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# Dynamic Evolution of the heat fluxes in a collisionless magnetized plasma. *

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The magnetofluid theory for collisionless magnetized plasmas is carried out one level beyond Chew-Goldberger-Low (CGL) analysis [1] in the hierarchy of fluid moment equations. The CGL parallel and perpendicular pressure evolution equations involve two heat flux variables that represent the parallel flow of parallel and perpendicular thermal energies respectively. Neglecting them yields the double-adiabatic closure. In the present work, the evolution equations for these two parallel heat fluxes are consistently derived and shown to reduce to a very compact form. This derivation, based on the fast gyromotion ordering, is not trivial because the contribution of the pressure tensor must be evaluated including the first gyroviscous terms, not just the zeroth order CGL terms. The heat flux evolution equations involve three higher moment variables, related to the energy-weighted and parallel-energy-weighted stress tensors. A heuristic relationship linking these to the parallel and perpendicular pressures and the density, thus providing a fluid closure, is provided.

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[1] G.L. Chew, M. L. Goldberger and F.E. Low, Proc. R. Soc. London, Sec. A, 236, 112 (1956).