Abstract Submitted
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Convective motion in low frequency trapped electron mode turbulence YONG XIAO[1], Institute for Fusion Theory and Simulation, Zhejiang University, China — Collisionless trapped electron mode (CTEM) is a prominent candidate for electron turbulent transport in burning plasmas. Global gyrokinetic simulation of CTEM turbulence finds both diffusive and convective motion using a Lagrangian analysis of the self-consistent electron orbits. A resonance broadening model fits well the diffusive and convective electron motion. The kinetic origin of the convective motion is identified to arise from the conservation of the second invariant when trapped electrons lose energy to the drift wave by toroidal precessional resonance. Strong correlation is found between the convection velocity and the kinetic energy loss rate, as shown by the 2D phase diagram. The connection between the convection velocity and the kinetic energy loss of trapped electrons are further verified by comparing analytic theory and simulation. The conservation of second invariant is found to act as a powerful constraint in low frequency turbulent transport, which can induce a convective motion by losing/gaining energy. This mechanism comes from single particle dynamics and is robust no matter whether the underlying process is quasilinear or not. The discovery has extensive applications in many fusion-related scenarios. (Phys. Plasmas 18 (letter), 110703, 2011)

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