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Hall-MHD and Two-Fluid Plasma Equilibria and Stability[1]
ELIEZER HAMEIRI, Courant Institute of Mathematical Sciences, New York University — Following our work on Hall-MHD which is a one-fluid model, we proceed to investigate the two-fluid plasma equilibrium state. This was investigated previously typically for an axisymmetric configuration. A known variational principle was used to produce only a small number of equilibria. We have stronger results, where we can produce what can be shown to be all possible equilibrium states both axisymmetric and 3D configurations. We can recover ideal MHD with equilibrium flow by some limiting process. As in MHD, stability cannot be easily determined by an energy integral since the integral is not of a definite sign even for stable plasmas. Another limiting case of interest is classical compressible fluids with no magnetic field. Here different configurations have their own different features (such as the number of constants of the motion), and must be treated differently. We produce a stability criterion which appears to be substantially different from the one applicable to rotating MHD plasmas, and is easier to satisfy.

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