It is known that in order to magnetize a magnetic it is necessary to attach a magnetic field to it. In this case, the magnetic properties of the magnet will depend not only on the magnitude of the magnetic field, but also on the direction of the magnetic field, which can be applied along the various crystallographic axes of the magnet. So for example, when magnetizing a high-anisotropic magnetic material along the axis of a difficult magnetization, magnetic saturation occurs (a complete rotation of the magnetization vector) in higher magnetic fields than along the axis of easy magnetization. In the case of a polycrystalline magnet, which consists of crystals with a random arrangement of crystal orientations, magnetic anisotropy will not be observed. Therefore, for studies of magnetic anisotropy, single crystals or magnets with induced magnetic anisotropy should be used.

To date, intermetallic compounds based on 3d-transition metals with 4f-metals have the highest magnetic anisotropy energy. The main use of such magnetic materials is associated with the creation of permanent magnets. As a rule, good temperature stability of magnetic properties is important for permanent magnets, which is mainly determined by the high Curie temperature of the permanent magnets. When approaching the Curie temperature, the magnetic anisotropy energy decreases. However, some anisotropic properties of magnets when approaching the Curie temperature, which are determined by the first derivative of the thermodynamic potential, increase. Such properties, for example, include the magnetocaloric effect (MCE), i.e. the change in the temperature of the magnetic material with its adiabatic magnetization. In physics of magnetic phenomena, two main types of MCE are distinguished. The first type comes from the paraprocess, i.e. MCE associated with the process of ordering the magnetic moments during magnetization of a magnetic material in a magnetic field, which were disordered as a result of thermal fluctuations. The second type is the rotational (anisotropic) MCE caused by the rotation of the magnetization vector as a result of the magnetization of the magnetic sample along the hard axis of the magnetization. The MCE is rather well studied, while the rotational MCE remains poorly understood. First of all, it is connected with the difficulties of creating samples and methods for such studies. So today the question of magnetic anisotropy in the field of magnetic phase transitions and the paramagnetic region remains open. It is known that the first constant MCA $K1 = I_s * H_a / 2$, where I_s is spontaneous magnetization, H_a is the field of MCA. According to this equation, the magnetic anisotropy energy at the Curie temperature should be zero, because the spontaneous magnetization at the Curie point is zero. However, modern studies show that there is a nonzero torque value, as well as significant MCE anisotropy even higher than the Curie temperature. For studies, the samples of RNi_5 single crystals will be synthesized, as well as polycrystalline samples with induced magnetic anisotropy, which have high magnetic anisotropy energy. MCE and anisotropy MCE will be investigated by direct method using a unique installation allowing developed by the authors of the project, which allows to investigate in magnetic fields up to 14 T. The importance of the use of high magnetic fields in the study of the magnetic anisotropy of highly anisotropic magnets is due to the fact that magnetic saturation (full rotation of the magnetization vector) during magnetization along the axis of difficult magnetization occurs in high magnetic fields. This gives an advantage in the study of this phenomenon, since modern installations for measuring MCEs, as a rule, apply a magnetic field of up to 2 T.

On the basis of the obtained experimental data, theoretical models will be created to describe the magnetic and magnetocaloric properties of this class of materials. The theory of MCE anisotropy will be expanded and supplemented. Research results can also be useful in creating magnetic refrigeration devices operating in the area of cryogenic temperatures, which are based on the MCE anisotropy phenomenon. The processes of magnetization and demagnetization of the working fluid in such magnetic refrigerators are realized due to the rotation of the working fluid in a magnetic field made of a magnetic material with high values of rotational MCE. In the traditional magnetic cooling scheme, magnetization (demagnetization) of the working medium is carried out by switching on (off) the magnetic field or by inputting (outputting) the working body to the region (from the area) of the magnetic field. In the technology of magnetic cooling based on rotational MCE, this is not required. The working body is always in a constant magnetic field. This allows to set the required rate of magnetization (demagnetization) of the working fluid, which increases the efficiency of magnetic refrigerators of this type. It does not require significant energy consumption for rotation of the working fluid in a magnetic field, since the anisotropy energy of the magnetic, which is caused by the rotational moment, decreases strongly in the region of the magnetic phase transition. In turn, the rotational MCE is determined by the derivative of the magnetic anisotropy energy with respect to temperature and reaches maximum values in the region of the magnetic phase transition.