Magnetism and structure in the magnetocaloric compounds $RE_5(Si_xGe_{1-x})_4$

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Many astonishing properties have been recently discovered in the $RE_5(Si_xGe_{1-x})_4$ rare-earth intermetallic materials [1]. A great research activity has been triggered due to an exceptional magnetoresponsive behavior such as the giant magnetocaloric effect [2], strong magnetoelastic effects [3], and giant magnetoresistance [4]. This phenomenology has been associated with the intrinsically sub-nanometric layered crystallographic structure combined with a magnetic-martensitic first-order phase transformation [5]. The strong magnetoelastic coupling responsible for these phenomena allows the magnetic-crystallographic transition to be reversibly induced by the change of external parameters such as temperature, external magnetic field, or hydrostatic pressure. Therefore, these alloys are attractive for their potential applications in magnetic refrigeration and also as magnetic sensors/actuators.

Neutron scattering techniques have played a paramount role in the investigation of the most outstanding properties arising from the strong interplay between the crystallographic structure and magnetism in the system $RE_5(Si_xGe_{1-x})_4$ [6-9]. In particular, the high-resolution D2B diffractometer from ILL (Grenoble, France) has become a powerful tool to unveil the magnetic structure of these alloys [7-9]. In this talk, we will focus on the temperature and magnetic-field dependence of the magnetic and crystallographic structures of this system, emphasizing the extreme importance of the D2B experiments in resolving these complex structures.

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