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Generation of Large-Scale Zonal Structures by Drift Flute Waves in High-Beta HED Plasmas[1] ESSAM YASIN, VLADMIR SOTNIKOV, JOSEPH KINDEL, O.G. ONISHCHENKO, University of Nevada, Reno, NV 89557, J.N. LEBOEUF, JNL Scientific, Casa Grande, AZ 85296 — Our aim is to develop a more general analysis of nonlinear dynamics of drift-flute waves, applicable to arbitrary plasma beta and arbitrary spatial scales in comparison with the ion Larmor radius. This study is of interest for fundamental plasma theory as well as for the interpretation of Z-pinch and laboratory astrophysics experiments. Description of low-frequency waves and in particular drift flute waves in a high beta plasma, generally speaking, requires a kinetic approach, based on the Vlasov-Maxwell set of equations. In the present work we show that the alternative two-fluid description can adequately describe the ion perturbations with arbitrary ratio of the characteristic spatial scales to the ion Larmor radius in so-called Pade approximation. For this purpose reduced two-fluid hydrodynamic equations which describe nonlinear dynamics of the flute waves with arbitrary spatial scales and arbitrary plasma beta are derived. The linear dispersion relation of the flute waves and the Rayleigh-Taylor instability are analyzed. A general nonlinear dispersion relation which describes generation of large-scale zonal structures by the flute waves is presented and analyzed.

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