

Quasi-linear analysis of the extraordinary electromagnetic wave destabilized by runaway electrons

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Relativistic runaway electron distributions are strongly anisotropic in velocity space. Due to this anisotropy they can give rise to electromagnetic waves via a resonant interaction, which in turn can cause the velocity-space scattering of runaway electrons. Previous studies considered the destabilization and evolution of the whistler wave (whistler wave instability, WWI), which indeed leads to rapid pitch-angle scattering of the runaways [1]. However, in a recent paper it was shown that runaways can destabilize also the so-called extraordinary-electron (EXEL) waves [2]. The number of electrons for destabilization of EXEL is several orders of magnitude lower than for the WWI, and therefore it is interesting to analyze what effect it could have on runaway beam formation.

In the present work we investigate the evolution of the runaway distribution affected by the quasi-linear diffusion process associated with the EXEL wave instability. The evolution of the distribution function is given by a diffusion equation in phase space, where the rate of growth of wave-energy is equal to the linear growth rate of the wave. The polarization of EXEL is calculated analytically from its unperturbed dispersion, and the resulting diffusion equation is solved numerically in order to determine the time evolution of the runaway distribution.

References

- [1] G. Pokol, T. Fülöp and M. Lisak, *Plasma Phys. Control. Fusion* **50**, 045003 (2008)
- [2] A. Kómar, G.I. Pokol and T. Fülöp, *J. Phys. Conf. Series* **401**, 012012 (2012)