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Quasilinear diffusion operator for wave-particle interactions in inhomogeneous magnetic fields[1] P. J. CATTO, J. LEE, A. K. RAM, MIT-PSFC — The Kennel-Engelmann quasilinear diffusion operator for wave-particle interactions is for plasmas in a uniform magnetic field. The operator is not suitable for fusion devices with inhomogeneous magnetic fields. Using drift kinetic and high frequency gyrokinetic equations for the particle distribution function, we have derived a quasilinear operator which includes magnetic drifts. The operator applies to RF waves in any frequency range and is particularly relevant for minority ion heating. In order to obtain a physically meaningful operator, the first order correction to the particles magnetic moment has to be retained. Consequently, the gyrokinetic change of variables has to be retained to a higher order than usual. We then determine the perturbed distribution function from the gyrokinetic equation using a novel technique that solves the kinetic equation explicitly for certain parts of the function. The final form of the diffusion operator is compact and completely expressed in terms of the drift kinetic variables. It is not transit averaged and retains the full poloidal angle variation without any Fourier decomposition. The quasilinear diffusion operator reduces to the Kennel-Engelmann operator for uniform magnetic fields.

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