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S E M I N A R

aus

Halbleiterphysik und Nanotechnologie

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"STRUCTURE OF EPITAXIAL LAYERS OF DILUTED FERROMAGNETIC SEMICONDUCTORS INVESTIGATED BY X-RAY RELATED METHODS"

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Magnetic semiconductors represent an important class of materials, in which the crystal structure is directly linked with their magnetic and transport properties. A detailed analysis of their crystal structure is therefore crucial for the optimization of the magnetic properties. X-ray related methods for the structure investigation of magnetic semiconductors are based either on standard x-ray diffraction or on x-ray absorption spectroscopy. In most cases, the application of usual x-ray diffraction method is complicated by the fact that the effect of magnetic impurities on the lattice parameters (and consequently on the Bragg angle) are known only roughly, since ab-initio simulations usually yield ambiguous results. Therefore, the densities of magnetic atoms diluted in substitutional or interstitial places have to be determined either by an exact measurement of lattice structure factors (i.e., diffracted intensities) or by anomalous diffraction effects using a steep energy dependence of the phase of the wave scattered from a magnetic impurity around the corresponding absorption edge. X-ray absorption spectroscopy methods (EXAFS or XANES) provide direct information of the lattice positions of the magnetic impurities; however the interpretation of the experimental data usually requires extensive numerical simulations. In the case of a structurally perfect epitaxial layer, x-ray standing-wave method can be used, too; in this method the intensity of x-ray fluorescence is measured as a function of the direction of the primary x-ray beam.

In the talk I will present several examples of our experiments performed on the archetypal diluted magnetic semiconductor GaMnAs, measurements on other semiconductors like GeMn and GaFeN will be briefly mentioned.