

Nikita A. Olekhno

Research Fellow, ITMO University

Born: 01 January 1994

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Affiliations

Dates: 2022 – Present

Work address: ITMO University, 49 Kronverksky ave., bldg. A, 197101 Saint Petersburg, Russian Federation

<https://physics.itmo.ru>

Title: Research Fellow, Industrial PostDoc

Dates: 2017 – 2022

Work address: ITMO University, 49 Kronverksky ave., bldg. A, 197101 Saint Petersburg, Russian Federation

<https://physics.itmo.ru>

Title: R&D Engineer

Dates: 2014 – 2017

Work address: Ioffe Institute, 26 Polytekhnicheskaya st., 194021 Saint Petersburg, Russian Federation

<http://ioffe.ru>

Title: Research Assistant

Teaching Activities

Dates: 2021 – present

Work address: ITMO University, 49 Kronverksky ave., bldg. A, 197101 Saint Petersburg, Russian Federation

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Title: Supervisor of the Bachelor students' scientific projects

Dates: 2018 – 2019

Work address: ITMO University, 49 Kronverksky ave., bldg. A, 197101 Saint Petersburg, Russian Federation

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Title: Supervisor of the scientific practice for high-school students

Dates: 2013

Work address: Lyceum "Physics and Technology High School" (PTHS), 8 Khlopina st., 194021 Saint Petersburg, Russian Federation

<http://school.ioffe.ru>

Title: Teacher of additional education

Principal subjects: "Introduction to Biophysics" lecture course

Education

2009-2011: Lyceum "Physics and Technology High School" (PTHS)

2011-2015: Peter the Great Polytechnic University, Department of Physics and Technology of Nanostructures

BSc in Physics (graded with honors)

Thesis title: "Describing plasmon resonances in disordered nanocomposites within the framework of LC -circuit model"

2015-2017: Alferov University, Department of Theoretical Physics

MSc in Physics (graded with honors)

Thesis title: "Two-dimensional plasmons in the random impedance network model of disordered nanocomposites"

2017-2021: ITMO University, School of Physics and Engineering

PhD in Physics

Thesis title: "Higher-order topological and entangled states of photon pairs in resonant nanostructures"

Additional Education

OSA Innovation School (Optical Society of America, Washington, DC, USA, online, 2020)

Intellectual Property in Digital Economy (Federal Institute of Industrial Property, Moscow, Russia, 2020)

Pre-acceleration Program (Technopark of Saint Petersburg, Saint Petersburg, Russia, 2020)

Research Projects Management

1. ITMO-Bosch Research Project "Spatial Structure and Dynamical Properties of Active Matter Based on Ensembles of Self-Propelled Particles", Chief Investigator, 2021 - Present
2. RFBR 18-32-01052 mol_a "Theory of nonlinear generation of entangled photon and plasmon states in nanostructures", Chief Investigator, 2018 - 2020
3. FASIE UMNİK 13468GU/2018 "The development of resonant dielectric nanostructures based on non-linear dielectric nanoparticles for application in entangled photon pair sources for quantum communications", Chief Investigator, 2018 - 2020

Participation in Research Projects

1. RSF 21-79-10209 “Electromagnetic topological states in metamaterials with bianisotropy and long-range couplings”, Principal Investigator, 2021 - Present
2. RSF 20-72-10065 “Higher-order topological states in resonant structures”, Principal Investigator, 2020 - Present
3. RSF 16-19-10538 “Metamaterials and structures with topological order”, Investigator, 2019 - 2020
4. RFBR 18-29-20037 mk “Infrared spectroscopy of topological states of entangled photons”, Investigator, 2018 - 2021
5. RFBR 18-02-01206 a “Theory of nonlinear second order processes in dielectric nanosystems”, Investigator, 2018 - 2020
6. RFBR 16-32-00359 mol.a “Plasmon resonances in disordered binary nanocomposites”, Investigator, 2015 - 2018
7. RFBR 16-02-00064 a “Dynamical processes within complex ferromagnetic structures bases on metals as well as semiconductors”, Investigator, 2016 - 2018
8. RFBR 15-02-01575 a “Quantum kinetics of electron and phonon response and drag effects in micro and nanostructures and low-dimension systems”, Investigator, 2015 - 2017

Journal Roles

Reviewer for the journals *Nature Communications*, *Photonics and Nanostructures - Fundamentals and Applications*, *Physical Review A*, and *Physical Review B*.

