

Mykhailo Vorobiov

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Citizenship: Ukraine

Education

- **Virginia Commonwealth University** **Richmond, VA, USA**
PhD candidate in Nanoscience and Nanotechnology *August 2018 – Present*
- **Virginia Commonwealth University** **Richmond, VA, USA**
M.S. in Physics and Applied Physics *January 2017 – January 2019*
- **Kharkiv National University of Radioelectronics** **Kharkiv, Ukraine**
M.S. in Electrical and Electronic Engineering *September 2012 – June 2013*
- **Kharkiv National University of Radioelectronics** **Kharkiv, Ukraine**
B.S. in Electrical and Electronic Engineering *September 2008 – June 2012*
- Additional training
 - Quantum Optics 1: Single Photons (online, École Polytechnique, 2021 [Certificate Link](#))
 - Cavity Quantum Optomechanics (online, EPFL, 2022 [Certificate Link](#))
 - Becoming an Antiracist Educator Series, Level I (online, VCU, 2022)

Working Experience

- **Graduate Teaching/Research Assistant** **Richmond, VA, USA**
Virginia Commonwealth University, Department of Physics *January 2017–Present*
 - During semesters I teach the laboratory portion of the calculus-based Introductory Physics I & II, and Modern Physics classes for students in engineering and sciences. Occasionally, I am leading recitation classes (problem-solving sessions), dealing with students in groups and in a one-to-one manner.
 - During summers I work as a Graduate Research Assistant in Dr. Reshchikov's Lab. As an experimentalist, I perform photoluminescence spectroscopy of point defects in Gallium Nitride thin films (not restricted to the summer times). Additionally, I am responsible for equipment maintenance and software development for its control.
- **Machine Learning Engineer** **Kharkiv, Ukraine**
IT-Jim, LLC *December 2015–December 2016*
 - Developed a unique new feature extraction method, using Krawtchouk and Chebyshev polynomials, and cumulant expansion, for texture classification.
 - Created a fusion algorithm system for texture classification based on Convolutional Neural Networks and Support Vector Machine frameworks that utilized the above feature extraction method.
 - Developed a client-server interface for the commercial augmented reality system for optical character recognition of the Tamil, Malay and Chinese languages.
- **Research Assistant** **Kharkiv, Ukraine**
Institute of Radio Astronomy of the NAS, Microwave Engineering Department *October 2014–December 2015*
 - Using multiple pass matched filtering I developed an adaptive accelerated targets detection algorithm for commercial pulse-Doppler radar.
 - As a stage in algorithms testing I created a software pulse-Doppler radar simulator.

Engineer

Kharkiv, Ukraine

- *Institute of Radio Astronomy of the NAS,
Microwave Engineering Department* *December 2013–October 2014*
 - Optimized the signal processing architecture for the spectroscopy software used as a primary analyzing tool in the UTR-2 radio-telescope that is operated by the astronomical departments of the institute.
 - Implemented and optimized numerous target detection algorithms for commercial radar hardware ranging from thresholding to various modifications of CFAR.

Research Assistant

Kharkiv, Ukraine

- *Institute of Radiophysics and Electronics of the NAS,
Department of Radiospectroscopy* *January 2012–May 2013*
 - Performed an experimental investigation of Anderson localization in microwave one-dimensional photonic crystals comprised of layers of quartz and polystyrene.
 - Studied the formation of defect modes in photonic crystals under local violation of periodicity in experiments as well as computationally.

Teaching Experience

Co-instructor, Semiconductor Nanostructures (Graduate Course, PHYS 560)

- *Virginia Commonwealth University* *Fall 2022*

Teaching Assistant, Modern Physics (PHYS 320)

- *Virginia Commonwealth University* *Spring 2019 – Fall 2022*
 - Provided students with guidance and feedback on their weekly lab work.
 - Prepared solution manual for the course.

