UNIVERSITÄT DUISBURG ESSEN

PHYSIK E=

Physikalisches Kolloquium

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13:00 Uhr
MC 122 und Zoom

https://uni-due.zoom-x.de/j/64228670246?pwd=RjVQeFNIUkRKRkpiNVpKYXhJaFNLdz09 (gilt für alle Vorträge)

X-ray-induced charge-transfer-process in solution

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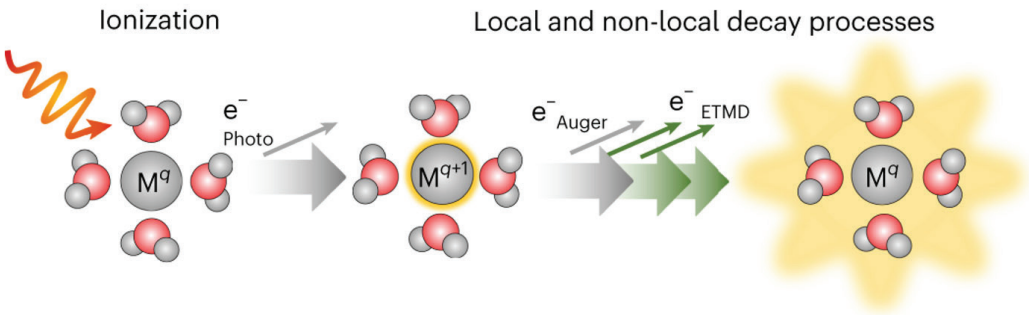

X-ray-induced core excitation and decay dynamics of isolated atoms is nowadays relatively well understood. How are such processes affected by an aqueous environment? In this presentation, I will discuss some recent studies on how water molecules may participate in non-local processes involving charge transfer, such as Intermolecular Coulombic Decay (ICD) [1], Electron Transfer Mediated Decay (ETMD) [2], and Intermolecular Radiative Decay (IRD) [3] in various stages of the core-hole excitation and decay. These processes are relevant for issues connected to radiation damage in an aqueous environment, and they also open the possibility to probe the local environment of solutes, and ultrafast solute-solvent electron dynamics.

Exciting or ionizing core levels to induce these processes provides chemical selectivity and the possibility to probe ultrafast processes. Chemical selectivity comes from the core-levels being atomic-like and localized, which enables selective probing of chemically inequivalent species. The core-holes have typically a lifetime of a few femtoseconds, which is used in core-hole-clock techniques to probe ultrafast processes from tens of femtoseconds down to a few hundred attoseconds. I will introduce these processes, and present recent results that exemplify some types of phenomena in solution that can be studied, and what can be learned. Some examples will be:

- The first steps towards a solvated electron, showing how the electron delocalization occurs on the sub-femtosecond timescale.
- The formation of a radiation-damage hotspot on a hundred-femtosecond timescale following Auger-Meitner decay in a solvated ion.
- How to get an insider's view of the solvation shell around to selectively probe how it differs from the bulk solution.

I will also give an outlook on how these types of studies could be developed towards other research questions.