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Dynamics of microsolvated (bio)molecules in general-chemistry conditions

Tuesday 16 September 2025 16:40 (20 minutes)

Observing molecules in action through the recording of "molecular movies", i.e., their spatiotemporal evolution during chemical dynamics, with atomic spatial and temporal resolution promises to revolutionize our understanding of the molecular sciences and to provide a time-dependent basis of chemistry. However, most *real-world* chemistry occurs at or near room temperature, yet the ultrafast dynamics of corresponding elementary chemical processes at this energy scale are largely unexplored. We aim to change this [1].

Experimentally, we build upon our approaches to prepare highly controlled samples that enable advanced imaging methods of individual molecular species and directly in the molecular frame. We prepare highly-controlled molecular samples for advanced ultrafast imaging experiments. This includes the preparation of ensembles of individual molecular species, e.g., single microsolvation environments, single conformers, or even single quantum states. Furthermore, the generated very cold samples are ideally suited to fix the molecules in space in laser-alignment or mixed-field orientation approaches.

I will discuss how we can utilize these highly controlled, ultracold samples to investigate "room-temperature" chemical dynamics. I will present first experimental results and discuss both the chemical information obtained as well as the challenges ahead for disentangling ultrafast elementary steps of general-chemistry in general.

[1] M. S. Robinson and J. Küpper, Unraveling the ultrafast dynamics of thermal-energy chemical reactions, *Phys. Chem. Chem. Phys.* **26**, 1587 (2024).

Keywords

Hydrogen bond: strong; State of system: gas

This abstract is submitted for....

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