Moment extracted method for solving kinetic Alfven wave dynamics

*Tomo-Hiko Watanabe[1], Yusuke Watanabe[1], Shinya Maeyama[1]

1.Graduate School of Science, Nagoya University

Kinetic Alfven waves (KAW), which play crucial roles in a variety of phenomena in space plasmas, involve multiple space- and time-scales. For example, the wavelength along the field line may extend to the system size, while the perpendicular wave numbers are characterized by the ion gyro-radius or the electron skin depth. The characteristic time is given the wave frequency or the electron transit time. Thus, drift kinetic or gyrokinetic simulations of low-frequency plasma dynamics including the KAWs often suffer from a sever Courant condition for explicit time-integrators or a poor convergence of iteration in implicit methods.
To overcome the numerical inefficiency, we have developed a new scheme for solving the KAW dynamics including drift kinetic electrons. In the new scheme, the low-order moments of electron distribution function are calculated separately from the drift kinetic equation for electrons. It enables us to easily implement implicit time-integrators and/or the semi-Lagrangian scheme while keeping the numerical stability and the conservation property. Some applications of the moment extracted formulation will be discussed.

Keywords: Alfven waves, simulation, gyrokinetics

