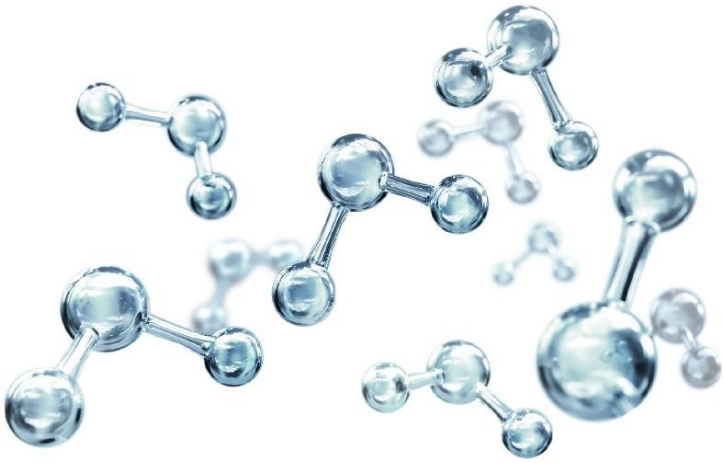
Seminar

CMWS Centre for Molecular Water Science

27th of May 2021
12:00 h

Zoom Virtual Meeting:

https://desy.zoom.us/j/93807418771
Meeting-ID: 938 0741 8771
Password: 748707



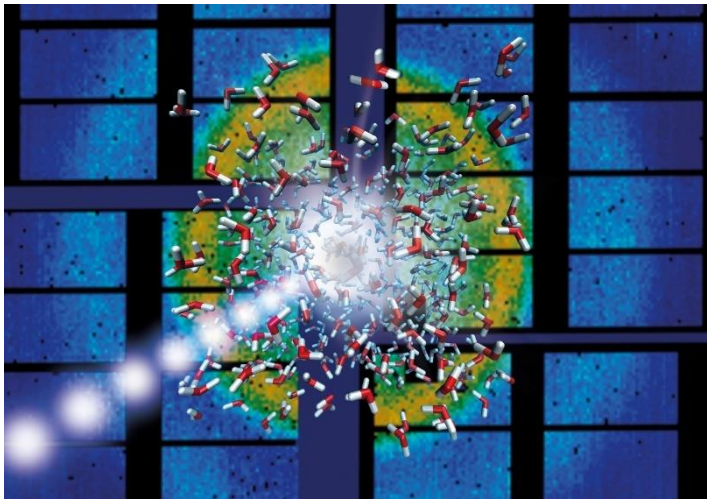
Felix Lehmkühler

Deutsches Elektronen-Synchrotron (DESY)

Probing nanoscale dynamics with MHz repetition rates – superheating water above 170 °C

Dynamics and kinetics in soft-matter physics, biology, and nanoscience frequently occur on (sub-) microsecond time scales, which are difficult to probe experimentally. One way to access dynamics over multiple length scales is X-ray photon correlation spectroscopy (XPCS) using coherent X-rays. In particular, the European XFEL enables XPCS experiments down to atomic length scales for the first time thanks to its MHz repetition rate.

In this talk I will first introduce the concept of XPCS. Afterwards I will present the results of microsecond XPCS at the SPB/SFX instrument of European XFEL on the dynamics of nanoparticles dispersed in water [1]. We found an exceptional beam stability over the pulse train, suggesting very weak—if any—shot-to-shot fluctuations of beam size, pointing, and coherence. By fine-tuning the fluence of the European XFEL pulses, we were able to observe different degrees of beam-induced heating of both the nanoparticles and the surrounding water. At fluences above 50 µJ/mm2, superheated-water states above 170°C were reached, which persisted at least for 100 µs. At the end of the talk I will give a short outlook on the possibilities of XPCS experiments at the next-generation X-ray light sources.



[1] F. Lehmkühler et al. PNAS 117, 24110 (2020).