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Interaction of light carrying orbital angular momentum with matter

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Recent advances in generating structured light fields for a wide range of pulse parameters has led to important discoveries and fascinating applications ranging from optical tweezers for microscale objects to electronics, life sciences, quantum information or optical telecommunications. Especially light pulses carrying orbital angular momentum (OAM) enable photomechanics for moving, trapping and rotating nanostructured objects molecular matter. OAM laser beams may also result in a novel type of photovoltaic effects [1,4]. In this poster, which supplements the talk of C. Granados, we will present recent discoveries and studies of our research group.

Our findings reveal the immense potential of optical vortices for applications in photovoltaics as well as laser-induced magnetism in nano-structures [2,3,5]. Even on the atomic scale the application of light carrying orbital angular momentum instead of conventional laser pulses changes has large consequences [6,7]. For instance, the change of the internal angular momentum state of an (photo)-ionized electron opens the door to the identification of its origin with respect to the energy, space and initial magnetic sublevel.

In mesoscopic systems, the abovementioned photomechanic effect on the charge carriers gives access to a totally different concept of photovoltaics: The transferred orbital angular momenta are transformed in directed circulating currents which are fully controllable by the winding number of the applied optical vortex without increasing the light field intensity. These photo-induced current loops open the door to optomagnetism [2] and photogalvanic applications [1].

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Primary authors: GRANADOS, Carlos (Institute of Physics, Universität Halle (Saale)); BERAKDAR, Jamal (Institute of Physics, Universität Halle (Saale)); WÄTZEL, Jonas (Martin-Luther Universität Halle-Wittenberg)

Presenter: WÄTZEL, Jonas (Martin-Luther Universität Halle-Wittenberg)

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