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Turbulent transport of energetic particles: Mechanisms and scalings THILO HAUFF, Max-Planck-Institut fuer Plasmaphysik, TILMAN DANNERT, Centre de Recherches en Physique des Plasmas, Ecole Polytechnique Federale de Lausanne, FRANK JENKO, Max-Planck-Institut fuer Plasmaphysik —
The interaction of energetic particles (like alpha particles or beam ions) with the background tokamak microturbulence is investigated. We study the multitude of different decorrelation mechanisms and obtain a validity condition for 'orbit averaging', which is shown to be a very crucial issue for the level of fast particle transport and directly related to to the magnetic shear. Furthermore, resonance mechanisms between the perpendicular particle drifts and the diamagnetic drifts of the bulk plasma are observed. We will show that for beam ions the transport may stay at a significant level for particle energies up to about 10 times the thermal energy of the background plasma, and then falls off like E^{-1}, which is much slower than orbit averaging would suggest. Our general studies are confirmed by means of nonlinear gyrokinetic simulations with the GENE code. Comparing the latter with quasilinear simulations, one finds that it is indeed the turbulent nature of the advecting field which is responsible for the slow decay of the particle transport with increasing energy. Finally, we discuss turbulent transport of energetic particles as a candidate for explaining recent experimental results on ASDEX Upgrade.

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