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Linear Study of Electromagnetic Hot Electrons Instabilities in a Closed Field Line Plasma. NATALIA KRASHENINNIKOVA, LUIS CHACON, LANL, JAY KESNER, PSFC (MIT) — Motivated by the electron cyclotron heating being employed on the Levitated Dipole Experiment, the hot electron instabilities are investigated by considering the simplest closed magnetic field line geometry - a Z-pinch. The linear theory of electromagnetic interchange modes in a plasma of fluid background and a small fraction of kinetic hot electrons was recently studied theoretically [1]. The model assumed that the species diamagnetic drift and magnetic drift frequencies are of the same order, and that the wave frequency is much larger than the characteristic frequencies of the background but much smaller than that of the hot species. We extend the framework outlined in this reference to allow mode frequencies of the same order as typical hot electron frequencies, and relax the large azimuthal wave number and local approximations. The characteristic equation, resulting from the eigenvalue formulation is a highly non-linear, integro-algebric function, and is handled in this work by a fast 1-D generalized Newton-based eigenvalue solver. This tool allows us to study the evolution of the mode frequency as a function of several parameters, such as the background profile steepness and the hot electron fraction. The results are discussed and compared with both theoretical predictions1 and experimental results.
[1] N. Krasheninnikova, P. J. Catto, Phys. Plasmas, 12, 32101 (2005).

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