Brilliant opportunities with X-ray Nanobeams

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The recent developments of X-ray focusing optics allow routine production of beam focus in the sub-micron down to few tens nanometers range [1]. This development has fostered the progress of a wide range of scanning microscopy approaches, exploiting spectroscopy and scattering signals, that are becoming interesting for an increasing number of research fields, such as energy materials, environment, biology, to cite a few. Beside scanning microscopy, nanobeams are useful tools for single object investigations, in contrast to conventional ensemble average measurements, especially relevant when the ensemble information is not representative of the single nanostructures [2]. Used as “local probe”, they can also provide access to structural and chemical information at specific location within complex or inhomogeneous systems [3] (e.g. heterostructures, device-like structures, etc).

Finally, the brightness of new generation synchrotron radiation facilities, like MAX IV in Lund, allows the production of nanobeams with high degree of coherence [4]. This characteristic can be exploited in the so-called "inverse" imaging approaches to reveal the internal structure of materials in 3D and with a resolution beyond the beam size [5].

In this lecture I will give a brief overview of the different uses of nanobeams, with a special focus on the possibilities for microscopy methods available at the beamline NanoMAX of MAX IV.

[1] J. Stangl *et al.* (2013). "Nanobeam X-Ray Scattering: Probing Matter at the Nanoscale" Wiley-VCH Verlag GmbH & Co ISBN: 978-3-527-41077-4.
[2] A. Biermanns *et al.* (2014) Phys. Status Solidi RRL, **7**: 860
[3] T. Etzelstorfer et al (2014). J. Synchrotron Rad. 21, 111.
[4] V. L. R. Jacques et al. (2013). Phys. Rev. Lett. **111**, 065503.
[5] P. Godard et al. (2011). Nat. Comm. **2** 568.