A 37: Poster: Twisted light and particles (SYTL)

Time: Thursday 17:00–19:00 Location: C/Foyer

A 37.1 Thu 17:00 C/Foyer

Photoionization of the hydrogen molecular ion by twisted light — •Anton Peshkov[1], Stephan Fritzsche[1,2], and Andrey Surzhykov[1] — [1]Helmholtz-Institut Jena, Germany — [2]Theoretisch-Physikalisches Institut, Friedrich-Schiller-Universität Jena, Germany

During the last decades the photoionization of diatomic molecules has been studied intensively in both experiment and theory. In these studies special attention has been paid to the interference between electrons emitted from either of two atomic centers of molecule. This interference leads to the oscillatory behavior of the angular-differential cross section similar to what was observed in the Young's double-slit experiment. Up to the present the Young-type ionization studies have been performed mainly with a plane wave incident radiation. However, owing to the recent developments in optics the photoionization of diatomic molecules can be explored also by using the twisted light beams. These beams are designed to carry a non-zero projection of the orbital angular momentum (OAM) onto to their propagation direction and can be produced with energies up to 100 eV. In this contribution we have investigated the interaction of aligned molecules with twisted Bessel light. Analysis is performed within the nonrelativistic framework and the first Born approximation. Detailed calculations have been performed for the hydrogen molecular ion H_2^+, whose electronic wave function was constructed as a linear combination of atomic orbitals. Results of these calculations indicate that the angular-differential cross section is sensitive to the position of the molecule within the wave-front as well as to the OAM and polarization of incident radiation.

A 37.2 Thu 17:00 C/Foyer

Photoabsorption and ionization of twisted light by many-electron atoms and ions — •Stephan Fritzsche[1,2], Daniel Seipt[1], Valery Serbo[3], and Andrey Surzhykov[1] — [1]Helmholtz-Institut Jena, 07743 Jena, Germany — [2]Theoretisch-Physikalisches Institut, Universität Jena, 07743 Jena, Germany — [3]Novosibirsk State University, 630090 Novosibirsk, Russia

The excitation of many-electron atoms and ions by twisted light has been investigated within the framework of the density matrix theory and Dirac's relativistic equation. In particular, general expressions were derived for the alignment of the excited states if the incident photons are prepared in a coherent superposition of two twisted Bessel beams. It is shown that both, the population of the excited atoms as well as the angular distribution of the photoelectrons, are sensitive to the transverse momentum and the (projection of the) total angular momentum of the incident radiation [1].

[1] A. Surzhykov *et al.*, submitted (2014).

A 37.3 Thu 17:00 C/Foyer

A basis of states for vortex beams — •Koen van Kruining — Max Planck Institut für Physik komplexer Systeme, Dresden

Quantum mechanics requires one to decompose a physical system in a complete orthonormal basis of eigenstates. For twisted light, a basis of transverse electric and transverse magnetic beams is presented. This basis is then applied for identifying the spin eigenstates and describing the interaction of a vortex beam with a birefringent medium.

A 37.4 Thu 17:00 C/Foyer

Relativistic electron beams carrying orbital angular momentum — •Teuntje Tijssen and Mark Dennis — H. H. Wills Physics Laboratory, Bristol, United Kingdom

A simple analytic form of a relativistic electron beam carrying orbital angular momentum is the so-called Bessel beam solution of the Dirac equation, whose components are eigenfunctions of the angular momentum operator around the beam axis with different integer azimuthal labels. Close to the axis of the beam, the different angular momentum labels of different components give rise to an angular interference effect, somewhat similar to the quantum cores studied for optical vortices. our analytic investigation includes careful regularisation of the relativistic electron Bessel beams to have finite energy and self-consistency with the induced electromagnetic field along the core.