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Collective particle kinetics in the lower hybrid drift instability[1]
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— We study the coupled evolution of energetic minority ions, background majority ions, electrons, and electromagnetic fields in magnetised plasma undergoing the lower hybrid drift instability. The evolving distribution of a drifting ring-beam population of energetic ions is simulated using a particle-in-cell code, fully kinetic for all species, with one spatial and three velocity space co-ordinates. Bulk plasma parameters approximate tokamak core conditions, in a scenario motivated by observations of ion cyclotron emission and relevant to alpha channelling (Cook et al, PRL 105, 25503 (2010)). Resonant energy transfer occurs at the two gyrophase angles where the speed of an energetic ion on its cyclotron orbit matches the phase velocity of the lower hybrid wave along the simulation domain. Electron space-charge oscillations determine the wavelength of the propagating wave. This governs the bunching of energetic ions, in physical space and gyrophase angle (Cook et al, PPCF 53, 074019 (2011)), as they drive the instability.

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