ANOMALUS HALL EFFECT IN IV – VI SEMICONDUCTORS

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In ferromagnetic metals and magnetic semiconductors, the off–diagonal conductivity is proportional to the external magnetic field, which is connected with ordinary Hall effect and an additional term which is proportional to the magnetization of the sample and does not disappear at zero magnetic field. This extraordinary term is known as the anomalous Hall effect (AHE). The origin of the AHE is the spin–orbit interaction in the presence of spin polarization. There are two groups of mechanisms that are responsible for AHE: so called extrinsic mechanisms (skew scattering and side jump) and intrinsic mechanisms which are related to the topology of electron energy bands. Though this effect has been known for a long time, nowadays it attracts much attention because it may be used for the measurements of magnetization in magnetic thin layers and another mesoscopic structures.

We consider narrow–gap IV–VI magnetic semiconductors, where the relativistic terms are not small and determine both the non–parabolicity of the energy spectrum and strong spin–orbit interaction. The AHE has been measured in structures like PbSnMnTe, SnMnTe and SnMnEuTe mixed crystals containing Mn up to 16 at %. The analysis of experimental results should take into account the peculiarity of the energy spectrum of these structures, but no calculations of the AHE in IV–VI crystals have been presented so far.

We use relativistic Dirac model and the Kubo formula to calculate the topological contribution to the off–diagonal anomalous Hall conductivity. We also present some experimental data and make the comparison of numerical and experimental results. Owing to this, we can estimate the magnitude of intrinsic contribution to the AHE in IV– VI magnetic semiconductors.