16.2–3 A MULTI-WAVELENGTH γ-RAY DIFFRACTOMETER. By J.R. Schneider, Hahn-Meitner-Institut für Kernforschung, Berlin (FRG)

A γ-ray diffractometer with a commercially available 200 Ci Ir-192 γ-source of half-life $T_{1/2}$ = 74 d has been built at the Hahn-Meitner-Institut. Including γ-radiation from the usual Au-198 source ($T_{1/2}$ = 2.7 d) we thus have at our disposal the laboratory on 4 monochromatic γ-ray beams of wavelengths between 0.02 and 0.04 A, i.e. below the short wavelength edge of the spectral distribution of currently available X-ray Synchrotron radiation.

In accurate structure factor measurements we can now correct for extinction by wavelength extrapolation to the limit of zero extinction even in cases where the mosaic spread is too small to allow the direct extinction correction applied in γ-ray diffractometry so far. Additionally the extrapolation procedure provides a model dependent mosaic spread parameter which can be verified by direct γ-ray measurements. For this purpose it was necessary to improve the angular resolution of the diffractometer to about 1 second of arc which was achieved by using a nearly perfect single crystal as a collimator. It is confirmed that the diffraction of our short wavelength γ-radiation can be well described within Darwin's model for secondary extinction.

The above improvements in γ-ray diffractometry allow for accurate charge density studies of a considerably larger class of materials, including 4d transition metals and simple transition metal compounds. In certain cases a few absolute γ-ray structure factors can already be used for scaling a conventional X-ray data set which improves the significance of the X-ray charge density study (Larsen & Hansen, Acta Cryst. in print). In special cases highly accurate structural parameters can be determined (Jauch, Schneider & Dachs, Sol.State Comm.(1983)48,907). The improved angular resolution opens new possibilities for the study of structural phase transitions (Bastie & Bornarel, J.Phys.C(1979)12,1785) as well as for the characterization of the perfection of large as grown single crystals (Schneider, J.Cryst. Growth,in print).

16.2–4 A THERMAL NEUTRON INTERFEROMETER WITH $\frac{\pi}{2}$-GEOMETRY AND FREE SAMPLE SPACE OF MORE THAN 5 × 5 cm^2. By U. Bonse and A. Rumpf, Institut für Physik, Univ. of Dortmund, Postfach, D-46 Dortmund 50, Federal Republic of Germany and Institut Laue-Langevin, Grenoble, France.

For the realisability of neutron interferometry at larger samples sufficient beam separation and free space between the interfering beams are important. Optimizing these parameters we have manufactured and successfully operated a silicon interferometer with $2\theta \sim \pi/2$ (θ = Bragg-angle) in which the interfering beams travel around a square with 5.2 cm long sides, see Fig. 1.

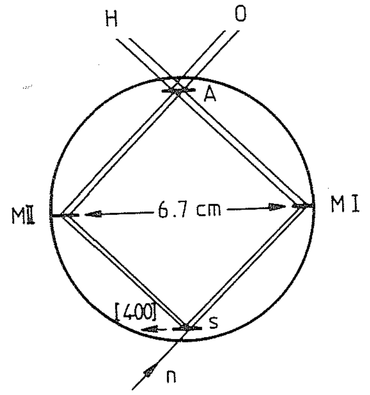

Fig. 1

With the silicon 400 reflection the corresponding wavelength is 1.927 Å. There are four separate wafers each 24 mm high acting as beam splitter S, mirrors M_I, M_2 and beam superimposing analyser A, respectively. By making M_I and M_2 less than about 0.6 cm wide free space of roughly 6.7 cm lateral extension is obtained between the beams in the center of the interferometer. This facilitates the use of bulley specimens which engage in all four beams simultaneously if desired. The wafer thickness is limited to 640 μm in order to keep beam widening by the Borrmann triangle as small as possible. Making the beam 0.45 cm high and 0.2 cm wide we obtain fringe contrast of better than 35 % with a flux of 375 $ns^{-1}cm^{-2}$ at the site of the S18 interferometer at the Institut Laue-Langevin, Grenoble. So far the new interferometer has been applied to measure neutron interference with moving samples. The multiple beam case (400, 040, 440, $\bar{4}40$) was of no importance, since with a 400 monochromator at the neutron guide tube the reflections 040, 440 and $\bar{4}40$ are highly dispersive and have three to four orders of magnitude lower intensity.