Abstract Submitted
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On the emergence of vortices in irregular evaporating sessile droplets[1] PEDRO J. SÁENZ, DIMITRIOS MAMALIS, KHELLIL SEFIANE, PRASHANT VALLURI, The University of Edinburgh, OMAR K. MATAR, Imperial College London — The spontaneous development of 3D azimuthal vortices parallel to the plane of substrate in an evaporating drop of water with irregular contact area is reported by means of experiments and direct numerical simulations (DNS). In spherical droplets, the non-uniform evaporation flux leads to a 2D axisymmetric flow with fluid being transported along the interface from the contact line (hotter) towards the apex (colder) due to the Marangoni effect. However, infrared recordings of a non-spherical drop show the break of symmetry and the consequent development of a preferential direction for thermocapillary convection. As a result, counter-rotating whirling currents emerge in the drop playing a critical role in regulating the interface thermal motion. This geometry-induced phenomenon is also investigated via simulations with a fully-coupled two-phase model. DNS show good agreement with experiments and reveal the intricate drop dynamics due to this geometry-induced phenomenon. The triggering mechanism is analysed along with the resulting bulk flow.

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Pedro J. Sáenz
The University of Edinburgh

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