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Convective and diffusive motion in low frequency trapped electron turbulence YONG XIAO, ZHIHONG LIN, UC Irvine — Collisionless trapped electron mode (CTEM) is an important instability candidate for burning plasma that leads to electron turbulent transport. Global gyrokinetic particle simulation of CTEM turbulence in toroidal plasmas finds both diffusive and convective electron motion using a Lagrangian analysis of the self-consistent particle orbits. A resonance broadening model fits well the diffusive and convective electron motion. The diffusion component is mainly contributed by the deeply trapped electrons, while the convection component could be caused by either deeply or barely trapped electrons. The kinetic origin of this convective motion is identified to arise from the conservation of the second invariant when trapped electrons lose kinetic energy to the drift wave through toroidal precessional resonance. The relation between the convection velocity and kinetic energy loss of the trapped electron is predicted by analytic theory and verified by simulation quantitatively. 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 discovery has extensive applications in many fusion-related scenarios.

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