Anomalous X-ray Scattering Methods for Structure Investigations of Semiconductor Nanostructures

Václav Holý[a], Julian Stangl[b], Günther Bauer[b], Tobias Schülli[c], Till Hartmut Metzger[c], [a]*Charles University Prague, Czech Republic*. [b]*J. Kepler University Linz, Austria*, [c]*ESRF Grenoble, France*. E-mail: holy@karlov.mff.cuni.cz

X-ray study of the structure of semiconductor nanostructures (quantum dots and wires) is a challenging task. Several methods have been developed for the determination of shape and local chemical composition of quantum dots and wires (see [1] for a review); the methods are based on a surface-sensitive scattering geometry, where the penetration depth of the incoming x-ray beam is limited by a very small incidence angle. Usually, a direct determination of the structure from the measured data is not possible; instead, the experimental data are fitted to a suitable structure model.

An anomalous x-ray scattering experiment uses two different x-ray energies close to and far away from the absorption edge of a selected element [2]. By comparing the data obtained at these energies one can determine the local chemical composition in the nanostructures without using any model *a-priori*. Moreover, measuring the energy dependence of the diffracted intensity close to the absorption edge (diffraction anomalous fine structure – DAFS) one can determine the local atomic ordering in the nanostrucures [3].

Several examples of anomalous scattering and DAFS experiments will be presented and the limits of these methods will be discussed.

[1] Stangl J., et al., *Rev. Mod. Phys.*, 2004, **76**, 725. [2] Schuelli T.U., et al, *Phys. Rev. Lett.*, 2003, **90**, 066105. [3] Letoublon A., et al., *Phys. Rev. Lett.*, 2004, **92**, 186101.

Keywords: nanostructures, surface x-ray scattering, anomalous scattering