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Electron Fluid Description of Wave-Particle Interactions in Strong Buneman Turbulence[1] HAIHONG CHE, GSFC/NASA — To understand the nature of anomalous resistivity in magnetic reconnection, we investigate turbulence-induced momentum transport and energy dissipation associated with electron heating in Buneman instability. Using 3D particle-in-cell simulations, we find that the macroscopic effects generated by wave-particle interactions can be described by a set of electron fluid equations. These equations show that the energy dissipation and momentum transports in Buneman instability are locally quasi-static but globally non-static and irreversible. Turbulence drag dissipates both the bulk energy of electron streams and the associated magnetic energy. The decrease of magnetic field maintains an inductive electric field that re-accelerates electrons. The net loss of streaming energy is converted into electron heat and increases the electron Boltzmann entropy. The growth of self-sustained Buneman waves satisfies a Bernoulli-like equation which relates the turbulence-induced convective momentum transport and thermal momentum transport. Electron trapping and de-trapping drives local momentum transports, while phase mixing converts convective momentum into thermal momentum.These two local momentum transports sustain the Buneman waves and act as the micro-macro link in the anomalous heating process.

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