



Name: Vuković N. Nikola

Title: Assistant professor at School of Electrical Engineering, University of Belgrade

Address: 73 Bulevar kralja Aleksandra, 11120 Belgrade, Serbia, room 104

Phone number: +38111/3218-309

e-mail: nvukovic@etf.bg.ac.rs

Web: <https://www.etf.bg.ac.rs/en/faculty/staff/nikola-vukovic-5009#gsc.tab=0>

Education: School of Electrical Engineering, University of Belgrade: graduated in 2012, master's degree in 2013, Ph.D. in 2018

Interests: electronic structure and optical properties of semiconductor nanostructures, quantum cascade laser, semiconductor metamaterials, ultrafast nonlinear optics, instabilities, and chaos

Short biography:

Nikola Vukovic was born on May 5, 1989, in Belgrade, where he finished elementary school and Mathematical grammar school with great success. During elementary school and high school, he competed in mathematics and physics and won awards. He graduated in 2012 from the School of Electrical Engineering, University of Belgrade, at the Department of Physical Electronics, at the module Nanoelectronics, Optoelectronics and Laser Engineering (NOLT) with a GPA of 9.70 out of 10. He enrolled in master's studies in 2012 on the NOLT module and finished them with a GPA of 10 in September 2013. The topic of the master's thesis was "The influence of nonparabolicity on the electronic structure of a quantum cascade laser", and the advisor was prof. Dr. Jelena Radovanovic. In October 2013, he enrolled in doctoral studies in the elective field of Nanoelectronics and Photonics and passed all the exams with a GPA of 10. The advisor of the doctoral dissertation "Risken-Numedal-Graham-Haken instability and self-pulsation in quantum cascade lasers" was prof. Dr. Jelena Radovanovic. He defended his doctoral dissertation in June 2018. From January 2014, he has been employed at the School of Electrical Engineering in Belgrade in the framework of the project of the Ministry of Education, Science and Technological Development (first as a trainee researcher and then as a research associate), and has been participating in several international projects. From October 2017 until March 2021, he has been employed as a teaching assistant. Dr. Vukovic is currently an assistant professor (narrower scientific area of Physical Electronics), at the Department of Microelectronics and Engineering Physics. He has been a member of the Optical Society of Serbia since 2015, and a member of the Scientific Committee of the international conference Photonica since 2020 (<http://www.photonica.ac.rs/committees.php>). He speaks English and French.

Projects:

Since January 2014, he has been participating in the project of the Ministry of Education, Science and Technological Development, grant number III45010 - "Photonics of micro and nanostructured materials", and he has participated or is participating in 7 international projects:

- "Terahertz QCL Based Spectrometer for Rapid Detection of Chemical Agents and Explosives", Science for Peace and Security Program, ref. no. 984068, (2014-2016),
- "Ultrafast Infrared Emitter on a Quantum Cascade - FastIQ" (SCOPES 2013-2016: Joint Research Projects), (2014-2017),
- COST action BM1205– "European Network for Skin Cancer Detection using Laser Imaging", (from 2014-2017),
- COST action MP1204– "TERA-MIR Radiation: Materials, Generation, Detection and Applications" (2014-2016)
- COST action MP1406– "Multiscale in modeling and validation for solar photovoltaics (MultiscaleSolar)" (from 2015-2019)
- "Multi-Scale Modeling of Terahertz Quantum Cascade Laser Active Regions", Multilateral scientific and technological cooperation in the Danube region 2020-2021 (from 2020-).
- "DEMETRA: Development of high-performance mid-IR / THz quantum cascade lasers for advanced applications", Science Fund of the Republic of Serbia, Serbian Science and Diaspora Collaboration Programme: Knowledge Exchange Vouchers (from 2020-).

Prizes and awards:

During the final year of undergraduate and master's studies, he was a scholarship holder of the Fund for Young Talents of the Republic of Serbia - Dositeja.

Selected in the group of success stories, for selected young researchers from all possible COST actions: <https://www.cost.eu/stories/getting-under-the-skin/>

Cooperation with foreign institutions:

During 2015 and 2017, as part of the COST Action BM1205, he visited Dr. Dmitri L. Boiko at the Center Suisse d'Electronique et de Microtechnique (CSEM) in Neuchatel (Switzerland) and performed activities related to the projects FastIQ and BM1205. He participated in a joint project with the School of Electrical and Electronic Engineering, University of Leeds, UK (COST action BM1205). He also collaborated on the FastIq project with the Institute of Microstructure Physics from Nizhny Novgorod in Russia (IPM RAS). He is currently participating in cooperation with groups with TU Wien and Université Paris Diderot (Paris 7) on a joint project within the program of multilateral scientific and technological cooperation in the Danube region 2020-2021 and with a

group in Leeds on the project DEMETRA within the program of the Science Fund of the Republic of Serbia, Serbian Science and Diaspora Collaboration Program: Knowledge Exchange Vouchers.

