

RESEARCH IN THE FIELD OF COMPUTER SIMULATION OF THE PERSPECTIVE MATERIALS PROPERTIES, TECHNOLOGICAL PROCESSES AND DEVICES OF MICRO- AND NANO-ELECTRONICS

Research and Development Laboratory 4.4
“Computer Aided Design in Micro- and Nanoelectronics”

Directions of scientific and applied research

- Computer-aided design of technological processes and devices structures
- Development and foundry-based fabrication of custom (analog, digital, and mixed) IC's on circuit, layout and system level
- Quantum-mechanical and molecular-dynamic modeling properties of functional materials and nanostructures

Used software tools

- **Silvaco*** (device-technological simulation)
- **Cadence**** (circuit and system level design)
- **VASP*** (quantum-mechanical and molecular-dynamic simulation)
- Open-source and free software tools

* The laboratory has an academic license to use the Silvaco software package and is the **only VASP users group** of in the Republic of Belarus

** Through EURORACTICE – Software and IC fabrication access for academic institutions (<http://www.europractice.stfc.ac.uk/welcome.html>).

Strengths

- Personal skills:
 - A motivated team (10 persons) consisting mainly of talented, recognized at the state level young scientists (middle age less than 30 years), including three PhD's, having an advanced experience in implementation of fundamental and applied projects of state and international scientific research programs and participation in the implementation of the European Commission funded projects.

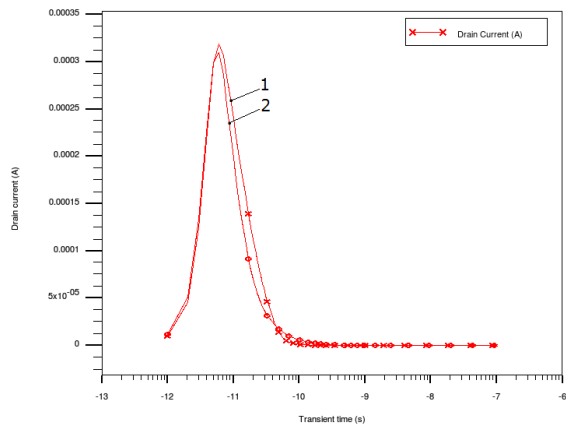
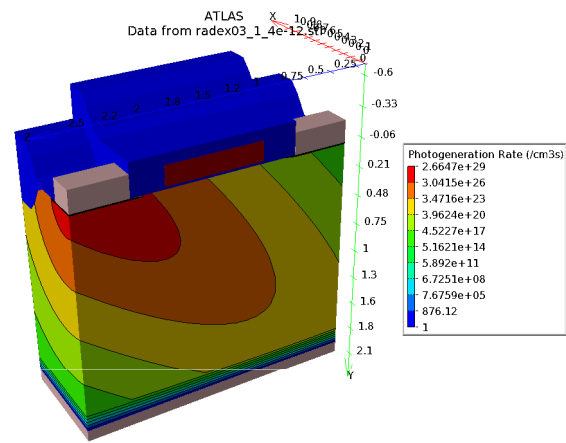
Strengths

- In the field of device-technological simulation and integrated circuit design:
 - Considerable practical experience of computer simulation and performance optimization of a wide range of semiconductor devices and structures: power electronics, microwave devices, HEMT, devices with nanoscale elements.
 - Original methods for calibration and verification of parameters of technological processes models and models of charge carrier transfer, realized in special software allowing to adapt the simulation results to the real production conditions.
 - Accounting for destructive effects on the characteristics of semiconductor devices - penetrating radiation, high / low temperature, thermal stress analysis.
 - Development of compact models, as well as methods of parameters identification and extraction for non-standard element base (sensors, power electronics, non-volatile memory devices).
 - Advanced experience of practical interaction with enterprises of the electronic industry – JSC “INTEGRAL”, and foundry-manufacturers – TSMC.

