

Inversion of Coherent Diffraction Images of Nanocrystals

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In this talk, I will present the progress we have made towards reconstruction of real space images by inversion of coherent X-ray diffraction from small crystals. We have found that iterative Fourier transform methods based on the Fienup/Gerchberg/Saxton method can be successful under some circumstances. These methods work because the diffraction pattern can be oversampled with respect to the spatial Nyquist frequency. A strong real-space constraint in the form of a "support" region surrounding the object appears to be sufficient, but some anti-stagnation strategy is also necessary. The resulting images of gold nanocrystals are interesting in that internal striations are present [1]. The striations probably arise because of stresses present during the growth of the crystals. I will discuss the merits of possible enhancements to the technique enabled by the introduction of focusing optics in front of the sample.

[1] "Three-dimensional Imaging of Microstructure in Gold Nanocrystals", G. J. Williams, M. A. Pfeifer, I. A. Vartanyants and I. K. Robinson, Physical Review Letters 90, 175501-1 (2003).