European XFEL

THEORY GROUP MEETING

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AER 19 Seminar Room 4.14

Single particle imaging of biological samples at X-ray Free-Electron Lasers: opportunities and challenges

by

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X-ray Free-Electron Lasers (XFELs) provide coherent x-ray pulses of unprecedented peak power. Single-particle diffraction imaging experiments at XFELs have a great potential for the structure determination of reproducible biological specimens that cannot be crystallized. One of the challenges in processing the data from such an experiment is to determine the correct orientation of each diffraction pattern from samples randomly injected in the FEL beam. In this talk an algorithm that can solve this problem will be described [1]. Presented approach can be applied to samples from tens of nanometers to microns in size, measured with sub-nanometer resolution in the presence of noise. Next, a direct, non-iterative approach for the recovery of the diffraction pattern corresponding to a single particle using coherent x-ray data collected from a two-dimensional disordered system of identical particles will be described [2]. In the end of the talk high intensity induced electronic dynamics, which can reduce the contrast of the measured diffraction patterns will be discussed [3].

[1] Yefanov O M, Vartanyants I A (2013). J. Phys. B: At. Mol. Opt. Phys. 46, 164013.
[2] Kurta R P, Dronyak R, Altarelli M, Weckert E, Vartanyants I A (2013). New J. Phys. 15, 013059.
[3] Lorenz U, Kabachnik N M, Weckert E, Vartanyants I A (2012). Phys. Rev. E 86, 051911.