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Particle-in-cell simulations of the excitation mechanism for fusion-product-driven ion cyclotron emission from tokamaks RICHARD DENDY, UKAEA Culham, JAMES COOK, SANDRA CHAPMAN, Warwick University — Suprathermal ion cyclotron emission (ICE) was the first collective radiative instability, driven by fusion products, observed on JET and TFTR. Strong emission occurs at sequential cyclotron harmonics of the energetic ion population at the outer mid-plane. Its intensity scales linearly with fusion reactivity, including its time evolution during a discharge. The emission mechanism is probably the magnetoacoustic cyclotron instability (MCI), involving resonance between: fast Alfvén waves; cyclotron harmonic waves supported by the energetic particle population and by the background thermal plasma; and a subset of the centrally born fusion products, just inside the trapped-passing boundary, whose drift orbits make large radial excursions. The linear growth rate of the MCI has been intensively studied analytically, and yields good agreement with several key observational features of ICE. To address outstanding issues in the nonlinear ICE regime, we have developed a particle-in-cell code which self-consistently evolves electron and multi-species ion macroparticles and the electromagnetic field. We focus on the growth rate of the MCI, as it evolves from the linear into the nonlinear regime for JET-like parameters.

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