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Ohm's Law in 3D turbulent magnetic Reconnection[1] HAIHONG CHE, J. DRAKE, M. SWISDAK, University of Maryland — The evolution of kinetic instabilities and their role in fast magnetic reconnection are long-standing puzzles. In this paper we investigate these two issues by studying the role of Buneman instability in the electron diffusion region of collisionless magnetic reconnection. We obtain a second-order approximation of the first moment of Vlasov equation for evolving kinetic instabilities in which non-linear wave-particle interactions dominate. The resulting Ohm's law shows two new important characteristics: the drag force and turbulence viscosity. Using particle-in-cell simulations we study the evolution of this new Ohm's law. We perform 2D and 3D simulations with a strong guide field for both low and high initial electron temperatures. In the high temperature 3D simulation turbulence around x-line is absent. In the low temperatures 3D simulation the Buneman instability develops and evolves into a state with strong turbulence. Our simulations show that the turbulence effects can support fast reconnection: 1) The turbulence-induced drag force and viscosity are important factors in supporting the reconnection electric field at the late stages of reconnection; 2) Turbulence heating enhances the role of non-gyrotropic pressure and weakens the role of electron inertia in supporting the reconnection electric field.

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