Project title:	**Ultrathin Sb layers as a new material with two-dimensional (2D) topological insulator properties**
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Research project hypothesis and objectives

We propose a complex study of ultrathin antimony films, potentially suited to become topological insulator, a newly discovered materials with unique and intriguing electronic properties. From two indispensable characteristic properties of the topological insulator – existence of energy gap and metallic surface states located within gap with specific symmetry protected by particle number conservation and time reversal symmetry, the antimony possesses only the surface states. Therefore, antimony is not a topological insulator.

> *The main goal is to learn and to understand mechanisms governing physics leading to opening an energy gap in ultrathin layer of antimony, a material with some topological insulator properties. In particular, we want to study effects of the thin film size quantization, controlled substrate morphology, electronic structure and surface adsorption influence, leading to Sb transition into topological insulator. We presume, that modified in this manner the ultrathin film of Sb should become the two-dimensional (2D) topological insulator.*

In semimetal a gap can be opened if the system is sufficiently thin and conditions for creation of quantum well are met. In Sb layer it happens at film thickness of order of a few atomic bilayers. Creation of the gap accompanies the interaction between surface states located at both surface and interface of the film therefore the surface states lose their symmetry. To verify our hypothesis advanced experimental and theoretical studies will be undertaken in order to explain nature of the surface state change due to thin film quantization and surface/interface modification.