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The largest resonant enhancements have been observed for incident X-rays near the M_{IV} absorption edges of the actinides and near the L_{III} edges of the rare earths and transition metals. 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. Current experimental work is reviewed and perspectives related to the operation of new, third generation synchrotron radiation sources are discussed.

MS-01.04.04 MAGNETIC CIRCULAR X-RAY DICHROISM: PROBING LOCAL MAGNETIC STRUCTURES by Gisela Schutz , Experimentalphysik II, Universitat Augsburg, Germany, and Slike Stahler, Fakultat Physik, E12, Technische Universitat Munchen, Germany

Circular magnetic x-ray dichroism in core-level absorption is the absorptive counterpart of magnetic resonance scattering. It is based on the same physical phenomenon, the difference in the imaginary part of the charge scattering amplitude for right and left circularly polarized photons in magnetic matter and a complementary element-and symmetry-selective methods to study the magnetic aspects of the electronic structure of solids. Typical magnetic absorption effects at K-and L-edges in the hard and soft x-ray range are presented. Their relation to the spin polarization of unoccupied bands as well as local magnetic spin and orbital moments are discussed in the frame of single-particle band-structure pictures and atomic multiplett theories. Focusing on magnetic multiayered systems as Co/Pt and Co/Cu it is demonstrated that the magnetic circular dichroism measurements yield important new informations on the exchange coupling mechanism especially the role of the -in the pure element non-magnetic-interlayer.
Also in the EXAFS range , the existence of a magnetic part (SPEXAFS) has been established to be an universal phenomenon, which allows to study local magnetic structures in ferro(i)magnetic materials. a comparison of the EXAFS allows a clear distinction between magnetic and nonmagnetic neighborhood also in case of non-magnetic absorbing atoms. Comparing the peak heights in the SPEXAFS strengths for various magnetic systems a direct correlation between the magnetic contribution to the EXAFS and the spin moment of the neighboring atom is found providing a new possibility of a quantitative investigation of local magnetic short-range order.

MS-01.04.05 SITE SPECIFIC MAGNETIC XANES. By H. Kawata, Photon Factory, National Laboratory for High Energy Physics, Tukuba, Japan.

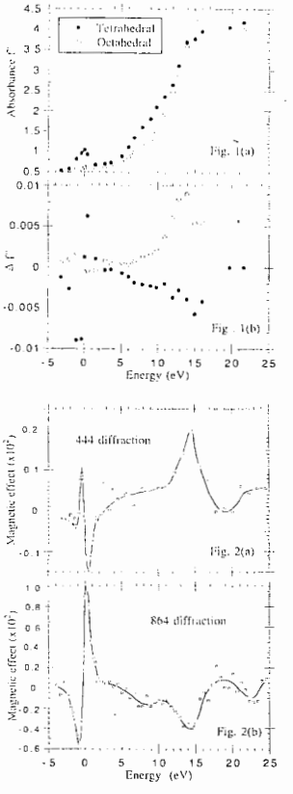
Magnetic X-ray Absorption Near Edge Structure (XANES) using circularly polarized X-rays gives on the spin-polarized unoccupied electron states [1,2]. Recently, the study for ferro- or ferri-magnetic materials by using this experimental method have been rapidly developed. In a case of ferri-magnetic materials, however, there are two different sites for magnetic atoms; for example in the case of $Y_3Fe_2(FeO_4)_3$ (YIG), the magnetic ions Fe^{3+} have two different sites. One is an octahedral site and another is a tetrahedral site. The directions of magnetic moments on these sites are opposite to each other. It is naturally expected that the magnetic XANES spectra of Fe K-edge for Fe^{3+} ion at the octahedral site is different from that for the tetrahedral site, because of the different chemical bonding and the different direction of the magnetic moment. Therefore, it is necessary to identify the site-specific magnetic XANES in order to study these materials. Here we present the first measurement of the site-specific magnetic XANES of YIG by mean of the following two methods.

