Physikalisches Institut
Fakultät für Mathematik und Physik
Albert-Ludwigs-Universität Freiburg

IRTG-Seminar

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"Impact of Casimir-Polder interaction on matter-wave diffraction at dielectric sub-micron particles"

Casimir-Polder (CP), or atom-surface interactions in general, play an important role in nanoscale systems. In particular, they have to be accounted for in material-grating-based atom-interferometers, which can be also used for their precise measurement. In this presentation I will discuss the advantages in using a Poisson spot interferometer for this purpose. There the relative intensity of a bright interference spot - named Poisson's spot - in the shadow of a spherical diffraction object is observed. The CP potential has an amplifying effect on the Poisson spot that depends on the distance behind the obstacle at which the spot is detected. We observe this effect for the case of thermally evaporated indium atoms that diffract into the shadow of spherical sub-micron silicon-dioxide particles. Furthermore, we compare the measured intensity of Poisson's spot to numerical simulation of Fresnel diffraction that takes into account the CP-induced phase shift. The experimental setup is compatible with many atomic beam species, and further studies of their CP interaction with dielectric spheres are planned in the near future. Finally, I will consider the prospect of using Poisson spot interferometry to reveal the particle-wave duality of increasingly large molecules, and thus to test the superposition principle of quantum mechanics in the quantum-to-macroscopic world transition.

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