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Mean Field Transport Equations Including E x B Velocity[1] G.M. STAEBLER, General Atomics — The stabilization of turbulence by $E \times B$ velocity shear has been incorporated into models of tokamak transport in a number of forms. The radial electric field is determined by the perpendicular and diamagnetic velocities through the radial force balance for the ions. Thus, the $E \times B$ velocity shear involves the second derivative of the ion pressure. This make the system of transport equations of third order in the pressure gradient. It has recently been pointed out that the solution one obtains can be stongly influenced by the choice of boundary condition for the second derivative of the pressure.[2] The choice of this boundary condition is undertermined by the physics. In this paper a systematic derivation of a set of mean field transport equations is presented. The turbulent fluxes are averaged over the instability time and length scales. The fluxes only involve first derivatives of the fields. An equation for the evolution of the $E \times B$ velocity is derived. Physically motivated boundary conditions exist for all of the fields. The poloidal velocity is determined from radial force balance. The poloidal velocity can strongly deviate from its standard neoclassical value due to the perpendicular turbulent viscosity.

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[2]J.B. Taylor *et al.*, Phys. Plasmas **5** (1998) 3065.

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