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Experimental investigation of low Reynolds number and laminar mixing in a tilted-rotating tank THOMAS WARD, North Carolina State University, WILLIAM HOURIGAN, University of California Los Angeles — A tilted-partially filled rotating tank is investigated experimentally at O(1) Reynolds and small ($\ll 1$) capillary numbers, to study the mixing of a viscous homogeneous fluid. Of particular interest is the transition from a previously studied low Reynolds number flow regime (Ward and Metchik, Chem. Engng. Sci., 2007), that exhibited two large vortices, to the laminar flow regime. In the laminar Reynolds number O (1) limit the two primary vortices, generated by a liquid rotation axis, interact with the bottom wall, generating two secondary vortices, via a cascade that is qualitatively similar to the well known Moffatt (Moffatt, J. Fluid Mech., 1964) vortices in Stokes flow. While the secondary vortices aid in transporting material from the walls to the bulk, they also intensify in magnitude with increasing rotation rate leading to de-mixing through the appearance of KAM-like surfaces (Alvarez- Hernández et al., Chem. Engng. Sci., 2002). Experiments are performed using a 90% glycerol, 10% water mixture at two volume portions with angles ranging between 25° to 65° measured from the horizontal. Laser fluorescence is used to illuminate the vortices via experimental Poincaré mapping (Fountain et al., Science, 1998), and the resulting images are analyzed to determine the mixed cross sectional area versus elapsed time.

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