

Context

Challenges in micro & nano technologies

- Scalability, variability, fluctuations
- Reliability of new electronic functions
- New technology development, sensors, transducers

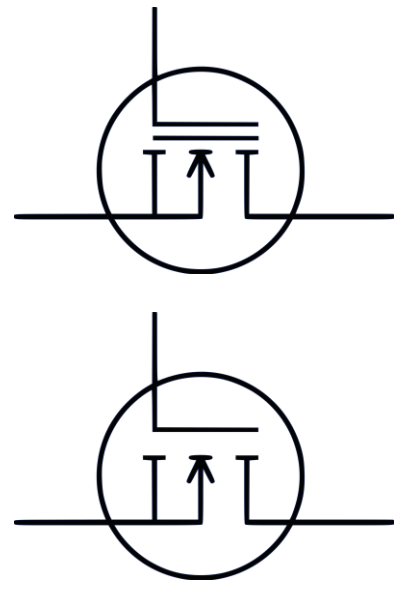
Goals

- Carry out semiconductor device physics research
- Improve characterization and modelling tools
- Quantify performances and impacts at the circuit level
- Identify degradation mechanisms
- Explore new concepts

TRANSISTORS & MEMORIES

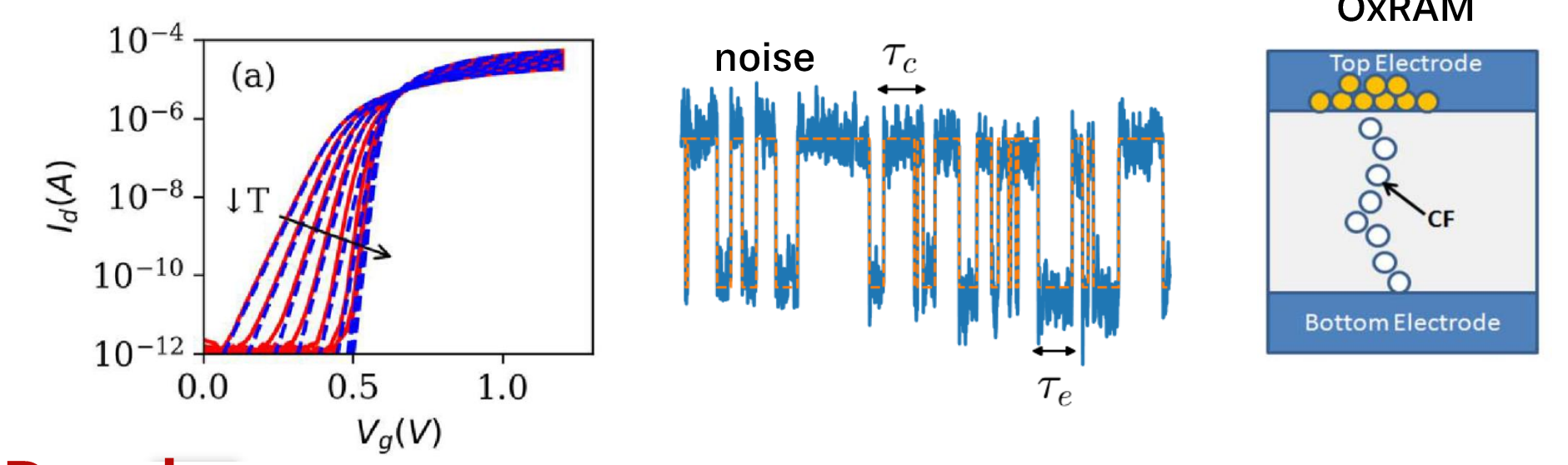
Characterize & model

- MOSFET FDSOI, HEMT, GaN, TFETs...
- ReRAM, 2D atomistors, DRAM
- Phase-change materials (PCMs)



