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Small scale particle acceleration processes in the auroral region: Remote sensing and "in situ" measurements

R. Pottelette (1), M. Berthomier (1), and J. Pickett (2)

(1) LPP, Saint Maur des Fossés, France (raymond.pottelette@lpp.polytechnique.fr), (2) Departemnt of Physics and Astronomy, the University of Iowa, USA (pickett@uiowa.edu)

Among the many problems in auroral physics that are barely understood the microphysical problems occupy a majority position. Thanks to high sampling and telemetry rates implemented on spacecraft devoted to the study of the auroral regions such as POLAR, FAST, CLUSTER 2..., it has become possible to determine the role of transient nonlinear structures in the basic microscopic processes regulating the Magnetosphere-Ionosphere interactions. Great progress has been achieved in probing the nonlinear turbulent plasma processes which accelerate energetic particles and generate radiation such as the Auroral Kilometric Radiation (AKR) in the auroral upward current region.

Narrow-in-altitude acceleration layers (double layers) can be identified by using both particles and waves measurements. Double layers once immersed in the plasma necessarily accelerate particles along the magnetic field, thereby generating locally strong turbulent processes leading to the formation of phase-space holes. As predicted by numerical simulations, we will emphasize the asymmetric character of the turbulence generated in the regions located upstream (low-potential side) or downstream (high-potential side) of a double layer. We will also point out that monitoring the time variation of the frequency drift of the elementary AKR radiators allows to qualitatively infer about the dynamics and the spatial extension of the field-aligned potential drops.