Spin spirals in FeAs and FeSb studied by Mössbauer spectroscopy

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Introduction and Experimental

Discovery of the iron-based superconductors containing iron pnictogen layers makes investigation of the iron pnictides compounds quite important. Iron mono-pnictides are particularly interesting as they exhibit very complex spin ordering as found e. g. for FeAs by using polarized neutron scattering method [1]. The complex spin structure is due to competition between metallic and covalent bonds.

Iron pnictides FeAs and FeSb were investigated by means of ⁵⁷Fe Mössbauer spectroscopy versus temperature.

Results and Conclusions

1) The antiferromagnetic ordering temperature was found as 69 K for FeAs and 232 K for FeSb.

2) The magnetic order leads to the incommensurate spin spirals propagating through the iron atoms in the direction of the c-axis with a complex pattern of the hyperfine magnetic fields distributed within a-b plane. Spiral symmetry corresponds approximately to the symmetry of the electron distribution within wave functions described by the angular momenta up to two, i.e. up to d electrons responsible for the itinerant magnetic order.

3) Spin spirals are very similar in FeAs and FeSb despite different crystal symmetry, i.e. orthorhombic for FeAs and hexagonal for FeSb. The possible reason of this similarity is the octahedral coordination of iron by pnictogen.

References