Casimir forces in quantum mesoscopic systems

Eric Akkermans
(joint work with A. Soret and K. Le Hur)

Fluctuation induced forces caused by the confinement of long-range correlated fluctuations have been thoroughly studied [1]. A celebrated and initial version, also known as Casimir forces, was first predicted and measured much later using perfectly conducting plates immersed in the QED vacuum [2]. Here, we consider intensity fluctuations of classical light propagating through a scattering medium. In the multiple scattering regime, the average light intensity behaves diffusively. Underlying mesoscopic coherent effects give rise to spatially long-ranged fluctuations [3]. The resulting fluctuation induced forces are described using an effective Langevin approach which properly incorporates the coherent mesoscopic corrections. Their magnitude depends on the dimensionless conductance g. This Langevin description bears a similarity with corresponding forces recently identified in non- equilibrium systems [4], resulting from long-ranged density fluctuations around the steady state density profile.

References

[1] M. Kardar and R. Golestanian. Rev. Mod. Phys. **71**, 1233, 1999.
[2] H. B. G. Casimir. Proc. Kon. Ned. Akad. Wet., **B 51**, 793795, 1948.
[3] E. Akkermans, G. Montambaux, *"Mesoscopic physics of electrons and photons"* , Cambridge University Press, 2007.
[4] A. Aminov, Y. Kafri, M. Kardar, Phys. Rev. Lett. 114, 230602 (2015).