Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Coffee Stains from Drops with Receding Contact Lines[1] JULIAN FREED-BROWN, University of Chicago — We present a framework for calculating the surface density profile of a coffee stain deposited by a drying drop with a receding contact line. For standard coffee stains, the fluid pins to the substrate, forces flow towards the exterior of the drop and deposits a thin, concentrated ring of particles. Unlike a pinned drop, a receding drop pushes fluid towards its interior and continuously deposits mass across its substrate as it evaporates. This gives rise to a new class of mountain-like morphologies that are not seen in the standard coffee ring effect but are reminiscent of recent experimental results. For a thin, circular drop with uniform evaporation, we calculate the surface density profile analytically and find that it diverges towards the center of the drop as $\eta \propto r^{-1/2}$, where r is the distance from the center. We estimate how this divergence is softened due to solute interactions at the final stage of drying. Our framework can easily be extended numerically or analytically to investigate novel stain morphologies left by drying drops of different shapes and evaporation profiles.

[1]This work is part of a thesis project advised by Tom Witten. It was supported in part by the National Science Foundation's MRSEC Program under Award Number DMR 0820054.

Julian Freed-Brown
University of Chicago

Date submitted: 14 Nov 2014 Electronic form version 1.4