Abstract Submitted
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Reduced two-fluid equations for plasma dynamics on the diamagnetic drift scale.[1] JESUS J. RAMOS, M.I.T. — A reduced system of finite-Larmor-radius two-fluid equations is derived, based on the "paraxial" or "long-thin" approximation, namely a large-aspect-ratio and long-parallel-wavelength ordering for plasmas in a strong guide magnetic field of weak curvature. The main new features are the full account of diamagnetic effects associated with temperature gradients and the allowance for strong pressure anisotropies, with dynamically evolved ion and electron parallel and perpendicular pressures. A slow dynamics ordering is assumed, whereby flow velocities and time derivatives are respectively comparable to the diamagnetic drift velocities and frequencies. Arbitrary three-dimensional background geometries are considered, but the analysis is later specialized to the tokamak-relevant case of an axisymmetric background. The final reduced system takes into account all the two-fluid effects associated with the Hall physics in the generalized Ohm's law, the ion gyroviscosity, the ion and electron pressure anisotropies (sometimes called parallel viscosities) and the diamagnetic perpendicular heat fluxes, within the assumed orderings. The parallel heat fluxes do not contribute to these lowest-order reduced equations by virtue of the large-aspect-ratio and small-parallel-gradient orderings, with the result that the system is consistently closed except for the collisional terms.

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