Contribution submission to the conference Mainz 2017

Three-dimensional characterization of free nanostructures via two-color coherent diffractive imaging — •Katharina Sander[1], Maxim A. Yurkin[2,3], and Thomas Fennel[1] — [1]Institute of Physics, University of Rostock, Germany — [2]Voevodsky Institute of Chemical Kinetics and Combustion, Novosibirsk, Russia — [3]Novosibirsk State University, Russia

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 [Fienup, Appl. Opt., 1982]. A 3D reconstruction is feasible by combining multiple scattering patterns for randomly oriented reproducible targets [Ekeberg, Phys. Rev. Lett., 2015] 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 [Barke, Nat. Comm., 2015]. 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.

Part: A
Type: Poster
Topic: Atomic clusters (together with MO)
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