Teaching Assistant (Lab Instructor), Introductory Physics II (PHYS 208)

- *Virginia Commonwealth University* *Fall 2020 – Fall 2022*
 - Led weekly laboratory classes with demonstrations and theoretical overview.
 - Participated in writing laboratory manual for the class.

Teaching Assistant (Lab Instructor), Introductory Physics I (PHYS 207)

- *Virginia Commonwealth University* *Spring 2017 – Spring 2019*
 - Led weekly laboratory classes providing engineering and science students with demonstrations and theoretical overview.
 - Tackled physics problems in one-to-one discussions.
 - Facilitated discussions in the recitation classes and instructed students on problem solving strategies.

Conferences

- M. Vorobiov, O. Andrieiev, D. O. Demchenko, and M. A. Reshchikov "Nitrogen vacancy - acceptor complexes in GaN" presented at the *31st International Conference on Defects in Semiconductors* (online)(July 2021)
- M. Vorobiov "Making physics classes inclusive" presented at *Modernization of Education in the Context of Multiculturalism and Inclusivity Conference* (online)(April 2021)
- M. Vorobiov and O. Andrieiev "Shallow state of beryllium acceptor in GaN" presented at the *International Symposium on Clusters and Nanomaterials, Richmond VA* (November 2019)

Publications

M. **Vorobiov**, O. Andrieiev, D. O. Demchenko, and M. A. Reshchikov. Nitrogen vacancy - acceptor complexes in GaN. In preparation, 2022.

Benjamin McEwen, Michael A Reshchikov, Emma Rocco, Vincent Meyers, Kasey Hogan, Oleksandr Andrieiev, Mykhailo **Vorobiov**, Denis O Demchenko, and Fatemeh Shahedipour-Sandvik. Mocvd growth and characterization of be-doped gan. *ACS Applied Electronic Materials*, 2022.

MA Reshchikov, DO Demchenko, M **Vorobiov**, O Andrieiev, B McEwen, F Shahedipour-Sandvik, K Sierakowski, P Jaroszynski, and M Bockowski. Photoluminescence related to ca in gan. *Physical Review B*, 106(3):035206, 2022.

MA Reshchikov, O Andrieiev, M **Vorobiov**, D Ye, DO Demchenko, K Sierakowski, M Bockowski, B McEwen, V Meyers, and F Shahedipour-Sandvik. Thermal annealing of gan implanted with be. *Journal of Applied Physics*, 131(12):125704, 2022.

Benjamin McEwen, Michael Reshchikov, Emma Rocco, Vincent Meyers, Kasey Hogan, Oleksandr Andrieiev, Mykhailo **Vorobiov**, Denis Demchenko, and Shadi Shahedipour-Sandvik. Toward highly efficient p-doping in iii-nitride optoelectronics: Mocvd growth of be-doped gan. In *Gallium Nitride Materials and Devices XVII*, page PC120010B. SPIE, 2022.

MA Reshchikov, DO Demchenko, D Ye, O Andrieiev, M **Vorobiov**, K Grabianska, M Zajac, P Nita, M Iwinska, M Bockowski, et al. The effect of annealing on photoluminescence from defects in ammonothermal GaN. *Journal of Applied Physics*, 131(3):035704, 2022.

Mykhailo **Vorobiov**, Oleksandr Andrieiev, Denis O Demchenko, and Michael A Reshchikov. Point defects in beryllium-doped GaN. *Physical Review B*, 104(24):245203, 2021.

M. A. Reshchikov, O. Andrieiev, M. **Vorobiov**, B. McEwen, F. Shahedipour-Sandvik, D. Ye, and D. O. Demchenko. Stability of C_NH_i complex and the BL2 luminescence band in GaN. *In peer review Phys. Stat. Sol.*, 2021.

MA Reshchikov, M **Vorobiov**, K Grabianska, M Zajac, M Iwinska, and M Bockowski. Defect-related photoluminescence from ammono GaN. *Journal of Applied Physics*, 129(9):095703, 2021.

