

Magnetic Pulse Induced by Orbital Angular Momentum Carrying Ultrafast Laser Beam

Koray Koksal

Bitlis Eren University, Metallurgical and Materials Engineering, Turkey

Control and manipulation of the parameters such as shape, phase, amplitude and frequency of the electromagnetic pulses are very important in fundamental science and engineering and telecommunication. As another parameter, electromagnetic pulses are able to carry spin and orbital angular momentum². Orbital angular momentum carrying lasers are called as twisted light or optical vortex. The angular momentum of light can be manipulated and transferred to quantum systems³. In this study, we investigate the effect of angular momentum transferred to the quantum systems on electron dynamics, the induced current and induced magnetic pulse^{4,5,6}. We will show that a laser pulse in the range of picosecond and femtosecond can be transformed to a same range magnetic field.

Keywords: Orbital momentum, ultrafast laser, magnetic pulse

References

1. Moskalenko, A. S., Matos-Abiague, A., & Berakdar, J. (2006). Revivals, collapses, and magnetic-pulse generation in quantum rings. *Physical Review B*, 74(16), 161303.
2. Allen, Les, et al. "Orbital angular momentum of light and the transformation of Laguerre-Gaussian laser modes." *Physical Review A* 45.11 (1992): 8185.
3. Volke-Sepulveda, K., Garcés-Chávez, V., Chávez-Cerda, S., Arlt, J., & Dholakia, K. (2002). Orbital angular momentum of a high-order Bessel light beam. *Journal of Optics B: Quantum and Semiclassical Optics*, 4(2), S82.
4. Köksal, K., & Berakdar, J. (2012). Charge-current generation in atomic systems induced by optical vortices. *Physical Review A*, 86(6), 063812.
5. Matos-Abiague, A., & Berakdar, J. (2005). Photoinduced charge currents in mesoscopic rings. *Physical review letters*, 94(16), 166801.
6. Quinteiro, G. F., and J. Berakdar. "Electric currents induced by twisted light in quantum rings." *Optics express* 17.22 (2009): 20465-20475.
7. Köksal, K., & Koç, F. (2016). Optical manipulation of photo-induced current in spherical semiconductor quantum dots by optical vortices. *Philosophical Magazine*, 96(25), 2686-2695.
8. Köksal, K., & Koç, F. (2017). Spin and orbital angular momentum transfer into Ga n As n nanocage: The change in induced magnetic field by tuning the light parameters and size of the molecule. *Computational and Theoretical Chemistry*, 1105, 27-32.
9. Köksal, K., & Koç, F. (2017). The effect of twisted light on the ring-shaped molecules: The manipulation of the photoinduced current and the magnetic moment by transferring spin and orbital angular momentum of high frequency light. *Computational and Theoretical Chemistry*, 1099, 203-208.