Diluted magnetic semiconductors (DMSs) are semiconductors alloyed with magnetic elements [1]. The physical properties of these materials can be tuned by both charge and spin, thus, they have great potential of being used in a wide variety of spintronic applications, such as magneto-optical, magneto-electrical, and magneto-transport devices. Spintronics (spin+electronics) is the technology that transforms reading and writing information by spin rather than by electron charge. This field is inbetween magnetic and electrical properties of semiconductors. Much researcher have been devoted to the study of dilute magnetic semiconductors for use as materials for spintronics. In the present study, we focus our attention on x-ray absorption spectra (XAS) as well as x-ray magnetic circular dichroism (XMCD) and x-ray magnetic linear dichroism (XMLD) in (Ga,Mn)As, (Ga,Mn)N, and (Ga,Gd)N DMSs. XMCD experiments measure the absorption of x-rays with opposite (left and right) direction of circular polarization [2].

The electronic structure of the (Ga,Mn)As, (Ga,Mn)N and (Ga,Gd)N, diluted magnetic semiconductors were investigated theoretically from first principles, using the fully relativistic Dirac linear muffin-tin orbital (LMTO) band structure method [3]. The electronic structure is obtained with the local spin-density approximation (LSDA), as well as the LSDA+U method [4,5]. The x-ray magnetic circular and linear dichroism spectra at the Mn, As, Ga, N K and Gd, Mn, As, Ga L\textsubscript{2,3} edges were investigated theoretically from first principles. The origin of the XMCD spectra in these compounds was examined. The effect of interstitial Mn atoms was found to be crucial for the x-ray magnetic dichroism at the Mn and As K and L\textsubscript{2,3} edges in the (Ga,Mn)As DMS. The influence of the exchange splitting and spin-orbit coupling strength on each of the constituent atoms were furthermore analyzed. The orientation dependence of the XMCD and XMLD at the Mn L\textsubscript{2,3} edges in the (Ga,Mn)As DMS were investigated by calculating the XMCD and XMLD spectra for the <001> and <110> magnetization axis. We found a quite small anisotropy in the XMCD and a giant anisotropy in the XMLD at the Mn L\textsubscript{2,3} edges. The exchange splitting of the initial Mn 2p core level was found to be responsible for huge magnitocristalline anisotropy of the XMLD at the Mn L\textsubscript{2,3} edges. The calculated results are compared with available experimental data.