PIC simulation on instabilities driven by ring-like energetic-ions: energetic-ion injection model.

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It is well-known that instabilities can occur when energetic ions have a ring-like velocity distribution perpendicular to the magnetic field. When a ring speed is larger than the Alfvén speed, electromagnetic fast magnetosonic waves are excited, which are often observed in the Earth’ s magnetosphere and are considered to accelerate ions and electrons. On the other hand, when a ring speed is much smaller than the Alfvén speed, electrostatic lower hybrid waves with the resonance frequency, $\omega_{LH} \sim \sqrt{\Omega_i \Omega_e}$, are excited, which are often observed in fusion plasma.
Many previous studies for these instabilities solve initial value problems; the density of energetic ions is constant throughout their simulations. They focus on the excitation of the waves and the relaxation of a velocity distribution. However, it is not enough to investigate the developments of the instabilities for a long period because, in the real situations, the injection or loss of energetic ions should occur and leads to the reshaping of the velocity distribution, which can cause further instabilities.
In this meeting, using a one-dimensional, electromagnetic, particle-in-cell code, we study the long-time evolution of the instabilities driven by ring-like energetic ions by an energetic-ion injection model. In this model, the density of energetic ions is zero at first and then increases with time. We also compare these simulation results with the initial value problem and the linear theory.

Keywords: PIC simulation, energetic-ion injection, ring-like velocity distribution

