Slow dynamics in disordered materials studied with coherent X-rays

Beatrice Ruta[1]

[1] *Univ Lyon 1 & CNRS, Light Matter Institute, Villeurbanne, France; beatrice.ruta@univ-lyon1.fr*

X-ray Photon Correlation Spectroscopy (XPCS) is a spatio-temporal coherent X-ray scattering technique that probes slow collective dynamics at the nanometric and atomic scale based on the observation of fluctuating far-field speckle patterns [1].
This technique has been successfully applied to the investigation of the slow relaxation processes occurring in disordered materials undergoing dynamical arrest and aging, such as glass formers across the glass transition [2], concentrated colloidal suspensions [3], and complex biological systems [4].
The Extreme Brilliance Source (EBS) upgrade of ESRF will allow to extend dramatically the dynamical range of XPCS, opening the field to new ground breaking experiments, covering 11 orders of magnitude in timescales. For the first time, it will be possible to explore microsecond fluctuations in biological systems and in hard materials, and to unveil the particle motion of complex materials under extreme conditions, in confinement and at buried interfaces.
In this talk, I will present some examples on the relaxation dynamics in arrested states, including glasses, bidimensional systems and gels, and I will also illustrate some of the future scientific possibilities offered by the EBS upgrade of ESRF.

References

[1] A. Madsen, A. Fluerasu and B. Ruta, Synchrotron Light Sources and Free-Electron Lasers, Springer International Publishing, 2015, pp. 1–21.
[2] B. Ruta et al. Topical Review, J. Phy.: Cond. Matter **29**, 503002, 2017
[3] V.M. Giordano and B. Ruta, Nat. Commun. **7**, 10344, 2016
[3] R. Angelini et al. Nat. Commun. **5**, 4049, 2014
[4] D. Orsi et al. Sci. Rep. **5**, 17930, 2015