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Physical Colloquium

„Quantum control of photo-induced electron dynamics: from nanoplasmonics to nuclear transitions“

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Room No. W02 1-148

In the past decades, time-resolved spectroscopy of photo-induced electron dynamics has provided unique tools for investigating a wide range of natural processes. This has opened up new avenues for understanding and manipulating matter on ultrafast timescales. In this seminar, we will explore recent advances in the study of photo-induced electron dynamics in complex systems, along with the concurrent development of state-of-the-art light sources.

The first part of the presentation will focus on real-time tracking of plasmonic dynamics in fullerenes [1]. Specifically, we demonstrate the dominant role of electron correlations in the dynamics of the giant plasmon resonance (GPR) in the subnanometer system C60, using attosecond photoemission chronoscopy. We observe a characteristic photoemission delay of up to 300 attoseconds, purely induced by coherent large-scale electron correlations in the plasmonic potential. These results provide insights into the nature of plasmon resonances in subnanometer systems and open new perspectives for advancing nanoplasmonic applications.

Electron dynamics also play a major role in subatomic processes, bridging atomic and nuclear physics. In the second part of the presentation, we will discuss recent measurements of photoinduced electron dynamics correlated with resonant nuclear excitation in 57Fe [2]. We show that photoelectron spectroscopy can be used to investigate the energy exchange between electronic and nuclear states, offering new opportunities for controlling nuclear transitions at the quantum level.

References: [1] Biswas S, Trabattoni A, et al., Sci. Adv. 11, eads0494 (2025). [2] Ravi, K., et al., in preparation (2025).

Host: Prof. Dr. Matthias Wollenhaupt