Particle simulations of instabilities driven by ring velocity distribution and density gradient

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In this contribution we study generation of electrostatic waves and their conversion to electromagnetic waves in systems where plasma density gradient and ring beam instability are present using 2D-3V electromagnetic code KEMPO2. Ring beam instability is characterized by velocity distribution drift in the direction perpendicular to the external magnetic field. Properties of plasma with such velocity distributions was recently studied [1,2] and it was found that this type of instability can generate strong emission of electrostatic waves in the direction perpendicular to the magnetic field (for example upper hybrid waves or Bernstein modes) [3]. Beside ring beam instability, density gradient can cause gradient drift instability [4]. Electrostatic waves generated by the mentioned instabilities can convert to electromagnetic waves like LO mode, RX mode, or whistler mode chorus emissions. In described system we study the temporal evolution of wave spectra, velocity distributions, Poynting flux, and electric and magnetic energies to identify the wave mode conversion. Such a conversion process might be a source of electromagnetic emissions measured by spaceraft on the plasma-pause density gradient.

References:
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