Societies Membership

IEEE (Institute of Electrical and Electronics Engineers), starting 2020

SPIE (Society of Photo-Optical Instrumentation Engineers), starting 2019

Optica (formerly Optical Society of America, OSA), starting 2018

Publications

Preprints

1. **Nikita A. Olekhno**, Mihail I. Petrov, Ivan V. Iorsh, Andrey A. Sukhorukov, Alexander S. Solntsev, Generating N00N-states of surface plasmon-polariton pairs with a nanoparticle, arXiv:2002.05268 (2020).
<https://arxiv.org/abs/2002.05268>

Journal Articles

1. **Nikita A. Olekhno**, Alina D. Rozenblit, Andrei A. Stepanenko, Alexey A. Dmitriev, Daniel A. Bobylev, and Maxim A. Gorlach, Topological transitions driven by quantum statistics and their electrical circuit emulation, *Physical Review B* **105**, 205113 (2022).
<https://doi.org/10.1103/PhysRevB.105.205113> <https://arxiv.org/abs/2108.10435>
2. **Nikita A. Olekhno**, Alina D. Rozenblit, Valerii I. Kachin, Alexey A. Dmitriev, Oleg I. Burmistrov, Pavel S. Seregin, Dmitry V. Zhirihin, and Maxim A. Gorlach, Experimental realization of topological corner states in long-range-coupled electrical circuits, *Physical Review B* **105**, L081107 (2022).
<https://doi.org/10.1103/PhysRevB.105.L081107> <https://arxiv.org/abs/2103.08980>
3. Pavel S. Seregin, Oleg I. Burmistrov, Georgiy A. Solomakha, Egor I. Kretoy, **Nikita A. Olekhno**, and Alexey P. Slobozhanyuk, Energy-harvesting coil for circularly polarized fields in magnetic resonance imaging, *Physical Review Applied* **17**, 044014 (2022), selected as an Editors' Suggestion.
<https://arxiv.org/abs/2106.06886>
4. Anna A. Nikolaeva, Kristina S. Frizyuk, **Nikita A. Olekhno**, Alexander S. Solntsev, and Mihail I. Petrov, Directional emission of down-converted photons from a dielectric nanoresonator, *Physical Review A* **103**, 043703 (2021).
<https://doi.org/10.1103/PhysRevA.103.043703> <https://arxiv.org/abs/2011.07842>
5. Alexander V. Poshakinskiy, Janet Zhong, Yongguan Ke, **Nikita A. Olekhno**, Chaohong Lee, Yuri S. Kivshar, and Alexander N. Poddubny, Quantum Hall phase emerging in an array of atoms interacting with photons, *npj Quantum Information* **7**, 34 (2021).
<https://doi.org/10.1038/s41534-021-00372-8>
<https://arxiv.org/abs/2003.08257>
6. **Nikita A. Olekhno**, Egor I. Kretoy, Andrei A. Stepanenko, Polina A. Ivanova, Vitaly V. Yaroshenko, Ekaterina M. Puhtina, Dmitry S. Filonov, Barbara Cappello, Ladislau Matekovits, and Maxim A. Gorlach, Topological edge states of interacting photon pairs emulated in a topoelectrical circuit, *Nature Communications* **11**, 1436 (2020).
<https://doi.org/10.1038/s41467-020-14994-7>
<https://arxiv.org/abs/1907.01016>
7. Janet Zhong, **Nikita A. Olekhno**, Yongguan Ke, Alexander V. Poshakinskiy, Chaohong Lee, Yuri S. Kivshar, and Alexander N. Poddubny, Photon-mediated localization in two-level qubit arrays, *Physical Review Letters* **124**, 093604 (2020).
<https://doi.org/10.1103/PhysRevLett.124.093604>
<https://arxiv.org/abs/1911.04113>
8. **Nikita A. Olekhno**, Yaroslav M. Beltukov, Random matrix approach to plasmon resonances in the random impedance network model of disordered nanocomposites, *Physical Review E* **97**, 050101(R) (2018).
<https://doi.org/10.1103/PhysRevE.97.050101>
<https://arxiv.org/abs/1801.09233>
9. **Nikita A. Olekhno**, Yaroslav M. Beltukov, Two-dimensional plasmons in the random impedance network model of disordered thin film nanocomposites, *Physical Review B* **97**,