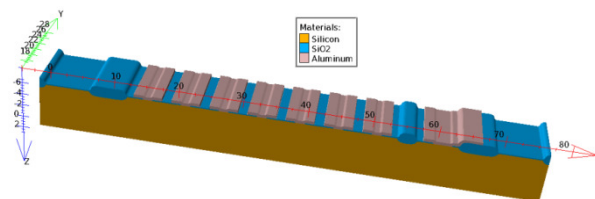
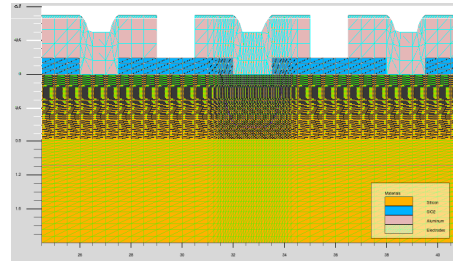
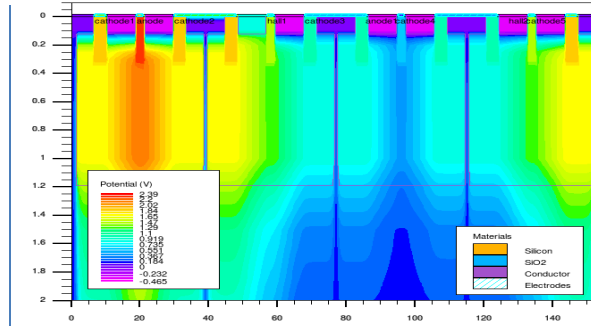
Strengths

- In the field of quantum-mechanical and molecular-dynamic simulation:
 - In-depth studies of the structural, electronic magnetic and optical parameters of promising materials for micro- and nanoelectronics.
 - Performing search studies (optimal composition and structural parameters) to ensure the best performance of nanostructured materials in opto- and microelectronics, spintronics and sensorics.

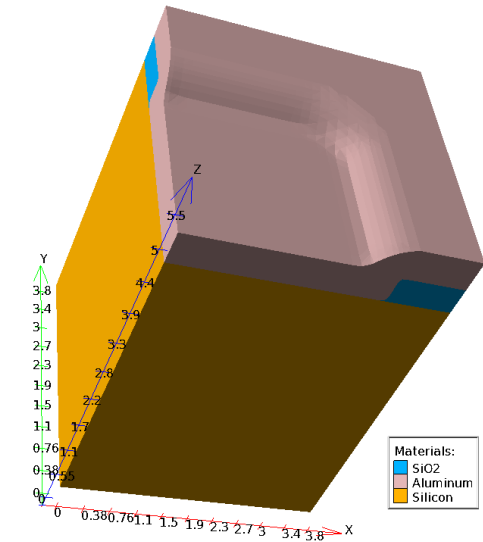
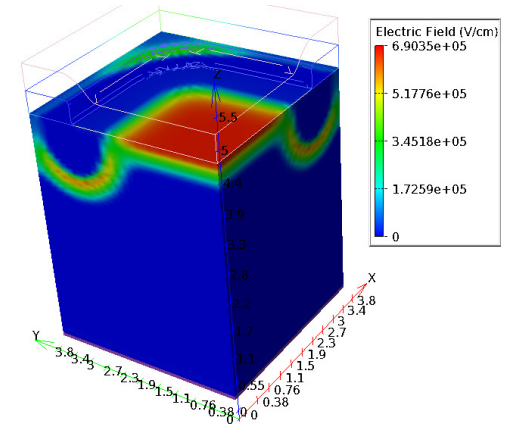
Computer-aided design and optimization of technological processes and devices structures



