Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Evaporation-triggered microdroplet nucleation and the four life phases of an evaporating Ouzo drop HUANSHU TAN, University of Twente, CHRISTIAN DIDDENS, Eindhoven University of Technology, PENGYU LV, University of Twente, J. G. M. KUERTEN, Eindhoven University of Technology, XUEHUA ZHANG, Royal Melbourne Institute of Technology University, DETLEF LOHSE, University of Twente — Evaporating liquid droplets are omnipresent in nature and technology, such as in inkjet printing, coating, deposition of materials, medical diagnostics, agriculture, the food industry, cosmetics, or spills of liquids. Here we show that the evaporation of such ternary mixtures can trigger a phase transition and the nucleation of microdroplets of one of the components of the mixture. As a model system, we pick a sessile Ouzo droplet (as known from daily life) and reveal and theoretically explain its four life phases: In phase I, the spherical cap-shaped droplet remains transparent while the more volatile ethanol is evaporating, preferentially at the rim of the drop because of the singularity there. This leads to a local ethanol concentration reduction and correspondingly to oil droplet nucleation there. This is the beginning of phase II, in which oil microdroplets quickly nucleate in the whole drop, leading to its milky color that typifies the so-called Ouzo effect. Once all ethanol has evaporated, the drop, which now has a characteristic nonspherical cap shape, has become clear again, with a water drop sitting on an oil ring (phase III), finalizing the phase inversion. Finally, in phase IV, all water has evaporated, leaving behind a tiny spherical cap-shaped oil drop.

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Date submitted: 20 Jul 2016 Electronic form version 1.4