This thesis focuses on the study of magnetic properties of three 5*f* electron itinerant ferromagnets $UCo_{0.990}Ru_{0.010}Al$, UCoGa and URhGa and investigation of their phase diagrams. The single crystals of high-quality were prepared by Czochralski method for all three compounds. The physical properties at ambient pressure were studied by macroscopic methods (magnetization, electrical transport and heat capacity measurements) and also by magnetic force microscopy (MFM). The measurements were done under various external conditions (high pressure, low temperatures, high magnetic field). Through all these measurements and external conditions we investigated the interesting physical properties and the ferromagnetic phase diagrams.

Effect of different conditions during the preparation and the thermal treatment on UCoGa was studied on two different single crystals. We show that annealing leads to improved quality of samples and the gallium evaporation from the melt during the growth leads to lower quality in parts of the ingot closer to melt. MFM images of UCoGa below the ordering temperature show domain branching and narrow magnetic domains wall made only of neighboring atoms with opposing moments.

We have grown first ever single crystal of URhGa with ferromagnetic ordering temperature T_C = 41 K. Anomalous maximum in temperature derivative of electrical resistivity and minimum at magnetoresistivity, were observed well below the ordering temperature. We attribute this to the effect of magnetic fluctuations.

The values of critical exponents of UCoGa and URhGa are explained by the results of renormalization group model for the 2D Ising system with long-range interactions. The range of long-range interactions is proportional to ordering temperature T_C as determined from our results and comparison with the results in the literature.

The phase diagrams of UCoGa and URhGa show a quite different behavior. In UCoGa the ordering temperature is suppressed by applied pressure until tricritical point (TCP) is reached at p_{TCP} ~ 6 GPa and T_{TCP} ~ 30 K. By applying pressure the ordering temperature increases in URhGa. The ordering temperature increases as an effect of low itineracy/high localization of 5*f*-electron states.

$UCo_{0.990}Ru_{0.010}Al$ is ferromagnet with T_C = 16 K. With applied pressure the phase diagram copies the discontinuous phase diagram of BKV theory together with thermodynamic constraints. The T_{TCP} is lower than the temperature of the critical endpoint (CEP) of pure UCoAl. Ruthenium doping is a source of quenched disorder, which leads to suppression of T_{TCP}.