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Thin viscous films on rotating spheres: statics, dynamics and instability DI KANG, MARINA CHUGUNOVA, ALI NADIM, Claremont Graduate University — We examine the behavior of a thin viscous liquid film on a rotating solid sphere under the influence of gravity, centrifugal force and surface tension. The model is based on the lubrication approximation in axisymmetric spherical coordinates, with no-slip at the liquid-solid interface and with normal and tangential stress balances, including Marangoni effects, at the liquid-air interface. The rotation axis is assumed to be aligned with the direction of gravity and the Coriolis force is neglected, identifying parameter regimes when the latter is justified. We show that for constant surface tension, the energy-minimizing steady states are of three different types: uniformly positive film thickness, or states with one or two dry zones on the sphere. The transient dynamics in approaching those states are also described. A stability analysis when Marangoni effects are present but in the absence of gravity and rotation identifies the parameter regimes for instability to occur and the corresponding unstable modes.

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