Hydrodynamic fluctuation stresses mediated across a randomly driven fluid film

Rudolf Podgornik[1]

[1] *Department of Theoretical Physics, Jozef Stefan Institute, and Department of Physics, Faculty of Mathematics and Physics, University of Ljubljana, SI-1000 Ljubljana, Slovenia*

Presentation type: Invited Speaker

I will describe fluid mediated effective interactions in a confined film geometry, between two rigid, no-slip plates, where one of the plates is mobile and subjected to a random external forcing with zero average. The fluid is assumed to be compressible and viscous, and the external surface forcing to be of small amplitude, thus enabling a linear hydrodynamic analysis. While the transverse and longitudinal hydrodynamic stresses (forces per unit area) acting on either of the plates vanish on average, they exhibit significant fluctuations that can be quantified through their equal-time, two-point correlators. For transverse (shear) stresses, the same-plate correlators on both the fixed and the mobile plates, and also the cross-plate correlator, exhibit decaying power-law behaviors as functions of the inter-plate separation with universal exponents. The same-plate stress correlator on the fixed plate increases and saturates on increase of the inter-plate separation, reflecting the non-decaying nature of the longitudinal forces acting on the fixed plate. The qualitative differences between the transverse and longitudinal stress correlators stem from the distinct nature of the shear and compression modes as, for instance, the latter exhibit acoustic propagation and, hence, relatively large fluctuations across the fluid film.