

Abstract Submitted  
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**Equilibrium relations in a two-fluid and drift-kinetic theory of weakly collisional, magnetically confined plasmas**<sup>1</sup> J.J. RAMOS, M.I.T. Plasma Science and Fusion Center — A two-fluid system with finite-Larmor-radius drift-kinetic closures, applicable to weakly collisional, magnetically confined plasmas is presented. The ordering of the collisionality differs from more traditional approaches in that the ratio of mean free paths to equilibrium confinement lengths is assumed to be of the same order as the ratio of such macroscopic plasma lengths to the ion gyroradius, the inverse of which is adopted as the basic expansion parameter  $\delta \ll 1$ . The drift-kinetic equations are expressed in the moving reference frames of the macroscopic flows, which facilitates their coupling to and precise compatibility with the complementary two-fluid, extended-MHD equations, and the macroscopic flows are assumed of the order of the diamagnetic drift velocities. Different electron and ion equations are derived, based on the ordering of the small mass ratio as  $\delta^2$ . Considering axisymmetric equilibria with diamagnetic flows, several new results are obtained. These include specific relations for the particle and heat flows, the electric potential, the density and the pressure anisotropies, a precise evaluation of the ion gyroviscosity and a novel expression for the parallel collisional friction force.

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