Meeting: 1003, Atlanta, Georgia, SS 27A, AMS-SIAM Special Session on Analysis and Applications in Nonlinear Partial Differential Equations, I

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Tao Luo* (tl48@georgetown.edu), Department of Mathematics, Georgetown University, Washington, DC 20057, and **Joel Smoller** (smoller@umich.edu), Department of Mathematics, Univeristy of Michigan, Ann Arbor, MI 48109. *Rotating Fluids with Self-Gravitation in Bounded Domains.*

We study the steady solutions of Euler-Poisson equations in bounded domains with prescribed angular velocity. This models a rotating Newtonian star consisting of a compressible perfect fluid with given equation of state $P = e^S \rho^\gamma$. When the domain is a ball and the angular velocity is constant, we obtain both existence and non-existence theorems, depending on the adiabatic gas constant γ. In addition we obtain some interesting properties of the solutions; e.g., monotonicity of the radius of the star with both angular velocity and central density. We also prove that the radius of a rotating spherically symmetric star, with given constant angular velocity and constant entropy, is uniformly bounded independent of the central density . This is physically striking and in sharp contrast to the case of the nonrotating star. For general domains and variable angular velocities, both an existence result for the isentropic equations of state and non-existence result for the non-isentropic equation of state are also obtained. (Received September 25, 2004)