Studies in the foundations of QM & QFT with atoms and molecules

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Abstract

Firstly we discuss how the entanglement between constituent particles of composite object (e.g., composite bosons) can tell about the behaviour of the object in scattering event with impurities, quantum tunnelling or Hong-Ou-Mandel effect. Further we discuss dissipation and decoherence effects when the object is coupled to quantized radiation field. Secondly we explore the Casimir effects between chiral metamaterials and chiral molecules. Chiral metamaterials and chiral molecules can make the Casimir force attractive or repulsive depending on their chirality. We propose a method to detect the chiral dependence of the Casimir effects. Finally, we briefly discuss our attempt to detect the energy difference between left-handed and right-handed chiral molecules arising from the electroweak interactions.

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