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## Physikalisches Kolloquium

Dec. 6, 2022 at 4:15 p.m. HS KPH

Prof. Dr. Peter Hommelhoff University of Erlangen

## Ultrafast currents in graphene: approaching lightwave electronics

Optical fields can now be controlled with similar degrees of freedom as microwave fields for many decades already: we can now control not just the pulse envelope but also the optical carrier field. With few cycle laser pulses, this allows steering of electrons in unprecedented ways. I will give an overview over recent experiments we performed mainly with the atomically thin material graphene. Here we can drive the intraband

motion of electrons but also interband transitions. For the intense ultrashort fields we employ, these processes become intricately coupled

- a hallmark of strongfield physics. In particular, we could observe subsequent coherent Landau-Zener transitions, leading to

Landau-Zener-Stückelberg-Majorana interferometry, representing fully coherent electron dynamics in a room-temperature material. In the

second part of the talk, we will shine light on the graphene-gold interface and how it will add to the currents we can excite. Because of

the different symmetries involved, we can disentangle virtual and real carrier excitations. With these insights, we have recently demonstrated

a first Boolean logic gate based on two laser pulses carrying the logic information in the carrier envelope phase, which might bring lightwave or petahertz electronics closer to reality.

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MATERIALS SCIENCE O PRISMA+

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