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Linear hybrid kinetic-MHD model of rotating plasmas via the interface of MINERVA stability and VENUS-LEVIS delta-f PIC codes
DAVID PFEFFERLE, Ecole Polytechnique Federale de Lausanne (EPFL), Centre de Recherches en Physique des Plasmas (CRPP), CH-1015 Lausanne, Switzerland, NOBUYUKI AIBA, Japan Atomic Energy Agency (JAEA), Rokkasho, Aomori 039-3212, Japan, JONATHAN P. GRAVES, WILFRED A. COOPER, Ecole Polytechnique Federale de Lausanne (EPFL), Centre de Recherches en Physique des Plasmas (CRPP), CH-1015 Lausanne, Switzerland — In the framework of hybrid kinetic-MHD with plasma rotation, this project focuses on computing, via a delta-f PIC scheme, the non-adiabatic contribution to the MHD pressure tensor from supra-thermal populations. The orbit code VENUS-LEVIS is employed to evolve an ensemble of weighted markers in the rotating magnetic equilibria produced by the MHD stability code MINERVA. The linearly perturbed Vlasov equation is solved by evolving the marker weights in the presence of MINERVA's most unstable MHD modes. Moments of the perturbed distribution are sequenced to yield the hot ion kinetic response. The Laplace transform of the perturbed parallel and perpendicular pressure is calculated at the resonance as a function of the radial position and the poloidal and toroidal mode number. The resulting profiles are fed back into MINERVA as an additional source term in the MHD force balance equation. The mode structure, the frequency and the growth rate of the perturbations are modified due to resonances with the hot particles' bounce/transit motion and their toroidal precession drift. The effect of toroidal plasma rotation on the mode stability is assessed.

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