SONDERKOLLOQUIUM

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IM HÖRSAAL II IM PHYSIKHOCHHAUS

Looking into the secret (ultrafast) dynamics of electrons

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The generation and characterization of trains and isolated attosecond (1as = 10-18 s) pulses have been achieved thanks to the continuous development of ultrafast intense laser sources over the last 20 years [1] and through theoretical advances in the description of their interaction with atomic and molecular systems [2]. Attosecond pulses are the shortest reproducible events produced so far and their duration is rapidly approaching the atomic unit of time (1 a.u. = 24 as) [3, 4], which represents the natural timescale of the electronic motion inside the atom in the Bohr model. In quantum mechanics, this timescale is determined by the inverse of the spacing between energy levels and it ranges between a few femtoseconds and tens of attoseconds for valence and core shell electrons. The first applications of attosecond pulses were mainly focused on simple atoms or molecules to validate new experimental approaches and to gain time- resolved information on processes driven by electron-electron or electron-nuclear correlation.

Experimental and theoretical results on the ultrafast dynamics initiated by isolated attosecond pulses in small molecules such as and H2, D2 and N2 will be presented. In these systems, several states of the neutral molecule (autoionizing states) or of the molecular ion can be accessed due to the large bandwidth of the attosecond pulses. The few-femtosecond and attosecond electron dynamics can be probed and controlled using a synchronized infrared few-cycle pulse [5]. New directions for the investigation of attosecond dynamics in more complex molecules and on condensed phase systems will be discussed.

References

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