**Project 4.10. Atomic short-range order in Heusler alloy nanostructures: NMR studies (eksperimental)**

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**Unit:** Division of Physics of Magnetism

**www:** http://www.ifpan.edu.pl/index_en.php

**Background**:

Ternary Heusler compounds (e.g. Co2FeZ, Co2Mn, Z= Si, Al) and their quaternary alloys display the highest Curie temperature among the materials that are theoretically predicted to display full polarization at the Fermi level, which makes them interesting for spintronic applications. However, the experimentally measured spin polarization is substantially below the expected 100%. Among the main sources of such degradation of spintronic properties is the atomic disorder, readily formed in the complex Heusler structure, consisting of the four interpenetrating cubic (fcc) sublattices. To provide information on the type and amount of atomic disorder, it is necessary to perform a thorough characterization of the Heusler nanostructures obtained in a particular technological process. The unique features of NMR in ferromagnetic materials can provide valuable feedback on the structural, topological and magnetic properties of the nanocrystalline Heusler alloys. Lattice disorder is evidenced by new spectral lines, distinct from those observed in case of the well-ordered structure.
NMR experiment in ferromagnetic materials belongs to the advanced characterization methods and there are only few laboratories in the world, equipped with spectrometers capable of performing this kind of research. NMR laboratory in the Magnetic Division of IF PAN is recognized as the worldwide leading group using this technique to investigate the magnetic materials with nanoscopic sizes. It is equipped with very sensitive spectrometers, based on the automatic data accumulation, making it possible to register even very weak signals. They cover a wide frequency range, suitable for all potentially interesting magnetic materials.

**Aim:**

We propose to use the Nuclear Magnetic Resonance (NMR) technique to determine the kind and amount of structural disorder in several nanostructures based on Heusler alloys and to link it with the degree of spin polarization as well as with the stability of half-metallic properties. The experiments will be carried out in the cryogenic temperatures, with and without a strong external magnetic field provided by a superconducting magnet.

**Requirements:**

- M.Sc degree in Physics (solid state physics)
- Good command of the English language, ability and interest to work in a team
- The knowledge of the programming C language and familiarity with the LabView program will be welcome.

**Funding**:
Standard Polish PhD scholarship.