

Dzyaloshinskii-Moriya interaction (DMI) is a type of exchange interaction found in non-centrosymmetric structures. It favors spin canting, and it is an important mechanism for stabilizing non-collinear magnetic structures, such as skyrmions, which are promising candidates for applications in spintronics. Furthermore, DMI plays a significant role in multiferroics and can support magnetoelectricity. Both phenomena are often observed in layered materials.

This thesis explores, through numerical simulations, the effect of out-of-plane DMI on magnetic ordering in two-dimensional triangular lattices. It uses the classical Heisenberg model together with Markov Chain Monte Carlo and spin dynamics simulation methods. Apart from DMI, the Hamiltonian includes ferromagnetic exchange interaction between nearest neighbours and interaction with external magnetic field.

In the first part, the zero-temperature properties of the system are computed for various DMI strengths and external magnetic fields, and a phase diagram is constructed. Three magnetic phases are observed: ferromagnetic, antiferromagnetic cycloidal, and conical – a mixture of the former two.

The second part focuses on finite-temperature properties, starting with specific heat capacity, magnetization, and magnetic susceptibility. DMI does not affect the critical ordering temperature but enhances magnetization at higher temperatures below the critical temperature. It was shown that DMI favours magnetization in the z-direction in the ferromagnetic phase. Next, finite-temperature hysteresis loops are presented. Anomalous hysteresis in the ferromagnetic phase induced by DMI and temperature is observed, resulting in non-zero coercivity increasing with DMI strength and temperature. The coercivity is associated with the DMI energy barrier and a possible explanation is outlined – traces of antiferromagnetic order were observed in the otherwise ferromagnetic phase at higher temperatures.