

Particle diffusion in two-dimensional and three electrostatic waves

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Anomalous transport of electrostatic drift wave turbulence is important in fusion plasmas. We discuss particle transport statistically in two-dimensional plasmas, using test particles as a probe of structure formation in turbulent plasmas. Hirshman 1980 indicated the deterministic trapping motion of the particles in two traveling waves in two-dimensional system due to the presence of time independent electrostatic potential field in the wave frame.

From this standpoint, we start with simplest problem, i.e. in three drift waves, and examine Hirshman conjecture that the third wave can break trapping. The particle motions become stochastic in the presence of the third wave due to the dispersion of the waves. In our model, both super-diffusion and sub-diffusion can take place in poloidal and radial directions, respectively, depending on the third wave mode number.