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Relativistic multifluid hydrodynamics for finite temperature neutron star cores from a variational principle PETER RAU, Cornell University — We describe a relativistic multifluid dynamics appropriate for application to neutron star cores at finite temperatures based on Carter's convective variational procedure. The model includes seven fluids, accounting for both normal and superfluid/superconducting neutrons and protons, leptons and entropy. Vortex lines and flux tubes, mutual friction, vortex pinning, heat conduction and viscosity are incorporated into the model after the basic hydrodynamics is described. The detailed vortex line/flux tube contributions to the equations of motion are found by comparison to a mesoscopic calculation which accounts for individual vortex lines/flux tubes. We find that the magnetic H-field inside a neutron star differs from that given in previous astrophysical works, but is in agreement with condensed matter physics literature. This also has a subtle effect on the Maxwell equations inside neutron stars, which could have implications for phenomena involving neutron star magnetic fields.

Peter Rau
Cornell University

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