<Magnetic XANES under a standing wave field>
The standing wave field method, which is obtained by exiting a dynamical Bragg diffraction in a crystal, gives us site-specific information. Therefore, magnetic XANES measurement under a standing wave field gives us the site-specific magnetic XANES[3]. Figure 1(a) and (b) show the site-specific XANES and magnetic XANES at Fe K-absorption edge. The black dots and open circles in each figures are these of the octahedral site and tetrahedral site, respectively. As shown in this figure, the characteristic structure at the pre-edge is mainly given by the tetrahedral site.

<Resonant magnetic Bragg scattering>
Recently, Stragier et al. presented the site-specific normal XANES by mean of DAFS[4]. The resonant magnetic Bragg scattering corresponds to the magnetic DAFS. Therefore, the resonant magnetic Bragg scattering from the different diffraction indexes also brings us the site-specific magnetic XANES. Figure 2(a) and (b) show the results from (444) and (864) diffraction. The structure factor of these indexes are as follows;

$F(444)=-12f_Y+8f_{Fe}{}^O-12f_{Fe}{}^T$,
$F(864)=-8f_Y-8f_{Fe}{}^T$.

Here, f_Y, $f_{Fe}{}^O$, and $f_{Fe}{}^T$ are atomic form factors of Y, Fe at the octahedral site, and Fe at the tetrahedral site, respectively. In the case of 864 diffraction, Fe at the tetrahedral site only contributes to the structure factor, and the spectrum of Fig. 2(b) is well explained by the magnetic XANES of the tetrahedral site in Fig. 1(b).



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PS-01.04.06 MAGNETIC STRUCTURAL STUDIES USING LONG-WAVELENGTH PULSED NEUTRONS. By J. B. Forsyth, C. J. Carlile and P. S. R. Krisna, Rutherford Appleton Laboratory, Chilton, Oxon. OX11 0QX, U.K.

Powder diffractometers at pulsed neutron sources such as ISIS can provide very high resolutions in backscattering, $\Delta d/d \sim 5\times10^{-4}$, which are almost constant over the whole range of d-spacings down to d ~ 0.3 Å. Whilst this is very effective for atomic structural studies, it is less adapted to the measurement of magnetic scattering since this intensity falls off rapidly with increasing $\sin\theta/\lambda$ due to the magnetic form factor. The low order reflections of interest occur at low $\sin\theta/\lambda$ and are weak due to the paucity of long λ neutrons from the 90 K moderators normally used. We now report measurements in which the incident beam came from a 25 K liquid H_2 moderator. The enhanced long λ flux gives powder patterns having good intensity, excellent

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peak-to-background ratios and an almost constant resolution of 2.5 $X10^{-3}$ down to $\sin\theta/\lambda = 0.04$ $Å^{-1}$ (25 Å neutrons). The contributions to the resolution are given. The performance has enabled us to determine the incommensurate magnetic propagation vector in the triclinic antiferromagnet $FeVO_4$ and to study its temperature dependence in the range from 4 K to its Néel point at 21 K. Other examples include the magnetic scattering from the two commensurate antiferromagnetic phases of Mn_5Si_3 and the pressure dependence of their magnetic structures. The design of a purpose-built cold neutron diffractometer is described.

PS–01.04.07 CIRCULAR MAGNETIC X-RAY DICHROISM AT FE K-EDGE AND GD $L_{2,3}$-EDGES IN Fe/Gd MULTILAYERED FILMS
F.Itoh*,+, M.Nakamura+, H.Sakurai+ and H. Kawata++
+ Department of Electronic Engineering, Gunma University, Japan
++ Photon Factory, KEK, Tsukuba, Ibaraki 305, Japan

Fe/Gd multilayered film is known to have interesting properties such as spin flop[1] and temperature compensation[2]phenomena which sensitively depend upon artifacial period of the multilayer. In this paper, we report measurements of circular magnetic x-ray dichroism(CMXD) at Fe K-edge and Gd L_2- and L_3-egdes of Fe/Gd multilayetred films as a function of artifacial period of the film, using circular polarized X-rays at AR NE-1 of KEK.

