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Interaction of vortex fields with atoms

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The interaction of spatially tailored laser pulses (such as photonic vortices) with matter is receiving an increasing attention recently. This is mainly due to the possibility of imparting to matter a well defined amount of orbital angular momenta (OAM) which is associated with winding number of the optical vortex [1]. This renders possible non-dipolar transitions or transitions with well defined polarity [2], and provides a new tool to control the spin in spin-orbital coupled systems [3]. Furthermore, appropriately tailored optical vortices result in strong mechanical forces [4].

In this contribution we will consider low-energy electron emission from atoms via vortex beams, particularly Laguerre-Gaussian beams. The low energy electron emission probabilities of atoms in vortex fields are calculated as a function of the OAM of the laser and the position of the target inside the beam. A modified threshold behavior of the corresponding ionization cross sections is found. We will also present and discuss the low-energy photoelectron angular distributions and contrast with recent experimental measurements [5].

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