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Equilibrium models of relativistic stars with differential rotation and toroidal magnetic fields[1] LOGAN CARPENTER, Brigham Young Univ - Rexburg, ERIC HIRSCHMANN, Brigham Young Univ — We construct equilibrium models of strongly magnetized neutron stars in general relativity under the assumptions of axisymmetry and stationarity. The matter is represented by a magnetized fluid in the ideal MHD approximation and incorporates differential rotation and a toroidal magnetic field. We solve for these equilibrium states using a numerical scheme similar to the self-consistent field method. We construct as an initial guess a TOV star, add differential rotation and subsequently include the magnetic field. We then explore the parameter space of these equilibrium solutions looking for maximum mass, magnetic field strength, and energy distribution in the star.

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