Geophysical Research Abstracts, Vol. 9, 06077, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-06077

Theory and simulations of nonlinear mirror modes near instability threshold

E. Kuznetsov(1) **T. Passot**(2), P.L. Sulem(2), F. Califano(3), P. Hellinger(4), P.Travnicek(4)

(1) L. D. Landau Institute of Theoretical Physics, 2 Kosygin street, 119334 Moscow, Russia, (2) Observatoire de la Côte d'Azur, PB 4229, 06304 Nice Cedex 4, France, (3) Dipartimento di Fisica, Universita' di Pisa, Largo Pontercorvo n.3, 56127 Pisa, Italy, (4) Institute of Atmospheric Physics, AS CR Bocni II/1401, 14131 Prague, Czech Republic.

The nonlinear dynamics of mirror modes in a magnetized plasma with anisotropic ion temperature and cold electrons is addressed near the instability threshold, using asymptotic analysis and numerical simulations of Vlasov-Maxwell (VM) equations. A reductive perturbative expansion leads to a pseudo-differential equation whose solutions blow up in a finite time, indicating the formation of finite-amplitude structures through a subcritical bifurcation. Hybrid numerical simulations performed both with Eulerian Vlasov and particle in cell (PIC) codes, show that the saturation of the mirror instability results in the formation of magnetic humps. A phenomenological modification of the asymptotic equation retaining the local variation of the ion Larmor radius is proposed, that reproduces the numerical observations and also simulates the formation of magnetic holes below the instability threshold for large enough initial perturbations. Such structures are also obtained in PIC simulations, when the β parameter is progressively reduced. These results are consistent with space plasma observations.