Graphene, a material with very interesting properties has been known for over a decade. It is very lightweight, durable and for this transparent. Moreover, it has a very high electrical and thermal conductivity (both the highest from all known materials). If you put graphene over the micro cavity it forms a membrane that is impermeable to gases and, respectively, by cutting the membrane graphene forms doubly clamped beam. Each of these nanomechanical devices has certain characteristic parameters such as the resonance frequency, spring constant, or Young's modulus.

While much attention has been paid to graphene, it was focused primarily on the knowledge of its electrical properties, less attention has been paid to understanding its mechanical properties. The aim of this project is to characterize the nanomechanical devices - membranes and beams made from graphene - in terms of their mechanical and electrical properties. To do this, during the project it is expected to make graphene membranes and doubly clamped beams on substrates containing holes etched through the substrate. In addition to the already mentioned mechanical properties it is expected to determine the electrical properties of these nanodevices such as electrical conductivity, work function or the doping level. To prepare graphene membranes and beams it is planned to use of microelectronics techniques compatible with those used in modern electronics. Characterization of such small devices requires the use of high resolution devices capable of measuring to the nearest single or fractions of nanometers. Accordingly we want to use the scanning probe techniques - scanning tunneling microscopy and atomic force microscopy and with related modes (STP, KPFM, SSRM) and scanning electron microscopy. In the case of home-built STM microscope is expected to implement scanning tunneling potentiometry mode. Additionally to the techniques listed above we plan to use Raman spectroscopy.

The following investigations will be a substantial contribution to the theoretical and practical knowledge about the mechanical and electrical properties of graphene suspended over the micro cavities at both the national and global levels. These will form the basis for further solutions of graphene based devices. By modifying such a membrane, or a beam or by adding to it an appropriate microelectronic environment it can be prepared devices which are able to detect the weight of individual atoms, molecules, or individual viruses or bacteria. This is due to the fact that if we want to make the device more sensitive, the smaller should it be.