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ELECTRON MOTION CONTROL IN Mg-PORPHYRIN VIA STRUCTURED BEAM

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Abstract: Tuning the electron motion is the remarkable subject of the recent studies on the nanostructures. Particularly in last decade, the studies on the twisted light (orbital angular momentum (OAM) carrying light) and circularly polarized light (spin angular momentum (SAM) carrying light) show that, these structured light beams bring great advantages for the manipulation of electron motion in the quantum structures [1,2,3]. An electron moving in a nanostructure is able to gain a net circulation as a result of SAM or OAM transferring from the light to the electron. And the direction of this circulation can also be tuned by the structured light parameters. For this study, the light parameters are beam waist (0.03 a.u.), the frequency (variable), pulse duration(0.03 a.u.), topological charge (+1).

The aim of this study is to investigate the magnetic field and current density induced by the twisted light and circularly polarized light in ring shape Mg-Porphyrin molecular cluster. We investigated Mg-porphyrin due to its aromatic structure and due to the fact that it is well known molecule. Through the calculations, electronic structure of the Mg-Porphyrin is obtained from Gaussian 09 program. We used Time Dependent Perturbation Theory to obtain the interaction term between Mg-Porphyrin and structured beams. The results show that SAM and OAM carrying light beam induces magnetic field and current in Mg-porphyrin and it is possible to control the magnitude and the direction of this magnetic field by changing the frequency of light and increasing OAM of the light.

Keywords: *Optical properties of clusters; Persistent currents; Atomic interactions with photons.*

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