184204 (2018).
<https://doi.org/10.1103/PhysRevB.97.184204>
<https://arxiv.org/abs/1710.00949>

10. **Nikita A. Olekhno**, Yaroslav M. Beltukov, and Dmitry A. Parshin, Spectral properties of plasmon resonances in a random impedance network model of binary nanocomposites, *JETP Letters* **103**, 577-581 (2016).
<https://doi.org/10.1134/S0021364016090046>
11. **Nikita A. Olekhno**, Yaroslav M. Beltukov, and Dmitry A. Parshin, Resonances in the generalized LC model of granular metal-dielectric nanocomposites, *Physics of the Solid State* **57**, 2479-2488 (2015).
<https://doi.org/10.1134/S1063783415120252>

Conference Proceedings

1. Alexey A. Dmitriev, Alina D. Rozenblit, Vadim A. Porvatov, Anastasia A. Molodtsova, Ekaterina M. Puhtina, Oleg I. Burmistrov, Dmitry S. Filonov, Anton Souslov, and **Nikita A. Olekhno**, Statistical Correlations in Active Matter Based on Robotic Swarms, *2021 International Conference Engineering and Telecommunication (En&T)*, 1 (2021).
<https://doi.org/10.1109/EnT50460.2021.9681775>
2. Vadim A. Porvatov, Alina D. Rozenblit, Alexey A. Dmitriev, Oleg I. Burmistrov, Daria A. Petrova, Georgy Yu. Gritsenko, Ekaterina M. Puhtina, Egor I. Kretov, Dmitry S. Filonov, Anton Souslov, and **Nikita A. Olekhno**, Optimizing self-rotating bristle-bots for active matter implementation with robotic swarms, *Journal of Physics: Conference Series* **2086**, 012202 (2021).
<https://doi.org/10.1088/1742-6596/2086/1/012202>
3. Alina D. Rozenblit, **Nikita A. Olekhno**, Alexey A. Dmitriev, Pavel S. Seregin, and Maxim A. Gorlach, Topological edge states of anyon pairs emulated in electric circuits, *Journal of Physics: Conference Series* **2015**, 012127 (2021).
<https://doi.org/10.1088/1742-6596/2015/1/012127>
4. Pavel Seregin, Oleg Burmistrov, Georgiy Solomakha, Egor Kretov, **Nikita Olekhno**, and Alexey Slobozhanyuk, Circularly polarized RF coil for energy harvesting in clinical MRI, *Journal of Physics: Conference Series* **2015**, 012134 (2021).
<https://doi.org/10.1088/1742-6596/2015/1/012134>
5. **Nikita A. Olekhno**, Alina D. Rozenblit, Valerii I. Kachin, Oleg I. Burmistrov, Alexey A. Dmitriev, Pavel S. Seregin, Dmitry V. Zhirihin, and Maxim A. Gorlach, Higher-Order Topological States in the Extended Two-Dimensional SSH Model and Their Electric Circuit Implementation, OSA Technical Digest (Optical Society of America, 2021), paper FTu1M.5 (2021).
https://doi.org/10.1364/CLEO_QELS.2021.FTu1M.5
6. Janet Zhong, Alexander V. Poshakinskiy, Yongguan Ke, **Nikita A. Olekhno**, Chaohong Lee, Yuri S. Kivshar, and Alexander N. Poddubny, Topological and Localized States in Waveguide Quantum Electrodynamics, OSA Technical Digest (Optical Society of America, 2021), paper FTh1P.3 (2021).
https://doi.org/10.1364/CLEO_QELS.2021.FTh1P.3

