MS01.02.05 AN HARD X-RAY WAVEGUIDE FOR SUBMICROMETER COHERENT BEAM PRODUCTION.
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A submicrometer line-focus beam with one dimension down to 150 nm has been obtained with a hard x-ray waveguide based on a resonance effect in thin films. Only for well determined incidence angles corresponding to different resonance orders the waveguide allows an enhancement of the e.m. field inside the thin film and a propagating resonant beam. A flux of 108 ph/s from the waveguide has been measured with an incident monochromatic beam of 13 KeV from BL1 of ESRF. The transverse dimension of the beam has been measured by means of a test lithographic pattern, yielding an effective beam dimension of 400 nm at about 0.1 mm from the waveguide. Considering the divergence of the beam this corresponds to about 150 nm at the waveguide exit. The spatial intensity distribution of the beam exiting from the waveguide has been measured in the far field by means of a pin-diode detector with an angular acceptance of 0.55 mrad. The Fraunhofer diffraction pattern for the different resonance orders has been measured and fitted by considering two coherent beams exiting from the waveguide with an angular aperture between them of twice the internal reflecting angle.

Considerable flux enhancement (5x109 ph/s/0.1 Å) has been obtained by using a multilayer beam with a bandpass of 10-2 at 15 KeV. In practice the whole energy range is transmitted through the waveguide. Test diffraction patterns of Al_2O_3 and polyethilene have been obtained with the submicrometer beam.

MS01.02.06 X-RAY PHASE PLATE TO CHARACTERIZE THE POLARISATION OF AN HELICAL UNDULATOR SOURCE AT 2.8 keV.
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A quarter-wave plate made of a *ca.* 16μm thick silicon single crystal was used at an energy as low as 2.8 keV to convert circularly polarised photons into linearly polarised ones.

The principle of x-ray phase plate based on the use of the forward-diffracted beam outside the reflexion domain is now well-established[1,2,3]. The originality of the approach presented here stems from the following points:
-the quarter-wave plate was inserted upstream with respect to the monochromator.
-the double crystal monochromator which is equipped with a pair of Si 111 crystals is operated at 2.8 KeV where the Bragg angle is 45°. The monochromator acts then also as a linear analyser. This experimental configuration makes it possible to analyse the polarisation state of the undulator beam without any alteration by the monochromator.
-instead of analysing the linear polarisation of the beam after the quarter-wave plate (as most frequently done), we have analysed the change of the electric field component normal to the diffraction plane of the Si 111 monochoromator (which is kept fixed) on scanning the angular offset of the quarter-wave plate. In other terms, what we scan is the phase-shift induced by the phase plate for a fixed orientation of the linear analyser.
-at such a low energy, the operation of the phase plate becomes more tricky due to the high absorption coefficient.

The result of the measurement is a circular polarisation rate P3 such that 0.95< P3 <1 in good agreement with theoretical predictions.

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MS01.02.07 A FREE ELECTRON LASER X-RAY SOURCE: DESCRIPTION AND SCIENCE.
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SSRL/SLAC is proposing the development of an X-ray source which would provide 150 fsec pulses of 1.5 Å, fully transversely coherent, radiation with peak brightness ~10^9 times, and time-averaged brightness ~10^2 times, 3rd generation synchrotron radiation sources. The Linear Coherent Light Source (LCLS) would operate on the principle of the free electron laser (FEL). but lasing would be achieved in a single pass of electrons accelerated to high energy (~15 GeV) by the SLAC linear accelerator. Since it does not employ the optical cavity resonator that is normally used in multi-pass, longer wavelength FELs, this approach is extendible to wavelengths below the region in which reflectors can be used to make such a cavity. Considerable R&D is required to achieve this goal. Since a FEL providing such radiation in the 30-100 Å presently seems feasible with existing technology and is an important step towards the LCLS, we are proposing to construct that first. The LCLS would advance a variety of experiments using coherent X-rays markedly. These include X-ray holography and time correlation (speckle) spectroscopy. Time resolved diffraction would be enhanced considerably, since a diffraction pattern could be obtained in a single 150 fsec pulse, which contains about $5x10^{12}$ photons in a 0.1% bandwidth. The LCLS itself, its radiation properties and some of the experiments which could be performed with it and the 30 Å FEL will be discussed in this talk.

PS01.02.08 A NEW METHOD FOR THE DETECTION OF SYNCHROTRON AND ELECTRON EXCITED KOSSEL-REFLEXES
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The KOSSEL-technique is a method for the determination of lattice constants, crystallographic orientation, tetragonal distortions of cubic lattices, scattering phases, and the assessment of dislocation densities. In 1992 we performed first synchrotron excited KOSSEL experiments at beamline L at HASYLAB by using X-ray film and 1995 by using high resolution image plates. The investigations were performed by means of the FUJI FDL 5000, an image plate reader originally intended for electron microscopy. For this measurements a pixel size of 25 μm x 25 μm was used, which results in a high spatial resolution of the image. Thus 3760 x 3000 pixels are scanned according to the effective area of the image plate of 94 mm x 75 mm. The signal is digitalized to 14 bit. To recording one KOSSEL image it is necessary to exposure six of this image plates in one „shot". This allows to record KOSSEL lines, although the intensity is not very different compared to the background. The advantages of this new method to recording KOSSEL images and a comparison between image plates and X-ray film are described.