

Experiment and simulations of kinetic instabilities in mirror-confined ECR discharge plasma

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Non-Maxwellian electron distribution functions give rise to a rich variety of kinetic instabilities, such as streaming instability, Weibel instability, and electrostatic and electromagnetic cyclotron instabilities. Electron ring-like distributions are ubiquitous in space plasmas and also occur in mirror-confined plasma where the loss-cone cuts a 'hole' in the distribution function. We report recent observations and simulations of instabilities in mirror-confined ECR discharge plasma [1], where excitation on harmonics and half-harmonics of the electron cyclotron frequency have been observed. The relevance to space plasma are also discussed where similar observations by satellites are common [2,3]. Theory and simulations show that electrostatic instabilities take place where two electron Bernstein modes merge [4]. Electromagnetic Vlasov simulations also show the coupling between electrostatic and electromagnetic electron Bernstein modes leading to instabilities near cyclotron harmonics.

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