7. **Nikita Olekhno**, Alina Rozenblit, Pavel Seregin, and Maxim Gorlach, Statistics-Induced Topological States of Interacting Anyons, *AIP Conference Proceedings* **2300**, 020093 (2020).
<https://doi.org/10.1063/5.0031727>
8. Alina D. Rozenblit, Vadim A. Porvatov, Daria A. Petrova, Ivan S. Khakhalin, Konstantin P. Kotlyar, Georgy Yu. Gritsenko, Anastasia A. Evreiskaya, Mikhailina F. Lebedeva, Egor I. Kretov, Dmitry S. Filonov, Anton Souslov, and **Nikita A. Olekhno**, Diffusive dynamics and jamming in ensembles of robots with variable friction, *Journal of Physics: Conference Series* **1695**, 012201 (2020).
<https://doi.org/10.1088/1742-6596/1695/1/012201>
9. Polina A. Ivanova, **Nikita A. Olekhno**, Valery I. Kachin, Dmitry V. Zhirihin, Pavel S. Seregin, and Maxim A. Gorlach, Realizing topological corner states in two-dimensional Su-Schrieffer-Heeger model with next-nearest neighbor couplings, *Journal of Physics: Conference Series* **1695**, 012142 (2020).
<https://doi.org/10.1088/1742-6596/1695/1/012142>
10. Janet Zhong, Alexander V. Poshakinskiy, Yongguan Ke, **Nikita A Olekhno**, Chaohong Lee, Yuri S. Kivshar, and Alexander N. Poddubny, Interaction-induced topological phases of photons interacting with atoms, *Frontiers in Optics, OSA Technical Digest (Optical Society of America, 2020)*, paper FM5A.2 (2020).
<https://doi.org/10.1364/FIO.2020.FM5A.2>
11. **Nikita A. Olekhno**, Egor I. Kretov, Andrei A. Stepanenko, Polina A. Ivanova, Vitaly V. Yaroshenko, Ekaterina M. Puhtina, Dmitry S. Filonov, Barbara Cappello, Ladislau Matekovits, and Maxim A. Gorlach, Topological States of Interacting Photon Pairs Emulated in a Topolectrical Circuit, 2019 Photonics & Electromagnetics Research Symposium - Fall (PIERS — Fall), 1082-1086 (2020).
<https://doi.org/10.1109/PIERS-Fall148861.2019.9021710>
12. **Nikita Olekhno**, Mihail Petrov, Ivan Iorsh, Andrey A. Sukhorukov, and Alexander Solntsev, Generating Quantum States of Surface Plasmon-Polariton Pairs with a Nonlinear Nanoparticle, 2019 Conference on Lasers and Electro-Optics Europe & European Quantum Electronics Conference (CLEO/Europe-EQEC), paper ck_p-1 (2019).
<https://doi.org/10.1109/CLEOE-EQEC.2019.8872429>
13. Mihail I. Petrov, Anna A. Nikolaeva, Kristina S. Frizyuk, and **Nikita A. Olekhno**, Second harmonic generation and spontaneous parametric down-conversion in Mie nanoresonators, *Journal of Physics: Conference Series* **1124**, 051021 (2018).
<https://doi.org/10.1088/1742-6596/1124/5/051021>
14. **Nikita A. Olekhno**, Mihail I. Petrov, and Ivan V. Iorsh, Generation of surface plasmon-polariton pairs by a nonlinear nanoparticle, *Journal of Physics: Conference Series* **1092**, 012105 (2018).
<https://doi.org/10.1088/1742-6596/1092/1/012105>
15. **Nikita A. Olekhno**, Mihail I. Petrov, and Ivan V. Iorsh, Generation of photon and plasmon pairs by a nonlinear semiconductor nanoparticle, *OSA Technical Digest (online) (Optical Society of America, 2018)*, paper NpM21.5 (2018).
<https://doi.org/10.1364/NP.2018.NpM2I.5>

