Interferometric phase contrast imaging and tomography using incoherent radiation sources

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We report how an interferometic method can produce quantitative x-ray and neutron phase contrast images. The interferometer is based on diffraction gratings fabricated using microlithography techniques. Separate phase and absorption images are recorded simultaneously [1]. By taking data sets under many viewing angles, a tomographic reconstruction of both the real part and the imaginary part of the objects complex refractive index distribution can be obtained.

In the x-ray case, the method can be used to enhance the contrast in medical radiography and it has the potential to reduce the applied radiation dose. As opposed to existing techniques, the method requires only little coherence and can be scaled up to fields of view of many centimetres (see Fig. 1). Its application is therefore not limited to be used at synchrotron light sources, but it can be used with standard x-ray tube sources [2]. This opens up a wide range of applications in medical imaging and non destructive testing.

In addition, very recent experiments with cold neutron radiation are presented [3]. Again phase contrast images and tomographic data sets were recorded. Our technique opens up the way for combining an imaging approach with information obtained through the quantum mechanical interactions of neutrons with matter.

[1] T. Weitkamp, A. Diaz, C. David, F. Pfeiffer, M. Stampanoni, P. Cloetens, E. Ziegler, *Optics Express* **13** (2005) 6296-6304
[2] F. Pfeiffer, T. Weitkamp, O. Bunk, and C. David, *Nature Physics* **2** (2006) 258 – 261
[3] F. Pfeiffer, C. Grünzweig, O. Bunk, G. Frei, E. Lehmann, C. David, in preparation

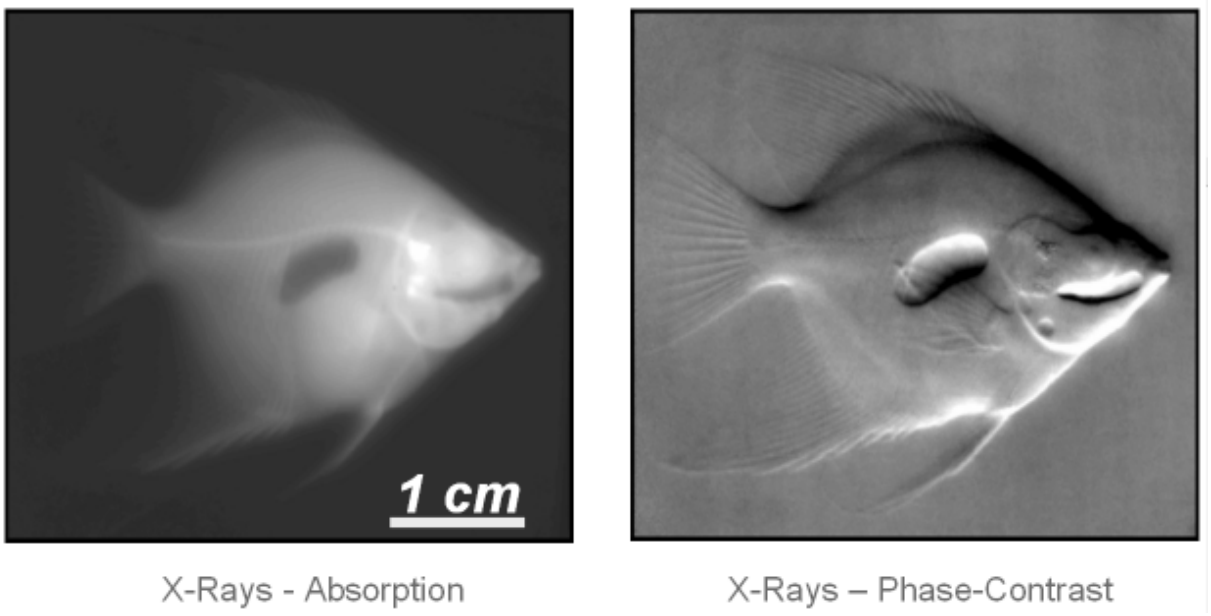

Fig. 1: X-ray images of a fish in absorption and phase contrast taken with an incoherent Mo x-ray tube.