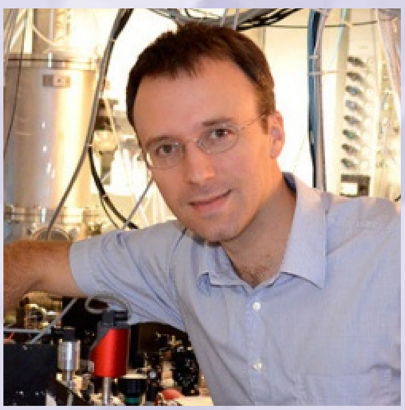
Конференц-зал ФИАН



21 марта в 12-00

Обзорная лекция

"Extending attosecond spectroscopy to complex systems: from molecules to liquids"

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Attosecond time-resolved measurements have so far mainly been performed on isolated molecules in the gas phase with first extensions to solids. In this talk, I will present several recent experiments that extend attosecond science into the liquid phase.

Applying attosecond interferometry to a liquid-water microjet [1], we have measured photoemission delays between the liquid and gas phases of water. The delays between photoemission from the highest-occupied valence band of liquid water and the highest-occupied valence orbital of isolated water molecules amount to 69±20 as and 48±16 as at photon energies of 21.7 and 31.0 eV, respectively. The challenge of the spectral overlap of multiple photoelectron bands was resolved by developing a new phase retrieval approach that generalizes attosecond interferometry to complex targets [2]. The detailed theoretical analysis of the liquid-gas delays revealed the existence of a new non-local mechanism in attosecond interferometry, which makes the technique sensitive, in general, to both mean-free paths and scattering delays [3]. Detailed quantum scattering calculations [4] on water clusters additionally reveal the importance of solvation on the electronic structure of the water molecules. Three-dimensional Monte-Carlo simulations including both effects demonstrate the dominance of solvation effects on the measured delays.

I will also report on the extension of high-harmonic spectroscopy to the liquid phase with the first observation of extreme-ultraviolet high-harmonic generation from the bulk of liquids [5], using the recently invented liquid-flatjet technique [6]. These experiments reveal a highly non-perturbative scaling of all observed harmonic orders with the driving field strength. The cut-off energy scales close to linear with the electric field strength, a behavior that is similar to solids and contrasts with that of gases. The observed high-harmonic spectra and their comparison with a strongly-driven few-band model further demonstrates the sensitivity of liquid-phase high-harmonic spectroscopy to the electronic structure of the liquid.

References

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Цикл приглашенных лекций ФИАН

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