Project 6.5 Theoretical study of THz plasma instabilities in low dimensional systems

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www: https://www.unipress.waw.pl/index.php?option=com_content&view=article&id=1020:nl-11-laboratorium-promieniowania-terahercowego-teragan&catid=82:teragan&Itemid=146&lang=en

Background:

Currently, the development of active devices capable of generating, detecting, modulating, and controlling electromagnetic (em) waves of the THz spectral range is the focus of modern semiconductor physics, high-frequency electronics, and optoelectronics. This great interest is stipulated by the unique properties of the THz waves that can find or already have found their applications in remote sensing, identifying hazardous substances and objects, imaging, wireless communications, etc.

However, despite all the advances in the development of THz spectroscopy the overall impact of THz technology still remains limited. To provide an effective coupling between the 2D plasmons and the em waves, is lateral structuring of a large area FETs, in the form of subwavelength metallic grating. In spite of interesting experimental results already observed, this research lack theoretical analysis. The project requires theoretical analysis i.e. the model development for mechanisms of THz radiation interaction with semiconductor grating-gate structures based on GaN and other semiconductors at different temperatures with and without magnetic field. The project also requires the analysis of THz radiation interaction with graphene and other low dimensional materials, particularly in combination with GaN structures.

Aim:

1. Theoretical description of THz radiation interaction with semiconductor grating-gate structures.
2. Theoretical study and model development of high frequency plasmonic excitations in presence of magnetic field and DC current;
3. Theoretical description of THz radiation interaction with low dimensional systems, like graphene and transition metal dichalcogenides.

Requirements:

- completed higher education studies in the field corresponding to the area of studies,
- knowledge of solid state physics, semiconductor physics, and quantum mechanics,
- willingness and ability to successfully enroll into a doctoral school capable of affiliating students to IHPP PAS,
- documented scientific achievements in the form of publications,
- experience in conducting research in field of plasmonics and nanotechnology,
- skilled in analytical calculations using Wolfram Mathematica,
- experience in the theoretical study of low-dimensional materials,
- advanced English (C1),
- motivation for research work.