01-Instrumentation and Experimental Techniques (X-rays, Neutrons, Electrons)

System, a new fully microcomputerized single crystal diffractometer control system and crystal structure analysis system have been developed successfully. The system works on a powerful flexible and expandable microcomputer system (80286/80386 CPU). Some features of this system are as follows:

(1) Highly stable X--ray generator and electronic recording system;

(2) A PC–80286 based powerful, flexible and expandable diffractometer control system, including 48 instructions written in QUICK BASIC programming language, and it is easy to add instructions with new functions;

(3) Peak searching with profile show on the screen simultaneously, parameters for peak recognition are easy to change so as not to lose weaker peaks;

(4) Data collection can go according to the index both from a calculation of formula or an index data file prepared by the user;

(5) A PC–386 based Crystal Structure Analysis System is equipped with several advanced software packages like HX–MULTAN/ HX–SHELX/ HX–SAPI etc. in PC–286/ 386/ 486 versions with co–processor;

(6) It includes a high resolution color crystal structure and crystal form displaying and drawing system (1024×768×256 TVGA mode). This system has been proved to be quite reliable by the fact that it has run normally up to over 4000 hours already.

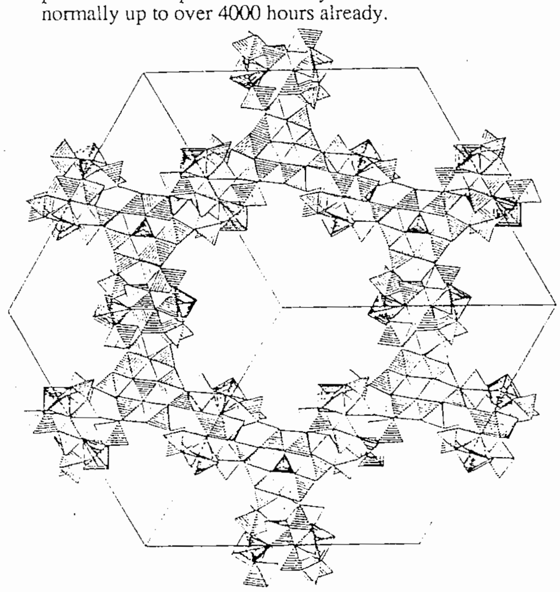

Figure 1 Cacoxenite crystal structure drawn by this system. P6₃/m,a = 2.7559nm; c = 1.055nm.

01.04 – Magnetic Scattering

MS–01.04.01 NEUTRONS AND X-RAYS FOR THE STUDY OF MAGNETISM.

by M.Blume*, Deputy Director, Brookhaven National Laboratory, Upton New York, USA

While neutrons have long been the probe of choice in studying magnetism, the development of synchrotron sources has led to increasing use of x–ray in such studies. The possible use of the relative advantages and disadvantages of each will be considered in this talk. We conclude that neutrons remain the most powerful tool for studying the broad range of magnetic properties. There is, however, an important supplementary role for x–rays in specific cases.

MS–01.04.02 X-RAY MAGNETIC CRITICAL SCATTERING.

By Doon Gibbs, Department of Physics, Brookhaven National Laboratory, Upton, NY 11973.

During the last several years, x-ray resonant magnetic scattering techniques have been exploited in a variety of interesting physical settings. For example, the polarization and energy dependence of the resonant cross-section has provided a new spectroscopy of magnetic states, which is only beginning to be developed in both scattering and absorption geometries. The existence of large resonant enhancements has also made possible experiments for which the signal rates were formerly thought too weak, for example, in studies of thin films, multilayers, and surfaces. In this talk, we describe the results of recent experiments concerned with x-ray magnetic critical scattering in rare earths and actinides. In some cases, it has been found that the magnetic fluctuations which occur within about 1 Kelvin above T_N exhibit two length scales, reminiscent of the structural-to-cubic transitions of the perovskites. The results obtained by x-ray scattering are compared to those obtained by neutron diffraction.

The speaker is indebted to his collaborators in these experiments, especially T. R. Thurston, G. Helgesen, J. Hill, B. Gaulin, G. Shirane, S. Langridge, W. Stirling, G. H. Lander, C. Vettier, F. de Bergevin, P. Dalmas, and J. B. Hastings. Work performed at Brookhaven is supported by the U.S. DOE, Division of Materials Science under contract No. DE-AC02-76CH00016.

MS–01.04.03 REVIEW OF MAGNETIC X–RAY DIFFRACTION EXPERIMENTS

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The first magnetic X–ray scattering experiments were performed in 1972 by de Bergevin and Brunel in NiO following the original calculations by Platzmann and Tsoar. Limited by the weak scattering cross–section the technique remained in the shadow of powerful neutron scattering until it was shown, both theoretically and experimentally, that a significant enhancement of the X–ray magnetic scattering intensity can be obtained by tuning the photon energy near distinct absorption edges of the atoms in the respective magnetic systems. Since then resonant and non–resonant magnetic scattering studies have been carried out in most of the heavy rare earth metals, rare earth magnetic multilayers and in a variety of actinides and transition metals.