Publications (last updated in June 2021):

9 papers in peer-reviewed international journals, 1 book chapter, and 19 conference papers.

Papers in peer-reviewed international journals:

1. N. Vuković, J. Radovanović, V. Milanović, D. L. Boiko, "Low-threshold RNGH Instabilities in Quantum Cascade Lasers," IEEE Journal of Selected Topics in Quantum Electronics 23, 1200616 (2017)., DOI: 10.1109/JSTQE.2017.2699139, ISSN 1077-260X.
2. N. Vuković, J. Radovanović, V. Milanović, D. L. Boiko, "Analytical expression for Risken-Nummedal-Graham-Haken instability threshold in quantum cascade lasers," Optics Express 24, pp. 26911-26929, (2016)., DOI: 10.1364/OE.24.026911, ISSN 1094-4087
3. N. Vuković, A. Daničić, J. Radovanović, V. Milanović, and D. Indjin, "Possibilities of achieving negative refraction in QCL-based semiconductor metamaterials in the THz spectral range," Optical and Quantum Electronics 47, 883-891, (2015) DOI: 10.1007/s11082-014-0020-2, ISSN 0306-8919.
4. N. Vuković, V. Milanović, and J. Radovanović, "Influence of nonparabolicity on electronic structure of quantum cascade laser," Physics Letters A 378 (2014), pp. 2222-2225, DOI: 10.1016/j.physleta.2014.04.069, ISSN 0375-9601.
5. N. Vuković, J. Radovanović, and V. Milanović, "Enhanced modeling of band nonparabolicity with application to mid-IR quantum cascade laser structure," Physica Scripta T 162 (2014) 014014 (1-4), DOI:10.1088/0031-8949/2014/T162/014014, ISSN 0031-8949.
6. M. Dubajić, A. Daničić, N. Vuković, V. Milanović, and J. Radovanović, "Optimization of cubic GaN/AlGaIn quantum cascade structures for negative refraction in the THz spectral range," Optical and Quantum Electronics 50 (10), p. 373 (2018). DOI: 10.1007/s11082-018-1639-1, ISSN 0306-8919.
7. N. Vuković, J. Radovanović, V. Milanović, D. L. Boiko, "Multimode RNGH instabilities of Fabry - Perot cavity QCLs: impact of diffusion," Optical and Quantum Electronics 48, 254 (1-10), 2016. DOI: 10.1007/s11082-016-0515-0, ISSN 0306-8919.
8. N. Vuković, J. Radovanović, V. Milanović, D. L. Boiko, "Numerical study of Risken-Nummedal-Graham-Haken instability in mid-infrared Fabry-Pérot quantum cascade lasers," Optical and Quantum Electronics 52, Opt Quant Electron 52, 91 (2020). <https://doi.org/10.1007/s11082-020-2210-4>
9. A.Gajic, J. Radovanović, N. Vuković, V. Milanović, D. L. Boiko „Theoretical approach to quantum cascade micro-laser broadband multimode emission in strong magnetic fields“ Physics Letters A 387, (2021), 127007, ISSN 0375-9601, <https://doi.org/10.1016/j.physleta.2020.127007>.

Book chapter:

J. Radovanović, N. Vuković, and V. Milanović, "Global optimization methods for the design of MIR-THz QCLs applied to explosives detection," in *NATO Science for Peace and Security Series B: Physics and Biophysics* (2021).

Conference papers:

