**Role of confinement on fluids statistical properties.**

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Thin liquid films confined between two surfaces and liquid flows in microchannels have many important applications in areas ranging from tribology, where lubricants are frequently squeezed to molecular dimensions, to geology, where liquids are often trapped in cracks and porous media, reaching biology where liquids are confined between membranes and small vessels. The properties of confined fluids have also obvious implications in nanofluidic and microfluidic, i.e. the study of fluid transport at nanometer and micrometer scales. For these reasons the mean properties of confined liquids have been widely studied both theoretically and experimentally under many different conditions and geometries. In contrast, the study of thermal fluctuations inside these systems has not received a comparable interest, in particular during the relaxation towards equilibrium after a temperature quench. Furthermore when the fluid is composed by a binary mixture which is driven close to a second order critical point, other effect appear such as the Critical Casimir effect whose time dependent properties have been studied only theoretically. These questions have important consequences at industrial level too as Solvay is interested to such a kind of developments.

The goal of the research is to study the statistical properties of polymer thin films and highly confined fluids using various techniques based on sensitive Atomic Force Microscopic (AFM) which is adapted with local (on nanometer scale) light scattering (SNOM) and dielectric measurements. These measurements will be associated to more standard macroscopic measurements (such as light scattering and dielectric) to compare the properties the macro with nano properties.

The experimental activity will be tightly connected to theoretical subjects studied in our laboratory.

The student will be involved in the use and development of very sensitive instrumentation such as AFM, SNOM, local dielectric and Optical tweezers. He/she will use more standard instrumentation such as MEB, light scattering (standard and DDM) useful to characterize the samples and the confining surfaces.

This project is an excellent subject for an experimental thesis and M2 internship.