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Gyrokinetic Energy Moment Equations[1] F.L. HINTON, R.E. WALTZ, J. CANDY, General Atomics, M.N. ROSENBLUTH, ITER EDA — Turbulence in tokamaks is believed to be described well by the nonlinear gyrokinetic equation. Massive computational resources are needed for its solution, however. A reduced description of the physics contained in the gyrokinetic equation is obtained by taking energy moments, integrating over energy but not pitch angle. Use of a relatively small number of moments reduces the computational requirements for the solution, as with other moment equations such as the gyrofluid equations. The equations are coupled kinetic equations with only one velocity space variable, the pitch angle, plus spatial variables and time. We show that solution of these moment equations in the limit of small gyroradius, for axisymmetric poloidal flows, yields the same collisionless long time residual potential as obtained previously from the gyrokinetic equation [Rosenbluth and Hinton, Phys. Rev. Lett. **80**, 724 (1998)]. This is in contrast to the gyrofluid equations, which give a zero residual potential because of the use of closures which are incorrect for axisymmetric potentials. Solution of our moment equations, for short times, yields the correct frequency of Geodesic Acoustic Modes, also.

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F.L. Hinton
hinton@gav.gat.com

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