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Parallel heat flux closures in toroidal plasmas[1] MUKTA SHARMA, J.Y. JI, E.D. HELD, Utah State University — Closures for the parallel conductive heat flux 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 [2] The Lorentz scattering term acting on F 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 and captures the physics of a substantial reduction in the heat flow due to the trapping of particles in magnetic wells. Results are compared with previous bounce-averaged theories.

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

Mukta Sharma
Utah State University

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