

# **Thin film drainage and surface forces between rigid and soft surfaces studied with i(nterferometry)AFM**

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Among the experimental techniques used to determine the hydrodynamic boundary conditions of various liquids in contact with different (rigid and soft) interfaces the colloid probe atomic force microscope (CP AFM) has proven to be a very sensitive one. However, the development of this technique has been held back due to the lack of independent measurement of the separation between interacting surfaces. The lack of this crucial parameter in CP AFM experiments was a major obstacle for quantifying the quasi-static interactions at nanoscale separations in systems involving deformable objects such as droplets, bubbles and biological. By implementation of an external interferometric technique we have achieved precise and independent measurements of both the force and the separation between two approaching interfaces.

Additionally, when the two surfaces are immersed in a liquid this modified CP AFM can be employed to study the properties of simple liquids under strong confinement. We discuss here such experiments and show that from the AFM force profiles we can investigate: (i) how the nature of the two limiting surfaces (solid and deformable) affect the structure of the adjacent liquid in a quasi-equilibrium situation, and (ii) the hydrodynamic boundary conditions at the two interfaces via a dynamic approaching experiment. The former is obtained straightforwardly for the force ‘oscillations’ observed upon the slow (quasi-static) approach of the two interacting surfaces. The latter requires a lubrication approximation analysis of the liquid film drainage, which depends on the hydrodynamic slip or stick boundary conditions, to calculate the hydrodynamic resistance contribution to the recorded force curve. Once the DLVO contributions are known, this allows one to extract the value of the hydrodynamic slip.