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Solutal Marangoni flow as the cause of ring stains from drying salty colloidal drops ALVARO MARIN, Max Planck + University of Twente Center for Complex Fluid Dynamics, STEFAN KARPITSCHKA, Max Planck Center for Dynamics and Self-Organization, Germany, MASSIMILIANO ROSSI, CHRISTIAN J. KAEHLER, Bundeswehr University Munich, Germany, DIEGO NOGUERA-MARIN, MIGUEL A. RODRIGUEZ-VALVERDE, Biocolloid and Fluid Physics group, University of Granada, Spain — Salts can be found in different forms in almost any evaporating droplet in nature, our homes and in laboratories. The transport processes in such apparently simple systems differ strongly from 'sweet' evaporating droplets since the liquid flows in the inverse direction due to Marangoni stresses at the surface. Such an effect has crucial consequences to salt crystallization processes and to the evaporation itself. In this work we show measurements that not only confirm clearly the details of the inverted flow patterns, but also permit us to calculate the surface tension gradients responsible for the reversal. Such a reversal does not prevent the coffee-stain effect; on the contrary, particles accumulate and get trapped at the liquid-air interface driven by the surface flow. In order to prove this, we show measurements of the full three-dimensional flow inside the evaporating salty droplet, confocal imaging is used to quantify the growth of the particle deposits for different salt concentrations, and we compare the experimental results with numerical simulations that capture the solvent evaporation, the evaporation-induced liquid flow and the quasi-equilibrium liquid-gas interface.

Alvaro Marin
Max Planck + University of Twente Center for Complex Fluid Dynamics

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