Contribution ID: **91** Type: **Talk**

Dose-efficient X-ray phase contrast imaging by Bragg magnifier optics

Saturday, November 26, 2022 11:00 AM (15 minutes)

Synchrotron-based X-ray imaging of biological samples is often hindered by the radiation dose deployed in the sample, in particular for in vivo imaging and at µm-resolution. Many efforts have been made to reduce the dose, e.g., by propagation-based phase contrast imaging at high photon energies (~30 keV) [1, 2]. However, the detection efficiency of indirectly converting, scintillator-based detector systems, usually employed for such measurements, drops significantly at these energies, especially for thin scintillators that are required for high resolution.

To overcome this bottleneck, we developed a so-called Bragg Magnifier (BM) system optimized for 29-31 keV. By Bragg diffraction from asymmetrically cut silicon single crystals, a 2D magnification of the X-ray beam profile up to a factor 150 is possible, with a sample placed upstream or downstream of the system realizing a microscope (BMM) or beam conditioner (BMC), respectively. In BMM mode and combined with a highly efficient large-area detector, e.g. a high-Z single photon counting detector, an overall detection efficiency of over 90% can be achieved at ~1 µm effective spatial resolution. In BMC mode, a large beam and thus a cm-sized field of view is achievable even at short beamlines and with the intrinsically small beams of 3rd and 4th generation synchrotrons. Here, we present first experimental results, demonstrating the theoretically predicted high detection efficiency at ~1 µm spatial resolution, as well as an exemplary application of the system to dose-efficient in vivo X-ray imaging of parasitoid wasps.

Category

Other

Authors: SPIECKER, Rebecca (Karlsruhe Institute of Technology, Laboratory for Applications of Synchrotron Radiation); BISWAL, Adyasha (entre for Organismal Studies, University of Heidelberg); PFEIFFER, Pauline (Department of Entomology, State Museum of Natural History Stuttgart); HESSDORFER, Holger (nstitute for Photon Science and Synchrotron Radiation, Karlsruhe Institute of Technology); HURST, Mathias (Laboratory for Applications of Synchrotron Radiation, Karlsruhe Institute of Technology); CECILIA, Angelica (nstitute for Photon Science and Synchrotron Radiation, Karlsruhe Institute of Technology); HAMANN, Elias (nstitute for Photon Science and Synchrotron Radiation, Karlsruhe Institute of Technology); SHCHERBININ, Mykola (Laboratory for Applications of Synchrotron Radiation, Karlsruhe Institute of Technology); BAUMBACH, Tilo (nstitute for Photon Science and Synchrotron Radiation, Karlsruhe Institute of Technology, H)

Presenter: SPIECKER, Rebecca (Karlsruhe Institute of Technology, Laboratory for Applications of Synchrotron Radiation)

Session Classification: Physics Talks - Biophysics, Medical Physics

Track Classification: Physics talks