Abstract Submitted
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Dynamics and turbulence in electron MHD MAXIM LYUTIKOV, Purdue University — We consider dynamics and turbulent interaction of whistler modes within the framework of inertialess electron MHD (EMHD). We argue there is no energy principle in EMHD: any stationary closed configuration is neutrally stable. We consider the turbulent cascade of whistler modes. We show that (i) harmonic whistlers are exact non-linear solutions; (ii) co-linear whistlers do not interact (including counter- propagating); (iii) whistler modes have a dispersion that allows a three-wave decay, including into a zero frequency mode; (iv) the three-wave interaction effectively couples modes with highly different wave numbers and propagation angles. In addition, linear interaction of a whistler with a single zero-mode can lead to spatially divergent structures via parametric instability. We derive the Hamiltonian formulation of EMHD, and using Bogolyubov transformation reduce it to a canonical form; we calculate the matrix elements for the three-wave interaction of whistlers. We solve numerically the kinetic equation and show that, generally, the EMHD cascade depends on the forcing and often fails to reach a steady state. Analytical estimates predict the spectrum of magnetic fluctuations for the quasi-isotropic cascade $\sim k^{-2}$. The cascade remains weak (not critically-balanced). The cascade is UV-local, while the infrared locality is weakly (logarithmically) violated.

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