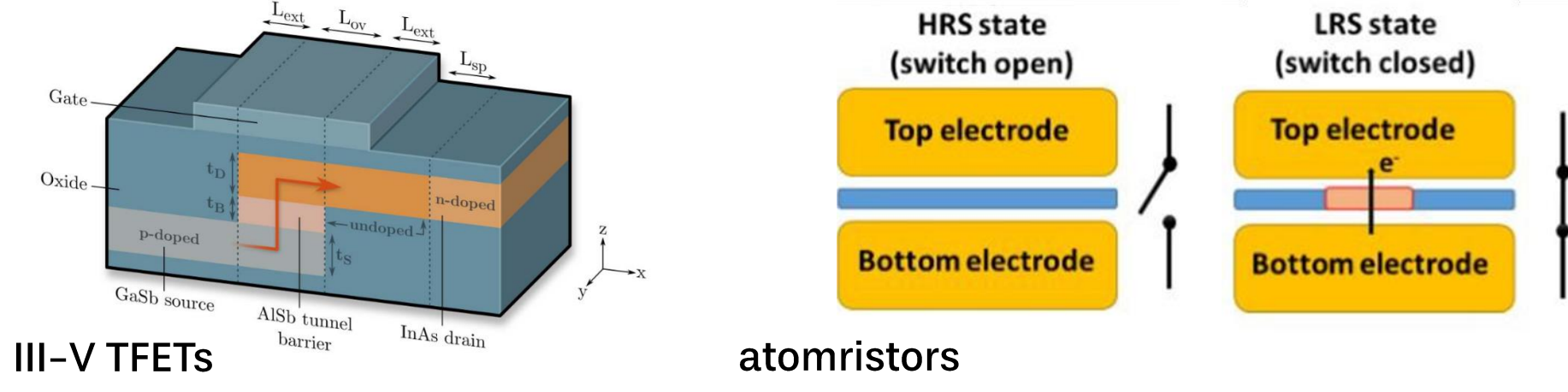
Study

- Variability, low frequency noise and defect
- Cryogenic electrical measurement for cryo-CMOS and superconducting electronic
- PCM properties as a function of temperature