1. N. Vuković, A. Daničić, J. Radovanović and V. Milanović, "Conduction-band nonparabolicity and gain calculations for THz Quantum cascade laser in strong magnetic field," Proceedings of 1st International Conference on Electrical, Electronic and Computing Engineering IcETRAN Vrnjačka Banja, June 2-5 2014, pp. MOI2. 2. 1-4 (2014).
2. A. Gajic, J. Radovanovic, N. Vukovic, V. Milanovic and D. L. Boiko, "Broadband Multimode Emission of Quantum Cascade Lasers in Strong Magnetic Fields," International School and Conference on Photonics - PHOTONICA2019, Belgrade 08/2019, Book of Abstracts, p. 150, (2019).
3. A. A. Antonov, D. I. Kuritsyn, A. Gajic, E. E. Orlova, N. Vukovic, J. Radovanovic, V. V. Vaks and D. L. Boiko, "Controlling the Quantum Cascade Laser Frequency Comb via Risken-Nummedal-Graham-Haken Instability", 26th INTERNATIONAL SEMICONDUCTOR LASER CONFERENCE (ISLC 2018), SANTA FE, NEW MEXICO, USA, 16-19 September, Book of Abstracts TuP37, p. 33, (2018).
4. N. Vukovic, J. Radovanovic, V. Milanovic, D. L. Boiko, "Self-pulsing in monolithic and external cavity mid-IR QCLs," International School and Conference on Photonics - PHOTONICA2017, Belgrade 08/2017, Book of Abstracts, p. 130, (2017).
5. N. Vuković, J. Radovanović, V. Milanović, D.L Boiko, "Self-pulsations in QCLs", International Quantum Cascade Lasers School & Workshop IQCLSW 2016, 4.-9. September 2016, Cambridge UK, Book of Abstracts, p.195-196, (2016).
6. N. Vuković, J. Radovanović, V. Milanović, D. L. Boiko, "Determination of RNGH Round-trip Gain in QCLs," 4th Annual Conference of COST Action MP1204 & SMMO2016 Conference, Lisbon, Portugal, 21.-24. March 2016, Book of Abstracts, P.08, (2016).
7. M. Dubajić, A. Daničić, N. Vuković, V. Milanović, J. Radovanović, "Possibilities of achieving negative refraction conditions in quantum well structures based on cubic nitrides," 4th Annual Conference of COST Action MP1204 & SMMO2016 Conference, Lisbon, Portugal, 21.-24. March 2016, Book of Abstracts, P.23, (2016).
8. N. Vukovic, J. Radovanovic, V. Milanovic, D.L. Boiko, "The Role of Carrier Diffusion in RNGH Instabilities of Quantum Cascade Lasers," Conference on Lasers and Electro-Optics Europe & European Quantum Electronics Conference, 21-25 June 2015 Munich, Advance programme, p. 202 (2015).
9. N. Vukovic, J. Radovanovic, V. Milanovic, D. L. Boiko, "Influence of Carrier Diffusion on RNGH Instabilities in Semiconductor Lasers," 3rd Annual Conference of COST Action MP1204 & 6th International Conference on Semiconductor Mid-IR Materials and Optics-SMMO2015, Book of Abstracts, p. 61, 8-11. April 2015, Prague, Czech Republic (2015).
10. N. Vukovic, J. Radovanovic, V. Milanovic, D.L. Boiko, "Determination of RNGH round-trip gain using bi-orthogonal perturbation approach," International School and Conference on Photonics - PHOTONICA2015, Belgrade 08/2015, Book of Abstracts, p. 126, (2015).
11. A. Danicic, N. Vukovic, J. Radovanovic, V. Milanovic, "Modeling and applications of Quantum Cascade in external magnetic field," International School and Conference on Photonics - PHOTONICA2015, Belgrade 08/2015, Book of Abstracts, p. 38, (2015).
12. N. Vuković, A. Daničić, J. Radovanović and V. Milanović, "Effects of Conduction-band Nonparabolicity on Electronic Structure and Gain of THz Quantum Cascade Laser in Magnetic

field,” International quantum cascade lasers school & workshop 2014 , 7-14. September 2014, Policoro, Italy, Workbook, pp. 242-243 (2014).

13. N. Vuković, J. Radovanović, V. Milanović and D. L. Boiko, “Exploring the relation between Risken–Nummedal–Graham–Haken instabilities and conditions for superradiance in a quantum cascade laser,” European Semiconductor Laser Workshop 2014 , Workbook, 18-19. September 2014, Paris, France (2014).
14. A. Daničić, N. Vuković, J. Radovanović, V. Milanović, “Realization of negative refraction in the THz spectral range via quantum cascades,” STSM Workshop & Management Committee Meeting, 13-15. November 2014, Warsaw, Poland, Workbook, (2014).
15. N. Vukovic, J. Radovanovic, V. Milanovic, D.L. Boiko, “Investigation of Risken–Nummedal–Graham–Haken instabilities in quantum cascade lasers,” 13th YOUNG RESEARCHERS’ CONFERENCE, Materials Science and Engineering, Belgrade 12/2014. Book of Abstracts, p. 18, (2014).
16. N. Vuković, J. Radovanović, V. Milanović, D. Boiko, “Recent progress on RNGH Instabilities in QCLs,” 9th Photonics Workshop, Kopaonik, Serbia, March 2-6, 2016., Book of Abstracts, p. 20, (2016).
17. N. Vukovic, J. Radovanovic, V. Milanovic, D.L. Boiko, “Multimode Risken–Nummedal–Graham–Haken Instabilities of Fabry-Perot Cavity Quantum Cascade Laser,” 8th Photonics Workshop, Kopaonik, Serbia, March 2015., Book of Abstracts, p. 28, (2015).
18. N. Vukovic, J. Radovanovic, V. Milanovic, A. Antonov, D. Kuritsyn, V. Vaks, and D. L. Boiko, “Possibility of Regular Self-Pulsations in Mid-IR Quantum Cascade Lasers in External Cavity Configuration,” 12th Photonics Workshop, Kopaonik, Serbia, March 2019., Book of Abstracts, p. 39, (2019).
19. N. Vukovic, A. Gajic, J. Radovanovic, V. Milanovic, A. Antonov, D. Kuritsyn, V. Vaks, and D. L. Boiko, “ Impact of Risken-Nummedal-Graham-Haken Instability on Mid-IR Quantum Cascade Laser Frequency Comb,” 13th Photonics Workshop, Kopaonik, Serbia, March 2020., Book of Abstracts, p. 22, (2020).