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Low-frequency ionization oscillations due to azimuthally rotating spokes in cross-field configurations KENTARO HARA, Texas A&M University, REI KAWASHIMA, University of Tokyo — Rotating spokes are self-organizing coherent structures observed in magnetron discharge, Penning discharge, and Hall effect thrusters. The unique feature about the rotating spokes is that the oscillations are in the kHz range, i.e., low frequency compared to the electron dynamics due to the ExB drift. This indicates that the rotating spokes are ionization oscillations due to interaction between neutral atoms, ions, and electrons. A two-dimensional (axial-azimuthal) hybrid kinetic-fluid model is used to model the discharge plasma in a Hall effect thruster. It has been reported that the potential solver assuming a drift-diffusion approximation with the current balance equation introduces an ill-conditioned matrix, which is difficult to solve. A pseudo-time stepping method in which the diffusion equation is solved in a time-advanced fashion enables stable calculation of the potential solver. The low-frequency rotating spokes obtained from the hybrid simulation show qualitative agreement with published experimental data. The local dispersion relation of gradient drift waves indicates that the instability occurs in the downstream of the discharge plasma, and the simulation results agree with the phase velocity obtained from theory.

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