Plenary Talk PV VII Wed 8:30 B Audimax

Ultrafast nonlinear optics in the mid-infrared: Expanding the realm of optical physics — •Aleksei Zheltikov — Physics Department, International Laser Center, M. V. Lomonosov Moscow State University — Department of Physics and Astronomy, Texas A&M University — Russian Quantum Center

Motivated and driven by numerous applications and long-standing challenges in strong-field physics, molecular spectroscopy, semiconductor electronics, and standoff detection, ultrafast optical science is rapidly expanding toward longer wavelengths. Recent breakthroughs in laser technologies enable the generation of few- and even single-cycle mid-IR field waveforms within a broad range of oeak oiwers and central wavelengths. Experiments with such mid-IR sources help understand complex interactions of high-intensity ultrashort mid-IR pulses with matter, giving rise to unique regimes of laser-matter interactions and revealing unexpected properties of materials in the mid-infrared. High-power mid-IR soliton transients and laser filaments in air demonstrated in recent experiments set new milestones in the 1000-year history of atmospheric optics, opening new horizons in high-power laser signal transmission and remote sensing of the atmosphere. Below-the-bandgap high-order harmonics generated by ultrashort mid-infrared laser pulses are shown to be ideally suited to probe the nonlinearities of electron bands, enabling an all-optical mapping of the electron band structure in bulk solids. This talk will offer an overview of recent discoveries in this field of research, which lead us to rethink the limits of the rapidly expanding realm of nonlinear optical physics.