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General Relativistic Hydrodynamics with Viscosity MATTHEW D. DUEZ, YUK TUNG LIU, University of Illinois at Urbana Champaign, STUART L. SHAPIRO, University of Illinois at Urbana Champaign, BRANSON C. STEPHENS, University of Illinois at Urbana Champaign — Viscosity and magnetic fields drive differentially rotating stars toward uniform rotation, and this process has important consequences in many astrophysical contexts. Here, we present the first numerical evolutions of rapidly rotating stars with shear viscosity in full general relativity. We self-consistently include viscosity in our relativistic hydrodynamic code by solving the fully relativistic Navier-Stokes equations in a BSSN formulation. We demonstrate the ability of our code to accurately follow both the *secular* viscous evolution of differentially rotating stars for many rotation periods, as well as dynamical evolution. We also investigate the ability of viscosity to drive bar or disk formation.

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