Effects of ionizing radiation on the characteristics of the MOS transistor

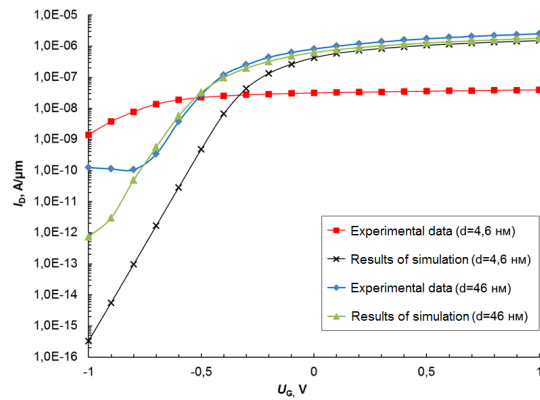
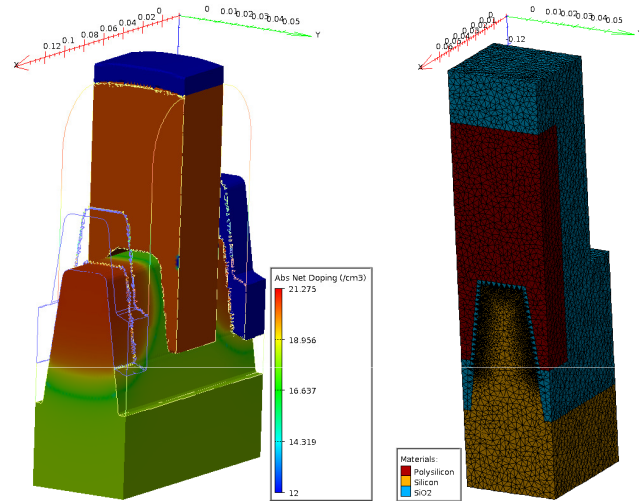


Field-effect transistor with
p-n junction control (JFET),
operating at low temperatures

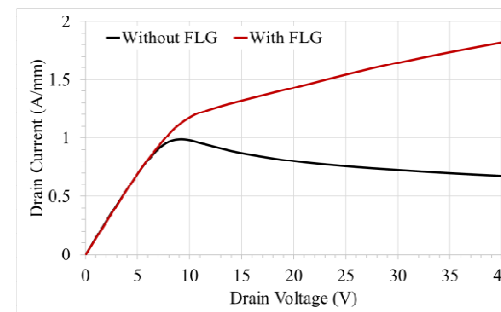
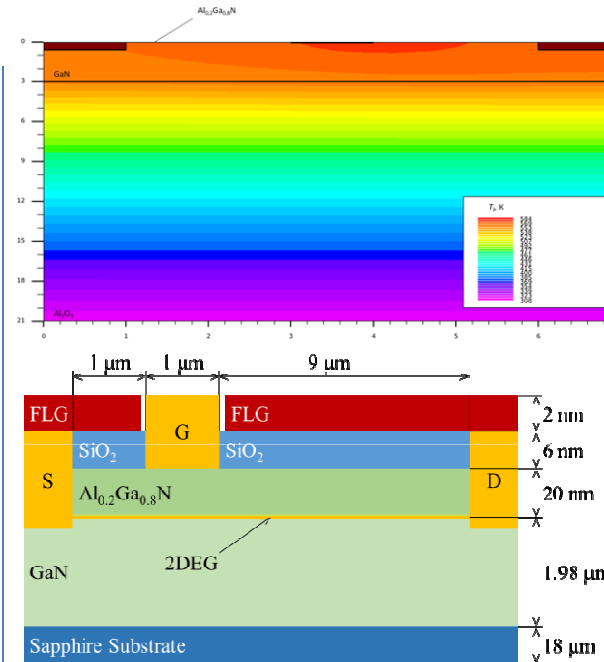


High-temperature Schottky diode

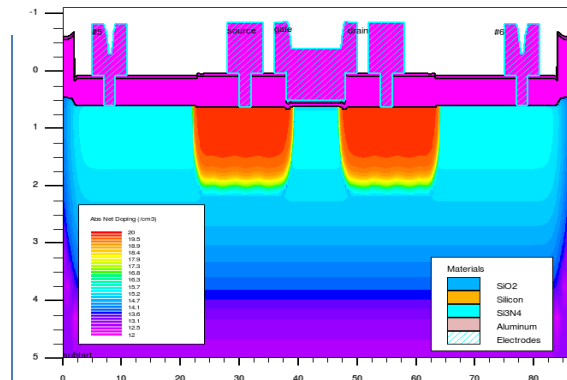
Computer-aided design and optimization of technological processes and devices structures



