Geophysical Research Abstracts, Vol. 8, 01974, 2006
SRef-ID: 1607-7962/gra/EGU06-A-01974

A fluid description of mirror instability and mirror mode structures

P.L. Sulem (1) , V. Ruban (2) , T. Passot (1)

(1) CNRS, Observatoire de la Cote d'Azur, B.P. 4229, 06304 Nice Cedex 4, France (sulem@obs-nice.fr, passot@obs-nice.fr)
(2) Landau Institute for Theoretical Physics, Moscow, Russia (ruban@itp.ac.ru)

A fluid model for quasi-transverse low-frequency waves in a homogeneous magnetized plasma is presented. It retains hydrodynamic nonlinearities together with a linear approximation of Landau damping and finite Larmor radius effects. It accurately reproduces the kinetic theory predictions for the mirror instability, including its quenching at small transverse scales. The dispersion relation of kinetic Alfvén waves is also recovered. This model is expected to provide an efficient tool to simulate the formation of mirror mode structures, for which kinetic effects play an essential role. A generalized equation of state for the quasi-static regime is proposed and used to compute stationary nonlinear solutions. Depending on the plasma parameters, magnetic holes, at moderate β, or magnetic humps, for β of order ten or larger, are obtained as stable minima of the system energy under the constraint of particule conservation and frozen-in magnetic field. The existence of a bi-stability regime for specific conditions of ion temperature anisotropy is in particular pointed out.

References

T. Passot and P.L. Sulem, A Fluid Model with Finite Larmor Radius Effects for Mirror Mode Dynamics, J. Geophys. Res., in press.

T. Passot, V. Ruban and P.L. Sulem, Fluid description of stationnary mirror structures in a magnetied plasma, preprint.