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Collisionless Damping of Parametrically Unstable Alfvén Waves in the Solar Wind

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Linear Vlasov theory and numerical hybrid simulation results of parametric instabilities of circularly polarized Alfvén waves using a 1D hybrid code for solar wind-like plasmas and supporting analysis of Landau damping of the driven ion acoustic-like waves are presented. We discuss the linear and the weakly nonlinear development of the parametric instabilities of the parallel propagating Alfvén waves, including kinetic effects and investigate the structure, growth and damping of the wave modes caused by the coupling of the pump wave to the plasma. It is shown that at low-beta, where fluid behavior could be expected to dominate, significant kinetic effect occurs and the dispersive properties of the plasma differ qualitatively from those in the MHD limit. The implications of our simulation results on observations in the fast solar wind and solar corona are also discussed.