PIC SIMULATIONS OF WAVE-MODE CONVERSION ON THE PLASMAPAUSE

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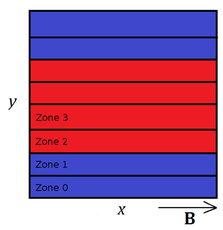
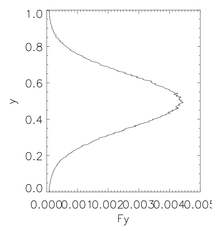
ABSTRACT

Bernstein waves are electrostatic waves originating within plasmas in external magnetic field. These waves exist in two modes: i) electron mode with characteristic frequencies around electron cyclotron frequency and its harmonics, and ii) ion mode with characteristic frequencies around ion cyclotron frequency and its harmonics [1]. The Bernstein waves propagate mostly perpendicularly to the external magnetic field. During the oblique propagation, their damping rate increases. These waves are detected from data measured by spacecraft in Earth's magnetosphere (e.g., by CLUSTER spacecraft [2]). The Bernstein waves as electrostatic waves can couple with electromagnetic waves on filamentary density irregularities aligned with magnetic field [3]. It means that electromagnetic waves can scatter on such irregularities to the electrostatic waves. In [4] authors proposed possibility of similar mechanism of direct scattering of electron Bernstein waves to electromagnetic modes.

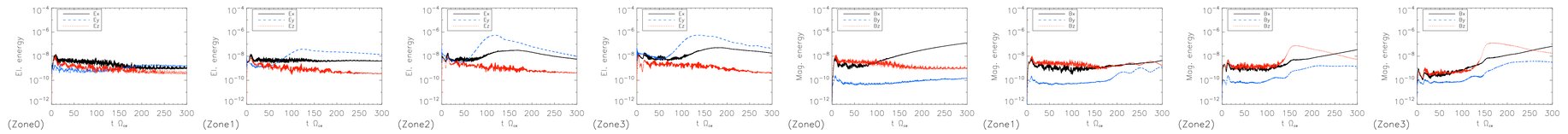
Numerical study of the scattering of electrostatic waves to the electromagnetic waves and its properties is subject of our present research. We use use 2D electromagnetic Particle In Cell code with implemented filamentary density irregularity to simulate the coupling between electrostatic and electromagnetic modes. Presented results shows a mode conversion from Bernstein waves to electromagnetic waves which propagates out from the dense region.

Parameter	Value	Parameter	Value
n_g	512	v_{the1}	2.0
Δt	0.03	v_{the2}	2.0
Δx	1.0	v_{the3}	1.0
Ω_c	0.5	$v_{d1,2}$	0.0
ω_{p1}	1.0	v_{d3}	8.0
ω_{p2}	5.0	N_e/cell	9216
ω_{p3}	1.0	m_i/m_e	1000

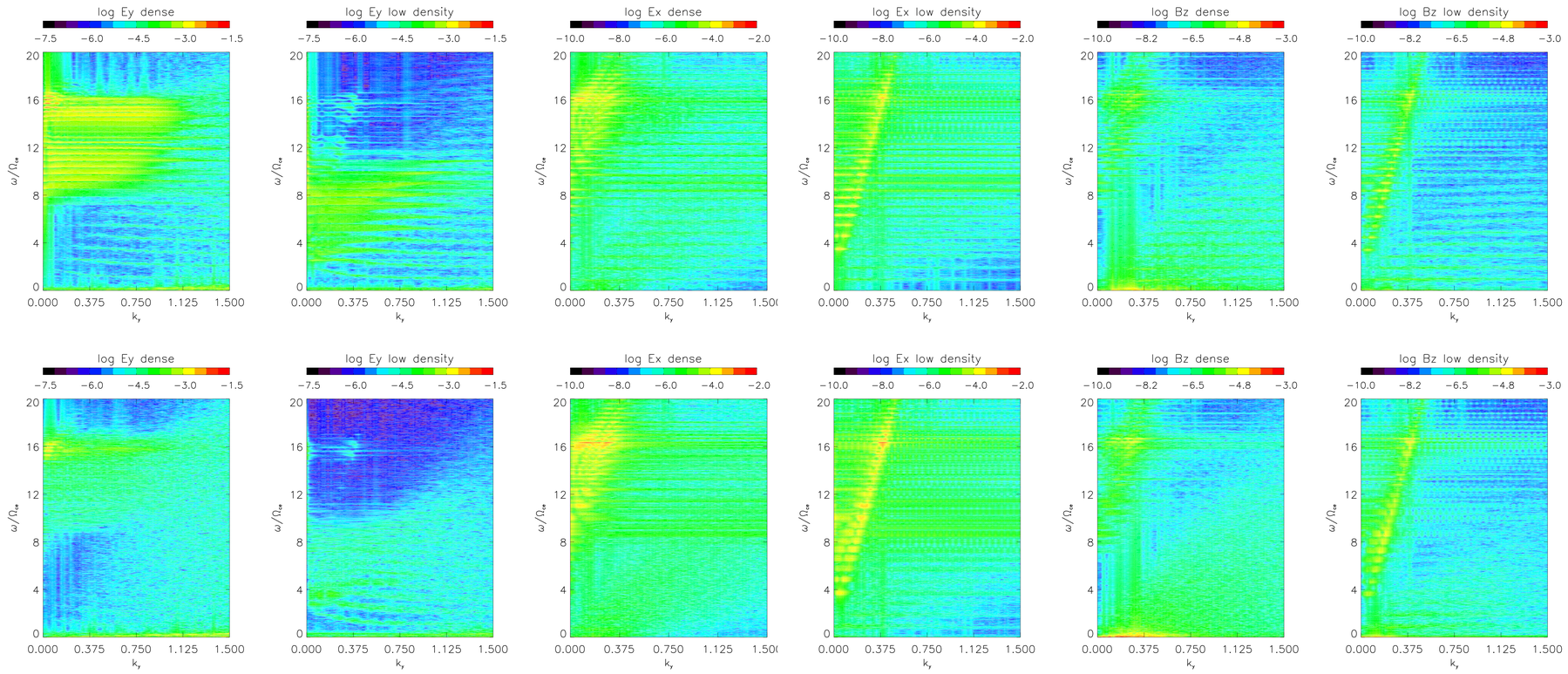




ENERGY TEMPORAL EVOLUTIONS

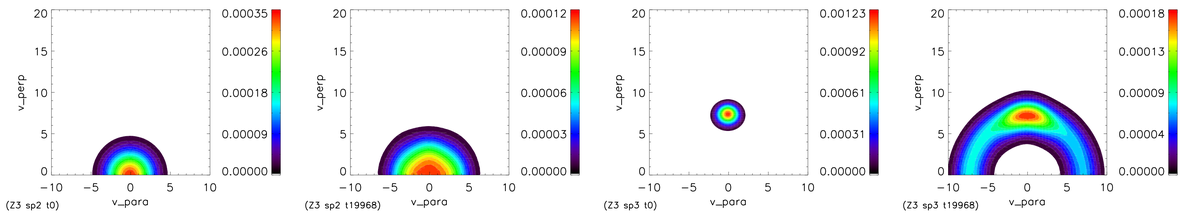


SPECTRA $\omega - k_y$



Spectra of electrostatic and electromagnetic components. Spectra for each component are taken in two different regions in simulation box and for two time instances - the first and the second half of the simulation.

VELOCITY DISTRIBUTIONS



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