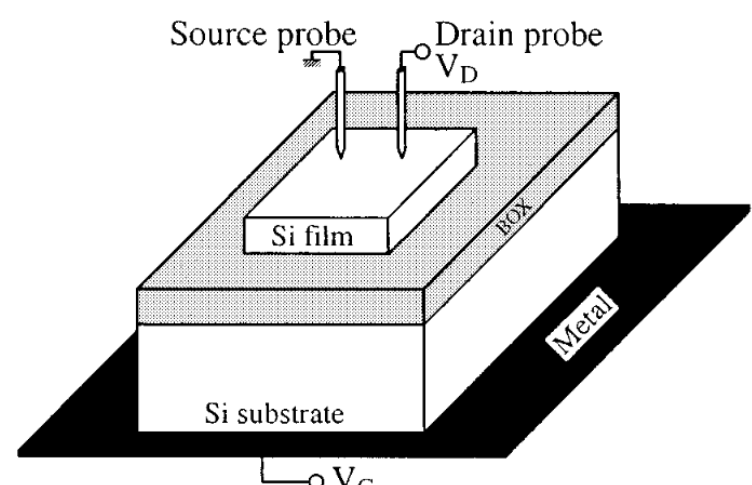


Develop

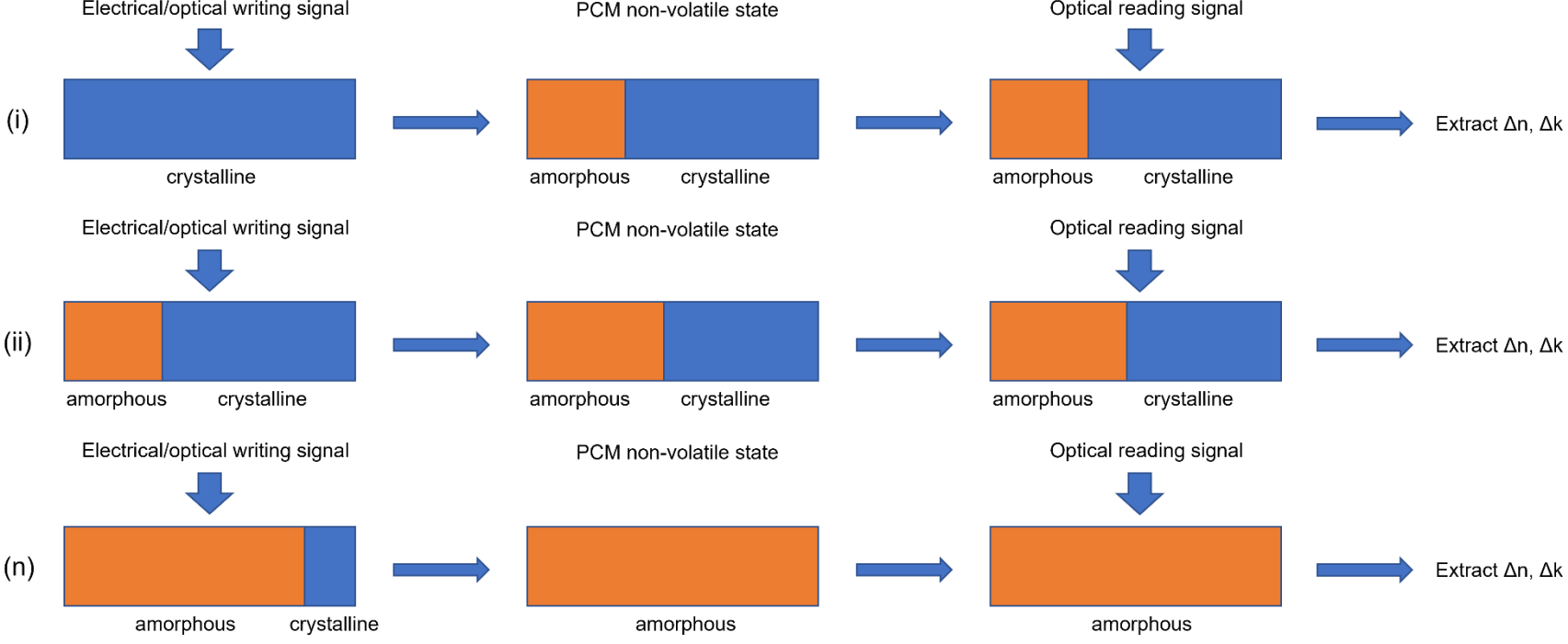
- DFT and NEGF methods for quantum transport modelling



