s7.m7.o1 Resonant X-ray Scattering: Applications to the study of magnetism. C. Vettier, *Institut Laue Langevin, BP 156, 38042 Grenoble Cedex 9, France*.
Keywords: magnetism, synchrotron, resonant scattering.

Resonant x-ray scattering can be regarded as a probe of the local site symmetry. This method can be applied to the study of magnetic systems, owing to the coupling of the local magnetisation to the electromagnetic radiation. The interaction leads to electric multipole transitions of a core electron to intermediate states near or above the Fermi level, which opens up resonant scattering channels. The magnetic sensitivity of the resonant scattering amplitude originates from the asymmetry of the transition probabilities due to the spin polarisation of the intermediate states coupled with spin-orbit splitting either in the core levels or in the excited states.

The resonant process is chemically selective and sensitive to the electronic shell symmetry. Moreover, the resonant x-ray magnetic scattering amplitude is much larger than the non-resonant scattering amplitude. These properties are at the origin of the success the method. Thanks to the chemical selectivity, magnetic behaviours of various elements in the same material can be studied independently; the sensitivity to the electronic shells allows the separation of the magnetism in the *d*, *f* or even *p* electronic shells. Finally, the large resonant scattering amplitude makes x-ray an ideal tool to investigate the magnetic properties of small scattering volumes, such as surfaces, thin films and micro-crystals.

Examples will be given which demonstrate the potential impact of resonant x-ray scattering. It should be mentioned that most of the experimental studies presented here have been preceded with neutron diffraction experiments. We suggest that the combined use of the two methods, neutrons and x-rays, is beneficial to the understanding of magnetism in solids.

s7.m7.o2 Anisotropy of resonance x-ray scattering and forbidden reflections in crystals and incommensurate structures. V.E. Dmitrienko[1] and E.N. Ovchinnikova[2], [1]*Institute of Crystallography, 117333 Moscow and* [2]*Physical Department, Moscow State University, 119899 Moscow, Russia.*
Keywords: instrumentation, resonant scattering, DAFS.

An overview of a recent development in the x-ray studies of "forbidden" Bragg reflections is presented (earlier works can be found elsewhere[1]). Those reflections are forbidden because of the glide-plane and screw-axis extinction rules. However those extinction rules are valid only far from x-ray absorption edges where the x-ray susceptibility of crystals is isotropic. Near an absorption edge, where the x-ray susceptibility becomes anisotropic owing to distortion of atomic orbitals by crystal fields, the "forbidden" reflections can appear. The polarization dependence of x-ray absorption is of similar physical origins, but in the last case only the imaginary part of the x-ray susceptibility, averaged over all the atomic positions in a unit cell, is relevant. As a result, in cubic crystals, the polarization dependence of x-ray absorption is absent. In contrast, the anisotropy-induced "forbidden" reflections can be observed (and have been observed) even in cubic crystals.

From the physical point of view, the "forbidden" reflections of this type supply us with a unique tool to study the distortion of atomic orbitals. Besides, they can be used for partial structure determination (to determine the positions of resonant atoms, to distinguish the enantiomorphic pairs of crystals, etc.).

After an introductory survey, several items will be discussed in detail:

i. The general expression for the x-ray susceptibility tensor near the absorption edges, when several anisotropic factors, such as the anisotropy of local atomic environment, magnetic ordering and orbital ordering exist simultaneously in a crystal[2].

ii. A solution of the phase problem for the "forbidden" reflections.

iii. The "forbidden" reflections in incommensurate crystals[3].

iv. The point-defect-induced "forbidden" reflections. Several example will be given, including a practically important case of point defects in Ge and Si (see also our poster report on this subject).

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