European XFEL

THEORY GROUP MEETING

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“X-ray scattering from non-crystalline materials: fluctuations and correlations ”

by

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Availability of the state-of-the-art x-ray sources with the unprecedentedly high flux, coherence and ultra-short pulse duration enable fascinating possibilities to access the structure of matter on the nanoscale. While x-ray studies of crystalline materials relay on solid theoretical and experimental basis, investigation of the structure of non-crystalline materials remains a challenge. This is an unfortunate gap considering that such materials may exhibit novel complex functional properties.

Angular x-ray cross-correlation analysis (XCCA) is a novel approach for studying the structure of disordered systems, such as glasses, colloidal systems, molecules in solution, etc. A general theoretical basis of XCCA will be considered. XCCA of intensity scattered from a disordered system can provide information covering a wide range of structural properties in the system, from local symmetries to medium range order. One of the most attractive challenges is to image an individual particle, e.g. biological molecule, at near-atomic resolution. While the implementation of single-particle coherent diffractive imaging for non-crystalline particles is complicated by current limitations on photon flux and hit rate, the concept “scatter from many – determine single” offers an alternative way of overcoming these difficulties. The latest theoretical and experimental results related to the exploration of correlations in the intensity scattered from non-crystalline systems will be presented.