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Imaging at the X-ray Frontier: Coherent Diffraction Imaging (CDI) for Nano and Bioscience

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For centuries, lens-based microscopy, such as light, phase-contrast, fluorescence, confocal and electron microscopy, has played an important role in the evolution of modern sciences and technologies. In 1999, a novel form of microscopy, i.e. coherent diffraction imaging (also termed coherent diffraction microscopy or lensless imaging) was developed and transformed our traditional view of microscopy, in which the diffraction pattern of a noncrystalline object or a nanocrystal is first measured and then directly phased to obtain a high resolution image. The well-known phase problem is solved by the oversampling method in combination with iterative algorithms whose principle can be traced back to the Shannon sampling theorem. In this talk, I will briefly discuss the principle of coherent diffraction imaging and illustrate its broad application in nano and bioscience by using synchrotron radiation, high harmonic generation and X-ray free electron lasers.