16.X–1 CONTACT, HOLOGRAPHIC, AND DIFFRACTION METHODS OF SOFT X-RAY MICROSCOPY. By D. Sayre, IBM Research Center, Yorktown Heights, NY 10598, USA.

Currently the most widely used form of soft x-ray microscopy is one which does not employ x-ray optics, but records a 1:1 contact image of the specimen, using soft x-rays and an ultra low-grain recording medium. (See R. Feder et al., in: X-Ray Microscopy, Springer-Verlag, 1984.) The contact image is then examined by electron microscopy. Resolution is limited primarily by diffraction blurring, and varies from 50 to several hundred Angstroms, depending on wavelength and specimen thickness. The technique is convenient, permits stereo, flash, and multiple-wavelength imaging, and can be used for the imaging of wet and/or living material. Examples will be shown, and future prospects for the technique will be discussed.

Other forms of "lensless" soft x-ray microscopy which are being investigated include soft x-ray holography and diffraction. A brief summary of the work in these areas being done at the Brookhaven soft x-ray ring will be given.

16.X–2 Derivation of Accurate Structure Factors from Intensities by A. McL. Mathieson Division of Chemical Physics, CSIRO, P.O.Box 160, Clayton, Victoria, Australia 3168

In theory, accurate structure factors can be obtained by estimating experimental reflectivities and applying appropriate methods to derive extinction-corrected integrated reflectivities. In practice, the classical procedure involves measuring the intensity profile, $I(\Delta\omega)$, whose one-dimensional nature obscures the required reflectivity information. In addition, the one-dimensional restriction conceals other limitations of the conventional procedure.

When one explores Bragg reflections two-dimensionally in the plane of reflection in terms of the parameters, $\Delta\omega, \Delta 2\theta$, not only are these limitations made evident but the increased resolution and evidence of loci which are characteristic of the experimental components allows, inter alia, the possibility of determining reflectivity variation within the individual Bragg reflection.

Even with correction for extinction, there is no guarantee that one-off measurements will necessarily give absolute structure factor values. To obtain such values requires extrapolation of a series of measurements made with a controlled range of an appropriate physical variable.

16.X–3 AREA DETECTORS: A GENERAL SURVEY by Jules Hendrix, EMBL, c/o DESY, Notkestr. 85, D-2000 HAMBURG 52, F.R.G.

A general survey of the types of detectors currently used for the detection of X-rays, together with their principles of operation, with the emphasis on their applicability in X-ray crystallography, is presented.

The now classical types of position sensitive detectors, the multi-wire proportional chamber, and the Vidicon-tube based systems, their spatial resolution, counting rate capability and dynamic range are discussed. Their characteristics, as anticipated, and as achieved in practice with existing systems, are compared.

Gas filled area detectors, based on parallel electrode structures offer better spatial resolution in both, X- and Y- directions, and a higher counting rate capability than multi-wire proportional chambers. This is of particular interest for applications in X-ray crystallography with synchrotron radiation. New developments in this field and first results are presented.

The requirements concerning data acquisition systems for high counting rate applications, with on-line data reduction are discussed. A system which is specifically designed for the data collection with area detectors using synchrotron radiation is described.

16.X–4 The Princeton Slow-Scan TV Area Detectors: 7 Years Experience of Continuous Operation by Sol M. Gruner Joseph Henry Labs, Department of Physics, Princeton University, Princeton, NJ 08540, USA.

The Princeton detectors are area detectors based upon the slow-scan read out of a Si-vidicon optically coupled to an image intensified phosphor screen (Geo. T. Reynolds, J. R. Milch and S. M. Gruner, Rev. Sci. Instr. (1978) 49, 1241; S. M. Gruner, J. R. Milch and Geo T. Reynolds, Rev. Sci. Instr. (1982) 52, 1770). In slow-scan operation, the x-ray signal is integrated on the cooled TV target for several minutes after which the target is read out in a 256 x 256 pixel raster at ~5 KHz rate. This yields a quantitative (0.5% of saturation) measurement of the signal accumulated in each pixel during the x-ray integration cycle. Because of the slow readout rate, the modes of operation are software controlled on standard minicomputers yielding considerable flexibility and simplicity of hardware design, features which differentiate these detectors from the quite different hardware and operating modes of video rate (5 MHz) TV detectors (S. M. Gruner, J. R. Milch and Geo. T. Reynolds, Nuc. Instr. Meth. (1982) 195, 287). In the last 7 years, 6 slow-scan detectors have been built and installed at various laboratories, yielding a mature design and considerable operating experience as applied to diffraction from muscle, polymers, biomembranes and liquid crystals. A standard test set (S. M. Gruner and J. R. Milch, Trans. Amer. Cryst. Assoc. (1981) 18: 149) for the quantitative evaluation of area detectors is urged. Applications, as drawn from the research literature, are presented to illustrate the modes of operation of these devices. Supported, in part, by DOE Grant DE-AC02-76EV03120 and NIH grant GM32614.