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Stirring in a tilted-rotating tank THOMAS WARD, DAVID SWAN, ANDREW WHITE, North Carolina State University — Inhomogeneous fluid mixing in a tilted-rotating tank is discussed at O(1-10) Reynolds and small < 1 capillary numbers. At low Reynolds numbers the flow exhibits two large vortices. As the Reynolds number increases to the laminar regime, the two vortices exhibit interactions with the bottom wall and begin a cascading effect that is similar to the well known Moffatt (J. Fluid Mech., 1964) vortices in Stokes flow in cavities. The additional vortices aid in transporting material from the the walls to the bulk of the region between them. But the vortices also intensify in magnitude with increasing rotation rate leading to the appearance of KAM surfaces, which are barriers to efficient mixing. Experiments are performed to study dispersing water in vegetable oil (5% water by volume) and using laser fluorescence to illuminate the vortices via experimental Poincaré mapping. The resulting images are analyzed to determine the mixed cross sectional area versus elapsed time as a function of the system parameters which are the tilt angle and Reynolds number.

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