



Physikalisches Kolloquium
Einladung

Physics Colloquium
Invitation

Monday, 29 April 2019

Lecture Hall N24/H13, 16:15

Coffee and cookies will be served in front of the lecture hall from 16:00

Synthetic chiral light for extremely efficient laser-controlled chiral discrimination

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Distinguishing left- and right-handed molecular enantiomers is challenging, especially on ultrafast time scale. Traditionally one uses a chiral reagent, an object of known handedness, to determine the unknown handedness of a chiral molecule. In optics, one uses the spatial helix formed by circularly polarized light as a “chiral photonic reagent”. However, in optical domain the pitch of this helix – the light wavelength – does not match the size of the molecule, leading to very small chiral signals. In dipole approximation, which neglects the size of the molecule with respect to light wavelength, circularly polarized light is not chiral, and the response of the two enantiomers is the same.

I will introduce a new concept of synthetic chiral light [1], which is chiral already in the dipole approximation. Compared to the inefficient chiral reagent – the light helix in space, here the helix is in time. In synthetic chiral light the electric field vector draws a three dimensional chiral Lissajous figure (Fig. 1), at every point in space. The key point is that this chiral structure will appear already in the dipole approximation. I will show how this chiral photonic reagent can be tuned to “react” with the desired enantiomer of a chiral molecule and not with its mirror twin, achieving the ultimate limit in efficiency of chiral discrimination, how synthetic chiral light affects fundamental non-linear optical processes and introduce new measures of optical chirality to characterize the handedness of such light. The simplicity of generating synthetic chiral light in a laboratory opens a broad field of shaping and controlling chiral matter with light.

[1] David Ayuso et al, Locally and globally chiral fields for ultimate control of chiral light matter interaction, <https://arxiv.org/abs/1809.01632>

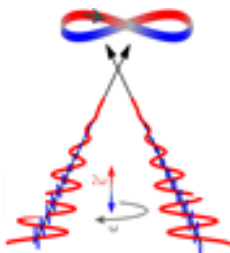


Fig. 1.: Synthetic chiral light: three dimensional chiral Lissajous figure drawn in time by the tip of electric field vector.

Host: Prof. Dr. Joachim Ankerhold, Institute of Complex Quantum Systems

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