

X-ray Phase Imaging with Grating Interferometers

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Hard X-ray grating interferometry is a relatively new method for wavefront sensing and phase radiography [1-4] in the energy range between 8 and 30 keV. Different measurement modes such as phase stepping or moiré interferometry can be used to obtain quantitative phase maps of X-ray wavefronts and/or objects in the beam, and the combination with tomography allows three-dimensional reconstruction of the X-ray refractive index of samples. The quantities measured are similar to those obtained by analyzer-based techniques such as diffraction-enhanced imaging.

While the spatial resolution of the technique can be as good as a few micrometers, the true promise of grating interferometry is to provide better images and new information where other phase-imaging methods cannot easily be used. This is at large fields of view, and using full-field beams of much wider cross section than is usually available at synchrotron sources. X-ray tube generators such as those used in medical diagnostic imaging provide such wide beams, and a relatively simple extension of the setup allows its efficient use with laboratory sources [5,6].

Some of the problems that impede the use of other phase-radiography methods with radiation from tube sources do not occur in a grating interferometer, but there are still many questions that remain to be answered in order to estimate whether the routine use of grating-interferometric radiography in medical diagnostics is a realistic prospect. These include the following: how chromatic is a grating interferometer? What is the maximum field of view? How robust is it? What limits the photon-energy range accessible to grating interferometry? Can the device be used with illumination by a strongly curved wavefront? Can a tube source provide the coherent flux needed? What are the requirements on detector resolution?

The presentation will address these questions after an introduction into image formation and measurement modes and some experimental results.

References

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