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From femtoseconds to hours –measuring dynamics over 18 orders of magnitude with coherent X-rays

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X-ray photon correlation spectroscopy (XPCS) enables the study of sample dynamics between micrometer and atomic length scales. As a coherent scattering technique, it significantly benefits from the increased brilliance of the next-generation synchrotron radiation and Free-Electron Laser (FEL) sources.

In my presentation I will introduce the XPCS concepts and show some recent examples of dynamics studies of soft matter and liquids at storage rings [1,2,3] and FEL [4] sources. Furthermore, I will discuss future opportunities of XPCS and the related technique X-ray speckle visibility spectroscopy (XSVS) at new X-ray sources. Thanks to its particular signal-to-noise ratio, the time scales accessible by XPCS scale with the square of the coherent flux, allowing to dramatically extend its applications. This will soon enable studies over more than 18 orders of magnitude in time by XPCS and XSVS.

[1] L. Frenzel et al., J. Phys. Chem. Lett. 10, 5231 (2019); Soft Matter 16, 466 (2020).
[2] A. Jain et al., Soft Matter 16, 2864 (2020).
[3] F. Lehmkühler et al., Sci. Adv. 6, eabc5916 (2020).
[4] F. Lehmkühler et al., PNAS 117, 24110 (2020).

About the speaker:
Felix Lehmkühler obtained his Ph.D. in physics at TU Dortmund (Germany) in 2010. Afterwards, he worked as postdoc in the Coherent X-ray scattering group at DESY and became a senior scientist in 2014 at DESY. Felix' research interests cover X-ray studies on the structure and dynamics of soft matter, nanomaterials and water-based systems, with special attention on developing and using coherent X-ray scattering methods at modern free-electron laser and synchrotron radiation sources.

Presenter: Dr LEHMKÜHLER, Felix (Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany)

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