Antiferromagnets (AFMs), which possess a zero net magnetic moment, up to very recently has played a passive role in spintronics. However, recent demonstration of manipulation of the magnetic states in AFMs makes them a promising alternative for use as active elements in the next generation data storage materials. In contrast to FMs, the AFMs are robust against magnetic perturbations and do not create stray fields, which is beneficial for ultimate down-size scalability of magnetic memory devices.

The aim of the project is to control magnetic state of thin antiferromagnetic films with a use of electric field. The project will be realized in two parallel paths. The first will concentrate on strain-induced piezoelectric switching of magnetic moments in AFMs. Here, we will grow metallic and insulating thin antiferromagnetic films on piezoelectric PMN-PT substrates and examine how the electric field applied to the substrate influence the magnetic state of AFM through magnetoelastic coupling. For metallic AFMs we will explore effect of modification of the spin-orbit interaction on the electrical switching characteristics.

The second path of the project focuses on demonstration of direct influence of electric field on magnetic anisotropy in AFMs, so called voltage control magnetic anisotropy (VCMA) effect. In this case an electric field will be applied directly to the AFM/dielectric interface. In both routes AFM layers will be grown by molecular beam epitaxy which offers a superior control of the interface and enables to grow the layers with sub-nanometer thicknesses. With a use of sophisticated techniques, like x-ray linear magnetic dichroism and x-ray photoemission electron microscope we will be able to characterize magnetic structure of AFMs and its dependence on (piezo-)-electric field induced switching. The feasibility of AFM piezospintronics and voltage control of magnetic anisotropy in AFMs will be presented via magnetotransport measurements.