The LED light bulbs routinely used for lighting our homes or offices contain sets of small semiconductor systems, “sandwiches” composed of layers of semiconductors with properly selected electric characteristics converting electric energy into blue light which, in turn, is converted in a phosphorescent material into light covering the visible spectrum, so we accept it as a ”warm” white light suitable for domestic use. The invention of this energy-efficient, environmentally friendly and long-living light source gave its authors – Akasaki, Amano, and Nakamura, the Nobel Prize in Physics in 2014. But definitely this was not the end of the story. This achievement paved the way for ideas of further development of even more energy and cost effective semiconductor light sources. There are still important physical phenomena and technological obstacles which limit the efficiency of energy conversion, from electric energy to visible light, below the theoretically achievable limit in the devices manufactured up to now. For example, fabrication of perfect thin layers of nitride semiconductor on a cheap substrate which has different parameters of crystal lattice is quite a challenge. One of the seriously considered solutions is to replace in light emitting devices some continuous layers of semiconductors with a “brush” of narrow sticks grown on the substrate. As they usually have diameter of the order of 100 nm or less – they are called “nanowires”. In such narrow structures, strains due to crystal lattice mismatch with the substrate can easily be accommodated and defect formation avoided. Moreover, new phenomena can be utilized, like resonances in cavities or light guiding, in order to improve light generation or extraction from the structure. However, new challenges also appear. If we want to control and improve properties of the whole devices we have to know and understand the optical and electronic properties of nanowires with submicron or nanometer resolution. This in turn, allows us revealing properties of such sub-structures of nanowires, as quantum wells, barriers, *p*- o *n*-type layers in the heterojunctions etc. Simultaneously, there is a continuous search for novel materials for efficient light sources and ways of their fabrication.

In our project we plan to develop growth technology of ZnO/(Al,Ga)N heterostructures in the form of nanowires and then study their properties by sophisticated techniques of electrical characterization and imaging in the sub-micron scale without a need of complicated transfer of nanowires from the growth substrate. This will give us an insight into phenomena appearing during the crystallization and allow for respective modifications of the growth technology leading to fabrication of nanostructures with required electronic and structural properties, and thus useful in semiconductor devices.