



Einladung

zum

Seminar des Instituts für Quantenphysik

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Relativistic description of spin effects of the diffraction of electrons at standing light waves

Dienstag, den 2. Juli 2019
14:00 Uhr
N24/227

Abstract:

The superposition of two counter-propagating laser beams is forming a standing wave of light, which can act as optical grating for traversing particles. This effect has already been discussed in 1933 by Kapitza and Dirac [1] and was demonstrated experimentally by Freimund, Aflatooni and Batelaan [2]. Nowadays, one of the main applications of the Kapitza-Dirac effect is the usage of diffraction for the study of macroscopic quantum objects in interference experiments [3]. Also electron spin effects are considered to be possible in the Kapitza-Dirac effect [4,5], though only for very specific parameters. In my talk, I will present a momentum space description for solving the relativistic quantum dynamics (Dirac equation) of the electron wave packet in a standing light wave. Based on this method I will discuss the possibility of spin effects and also spin-dependent diffraction from numeric and analytic solutions of the theoretical quantum description. At the end I will further discuss considerations about the experimental feasibility of spin-dependent electron diffraction.

[1] Kapitza and Dirac, Math. Proc. Cambridge Philos. Soc. 29, 297 (1933).

[2] Freimund, Aflatooni and Batelaan, Nature 413, 142 (2001).

[3] Arndt, Nairz, Vos-Andreae, Keller, van der Zouw and Zeilinger, Nature 401, 680 (1999).

[4] Ahrens, Bauke, Keitel and Müller, Phys. Rev. Lett. 109, 043601 (2012).



[5] Dellweg and Müller, Phys. Rev. Lett. 118, 070403 (2017).