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Free surface shapes in rigid body rotation ENRIQUE RAME, R. BALASUBRAMANIAM, National Center for Space Exploration Research — When a given volume of fluid in a container spins as a rigid body, the shape of the free surface can be found from the normal stress balance because the pressure field is known up to an additive constant. The properties of periodic (tubular) free surface shapes in rigid rotation have been studied in the past. In this talk we present results for the more practical case of shapes produced by a fixed fluid volume in a cylindrical container of given radius. We will discuss the shapes of vortices spanning the whole cylinder cross section and developing in an infinitely long container, as a function of rotation number. A critical state develops as the rotation rate approaches a critical value, where the vortex depth exhibits a logarithmic asymptotic growth rate with rotation. We will discuss the relation of these critical values to properties previously discovered by D.D. Joseph & colleagues. We will also present properties of shapes in finite-height containers. First, we discuss the case of a vortex of given volume whose free surface contacts the container bottom and wall; next, the case when the free surface contacts the top and bottom lids of a rotating container, in the asymptotic limit of large rotation numbers.

Enrique Rame
National Center for Space Exploration Research

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