Abstract Submitted
for the 4CF06 Meeting of
The American Physical Society

General parallel closures for tokamak plasmas[1] M. SHARMA, J.-Y. JI, E.D. HELD, Utah State University — Analytical and numerical work is done to understand controlled magnetic fusion experiments such as tokamaks, a doughnut-shaped magnetic confinement device that may form the basis of future fusion reactors. In such systems plasma can be described in terms of transport equations obtained from the kinetic equation. We close the density, momentum and energy conservation equations by solving the drift kinetic equation and taking closure moments. A Chapman-Enskog-like approach is adopted where the distribution function is written as the sum of a dynamic Maxwellian and a kinetic distortion, F, expanded in Legendre polynomials $P_l(v_{\|}/v)$. For an accurate treatment of collisional effects, a moment approach is applied to the full, albeit linearized Coulomb collision operator. This approach leads to denumerable infinity of equations describing the system. Truncation at some suitable order permits a derivation of neoclassical closures for the parallel conductive heat fluxes and stresses. The parallel gradient operator, acting on F as well as $v_{\|}/v$, is inverted via the Legendre-polynomial expansion and subsequent diagonalization of the differential equation system for the expansion coefficients is done. This approach allows examination of the closures in all collisionality regimes and thus aids in understanding the complex behavior of confined tokamak plasmas.

[1]Research supported by DOE under grant no. DE-FC02-04ER54798 in conjunction with the SciDAC Center for Extended MHD Modeling.

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Date submitted: 12 Sep 2006 Electronic form version 1.4