X-Ray Ptychography : Ultimate Performance and Everyday Operation

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Lensless imaging has long been heralded as ultimately dose-efficient approach to X-ray microscopy, promising optimally efficient use of the dose imparted on the specimen in terms of both resolution and sensitivity. Experimental requirements have proven rather challenging, however, and only few instances have matured to be used in regular imaging campaigns.
Developed in the 1960‘s and 70‘s, ptychography, a scanning variant of coherent diffractive imaging, has received tremendous attention since it was merged with iterative phase retrieval techniques about a decade ago. This alleviated drastically stringent sampling requirements and, together with a new generation of detectors becoming available, allowed the technique to become practicably usable.
The Swiss Light Source has played a pivotal role in establishing ptychography as X-ray microscopy technique that is now routinely available at a multitude of instruments worldwide. Extending the very scope of the technique, improving its image reconstruction schemes, and dedicated instrumentation have allowed both pushing the state of the art in high-resolution X-ray imaging as well as keeping the technique reliable and sufficiently well-conditioned to be offered in regular user operation.
Past and ongoing developments at the Swiss Light Source, both methodological and instrumental, will be discussed, as well as recent applications from the materials and life sciences.