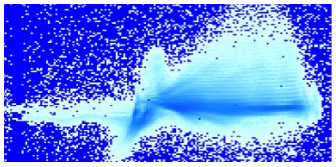

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Microsecond Dynamics in Complex Liquids with MHz XPCS

Complex liquids are a broad family of materials that cover key roles in several aspects of everyday life, from biological processes that can take place only in such environments to industrial applications that sees complex liquids either as a final product or as a fundamental manufacturing step. From a physicist perspective most of the interesting phenomena take place at inter-particle distances, which for proteins and nanoparticles correspond to few nanometers, accessible only via X-ray based techniques. Moreover, such processes are often connected to diffusion mechanisms, which for water-based systems implies timescales of the order of few microseconds. These time and spatial constraints pose a real challenge to current 3rd generation synchrotron sources, limiting experiments only to a handful of complex experiments on prototypical systems [1].
The MHz repetition rate of the European XFEL matches perfectly with these timescales making it an ideal choice for this kind of experiments. Here we report the results from MHz X-ray Photon Correlation Spectroscopy (XPCS) experiments performed at the instruments MID and SPB/SFX [2,3], showing how it is possible to execute measurements both on prototypical charge-stabilized silica in water and on radiation-sensitive core (silica) –shell (PNIPAm) nanoparticles. Tuning the pulse intensity and repetition rate it is possible not only to measure the original dynamics of the systems but also to control the radiation-induced heating of the system without necessarily damaging it even for more delicate PNIPAm - based samples. This possibility, combined with the capabilities of the XPCS techniques, opens the way to the study of out of equilibrium dynamics in the microsecond time-scale for a large variety of complex systems.

[1] Q. Zhang, E. M. Dufresne, S. Narayanan, P. Maj, A. Koziol, R. Szczygiel, P. Grybos, M. Sutton, and A. R. Sandy, Journal of Synchrotron Radiation, 2018, 25(5), 1408–1416
[2] F. Lehmkühler, F. Dallari., A. Jain, M. Sikorski, J. Möller, A. Madsen, A. P. Mancuso, and G. Grübel et al. PNAS, 2020, 117, 39, 24110-24116.
[3] F. Dallari A. Jain, M. Sikorski, J. Möller, A. Madsen, A. P. Mancuso, G. Grübel, F. Lehmkühler et al. IUCrJ, 2021, 8, 5, 775-783,
[4] F.Dallari, F. Lehmkühler et al, submitted

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