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Vlasov simulations of negative mass instability of Langmuir waves
KENTARO HARA, University of Michigan, THOMAS CHAPMAN, JEFFREY BANKS, RICHARD BERGER, ILON JOSEPH, Lawrence Livermore National Laboratory, STEPHAN BRUNNER, EPFL, IAIN BOYD, University of Michigan — An unambiguous signal of the negative mass instability (NMI) of large amplitude Langmuir waves has been observed for the first time using a 1D-1V Vlasov simulation code. During the NMI, recently proposed by Dodin (PRL **110**, 215006 (2013)), particles trapped in the potential well move to different trapped orbits with different bounce frequencies due to mutual Coulomb repulsion and potentially undergo phase bunching. The NMI in Langmuir waves has been studied using the Vlasov simulation with initial conditions conducive to comparison with theoretical estimates of the growth rate. In order to investigate the instability, Fourier analysis of the trapped particle distribution has been performed in action-angle coordinates. Theoretical and numerical growth rates of the NMI are in good agreement when the trapped particle population is initialized as a delta-like function in energy. The mechanism of nonlinear saturation of the NMI is also discussed. *This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344 and supported by the U.S. Department of Energy Office of Science, Fusion Energy Sciences Program, Grant DESC0001939.*

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