Max-Planck-Institut für Struktur und Dynamik der Materie

Max Planck Institute for the Structure and Dynamics of Matter

Thursday, April 27th , 2017 – 11:00 a.m.
CFEL Seminar room IV (Bldg. 99)


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# Relativistic quantum dynamics and the electron spin in standing light waves


Strong laser beams allow for the coherent control of electrons, as for example electron diffraction in standing light waves [1]. In my talk I will discuss the possible manipulation of the electron spin in X-ray diffraction, in which the interacting standing wave of light can be formed from intensive and coherent X-ray beams from free-electron lasers [2]. The quantum dynamics of this process is theoretically modeled by inserting a plane wave ansatz for the electro-magnetic field and the electron wave function into the Dirac equation [3]. Based on this relativistic quantum description and substantiated by numeric and analytic solutions I will talk about the necessary kinematic conditions for generating spin effects in light-matter interaction. To the end I will present spin dynamics in circularly polarized laser fields [4,5] and discuss how circular polarization can be used for generating spin-dependent diffraction and spin polarization [6].



[1] D. L. Freimund, K. Aflatooni, H. Batelaan, Nature 413, 142 (2001).

[2] S. Ahrens, H. Bauke, C. H. Keitel, and C. Müller, Phys. Rev. Lett. 109, 043601 (2012).

[3] S. Ahrens, H. Bauke, C. H. Keitel, and C. Müller, Phys. Rev. A 88, 012115 (2013).

[4] H. Bauke, S. Ahrens, C. H Keitel, R. Grobe, New J. Phys. 16, 103028 (2014).

[5] H. Bauke, S. Ahrens, R. Grobe Phys. Rev. A 90, 052101 (2014).

[6] S. Ahrens, arXiv:1604.06201 [quant-ph] (2016).


Host: Angel Rubio