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# Dynamics of collisionless shock front: Macro- to micro-scales turbulence

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As evidenced by in-situ experimental observations and numerical simulations, collisionless shocks reveal to have a strong turbulent activity due to non-stationary processes. PIC simulations have shown that some dissipation and nonlinear dispersion mechanisms may be responsible for nonstationary behavior of the shock front which develops over large (ion) time and spatial scales for certain plasma conditions. These large scales processes have a strong impact on both downstream and upstream regions, in the sense that they modulate the percentage and the energy gain of transmitted and reflected particles. On the other hand, PIC simulations have shown recently that some microinstabilities may also develop locally within the shock front itself, over scales much smaller than ion scales. These scales can be even lower than the electron inertial length. In contrast with many previous works where local homogeneous (no gradient) and stationary plasma conditions have been used, these microinstabilities have been evidenced and analyzed within a more realistic self consistent approach including the intrinsic shock dynamics. These small scale microinstabilities bring some additional sources of dissipation which may alter the dynamics of large scale dissipation processes. Efforts have been developped recently to analyse (i) the mutual impact of these different sources of dissipation in terms of shock front nonstationarity, and (ii) how these succeed to coexist and/or to annihilate each other. These informations are quite helpful to interpret the electrostatic and electromagnetic turbulence commonly evidenced in experimental results and more recently in CLUSTER mission data. A review of these different processes will be presented.