

Photoionization of hydrogenlike ions with Bessel beams

O. Matula^{1,2}, A. Hayrapetyan¹, S. Fritzsche^{2,3}, A. Surzhykov^{1,2}

¹*Physikalisches Institut, Universität Heidelberg, D-69120 Heidelberg, Germany,*

²*GSI Helmholtzzentrum für Schwerionenforschung, D-64291 Darmstadt, Germany,*

³*FIAS Frankfurt Institute for Advanced Studies, D-60438 Frankfurt am Main, Germany,*
omatula@physi.uni-heidelberg.de

Atomic photoionization is one of the fundamental processes in the interaction of radiation with matter and has been studied intensively in the last decades, both in experiment and theory [1]. Besides detailed investigations of the total ionization rates, much attention has been paid to the angular distribution of the emitted photoelectrons [2]. These angle-differential studies, however, considered up to now solely the spin degree of freedom of the incident light. Recent advances in photo-optics allow nowadays to precisely control not only the spin (polarization) of photon beams but also their orbital angular momentum (so-called twisted photons) [3].

In this work, we present a theoretical analysis for the angular distribution of electrons emitted in photoionization of hydrogenlike ions with (twisted) Bessel beams that carry an orbital angular momentum. Calculations are performed based on the non-relativistic Schrödinger theory and the first-order time-dependent perturbation approach. Special attention is paid here to the dependence of the electron distribution on the photon-ion impact parameter. Our computations for photoionization of hydrogen atoms show that the angular characteristics of the emitted electrons are extremely sensitive to a variation of the impact parameter if the atom is situated near the beam axis [4].

References:

- [1] J. Eichler, Th. Stöhlker, *Phys. Rep.* **439**, 1 (2009).
- [2] A. Ichihara, J. Eichler, *At. Data Nucl. Data Tables* **79**, 187 (2001).
- [3] G. Molina-Terriza, J. P. Torres, L. Torner, *Nature Phys.* **3**, 305 (2007).
- [4] O. Matula *et al.*, *J. Phys. B*, *to be submitted*.