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On stochastic and kinematic modeling of Alfvenic states in the solar wind plasma

Yasuhiro NARIYUKI
Faculty of Education, Academic Assembly, University of Toyama
e-mail: nariyuki@edu.u-toyama.ac.jp

It is well known that magnetohydrodynamic fluctuations in the solar wind plasma frequently show "Alfvenic" nature[1], which ideally has correlation between magnetic field and bulk velocity, the equipartition between magnetic energy and bulk kinetic energy, and constant magnetic intensity. Since Alfvenic states observed in the solar wind are non-ideal Alfvenic states, normalized cross-helicity is not equal to unity and the residual energy is not zero; there is the radial dependence of the cross-helicity and the residual energy in the solar wind[2].

Radial dependence of the cross-helicity and the residual energy has been addressed by using MHD turbulence modeling[3,4]. Recently, a Langevin system for particles has been applied to model the solar wind fluctuation and has been shown that the linear relation between the cross-helicity and the residual energy[3] can be reproduced by the Langevin model[5]. Although the Langevin model includes the phenomenological parameter on the energy dissipation (the friction coefficient), it gives the relation between the energy dissipation and the cross-helicity/residual energy and the fluctuation dissipation-like relation of the nonequilibrium work[5].

In this presentation, recent progresses on stochastic modeling of the Alfvenic state in the solar wind are presented. The fluctuation dissipation-like relation given by the Langevin system give a probabilistic model of wave-particle interaction, which is possibly validated in *in situ* measurement of space plasmas[6]. We also discuss stochastic modeling of Alfvenic states from the point of view of generation of synthetic turbulence by kinematic approaches[7].

References

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