Delocalization in the light matter interaction

Nadine Stritzelberger

University of Waterloo, Canada

Abstract

In the study of the light matter interaction, the modeling of atoms as Unruh-deWitt detectors has proven to be a very useful tool for the analysis of key processes, such as absorption and emission, entanglement harvesting and quantum communication. However, as I will point out, the range of validity of the Unruh-deWitt detector model is limited to the case of large detector masses. For the case of a finite Unruh-deWitt detector mass, the degree of delocalization of the orbital degree of freedom must be expected to affect the light matter interaction and, potentially, to lead to qualitatively new phenomena. Indeed, I will show that the decay rate of an excited atom can depend on its degree of delocalization and also on whether the delocalization is coherent or incoherent. Finally, I will outline how the delocalization state of matter should also affect entanglement harvesting and quantum channel capacities in the light matter interaction.