- Pseudo-MOS characterization for SOI substrates



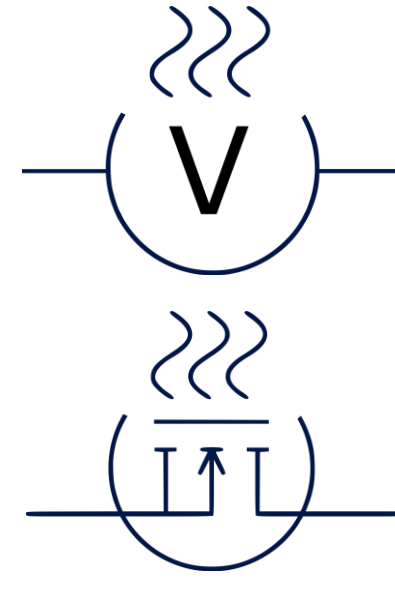
- Optical PCM characterization methods



MULTIPHYSICS TRANSDUCERS

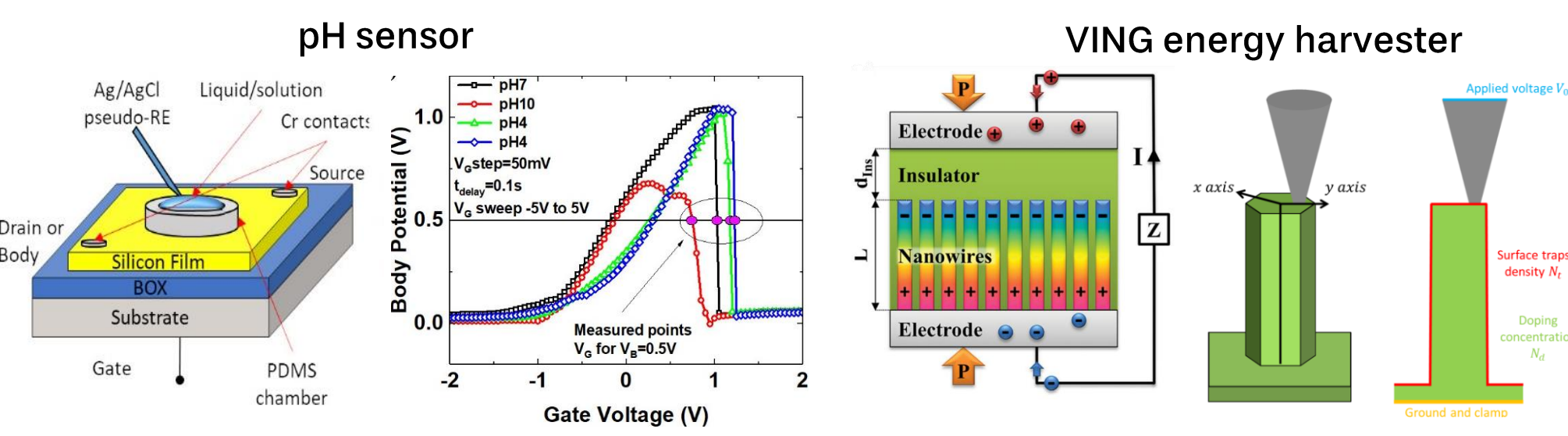
Characterize & model

- Sensors for biological and health applications
- Energy harvesting actuators
- Models for electrically/optically-actuated PCMs



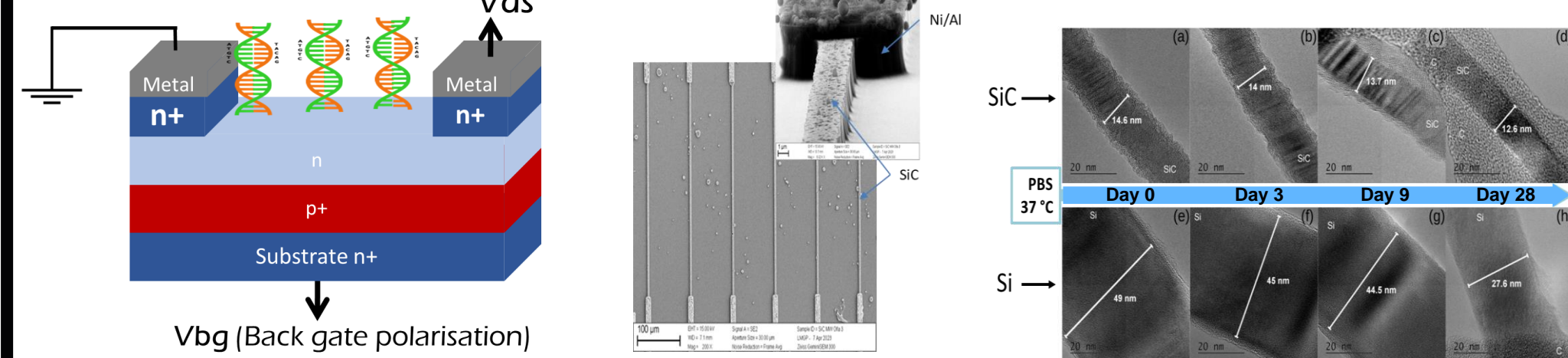
Study

- Transitory signals for improved detection scheme
- Low frequency noise for sensing
- New sensing protocols for improved sensitivity

