A perturbative solution of the drift kinetic equation yields pinch type convective terms in the particle and energy fluxes for strong electrostatic turbulence

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Abstract. Approximate linearized solutions to the drift kinetic equation (DKE) can provide physical insights into turbulent transport processes in a tokamak plasma. These types of solutions can provide a useful supplement to the results of numerical solutions to either the gyrokinetic equation or to nonlinear fluid equations. Here the DKE is solved in a iterative fashion with an attempt to include the tokamak geometry in a realistic way. The gradients in the DKE are expressed in tokamak geometry, not just by the plane wave approximation. The ballooning type spatial dependence of the electrostatic turbulence is assumed to have a given poloidal dependence. There is no attempt to solve for the radial, poloidal or toroidal dependence of the turbulence. This approximate solution shows that the non-adiabatic part of the perturbed electron distribution function yields particle fluxes which have pinch like terms proportional to the electron temperature gradient and the safety factor gradient. The terms proportional to the safety factor gradient are inward, but the terms proportional to the temperature gradient can be either inward or outward.

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