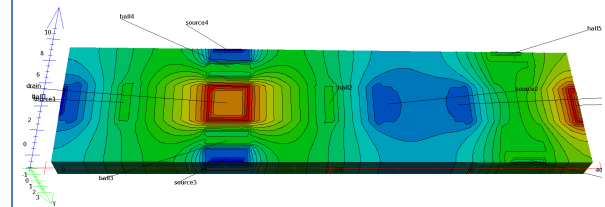
Multi-gate MOSFET (FinFET)



AlGaN / GaN high electron mobility transistor (HEMT) with graphene based heat removal system

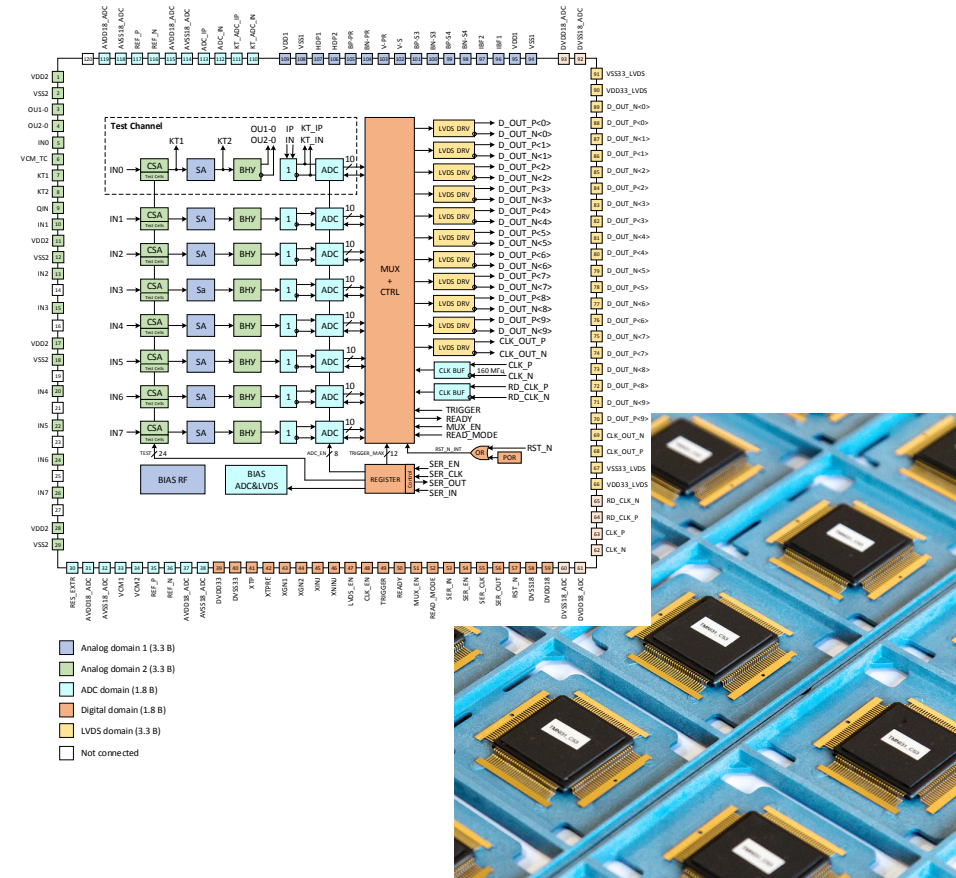
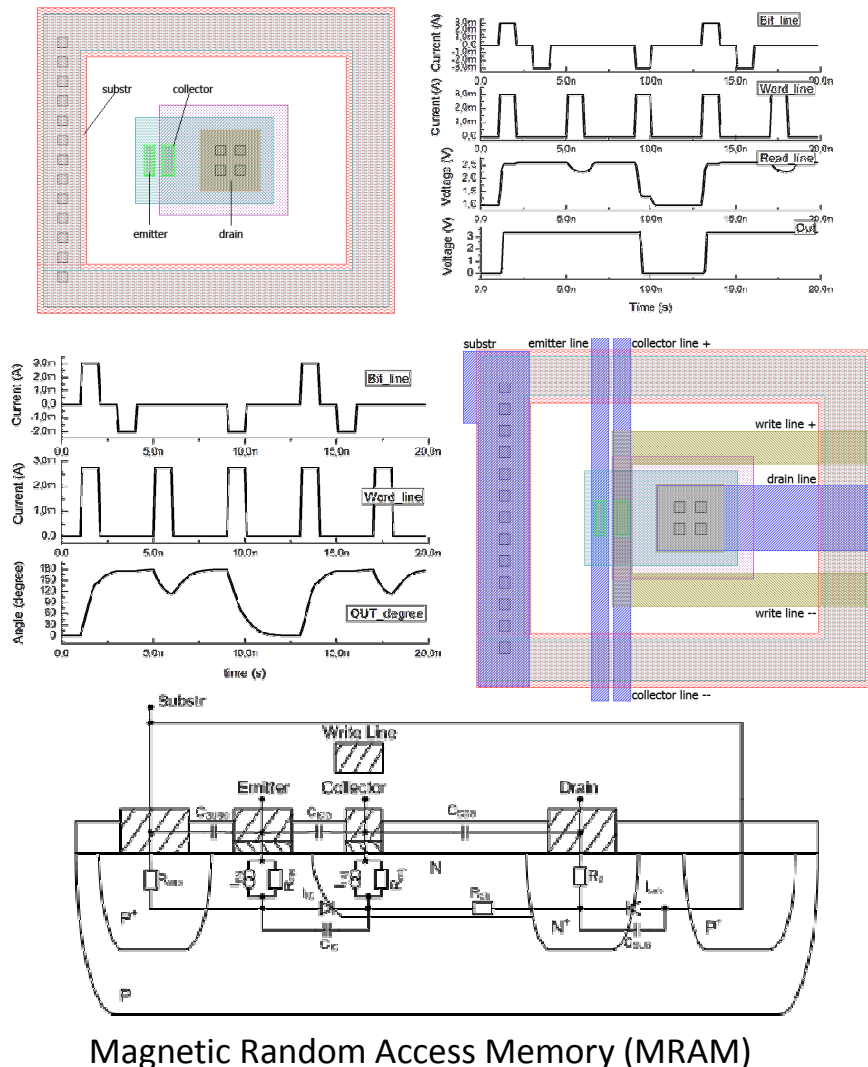


