

Abstract Submitted
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Flow field inside a stationary microdroplet in a Hele-Shaw cell

SUNGYON LEE, CHARLES BAROUD, LadHyX and department of Mechanics, Ecole Polytechnique — We consider the flow field inside a water drop held stationary in a flowing external oil, experimentally and theoretically. The droplet is strongly confined in the vertical direction, making it take a “pancake”-like shape. It is anchored in place by introducing a local variation in the channel height which reduces the free surface energy, with minimal modifications to its general shape. Two contrasting flow regions are visible inside the drop: a fast recirculation flow is observed near the droplet boundary, while a slower flow takes place in the central region. While the central flow is well described by the standard Hele-Shaw model, the flow near the droplet edge displays strong three-dimensional recirculation, pointing to a complex hydrodynamic coupling between the droplet and outer flows. These two regimes are characterized for different droplet geometries and external flow rates, and a theoretical justification for their existence is provided.

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