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Transport of Energetic Particles by Microturbulence in Fusion Plasmas[1] WENLU ZHANG, ZHIHONG LIN, LIU CHEN, Department of Physics and Astronomy, University of California, Irvine, California 92697 — The diffusion of the the energetic particles by the microscopic ion temperature gradient (ITG) turbulence is investigated in large scale first-principle simulations of fusion plasmas using the global gyrokinetic toroidal code (GTC) [Lin, Science 1998]. The ion radial spread as a function of energy and pitch angle is measured in the steady state ITG turbulence. The probability density function of the radial excursion is found to be very close to a Gaussian, indicating a diffusive transport from a random walk process. The radial diffusivity as a function of the energy and pitch angle can thus be calculated using the random walk model. We find that the diffusivity decreases drastically for high energy particles due to the averaging effects of the large gyroradius and banana width, and the fast decorrelation of the energetic particles with the ITG oscillations. By performing the integration in phase space, we can calculate the diffusivity for any distribution function. The diffusivity driven by the ITG turbulence for the NBI ions with a slowing-down distribution function is found to decrease rapidly for the born energy up to an order of magnitude of the electron temperature and more gradually to a very low level for higher born energy.

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