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Motion-related effects of quantum vacuum fluctuations

When two neutral bodies are set into relative motion or, more generally, a time-dependent boundary condition is imposed over the vacuum field by some external agent, virtual or real photons can be excited out of the quantum vacuum, given rise to dissipative effects. On this talk I will show how to use the effective action to study the so called quantum friction between two graphene sheets moving at constant relative speed, and to relate the effects of quantum friction and decoherence when a particle moves in front of a imperfect mirror. Using a different theoretical background, I will show the effects of applying external fields to any member of the graphene family that interacts via the vacuum EM field with a moving metallic nanoparticle. On the other hand, I will propose a possible quantum simulation of the Dynamical Casimir Effect using a single cold ion trapped in a Paul's trap, that could be experimentally accessible.