Semiconductor based technology has revolutionized virtually every sphere of our lives. We are using it every day in our mobile phones, personal computers but also for the most challenging problems like drug design or in the space industry. It is no wonder then, we are looking for various ways of enhancing this technology. Unfortunately, capabilities of a silicon, element which is a base for the most of commercial devices are about to deplete. That is why endeavor of researchers around the world is aimed on searching of alternative materials and solutions which could extend boundary of the current semiconductor technology.

Almost 10 years ago a new phase of matter was discovered – the Topological Insulators. These materials are conducting current only on their surface (or boundary) while the interior behaves like insulator . Existence of these metallic surface states is due to specific symmetry of interactions between electrons (time-reversal symmetry) and relativistic phenomena. Symmetries of above mentioned interactions are described within the field of mathematics known as topology – that is why these materials are called Topological Insulators. What makes them even more interesting, electrons on the topological insulators surfaces are immune to certain type scatterings. This means they can conduct current with much less dissipated heat and that is why they are of special interest for an application in electronics.

Those intriguing materials were discovered only in 21st century, because the presence of surface carriers is hidden by the bulk. In practice, what is a perfect insulator in theory, appears to be a very well conducting material and this conductivity dominates, rendering detection of effects specific to the surface challenging.

This project aims at understanding what is the nature of magnetic properties of the metallic states present on the surface of topological insulators. Firstly, we will examine a response of the surface carriers in the presence of external magnetic field. In the next step, we are going to introduce magnetic dopants inside those systems and check how internal, magnetic order will influence behavior of topological surface states.

Understanding of an interplay between topological states and internal and external magnetic fields is essential for getting a broader picture of the physics of topological insulators and in the long run, may lead to creation of devices based on topological properties of this fascinating materials.