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Kinetic wave instabilities that constrain space plasma properties

Marian Lazar (1), Stefaan Poedts (1), and Reinhard Schlickeiser (2)

(1) Center for Mathematical Plasma Astrophysics, K.U. Leuven, Belgium, (2) Ruhr-University Bochum, Theoretical Physics 4, Bochum, Germany (mlazar@tp4.rub.de)

A realistic perspective upon the dynamics of space plasmas reveals the fundamental role played by the wave fluctuations in the heating, transport and stability of plasmas. These fluctuations are sustained and driven unstable by the kinetic anisotropies of charged particles, like beams, suprathermal populations or the temperature anisotropies. In turn, the wave-particle interactions are particularly interesting in a the solar wind and magnetospheric plasmas because these are poor-collisional, and the adiabatic expansion or Coulomb collisions are not sufficient to explain the observed relatively small anisotropy of the temperature.

Here we present a new report of the kinetic wave instabilities predicted by the linear and nonlinear dispersion theory as plausible constraints for the temperature anisotropy in these environments. In contrast to previous studies, here the entire wave spectrum of the competing instabilities is investigated, paying particular attention to the relatively poorly known aperiodic instabilities. These can develop in the same conditions with the propagating wave instabilities, puzzling once more over their role in conditioning the space plasma properties. A new hierarchy is proposed on the basis of a detailed examination of the competing modes.