the transport barrier and proceeds deeper inward magnetosphere. It agrees with the kinetic energy transformation into the thermal one inside the barrier – the turbulent dissipation of the magnetosheath kinetic energy – as simultaneously with the ion temperature rise the general velocity component drops from its model prediction. Fitting the log-Poisson model for 1D most- dissipative structures gives qualitatively similar result.
In sense of the momentum transfer the Alfvenic turbulent barrier effectively isolates the high- part of the magnetospheric cusp, from rather fast- flowing ($\sim$ 200 km/s) magnetosheath. Contrary to that, several examples from different missions and different plasma parameters demonstrate the super-diffusive transport character. The individual Alfvenic 'collapsons' have similar scale chains to that of high kinetic pressure jets, showing mutual interaction features. We think that the interacting jets and barriers, accompanying by classic and/ or micro-reconnection, have rather general importance for the plasma physics, and for understanding of turbulence and mechanisms of magnetic field generation. These coherent, nonlinear interacting structures will be further explored in details by such missions as ROY and Cross-Scale/ SCOPE. We compare the statistical properties of transport barriers in space and fusion devices.