

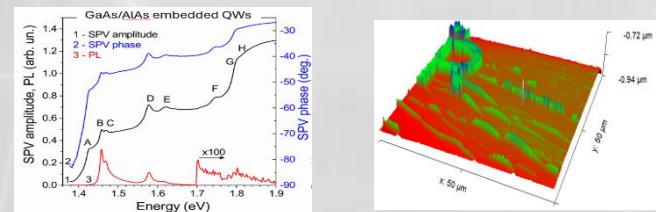
Solid-state materials and nanostructures group



The group conducts fundamental and applied research on optical, vibrational and electrical properties of bulk materials and semiconductor nanostructures for application in information and communication technologies, optoelectronics and photovoltaics. Advanced experimental characterization techniques such as photoluminescence, Raman scattering, surface photovoltage, photoconductivity, atomic force microscopy, UV-VIS-NIR transmission and reflectance, etc. are used.

Equipment

- spectrometer SPEX 1404 (0.85m) with GaAs photomultiplier RCA C31034 (200-930 nm),
- monochromator SPEX Minimate (0.25m)
- photodetectors: InGaAs (0.9-2.57 μm), Ge (0.8-1.8 μm)
- lasers: Ar, He-Ne; diode laser systems (405 nm; 520 nm)
- Lock-in amplifiers (SR830)
- Pico-ampermeter (HP4140B)
- Optical cryostats
 - Closed-cycle ARS (9-300 K)
 - Leybold-Heraeus (65-300 K)
- AFM (MFP-3D Origin, X&Y range 120 μm , Z range >15 μm) •
- I-V, C-V, $\sigma/\rho(T)$



Objects of research

- GaSb micro-islands on Si
- New materials for solar cells: perovskite and perovskite/Si structures; LPE grown InGaAs(Sb)N, GaAsSb(N) layers;
- Carbon layers, graphene
- III-nitrides: GaN, AlN, InN, InGaN, AlGaN, multi-quantum wells (AlGaN/GaN) and superlattices (AlN/GaN) for emitters, detectors

Recent research projects

- CoE “National centre of mechatronics and clean technologies”(2018-2023, 2025 -)
- SUMMIT (Sofia University Marking Momentum For Innovation and Technological Transfer) - Work Group 3.2.3 “New Materials and Photonics” (2023 -)
- Investigation of GaSb micro-dots on Si substrates (2024, Sofia University Research Fund)
- PERMAVOLT (Perovskite materials and structures for photovoltaics) - within the framework of the Franco-Bulgarian partnership program - RILA 2021) (2022-2023)
- National Scientific Program E+: Low Carbon Energy for the Transport and Households (2018-2022)

Selected publications

Vesselin Donchev, Malina Milanova

[Surface Photovoltage Method for Photovoltaic Quality Control of GaAs-Based Solar Cells Coatings](#) **13** (12), 2052 (2023) <https://doi.org/10.3390/coatings13122052>

Vesselin Donchev, Davide Regaldo, **Stefan Georgiev**, Aleksandra Bojar, Mattia da Lisca, **Kiril Kirilov**, José Alvarez, Philip Schulz, and Jean-Paul Kleider

[Surface Photovoltage Study of Metal Halide Perovskites Deposited Directly on Crystalline Silicon](#)

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E Valcheva, **K Kirilov**, N Bundaleska, A Dias, E Felizardo, M Abrashev

[Low-temperature electrical transport in microwave plasma fabricated free-standing graphene and N-graphene sheets](#)

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