PH-sensor



Hall-sensor

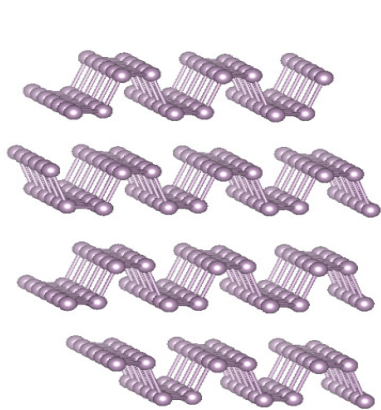
Development and foundry-based fabrication of custom (analog, digital, and mixed) IC's on circuit, layout and system level



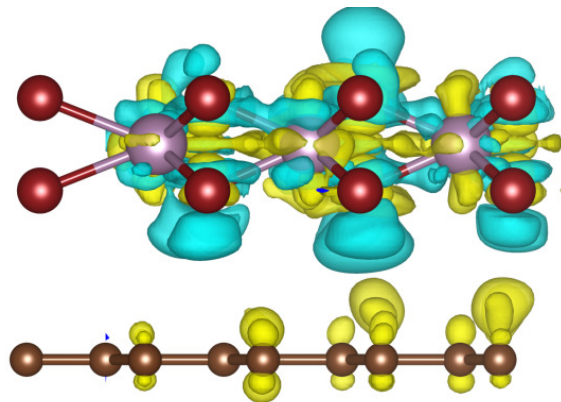
The 8-channel front-end integrated circuit for Time Projection Chamber – design and fabrication (TSMC)