DO Demchenko, M **Vorobiov**, O Andrieiev, TH Myers, and MA Reshchikov. Shallow and deep states of beryllium acceptor in GaN: Why photoluminescence experiments do not reveal small polarons for defects in semiconductors. *Physical Review Letters*, 126(2):027401, 2021.

MA Reshchikov, M **Vorobiov**, O Andrieiev, K Ding, N Izyumskaya, V Avrutin, A Usikov, H Helava, and Yu Makarov. Determination of the concentration of impurities in gan from photoluminescence and secondary-ion mass spectrometry. *Scientific reports*, 10(1):1–7, 2020.

MA Reshchikov, M **Vorobiov**, DO Demchenko, Ü Özgür, H Morkoç, A Lesnik, MP Hoffmann, F Hörich, A Dadgar, and A Strittmatter. Two charge states of the C_N acceptor in GaN: Evidence from photoluminescence. *Physical Review B*, 98(12):125207, 2018.

Society Memberships and Service

- American Physical Society
- Optical Society of America
- Journal of Applied Physics (Ad-hoc reviewer)

- Journal of Materials Chemistry C (Ad-hoc reviewer)

Notable Projects and Awards

- **Masters thesis (2018):** *'Photoluminescence from GaN co-doped with C and Si'*

Advisor: Michael A. Reshchikov

The master's thesis was prepared as a part of the project funded under the NSF grant (No. DMR-1410125). As the main result of this work I identified and characterized the new defect-related luminescence band in GaN termed as BL_C . We determined its electron and hole-capture coefficients as well as noted that it appears only in the samples with relatively high concentrations of Carbon impurity, that causes yellow luminescence band dominate the spectrum. Further numerical calculations using phenomenological rate-equations model with first-principles calculations suggested strong evidence that it is the Carbon substituting for Nitrogen defect that due to the presence of the two thermodynamic $-/0$ and $0/+$ transition levels give rise to the yellow and BL_C bands.

- **Physics Graduate Academic Award (2018):**

The award for academic excellence issued by the VCU College of Humanities and Sciences

- **Equipment assembly (2017):** *'Integrated setup for semiconductor photoluminescence experiment'*

As a master student I assembled the setup for the photoluminescence experiment including custom software for integrated control over monochromator and lock-in amplifying system.

- **Technical project (2016):** *'Feature extraction method for machine learning applications'*

A unique feature extraction method was developed based on Krawtchouk moments with further dimensionality reduction using cumulant expansion. This method was implemented in the image texture recognition software showing 99% recognition capability.

- **Technical project (2015):** *'Spectroscopy software improvement for UTR-2 radio-telescope'*

In this project I played one of the main roles in code optimization intended to boost the performance of the spectroscopic software system for UTR-2 radio-telescope.

Practical Skills

- **Programming Languages:** Python, C/C++, Verilog HDL(basics), Matlab, Mathematica, LaTeX.
- **Electronics:** Signal Processing (python, Matlab), PCB Design (KiCAD), Soldering, Arduino, STM32 microcontrollers, FPGA (basic Verilog).
- **Lab equipment:** Lab optics, Oscilloscope, VNA, Lock-in amplifier, PMT, APD, Monochromators, Closed Cycle Cryocooler (10 K), He-Cd (cw) and Nitrogen (pulsed) Lasers, Scanning Electron Microscope, Transmission Electron Microscope, X-ray diffraction analysis.
- **Lab Research Software:** Origin, gnuplot, matplotlib, pandas, Linux.
- **Ab-initio electronic structure codes:** GPAW, VASP.
- **Microwave simulation:** CST Microwave Studio, MEEP.
- **Extra math background:** Statistics (classical and Bayesian), Stochastic processes.
- **Extra:** Lab equipment control software development, CAD, 3D printing.

Personal Skills and Interests

- **Languages:** Ukrainian (native), Russian (fluent), English (fluent).
- **Interests:** Swimming, Mountain Hiking, Guitar.