Geophysical Research Abstracts
Vol. 12, EGU2010-3367-1, 2010
EGU General Assembly 2010

Evolution of nonlinearly coupled drift wave-zonal flow system in a nonuniform magnetoplasma

Dušan Jovanović (1), Padma Kant Shukla (2), and Bengt Eliasson (3)

(1) Institute of Physics, Pregrevica 118,11080 Beograd, Serbia (dusan.jovanovic@phy.bg.ac.rs), (2) Institut für Theoretische Physik IV, Fakultät für Physik und Astronomie, Ruhr-Universität Bochum, D-44780 Bochum, Germany, (3) Institut für Theoretische Physik IV, Fakultät für Physik und Astronomie, Ruhr-Universität Bochum, D-44780 Bochum, Germany

The amplitude modulation of a finite amplitude drift wave by zonal flows in a nonuniform magnetoplasma is considered. The evolution of a nonlinearly coupled drift wave-zonal flow (DW-ZF) system is governed by a nonlinear equation for the slowly varying envelope of the drift waves, which drives (via the Reynolds stress of the drift wave envelope) the second equation for zonal flows. The nonlinear dispersion relation for the modulational instability of a drift wave pump is derived and analyzed. In a special case, the DW-ZF system of equations reduces to the cubic nonlinear Schrödinger equation, which admits localized solutions in the form of DW envelope solitons, accompanied by a shock-like ZF structure. Numerical solutions of the nonlinearly coupled DW-ZF systems reveal that an arbitrary spatial distribution of the DW rapidly decays into an array of localized drift wave structures, propagating with different speeds, that are robust and in many respect behave as solitons. The corresponding ZF evolves into the sequence of shocks that produces a strong shearing, i.e multiple plasma flows in alternating directions.