Quantum-mechanical simulation of nanoscale systems

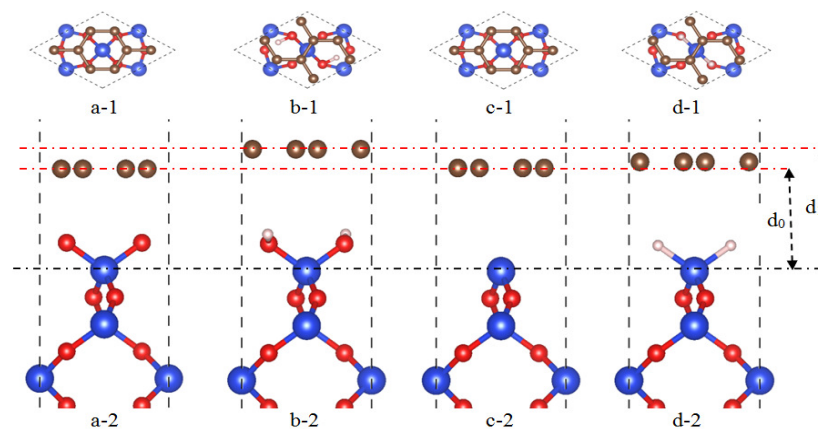
(structural, electronic, magnetic and optical properties of bulk, including layered, materials, 2D materials, surfaces, heterostructures; influence of defects on the electronic and optical and magnetic properties of the structures under study; accounting for the effect of an external electric field)



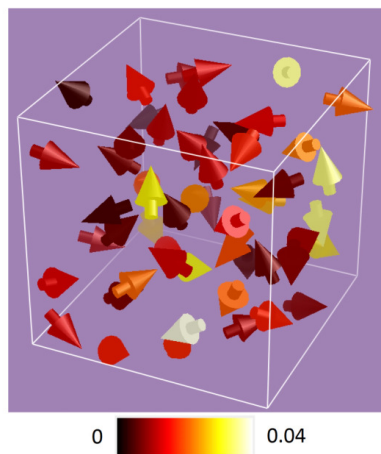
Quasi-two-dimensional (layered) materials - phosphorene



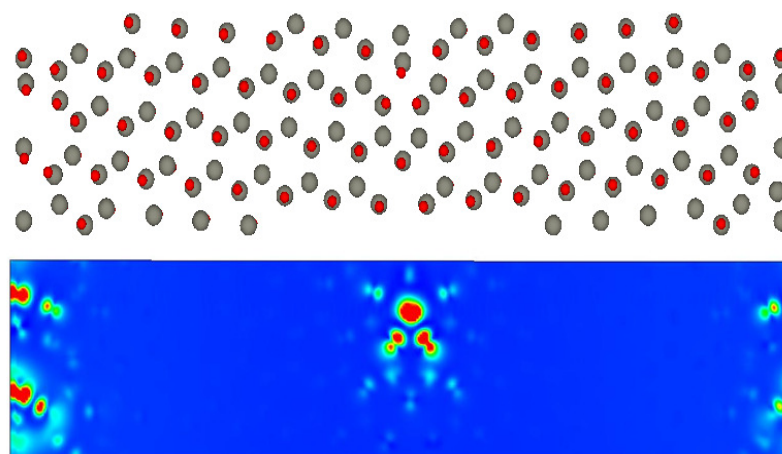
Graphene doped with silicon



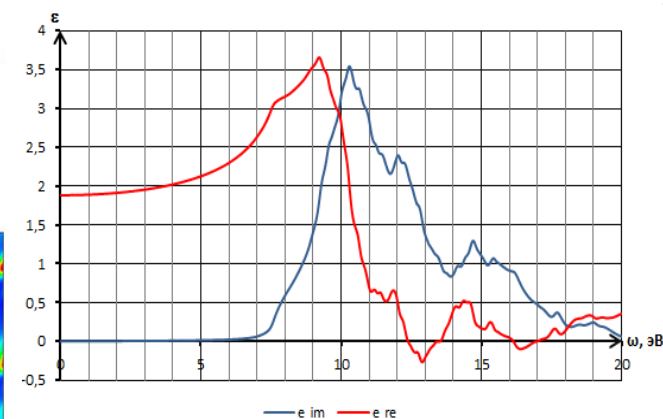
Graphene deposition on a silicon substrate



Non-collinear calculations of magnetic properties



Investigation of magnetic properties at the grain boundary of zinc oxide



Optical properties of CuCr_2Se_4

Contact Information

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