Dewetting of a stratified liquid thin film

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Dewetting is the process under which a liquid thin film withdraws a solid substrate leaving dry patches. For simple liquids, the situation is now well characterised experimentally and understood theoretically[1]. Binary fluids on the other hand can reveal novel scenarios yet partially understood[2]. Apart from the fundamental aspect, dewetting of binary fluids is also relevant for industrial applications such as coating or lithography where the films used consist of more than one component.
In this presentation, we study the dewetting of a liquid bilayer on a solid substrate, using numerical simulations. To this end, we extend a coarse-grained simulation method (dissipative particle dynamics DPD) to deal with interfaces[3]. We analyze the influence of the viscosity contrast between the two components of the film on the dewetting kinetics and the film morphology. We find that the dewetting velocity significantly depends on the location of the more viscous component with respect to the solid substrate. The asymmetry in the dewetiing behaviour is interpreted by analyzing the velocity field as well as the viscous dissipation patterns within the film, which display a rather different structure with respect to that of a monocomponent liquid. We propose a theoretical explanation of the observed behavior[4].

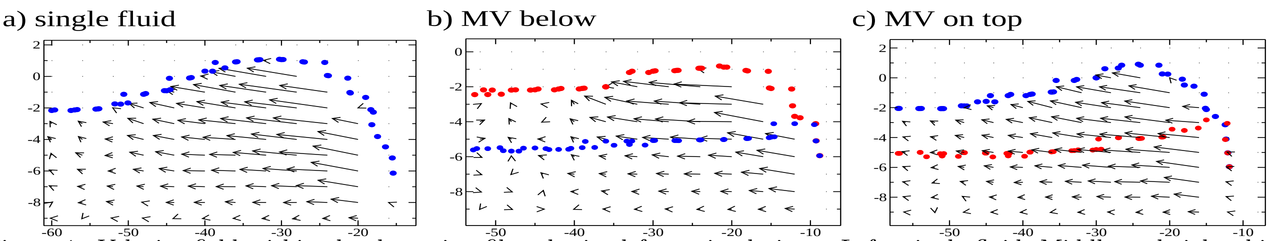

Figura 1. Velocity field within the dewetting film obtained from simulations. Left: single fluid; Middle and right: binary stratified fluids with a viscosity contrast between the two components. Middle: the more viscous component is below. Right: the more viscous fluid is on top. The symbols indicate the positions of the liquid/vapor and liquid/liquid interfaces.

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