

**PHYSICAL COLLOQUIUM**

**INVITATION**

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Monday, 11.01.2021, 4.15 p.m.,  
video conference: <https://meeting.uol.de/b/anj-2vc-j6s-fwe>

speaks

**Prof. Dr. Manfred Lein,**  
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about

**“Gouy phase and Berry phase in strong-field physics”**

The dynamics of atoms in the presence of strong driving fields is an ideal testbed for observing quantum mechanical phenomena. Periodic driving implies that external parameters undergo closed circuits. This, in combination with periodic states of the atom known as dressed states, causes geometric Berry phases, meaning that the quantum state acquires a phase in addition to the usual time-integrated energy. Our simulations demonstrate that tailored two-dimensional driving fields can lead to nontrivial geometric phases which have an effect on the dressed-state energy of the atom. The Gouy phase is another intriguing aspect of wave dynamics. It is known as a  $\pi$  phase shift of an optical beam passing through a focus. We show that there is an analogue in the time evolution of an electron wave when a strong laser field ionizes an atom and forces the electron to return and scatter from the parent ion. The attractive Coulomb potential induces Coulomb focusing of the electron wave with a Gouy phase of  $\pi/2$ . In the photoelectron momentum distributions, the phase is observable as a fringe shift in the photoelectron holography effect, where the focused scattered wave interferes with a reference wave that does not pass a focus. We discuss how this phenomenon arises from the semiclassical theory of quantum dynamics.

All interested persons are cordially invited.

Sgd. Prof. Dr. Matthias Wollenhaupt