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Relativistic Quasilinear Theory for Transport by RF Waves in Toroidal Plasmas[1] Y. KOMINIS, NTUA, Athens, Greece, A.K. RAM, PSFC, MIT, K. HIZANIDIS, NTUA, Athens, Greece — We derive the relativistic operator for momentum and spatial diffusion of electrons due to RF waves and non-axisymmetric magnetic field perturbations in a tokamak. Non-axisymmetric magnetic field perturbations can be due to magnetic islands as in neoclassical tearing modes. The plasma equilibrium is expressed in terms of magnetic flux coordinates of an axisymmetric tokamak. The electron motion is described by guiding center coordinates using action-angle variables of motion. We use the Lie perturbation technique to derive a non-singular, time dependent diffusion operator which describes resonant and non-resonant electron diffusion in momentum space and diffusion in configuration space. Momentum space diffusion leads to current generation and spatial diffusion describes the modifications to the current profile. In deriving the diffusion operator it is assumed that the underlying electron dynamics is non-Markovian. Consequently, the operator is time dependent and valid for a dynamical phase space that is a mix of correlated regular orbits and decorrelated chaotic orbits. The diffusion operator is expressed in a form suitable for implementation in a numerical code.

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