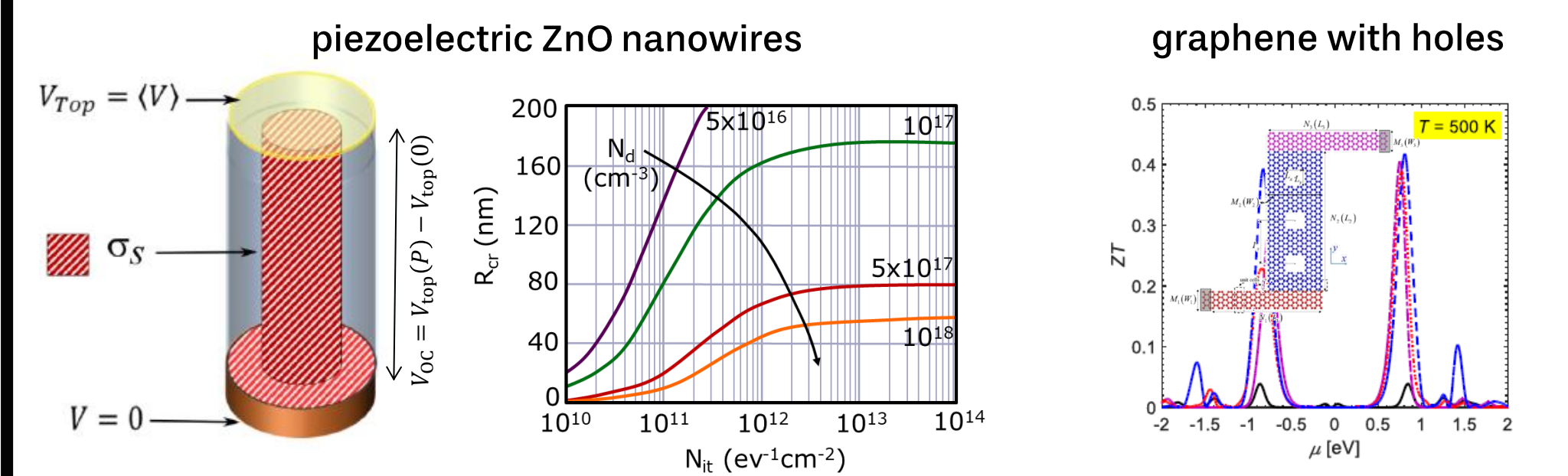


Develop

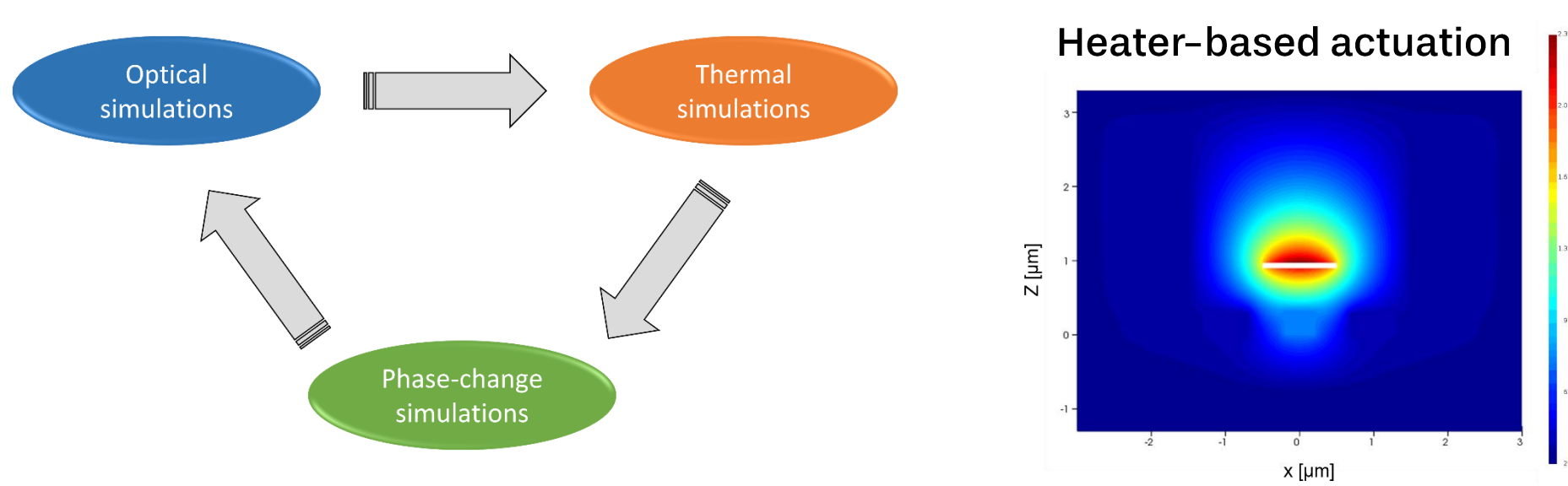
- SiC nanowire Junction ISFETs for biological applications



- Simulation tools for energy harvesters, sensors and actuators



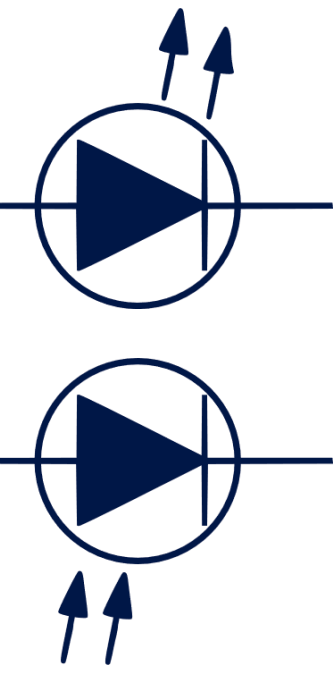
- Compact models and tools for PCM-based optical devices



