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Spectral analysis of the Weibel turbulence with PIC simulations[1]
MICHAEL SITARZ, MIKHAIL MEDVEDEV, Univ of Kansas, ALEXANDER PHILIPPOV, CCA, Flatiron Institute — The filamentation (Weibel) instability is ubiquitous in energetic astrophysical systems, such as in collisionless shocks of gamma-ray bursts, supernovae, relativistic jets, accretion shocks in galaxy clusters and others. It is generated in weakly-magnetized environments, where the initial magnetic energy density is well below equipartition, and with anisotropic particle distribution function in momentum space. Radiation from the Weibel-generated, sub-Larmor-scale magnetic fields, known as the jitter radiation, differs significantly from the cyclotron or synchrotron radiation. In particular, the radiation spectrum carries much information about the magnetic field properties, as is shown in both theoretical and numerical studies. We perform simulations of the Weibel instability with the state-of-the-art PIC simulations. Next, we perform spectral analysis of the produced turbulent state which includes electromagnetic and fast magnetosonic modes. Thus, our analysis is the first, truly first-principles study of the Weibel turbulence state. We discuss our numerical techniques and present preliminary results.

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