MS16-P06 | FORBIDDEN/NON-FORBIDDEN BRAGG REFLECTIONS STUDY UNDER PHASE TRANSITIONS AND EXTERNAL INFLUENCES

Ovchinnikova, Elena (M.V.Lomonosov Moscow State University, Moscow, RUS); Dmitrienko, Vladimir (A.V. Shubnikov Institute of Crystallography, FSRC "Crystallography and Photonics" RAN, Moscow, RUS); Zchornak, Matthias (Inst. of Experimental Physics IEP, TU Bergakademie Freiberg TUBAF, Freiberg, GER); Oreshko, Alexey (M.V.Lomonosov Moscow State University, Moscow, RUS); Kozlovskaya, Ksenia (M.V.Lomonosov Moscow State University, Moscow, RUS)

A method has recently been developed that demonstrates a record sensitivity to atomic displacement, which uses a study of the energy dependence near the absorption edges of weak Bragg reflections [1]. In this method, the anisotropic properties of resonant X-ray scattering are neglected. However, the resonant anisotropic contribution to the scattering amplitude always exists, although it is small compared with charge scattering.

We propose to use polarization analysis to study the resonant scattering of σ-polarized radiation into π-polarization in allowed reflections. The σ-π channel is not forbidden in resonant X-ray scattering close to the absorption edges, in contrast to the conventional Thomson scattering. The study of this scattering channel can provide additional information when studying phase transitions and the effects of external influences on crystals. For example, in [1], the applied electric field caused a phase transition in $SrTiO_3$ from the phase with cubic symmetry Pm3m to the phase of an MFP with symmetry P4mm. In the studied reflection 007 there is no scattering channel σ - π, but it exists, for example, in reflections h0l. In the Pm3m space group, this is ensured only by dipole-quadrupole resonance scattering, but in the MFP phase, a stronger dipole-dipole resonant σ-π scattering channel is possible. Therefore, this phase transition can be observed as a jump in the reflection intensity using σ-polarized synchrotron radiation and a polarization analyser.

[1] C. Richter, et al., Nature Communications. V. 9, p. 178 (2018).