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Recent results on wetting

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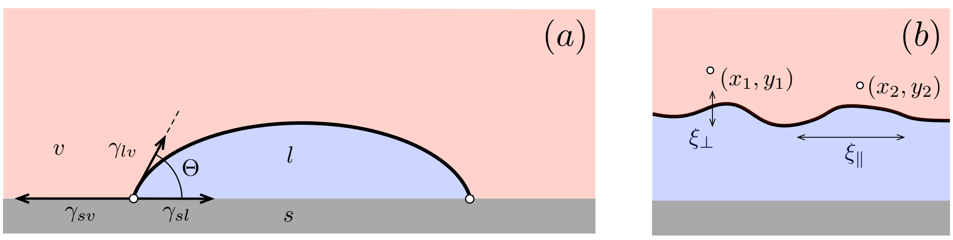
Abstract

The exact characterization of density correlations in the presence of strongly fluctuating interfaces has always been considered a difficult problem in classical statistical mechanics. In this talk we present exact results for density correlations for an interface forming a droplet in two dimensions whose endpoints are pinned on a wall. Our framework, which hinges on recently developed field-theoretical techniques, applies to interfaces entropically repelled by a hard wall as well as to the regime of wetting transitions; Fig. (a) and Fig. (b), respectively. In particular, we will show that for entropically repelled interfaces the finite extent of the sessile droplet yields finite-size corrections to one- and two- point functions. These corrections are interpreted as adsorption of bubbles and self-interaction of the interface, their exact form is identified, interpreted in terms of Brownian excursions, and finally tested against high-precision Monte Carlo simulations in the absence of adjustable parameters. This analysis allows us to resolve a 40-years old discrepancy occurred in early Monte Carlo studies. The regime of wetting is also considered and in this case we provide the exact form of the density-density correlation function. We show that correlations are long ranged for entropic repulsion and at wetting. For both regimes we investigate correlations in momentum space by generalizing the notion of interface structure factor to semi-confined systems. Distinctive signatures of the two regimes manifest in the structure factor through a term that we identify on top of the capillary-wave one.



This seminar is aimed at a wide audience with no prior knowledge of non perturbative techniques. After having recalled some key notions in the theory of wetting in 3D systems, we will show the intriguing features of phase separation in 2D systems and how these ones can be characterized in an exact fashion within the unified language of field theory.