

## **Tuning magnetism of the antimonene-based 2D ferromagnetic heterostructures**

Antimonene is a new two-dimensional (2D) material and similarly to other structures of this type it is formed by the thinnest possible layer of atoms, in this particular case, Sb atoms. In nature antimony forms various nonmagnetic allotropes. According to theoretical calculations by applying a proper treatment it is possible to induce magnetism in a single layer of Sb atoms.

Theory also predicts that by making a single layer of atoms magnetic it is possible to observe new phenomena which do not exist in thicker matter. It appears that these novel effects can be applied in the next generation electronics if they sustain room and higher temperatures. It is also necessary to keep ferromagnetic order in the considered temperature range. Unfortunately, in most cases of 2D materials ferromagnetism exists at temperatures of the order of several or several tens of Kelvin what makes them very difficult for studies and use in applications. Preparation of 2D and heterostructures based on 2D materials with enhanced ferromagnetic properties at room temperature is currently very important task.

Among broad range of 2D systems those which possess band gap are particularly interesting as they can be used in future electronics. Such promising candidates have been recently synthesized from elements of the XVth group of the periodic table namely phosphorene, antimonene and bismuthene. In that family antimonene plays an important role as it has a direct band gap, high mobility of charge carriers and is resistant to ambient conditions. Making it ferromagnetic at room or higher temperatures would be a great step towards studying new phenomena and building ultrafast electronics.

The main goal of the project is to make antimonene which will reveal strong magnetism at room temperature. In order to do it antimonene layer will be prepared as a neighbour of other single atomic layers of various elements forming heterostructure. The presence of other atoms in a close vicinity modify properties of antimonene layer by e.g. delivering additional charge carriers, changing distance between Sb atoms or influencing their properties by proximity.

Having prepared antimonene-based 2D ferromagnetic heterostructures we are going to perform experimental and theoretical studies of their structural, electronic and magnetic properties.