**Project 4.1 PbTe/CdTe multilayers, a new material with controlled properties for infrared sensing (experimental)**

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**Background:**

The CdTe/PbTe quantum structures, with narrow gap PbTe regions forming quantum wells or quantum dots embedded in the CdTe barriers, exhibit very strong photoluminescence intensity resulting from the large difference in the energy band gaps of the both materials. In addition, the both materials show very large contrast in refractive indexes, what makes the CdTe/PbTe material system particularly attractive for construction of devices for infrared sensing or emission exploiting photonic properties of this heterostructures. Photonic crystal is a well-defined nano- or microstructure with periodic distribution of refractive index in one, two or three spatial directions. Within CdTe/PbTe heterosystem (using molecular beam epitaxy) it is possible to obtain all types of photonic structures in the form of CdTe/PbTe multilayers (1D photonic crystal), PbTe (CdTe) nanopilars (2D p.c.) and PbTe (CdTe) dots (3D p.c.) embedded in CdTe (PbTe) matrix.
In particular, the project envisages: molecular beam epitaxy of CdTe/PbTe heterostructures; numerical simulations of optical (photonic) properties of CdTe/PbTe 2D and 3D heterostructures, developing of experimental set-up as well as performing optical and electric measurements of prototype detectors; data analysis; writing papers; presenting results in oral and written forms.

**Aim:**

The main objective of the proposed project is to manufacture and study optical and electric behavior of composite structures (detectors and light sources) made of CdTe/PbTe semiconductor heterosystem using experimental and theoretical methods. We expect that the realization of the project will results, among others, in a development of control and integration methods of CdTe/PbTe structures for new kinds of optical devices exploiting simultaneously quantum and photonic properties of this semiconductor system.

**Requirements:**

- Master of Sciences in physics,
- experience in solid state physics,
- knowledge of molecular beam epitaxy growth method,
- basic knowledge of optical experimental techniques, particularly in infrared spectral region,
- experience in simulation software for light propagation in solids will be an asset,
- knowledge of written and spoken English

**Funding**:
Scholarship: grant funding of 5000 PLN per month, before subtracting obligatory employer and employee social security contributions (~15%), for 48 months.

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