JOHANNES KEPLER UNIVERSITÄT LINZ

P H Y S I K K O L L O Q U I U M

Fachbereich für Physik

Im Rahmen des Physikkolloquiums spricht

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über

Synchrotron Radiation for X-ray imging: How to see more by merging reciprocal and real space

Abstract:

The advent of synchrotron radiation in the second half of the 20th century has led to the development of one of the most powerful tools of experimental science. Covering a vast part of the electromagnetic spectrum, the biggest machines are in general optimized to emit in the hard X-ray regime. By utilizing hard X-rays, most of our knowledge about the structure of matter has been revealed through diffraction. Traditionally x-ray diffraction is considered as a method with poor spatial resolution yielding only spatial averages as useful results. Very recent developments in the use of highly focused beams produced on the most advanced synchrotron sources show however a great and rapidly developing potential of diffraction imaging techniques. These are much improving the resolution of traditional x-ray imaging and topography but are as well combined with x-ray diffraction. In this way a new portfolio of techniques emerges, coupling the information of strain and texture with spatial information. As so far most of these new imaging techniques are brilliance limited they are naturally developed at synchrotrons. With the rapid development of the availability of synchrotron radiation throughout Europe and in interaction with the very active user community in this field, new imaging techniques rapidly gain practically all fields of materials science and biomedicine. While x-ray optics typically limit today's resolution to about 100 nm, technological progress in this field, as well as the use of reconstruction techniques pave already the way towards nanometric resolution in space while preserving the structural information available through diffraction. With new source projects at the horizon these exciting imaging techniques will be established on a growing number of beamlines.
With the completion of the first phase of the upgrade of the European Synchrotron Radiation Facility (ESRF), several spectro-nanoprobes and diffraction imaging beamlines have returned successfully to user operation. Offering scanning microscopy with x-ray beams focused down to 20 nm, full field x-ray microscopy using compound refractive lenses or parallel beam techniques, and with the use coherent Bragg diffractive imaging applications the ESRF can supply a vast spectrum of techniques for high resolution (strain) imaging.

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