16. **Nikita A. Olekhno**, Mihail I. Petrov, and Ivan V. Iorsh, Spontaneous parametric down-conversion of light by a dielectric nanoparticle, *Journal of Physics: Conference Series* **993**, 012022 (2018).
<https://doi.org/10.1088/1742-6596/993/1/012022>
17. **Nikita A. Olekhno**, Yaroslav M. Beltukov, 2D-plasmons in a Random Impedance Network Model of Disordered Nanocomposites, 2017 Progress In Electromagnetics Research Symposium - Spring (PIERS), 1529-1534 (2018).
<https://doi.org/10.1109/PIERS.2017.8261989>
18. **N.A. Olekhno**, Yaroslav M. Beltukov, and Dmitry A. Parshin, Surface modes of big clusters and resonances in generalized *LC*-model of metal-dielectric nanocomposites, *Journal of Physics: Conference Series* **661**, 012042 (2015).
<https://doi.org/10.1088/1742-6596/661/1/012042>
19. **Nikita A. Olekhno**, Yaroslav M. Beltukov, and Dmitry A. Parshin, A theory of spectral properties of disordered metal-semiconductor nanocomposites, *Journal of Physics: Conference Series* **643**, 012118 (2015).
<https://doi.org/10.1088/1742-6596/643/1/012118>
20. **Nikita A. Olekhno**, Yaroslav M. Beltukov, and Dmitry A. Parshin, Resonances in random reactance networks with fluctuating entries, *Journal of Physics: Conference Series* **572**, 012037 (2014).
<https://doi.org/10.1088/1742-6596/572/1/012037>
21. **Nikita A. Olekhno**, Yaroslav M. Beltukov, and Dmitry A. Parshin, Spectral properties of random *LC* networks with uniformly distributed entries, *Journal of Physics: Conference Series* **541**, 012075 (2014).
<https://doi.org/10.1088/1742-6596/541/1/012075>

Awards

1. Honorable Mention in Best Student Paper Award at PIERS-2019 Xiamen
2. Diploma for the featured oral presentation at 19th Russian Youth Conference on Physics of Semiconductors and Nanostructures, Opto- and Nanoelectronics, 2017
3. Best Student Paper Award at PIERS 2017 St. Petersburg
4. Diploma for the best poster presentation at 3rd International School and Conference “Saint Petersburg OPEN”, 2016
5. First prize in Young Scientist Award Competition at Ioffe Institute International Winter School on Semiconductor Physics, 2016
6. Diploma for the best poster presentation at International Youth Conference PhysicA.SPb/2015
7. Diploma for the best poster presentation at 2nd International School and Conference “Saint Petersburg OPEN”, 2015
8. Bronze medal (Third prize) as the Student of the Year in Peter the Great Polytechnic University, 2014

9. First prize for the oral talk at Peter the Great Polytechnic University Week of Science, 2014
10. Second prize in Young Scientist Award Competition at Ioffe Institute International Winter School on Semiconductor Physics, 2014
11. Second prize for the oral talk at Peter the Great Polytechnic University Week of Science, 2013
12. Second prize in Saint Petersburg Open Olympiade on Physics for the Students of Universities, 2013

Scholarships

1. President of Russian Federation Scholarship for Young Scientists (starting 2022)
2. SPIE 2021 Optics and Photonics Education Scholarship (2021)
3. “Basis” Foundation Scholarship for PhD students in Theoretical Physics (2018 - 2021)
4. President of Russian Federation Scholarship for PhD students (2017 - 2020)
5. “Dynasty” Scholarship for Master students in Theoretical Physics (2015 - 2017)
6. President of Russian Federation Scholarship for Master students (2016 - 2017)
7. Alferov’s Foundation Scholarship for Master students (2015 - 2016)
8. Saint Petersburg Administration Scholarship for the winners of the grant competition for the students of universities (2015, 2017, 2018)
9. Peter the Great Polytechnic University Scholarship for the excellence in study and achievements in scientific research (2013 - 2015)
10. Ioffe Scholarship for students (2013)
11. Lift to the Future Scholarship (2013)
12. Saint Petersburg Administration Scholarship for Students in Physics (2011 - 2013)