Parallel heat flow and stress tensor in toroidal plasmas MUKTA
SHARMA, E.D. HELD, J.Y. JI, Utah State University — Closures for the parallel
conductive heat flux and stress are derived using a Chapman-Enskog-like approach
that maintains a maximal ordering between parallel streaming, particle trapping
and collisional effects. The distribution function is written as the sum of a dynamic
Maxwellian and a kinetic distortion, $F = \sum_l P_l(v_\parallel/v)F_l$, where the parallel gradient
operator acts on both the coefficients, F_l, and the Legendre polynomials, $P_l(v_\parallel(x)/v)$.
A moment approach is used to treat $\hat{b} \cdot \vec{\nabla} B$ terms as well as the linearized Coulomb
collision operator.[1] The Lorentz scattering term acting on F is inverted along with
the free streaming term and the coupled ODE system for the F_l's is diagonalized.
Integrating the separated ODEs along magnetic field lines and taking the necessary
moments yields the desired closures. This general approach allows examination of
the closures in all collisionality regimes. Results are compared with previous bounce-
averaged theories.

[1]J.-Y. Ji and E. D. Held, Phys. Plasmas **13**, 102103 (2006).

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