

Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Levitation of a drop over a moving surface¹ HENRI LHUISSIER,
YOSHIYUKI TAGAWA, TUAN TRAN, CHAO SUN, POF - University of Twente
- The Netherlands, POF TEAM — We investigate the levitation of a drop gently
deposited onto the inner wall of a rotating hollow cylinder. For a sufficient velocity
of the wall, the drop steadily levitates over a thin air film and reaches a stable
angular position in the cylinder, where the drag and lift balance the weight of the
drop. Interferometric measurements yield the three-dimensional air film thickness
under the drop and reveal the asymmetry of the profile along the direction of the
wall motion. A two-dimensional model is presented which explains the levitation
mechanism, captures the main characteristics of the air film shape and predicts
two asymptotic regimes for the film thickness h_0 : For large drops $h_0 \sim \text{Ca}^{2/3} \kappa_b^{-1}$,
as in the Bretherton problem, where Ca is the capillary number based on the air
viscosity and κ_b is the curvature at the bottom of the drop. For small drops $h_0 \sim$
 $\text{Ca}^{4/5} (a\kappa_b)^{4/5} \kappa_b^{-1}$, where a is the capillary length.

¹We thank Detlef Lohse for the opportunity to carry this work.

Henri Lhuissier
POF - University of Twente - The Netherlands

Date submitted: 29 Jul 2013

Electronic form version 1.4