Abstract Submitted
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Effect of droplet shape on ring stains from dried liquid MELVIN SANTIAGO, Department of Physics, Case Western Reserve University, Cleveland, Ohio 44106-7079, KATHERINE BROWN, Department of Physics, Hamilton College, Clinton NY 13323, HARSH MATHUR, Department of Physics, Case Western Reserve University, Cleveland, Ohio 44106-7079 — A landmark experimental paper on coffee stains by Deegan et al included a simple theoretical analysis of circular droplets [1]. The analysis was based on a model informally called the Maxwell House equations. It describes the evolving height profile of the droplet, the evaporation of the solvent and the outflow of solute to the rim of the droplet. Since typical droplets are not circles, here we extend the analysis to more general shapes. We find that for thin droplets the height profile may be determined by solving Poisson's equation in a domain corresponding to the footprint of the droplet. Evaporation is treated in a simple approximation via an electrostatic analogy and is dominated by the sharp edges of the droplet. Assuming zero vorticity allows us to analyze the solvent flow in droplets of arbitrary shape. We compare circular droplets to other shapes including long linear droplets, ring shaped droplets and droplets with an elliptical footprint. [1] R.D. Deegan et al, Nature 389, 827 (1997).

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