

Quantum decoherence, Casimir effect, quantum vacuum fluctuations

Two lectures by Prof. Paulo A. Maia Neto, Institute of Physics, Federal University of Rio de Janeiro, Brazil

Lecture 1: Decoherence of massive particles by radiation pressure – 18 December 2023 / 1 hour

Abstract: This lecture will discuss quantum decoherence effects in relation with ground state cooling of nanoparticles. This lecture is motivated by the recent experiments performed in the groups of M. Aspelmeyer, University of Vienna, and L. Novotny, ETH-Zürich, where the motion of a levitated particle has been controlled at the quantum level.

Methods: the lecture will review the formalism of quantum master equation and exploit it to describe the quantum motion of the center of mass of an optically trapped nanosphere.

Prerequisite: M1 level in quantum physics

Lecture 2: Dynamical Casimir effects with atoms – 21 December 2023 / 1 hour

Abstract : This lecture will focus on the description of quantum effects associated with atomic center-of-mass motion in the presence of van der Waals/Casimir interactions with a surface. In this context, the mechanical effects of quantum vacuum fluctuations are central. In particular, the relevant description for the environment of the system of interest (atomic center-of-mass) are the degrees of freedom of both the atom (atomic dipole) and the electromagnetic field.

Methods: The lecture will present the formalism of “influence functional” for quantum open systems.

Prerequisite: M1 level in quantum mechanics