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FLASH HALL (28c) - Seminar Room

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Ultrafast dynamics in surface and solid state physics: Coupling between electronic and nuclear degrees of freedom

A fundamental understanding of chemical reaction dynamics relies on the Born-Oppenheimer approximation, a key concept in chemical physics which assumes that the reaction evolves electronically adiabatically on the ground or an excited potential energy surface. Thereby, nonadiabatic coupling effects between nuclear motions and electronic degrees of freedom are neglected. However, in surface femtochemistry at metals, where a chemical reaction on a surface is initiated by an ultrashort laser pulse, exactly this nonadiabatic coupling between electron-hole pair excitations in the metal substrate and nuclear (vibrational) degrees of freedom of the adsorbed reactants provides the base to describe the evolving reaction dynamics. The appeal of surface femtochemistry is to switch on this nonadiabaticity directly in the time domain. Various time-resolved spectroscopic techniques are used to obtain microscopic-level information on the underlying reaction mechanism, coupling times and energy partitioning between different degrees of freedom of the reaction product as will be illustrated by examples of femtosecond-laser induced surface reactions [1,2].

[1] S. Wagner et al., *New J. Phys.* 10, 125031 (2008)

[2] C. Frischkorn, *J. Phys.: Condens. Matter* 20, 313002 (2008)