

Mykhailo Vorobiov

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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 – July 2013*
- **Kharkiv National University of Radioelectronics** **Kharkiv, Ukraine**
B.S. in Electrical and Electronic Engineering *September 2008 – July 2012*
- Additional training
 - Quantum Optics 1: Single Photons (online, École Polytechnique, 2021 [Certificate Link](#))
 - Quantum Optics 2: Two photons and more (online, École Polytechnique, in-progress)
 - Optique non-linéaire (online, École Polytechnique, in-progress)

Working Experience

- **Graduate Teaching/Research Assistant** **Richmond, VA**
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*
 - I developed a unique new feature extraction method, using Krawtchouk and Chebyshev polynomials, and cumulant expansion.
 - I 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.
 - I 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**
The Institute of Radio-Astronomy of the NAS of Ukraine, 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

- *The Institute of Radio-Astronomy of the NAS of Ukraine, 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

- *The Institute of Radiophysics and Electronics of the NAS of Ukraine, Department of Radio-spectroscopy* *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

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.

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

- *Virginia Commonwealth University* *Fall 2020 – Fall 2021*
 - Led weekly laboratory classes with demonstrations and theoretical overview.
 - Participated in writing laboratory manual for the class.

Teaching Assistant, Modern Physics (PHYS 320)

- *Virginia Commonwealth University* *Spring 2019 – Fall 2021*
 - Provided students with guidance and feedback on their weekly lab work.
 - Prepared solution manual for the course.

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

- [1] **(In preparation)** M. Vorobiov, O. Andrieiev, D. O. Demchenko, and M. A. Reshchikov, "Nitrogen vacancy - acceptor complexes in GaN,"

- [2] **(Submitted to PRB)** M. Vorobiov, O. Andrieiev, D. O. Demchenko, and M. A. Reshchikov, "Point defects in Beryllium doped GaN," 2021.
- [3] **(Submitted to PSS)** M. A. Reshchikov, O. Andrieiev, M. Vorobiov, B. McEwen, F. Shahedipour-Sandvik, D. Ye, and D. O. Demchenko, "Stability of $C_N H_i$ complex and the BL2 luminescence band in GaN," 2021.
- [4] M. Reshchikov, M. Vorobiov, K. Grabianska, M. Zajac, M. Iwinska, and M. Bockowski, "Defect-related photoluminescence from ammono GaN," *Journal of Applied Physics*, vol. 129, no. 9, p. 095703, 2021.
- [5] D. Demchenko, M. Vorobiov, O. Andrieiev, T. Myers, and M. 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*, vol. 126, no. 2, p. 027401, 2021.
- [6] M. Reshchikov, M. Vorobiov, O. Andrieiev, K. Ding, N. Izyumskaya, V. Avrutin, A. Usikov, H. Helava, and Y. Makarov, "Determination of the concentration of impurities in GaN from photoluminescence and secondary-ion mass spectrometry," *Scientific reports*, vol. 10, no. 1, pp. 1–7, 2020.
- [7] M. Reshchikov, M. Vorobiov, D. Demchenko, Ü. Özgür, H. Morkoç, A. Lesnik, M. Hoffmann, F. Hörich, A. Dadgar, and A. Strittmatter, "Two charge states of the C_N acceptor in GaN: Evidence from photoluminescence," *Physical Review B*, vol. 98, no. 12, p. 125207, 2018.

Society Memberships and Service

American Physical Society

Optical Society of America

Ad-hoc reviewer for the Journal of Applied Physics

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 plaid 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, Matlab, Mathematica, LaTeX.
- **Electronics:** PCB design, soldering, Arduino, SMT32 microcontroller programming, FPGA programming using Verilog HDL.
- **Lab equipment:** Spectrometers and Lab Optics, Closed Cycle Cryostat, He-Cd and Nitrogen Lasers, Scanning Electron Microscope, Transmission Electron Microscope, X-ray diffraction analysis.
- **Lab Research Software:** Origin, gnuplot, CST Microwave Studio, Linux.
- **Ab-initio codes:** GPAW, VASP.
- **Extra math background:** Stochastic processes, Group theory.
- **Extra:** CAD, 3D printing.

Personal Skills and Interests

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