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High reconnection rate and associated strong electron acceleration in the vortex-induced-reconnection process

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Magneto-hydrodynamic (MHD) turbulence has often been observed in various regions of space. The MHD turbulence has been an important candidate for the source of non-thermal, high-energy particles. For direct understanding of the particle acceleration process in MHD turbulence, kinetic simulations are necessary to be performed. However, it is impossible to directly solve a large-scale MHD-turbulence by kinetic simulations. Thus, in this study, we performed full particle simulations on an element of a developed turbulence, that is, a vortex, and tried to predict how particles are accelerated in the turbulence. As a result, we found that magnetic reconnection driven by the vortex flow (so-called the vortex-induced-reconnection) can cause the anomalously strong electron acceleration. This is because the reconnection rate of the dynamic vortex-induced-reconnection process is anomalously higher than that of the static reconnection process. In this presentation, we will show the results of a parameter survey of the degree of the electron acceleration for the size of the vortex, and discuss how electrons are accelerated in a developed turbulence, which consist of the various-scale vortices.

Keywords: Kelvin-Helmholtz, vortex, MHD turbulence, particle acceleration, particle simulation, magnetic reconnection