X-RAY STANDING WAVES AS A TOOL FOR TRANSITION- AND SITE-SELECTIVE X-RAY SPECTROSCOPY

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Diffraction of X-rays can be utilized to generate a standing wave field inside a crystal. Having a periodicity comparable to the atomic separation, X-ray standing waves (XSW) can be exploited to obtain spectroscopic information with atomic site selectivity [1]. In addition to position sensitivity, it has been recently demonstrated [2-3], that diffraction produced XSW can also be used to modify the probabilities of dipolar and quadrupolar transitions.

We show how Laue (transmission) case diffraction by single crystal induced standing waves can be used in conjunction with resonant inelastic x-ray scattering spectroscopy to gain access to quadrupolar electronic *2p – 4f* transitions of Gd in gadolinium gallium garnet ($Gd_3Ga_5O_{12}$). We also demonstrate the utilization of Bragg (reflection) case diffraction to selectively excite tetrahedral and octahedral iron atoms in yttrium iron garnet ($Y_3Fe_5O_{12}$). This set of new methods may open up novel applications of studies of electronic states and chemistry in these systems.

[1] The X-ray Standing Wave Technique. Principles and Applications. Edited by J. Zegenhagen and A. Kazimirov (World Scientific, 2013).
[2] R. F. Pettifer, S. P. Collins, and D. Laundy, Nature 454, 196 (2008).
[3] K. O. Ruotsalainen, A.-P. Honkanen, S. P. Collins, G. Monaco, M. Moretti Sala, K. Hämäläinen, M. Hakala, and S. Huotari (2016), Scientific Reports 6, 22648 (2016)