# 運動論効果を含む太陽風磁気流体乱流モデル

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# A novel kinetic-fluid model for solar wind magnetohydrodynamic turbulence

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Describing the solar wind turbulence has been one of the central issues in the heliospheric physics more than four decades. Actually, the characteristics of solar wind turbulence such as three dimensionality, compressibility, anisotropy, and nonuniformity complicate not only the observational studies but also the theoretical and numerical modeling. The solar wind turbulence is also a multi-scale phenomenon, which includes discontinuities, shocks, power spectrum scaling, collisionless damping of the dissipation range turbulence, energy transfer processes in the wavenumber/frequency space, energetic particle transport, and so on. For instance, the past studies suggest that the power spectrum scaling of the inertial range may depend on the cross-helicity (Alfvenicity) of the turbulence, while the dissipation range turbulence has the different power spectrum scaling. In fact, the wave modes composing the dissipation range turbulence has not been clarified yet.

In order to approach such multi-scale nature of the solar wind turbulence and the physical characteristics of the dissipation range turbulence, the kinetically-modified fluid models (or reduced kinetic models) such as the Landau fluid models and gyrokinetic models have been discussed during the past decade. In this presentation, a novel kinetic-fluid model including the ion kinetic effects and the electron inertial effects is demonstrated as a solar wind turbulence model. The properties of the wave modes are studied based on the linear analysis of the models. We will discuss the applicability of the model in detail.