# HIGH MACH NUMBER NONSTATIONARY SHOCKS: OVERTURNING PROCESS

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High Mach number shocks are supposed to manifest strong temporal variations as it was shown in computer simulations [1-3] and in theoretical studies [4-6]. The non-stationarity of the shock front consists in the growth of the potential electric field up to extremely large values in some localized sites and of the magnetic field gradients. The energy dissipation occurs due to the quasiperiodic overturning of the ion flow that is accompanied by the formation of the regions of the multi-flow motions. The overturning process results in the explosive growth of the potential electric field and in the acceleration of the ion flows, that gives rise to the strong variations of the reflected ions density and energy. Strong variations of the potential electric field in the vicinity of the "gradient catastroph" sites can accelerate electrons up to quite high energies. In our work we study self-similar behavior of electric and magnetic fields in the vicinity of the boundaries of the multi-flow regions where the gradient catastrophs occur. We show that the regions of multi-flow motions when they are formed have three-dimensional spatial structure similar to typical "catastroph domains" but then their temporal evolution has some characteristics defined by the motion of particles after formation of the multi-flow motion in the background magnetic field. The system shows periodic "flickering" that can result in generation of upwards propagating oscillations. The effect of the formation of the tails of the energetic ions is similar to the one that occurs when two different plasmas penetrate each other as a result of the decay of the initial discontinuity first investigated by Gurevich and Pitaevsky [7]. The authors acknowledge the financial support of ISSI (Bern).

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