OPTOELECTRONIC DEVICES

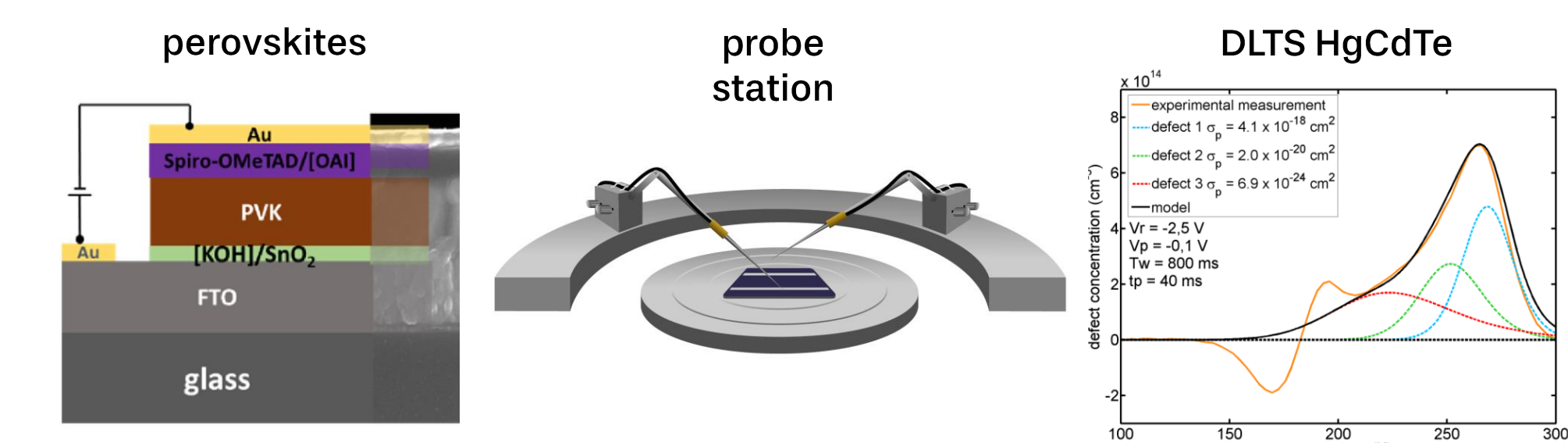
Characterize & model

- Photodetectors, imagers, photovoltaic cells
- Functional materials for optoelectronic



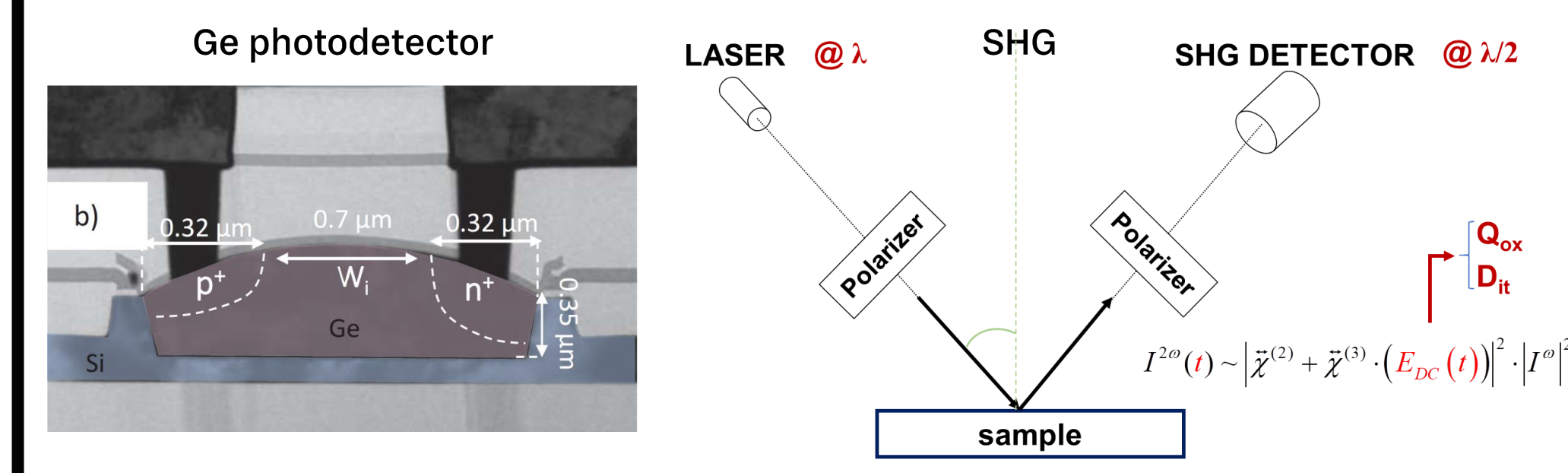
Study

- The creation of defects and the reliability
- Properties of functional materials

