Plenary Talk PV XI Wed 9:00 Audimax 2

Quantum choreography to the beat of light — •Rupert Huber — Department of Physics and Regensburg Center for Ultrafast Nanoscopy (RUN), University of Regensburg, Regensburg, Germany

Lightwave electronics has pushed the control of condensed matter to unprecedented time scales. By harnessing the carrier wave of intense light as an alternating voltage, electrons can be driven faster than a cycle of light, opening a fascinating quantum world full of promise for future quantum technologies.

We will discuss prominent examples of lightwave-driven dynamics in solids, ranging from dynamical Bloch oscillations to lightwave valleytronics and super-resolution all-optical band structure reconstruction. In topological insulators, ballistic and quasi-relativistic electron motion leads to a new quality of non-integer high-harmonic generation, unveiling the Berry curvature of the surface state. Moreover, we combine lightwave electronics with low-temperature scanning tunneling microscopy to take atom-scale slow-motion movies of an individual vibrating molecule. Lightwaves inside the tunnelling junction can even serve as femtosecond atomic forces to choreograph a coherent structural motion of a single-molecule switch. This concept offers a radically new way of directly watching and controlling key elementary dynamics in nature and steer (bio)chemical reactions or ultrafast phase transitions, on their intrinsic spatio-temporal scales.