11.7–7 ACCURATE DETERMINATION OF THE STRUCTURE FACTORS OF GaAs AND InP BY THE PENDELLÖSUNG BEAT MEASUREMENT USING WHITE RADIATION.

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The present authors have proposed a new method of measuring the Pendellösung intensity beats using white radiations and the energy-dispersive X-ray diffraction technique. This method requires only a small perfect region in a parallel-sided single crystal specimen and the atomic scattering factors of several pure materials have so far been determined by this method.(Acta Cryst.(1980)A36,1025; JJAP(1981) 20,1183; Phil.Mag.B(1982)45,615; Trans.JIM(1982)23,153; JJAP(1984)23,11.)

In the present study the same technique was applied to evaluate the structure factors of Two semiconductors, GaAs and InP. GaAs: 14 structure factors, F_{111}–F_{551}, were determined for 5 single crystal specimens with different thicknesses. The values agreed within 1%. A monotonic increase in $F_{hk\ell}$ was clearly observed, which can be attributed to the anomalous dispersion effect. The obtained values are close to those by Matsushita et al(phys.stat.sol.(1977)a 41, 139) but differ remarkably from those by Uno et al(J.Phys.Soc.Japan(1970)28,437). InP: An abrupt change in $F_{hk\ell}$ near the absorption edge of In was observed due to the discontinuous change in f'. The obtained values of F_{111}–F_{444} were somewhat different from Shirota's data(Acta Cryst.(1969)A25,223).

11.7–8 NEUTRON INTERFERENCE IN NONINERTIAL FRAMES,

by U. Bonse and T. Wroblewski, Institut für Physik, University of Dortmund, Postfach 500 500, D-46 Dortmund, Fed. Rep. of Germany and Institut Laue-Langevin, Grenoble, France.

Neutron interferometry performed with a single crystal interferometer in noninertial frames is essentially influenced by dynamical diffraction effects. Due to the change of the $\vec{K}$-vector the pendellösungsfringes are distorted resulting into an additional phase shift which has to be added to the phase shift calculated by D.M. Greenberger and A.W. Overhauser (Rev. Mod. Phys. (1979) 51, 43) for interferometry in the gravitational field, which is equivalent to interferometry in an accelerated frame. In the COW experiment (R. Colella, A.W. Overhauser, S.A. Werner, Phys. Rev. Lett. (1975) 34, 1472) some discrepancy with the phase shift following from the simple theory can be taken as indication of the pendellösungseffect. In a recent experiment with an accelerated interferometer (U. Bonse, T. Wroblewski, Phys. Rev. Lett. (1983) 51, 1401) which was considerably more sensitive to dynamical effects we found agreement of experiment and theory by including the pendellösungseffect.

Our theory including the distortion of pendellösungsfringes also explains the contrast fading occurring with increasing acceleration, which was also observed in the COW experiment.

11.7–9 DETERMINATION OF BEAM POLARIZATION THROUGH Ge 220 ANOMALOUS TRANSMISSION PEAKS.

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X-ray photons produced by targets are always a superposition of the bremstrahlung and emission lines. Furthermore, to factor out the part of the scattered intensity which depends on electron density, the polarization dependence of the scattered radiation must be carefully characterized. Several aspects must be considered: (i) polarization of the incident bremstrahlung radiation from the anode or synchrotron (atomic excitation lines are not polarized), (ii) the effect of the monochromators on the polarization (perfect crystal and ideally mosaic crystal monochromators have different polarization dependences and are not easily classified, however, a wrong classification can result in 10% errors in the derived structure factors). The anomalous transmission method in perfect crystals (Borrmann effect) seems to be the best means of measuring the extent of beam polarization. It consists of rotating a perfect germanium crystal around a 220 reflection for various orientations of the rotation axis with respect to the major axis of the polarization ellipse. The plot of the integrated intensities as a function of the orientation angle exhibits a 180° periodic behavior. This clearly shows that the polarization of the photons coming from the bremstrahlung can be detected, even though they represent a weak contribution to the total intensity at the energy of the tungsten L_1 excitation line. The position of the L_1 line is on the low energy side of the maximum intensity produced by the bremstrahlung, which is approximately where the K lines are. It is expected that this effect will be larger for the K lines.

11.7–10 BORRMANN PRISM- THE BORRMANN FAN FOR N-BEAM TRANSMISSION OF X-RAYS.

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Numerical calculations for the direction of Poynting vector, based on plane wave dynamical diffraction theory of X-rays for perfect single crystals, are carried out to map the diffracted beams on the exit surface of a crystal plate for N-beam Borrmann transmission.
The calculated picture of mapping is confirmed experimentally by the observation of the transmitted beam image for the silicon (000) (2̄20) (400) (220) four beam case for MoKα radiation. This experiment results indicates that the Borrmann "fan" for this N-beam case is a prism and the Poynting vector associated with anyone of propagation modes cannot lie outside the prism. The vertex of the prism situates at the entrance point and its base has the geometry of a polygon which is a projection of that formed by the involved reciprocal lattice vectors.
Beam path at the exit surface for a fixed divergency of the incident beam, for each mode of propagation, are also discussed.

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