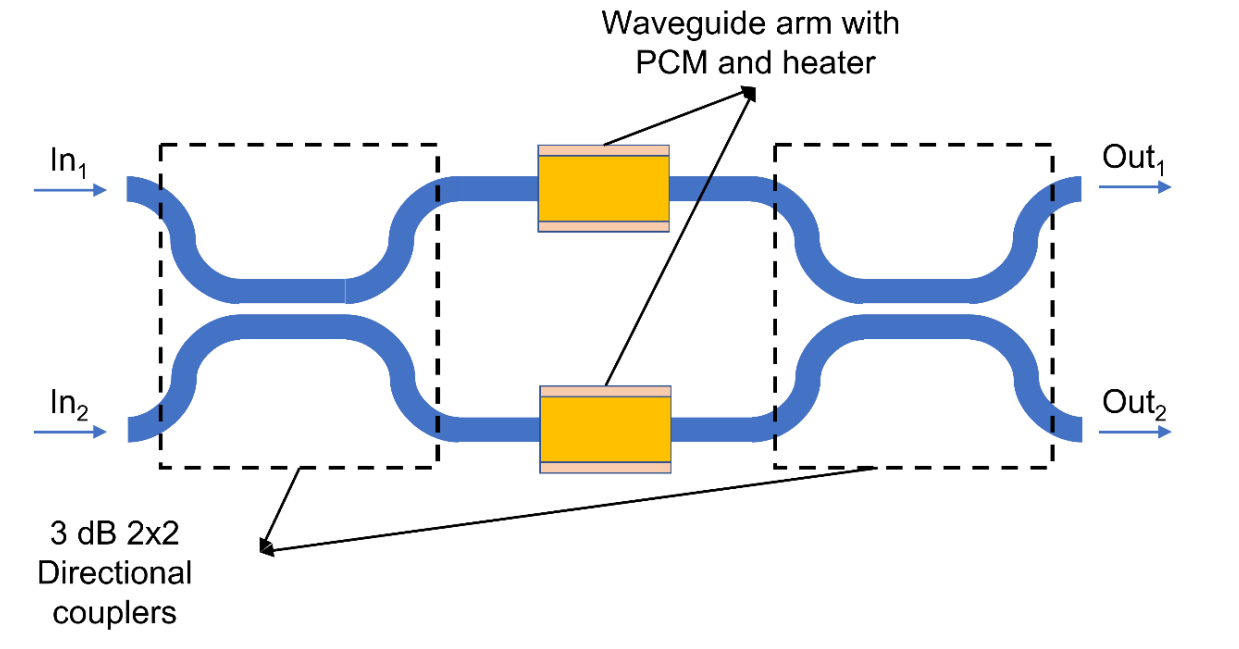


Develop

- Low frequency noise characterization of defects in diodes
- SOI substrate characterization using the second harmonic generation (SHG)
- Novel PCM-based optical devices for applications in security, neuromorphic computing, and communications



PCM-enhanced Mach-Zehnder interferometer



Our skills

Device electrical characterization

- Current-voltage, impedance/admittance
- Low & cryogenic temperature, 300 mm & die
- Magnetoresistance, 9 T / 4 K
- Semi-automatic 300 mm cascade station
- Deep Level Transient Spectroscopy
- Near field AFM measurement
- Low frequency noise techniques
- Energy harvesting efficiency measurement

Simulation and modelling

- Non Equilibrium Green function simulations
- DFT tools for band structure and Hamiltonian calculations
- Device TCAD simulations
- Device analytical modelling for electrical characterization
- Compact models and Verilog-A

Clean room fabrication

- Test device fabrication
- SiC nanowire based ISFET process
- Micro-fluidic packaging



Previous and current collaborations with Korea

- About 10 PhD students in twenty years
- Hubert Curien Partnership (PHC) - Programme STAR
- Korean International Summer School on Nano-Electronics
- Visiting Professor at Kyungpook National University (World Class University)

Contracts

- Industrial partnerships: ST Microelectronics, LYNRED, Global Foundry, Aledia...
- DECIDE shared laboratory with LYNRED
- EU projects: SEQUENCE, ICOS, INPACE, INFRACHIP, Neuropuls
- European networks: SINANO Institute
- International partners: Korea, Italy, Greece, Germany, Spain, USA, Estonia, Tunisia...

Publications & IP

- Between 30 and 40 international articles per years
- 2 patents in the last five years