It is shown that the CMXD spectra of Fe K-egde in samples with longer period than 10 Å is similar to that in pure Fe while the CMXD spectra of Gd L_2- and L_3-edges are opposite in sign to that in pure Gd. In samples with shorter period than 5 Å, on the other hand, spectra of Fe K-egde and Gd L_2 and L_3-egdes are com@pletely reversed compared to those in samples with longer period. This means that Fe moments are dominant in sapmles with longer period than 10Å, while Gd moments become dominant in samples with shorter period than 5Å, keeping both Fe and Gd moments anti-ferromagnetic. A L-S separation of Gd moment was tried based on the sum rule[3], showing clear change of both components against the artifacial period of the multilayered film.

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PS–01.04.08 MAGNETIC X-RAY DIFFRACTION FROM FERROMAGNETIC MATERIALS
S P Collins and D Laundy and R J Cernik*, SERC Daresbury Laboratory, Warrington, UK

This poster describes the simple 'White-beam' technique, developed at the SRS to measure non-resonant magnetic X-ray diffraction from ferromagnetic crystals with synchrotron radiation. The results of several experiments are presented.

Early work on iron [1, 2] has demonstrated the feasibility of the X-ray technique, and produced data which are in excellent agreement with, and of similar quality to, the first polarized neutron measurements.

More recent data have highlighted the complementarity between X-ray and neutron diffraction in two important respects. First, X-ray diffraction has been adopted to determine the *ratio* of spin to orbital magnetization in a ferrimagnetic Rare Earth compound [3] - a measurement which cannot be made directly with neutron diffraction.

The second aspect of complementarity brought to light by the synchrotron X-ray measurements concerns the accessible range of momentum transfers. We show that high-energy X-ray data can extend far beyond the maximum wavevectors which are practicable with thermal neutrons, and that the corresponding data quality is surprisingly good This is in contrast to situation with low momentum transfers where neutron data are currently of far superior quality.

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PS–01.04.09 EXCITATIONS OF CONDENSED MATTER STUDIED BY INELASTIC X-RAY SCATTERING WITH HIGH ENERGY RESOLUTION By E. Burkel, Sektion Physik, University of Munich, Munich, Germany

Very high energy resolution measurements using X-rays can be achieved by extreme backreflection (Bragg angle close to 90^0) from perfect crystals. This technique allowed the development of the instrument INELAX for inelastic scattering experiments at the HARWI wiggler at DORIS, DESY Hamburg. At present, an energy resolution of 9 meV is achieved and the instrument proves to be an excellent tool to investigate collective excitations in condensed matter. Energy transfers from 10 meV to 5 eV and wavevectors up to 13 $Å^{-1}$ are accessible.

Longitudinal and transverse dispersion curves of beryllium and diamond were extracted from measurements of phonons in single crystals of these materials. The method was also applied to single crystals of He and to superconductors.

Furtheron, collective excitations of liquid lithium were studied and the dispersion of these excitations could be detected.

An important application of inelastic X-ray scattering is the study of electronic excitations in solids. Measurements of such excitations in single crystals of lithium were performed up to energy transfers of 5 eV with an energy resolution of 38 meV. They provided information on the dispersion of excitations which can be described as zone boundary collective states. The measurements revealed a fine structure which was not observed before.

01.05 – X–ray and Neutron Powder Diffraction

MS–01.05.01 MODELING AS A COMPLEMENT TO POWDER DIFFRACTION EXPERIMENTS IN STUDYING INORGANIC AND ORGANIC SOLIDS. By C. M. Freeman and J. M. Newsam*, BIOSYM Technologies Inc, 9685 Scranton Road, San Diego CA 92130, USA

Dramatic improvements in analytical instrumentation have been paralleled by equally impressive advances in computer hardware and in modeling and theoretical methods. Computer modeling has in fact become established as a key complement to diffraction experiments, aiding in the evaluation of experimental results and in the interpretation of analytical data in terms of atomic-level behavior. A suite of modeling methods appropriate for