Graduate School Seminar

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3D characterization of free nanostructures via two-color coherent diffractive imaging

Coherent x-ray diffraction promises high-resolution structural characterization of single free nanoparticles such as biological specimens, aerosols and atomic clusters. Hard x-ray diffraction patterns contain small angle scattering data and allow for efficient reconstruction of the 2D projected target density with well-established phase retrieval algorithms [1]. A 3D reconstruction is feasible by combining multiple scattering patterns for randomly oriented reproducible targets [2] if the particle orientation problem can be solved - typically a highly complex task involving statistical analysis. Here, we propose a 3D phase retrieval scheme based on the simultaneous measurement of hard and soft x-ray diffraction images to mitigate this difficulty. In the wide angle soft x-ray scattering, important additional information about the target orientation is contained in the diffraction images [3]. In this theoretical study, we explore routes to assign the target orientation to the respective hard x-ray scattering images using a pre-calculated dataset of the soft x-ray scattering patterns and test retrieval of the 3D target shape including its inner structure.

[1] J. R. Fienup, Appl. Opt. **21**, 2758 (1982).
[2] T. Ekeberg *et al.*, Phys. Rev. Lett. **114**, 098102 (2015).
[3] I. Barke *et al.*, Nat. Comm. **6**, 6187 (2015).

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