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Ion heating by the nonlinear evolution of low-frequency Alfvenic turbulence in the radially expanding solar wind

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It is well known that the magnetohydrdynamic (MHD) turbulence with the high cross helicity (Alfvenic turbulence) is ubiquitously observed in the solar wind plasmas. The Alfvenic turbulence generated in the vicinity of the photosphere may play an important role in heating of coronal plasmas, and a number of authors have investigated the "wave modeling" of the solar wind plasmas. On the other hand, while the heating of ions is dominated by the collisionless damping of the low-frequency waves, few models including the low-frequency Alfvenic turbulence have gone beyond the MHD description. In this study, we present the nonlinear evolution of low-frequency Alfvenic turbulence in the radially expanding solar wind by using a kinetic-fluid model (Vlasov-MHD model). The heating of ions by low-frequency Alfvenic turbulence in the absence of the ion cyclotron resonance is demonstrated. In order to discuss the self-consistency of the ion kinetics, we carry out the test-particle simulation, in which the numerical data of the global MHD simulation is used. The other non-MHD effects are also discussed as the phenomenological parameters.

Keywords: solar wind, Alfvenic turbulence, ion heating