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Google scholar h-index 15

## RESEARCH INTERESTS

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One of a global problem in the field of optical technologies and photonics is creation of optical microcavities with a high-quality factor being compatible with planar technologies. The high-Q resonators allow to accumulate large densities of electromagnetic energy in a small volume of space. During my BS and MS, I was studying whispering gallery mode cavities. Record quality factor was reached in spherical resonators, which shape and size aren't compatible with planar technologies. During PhD program, I explored resonators supporting optical bound states in the continuum (BICs), which are characterized by infinity large Q-factor limited only by material losses and simple cavity design including planar one, for example, a grating or even a single cylinder. Now I'm working on active BICs devices, made from perovskite, chiral and gyrotropic materials. All results were published in high-impact journals (PRL, ACS Photonics, PRB) and supported by my personal grants and group research grants.

## EDUCATION

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**Department of Nanophotonics and Metamaterials,** 2019  
**ITMO University, St.Petersburg, Russia**  
**PhD, Physics**  
Dissertation: « Optical bound states in the continuum in one- and two-dimensional photonic structures»

**Department of Physics and Nanotechnology,**  
**St.Petersburg National Research Academic University, Russian**  
**Academy of Science**  
**MS, Physics**  
Dissertation: «Whispering gallery modes in dielectric microdisks resonators» 2015

## **RESEARCH EXPERIENCE**

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### **Department of Nanophotonics and Metamaterials, ITMO University, St.Petersburg**

- Investigated high quality whispering gallery modes in microdisks, microrings and racetrack resonators: finding optimal design, calculating modal spectrum, analyzing experimental spectra.
- Investigated optical bound states in the continuum and its transformation into the resonant state with finite lifetime due to influence of substrate and surface roughness
- Developed numerical models for calculation the eigenmodes, reflection and transmission spectra of periodic one- and two-dimensional dielectric and perovskite structures. The modes take into account substrate, losses, surface roughness.
- Developed numerical models for calculation the scattering spectra of single dielectric particles. Improved the default Comsol Multiphysics Module resulting in increasing calculation speed by an order.
- Investigated quasi bound states in the continuum in dielectric cylinders.
- Investigating the quality factor of bound states in the continuum in finite photonic structures and its dependence on different factors: the symmetry transformations, length, (i.e. number of periods), surface roughness, imperfections, substrate influence, etc.
- Multipole decomposition analysis of bound states in the continuum in periodic arrays and photonics crystal slab
- Microwave experiment

## **PROFESSIONAL SKILLS**

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Optics: bound states in the continuum, microresonators, photonic crystals, whispering gallery modes, semiconductor lasers, nonlinear optics

Modeling: Comsol Multiphysics, Lumerical, CST Studio, SMUTHI, Fourier modal method (FMM)

Programming: Matlab, Mathematica, Fortran, C, C++, Python

Theoretical photonics: classical electrodynamics, quantum mechanics, multipolar decomposition method, coupled-mode theory (CMT), rigorous coupled wave analysis (RCWA), group theory

Experiment: S-parameters measurement in microwave range

## LANGUAGE SKILLS

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*English* - upper-intermediate level

*German, Spanish, Italian* - basic level

## HONORS & AWARDS & SCHOLARSHIPS

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**Leader** of the group research grant supported by Russian Science Foundation (RSF) “Spin-polarization nanophotonics: new concepts and devices” (2023-2026)

**Leader** of the group research grant supported by Russian Science Foundation (RSF) “Bound states in the continuum supported by one-dimensional periodic photonic structures with Kerr nonlinearity” (2020-2022)

**Winner** of Award of the St. Petersburg Government for the young scientists (2021)

**Winner** of Award of the St. Petersburg Government for the young scientists (2020)

**Winner** of Award of the St. Petersburg Government for the PhD students and young researchers (2019)

### IEEE Photonics Society (IPS) 2019 Graduate Student Fellowships

**Leader** of the group research grant supported by Russian Fund of Basic Research (RFBR) “Optical signal filtering and transmission via bound states in the radiation continuum” (2018 - 2020)

**Winner** of the personal research grant competition organized by Foundation for the Advancement of Theoretical Physics and Mathematics “BASIS” (2018)

### Russian Federation President Scholarship (2018)

**Best poster award**, International Winter School on Physics of Semiconductor (St Petersburg, Russia, 2017)

**Finalist** of “FASIE (Fund Assistance to Small Innovative Enterprises)” grant in the “Modern materials and their manufacturing techniques” section (St.Petersburg, Russia, 2017)

## **SCIENCE SCHOOLS AND TRAINEESHIP:**

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**2021 — Traineeship program** “Modular program for the development of leaders of scientific groups” (4 days)

ITMO University, St.Petersburg, Russia

**2021 — Traineeship program** “Public speaking skills” (2 days)

ITMO University, St.Petersburg, Russia

**2020 — Traineeship program** “Oratory for University Teachers” (2 days)

ITMO University, St.Petersburg, Russia

**2019 — 39th EUROMETA Distributed School on Metamaterials** “Spatial, temporal and phase control in meta materials and metasurfaces: new frontiers in wave tailoring” (2 days)

Rome, Italy

**2018 — 28th Jyväskylä Summer School (3 weeks)** - Jyväskylä, Finland

*Courses:*

- *Optomechanics in quantum regime (2ECTS)*
- *Nanophotonics: Fluorescence and Plasmon Controlled Fluores (2ECTS)*
- *Data analytics & Machine learning & Optimization (4ECTS)*

**2016, 2017 — Doctoral Summer School on Nanophotonics and Metamaterials (1 week)** - St.Petersburg, Russia.

- course on Metamaterials and Nanophotonics consisting of 40 hours of lectures, practical work, self-study, and examinations. 6 ECTS Credits.

**2015 — Traineeship program** (2 weeks) Joensuu University of Eastern Finland, Finland

## **PUBLICATIONS (selected)**

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**2024**

**1. Fast simulation of light scattering and harmonic generation in axially symmetric structures in COMSOL**

Gladyshev, S., Pashina, O., Proskurin, A., Nikolaeva, A., Sadrieva, Z., Bogdanov, A., Frizyuk, K., *ACS Photonics*, <https://doi.org/10.1021/acsp Photonics.3c0116>

**2. High-Q Mie resonators for refractive index sensing**

Esmaeel Zanganeh, Zarina Sadrieva, Polina Kapitanova and Andrey Bogdanov,  
*Phys. Rev. Applied*

**2023**

**3. Optical Biosensor in a One-Dimensional Photonic Structure with Bound States in the Continuum**

Nazarov R., Sadrieva Z., *Optical Memory and Neural Networks*, 32.Suppl 1 (2023): S97-S101, <https://doi.org/10.3103/S1060992X23050156>

**4. Transporting Particles with Vortex Rings**

Gulinyan V., Kuzikov F., Podgornyi R., Shirkin D., Zakharov I., Sadrieva Z., Korobkov M., Muzychenko Ya., Kudlis A., *Fluids*, 8(12), 315 <https://doi.org/10.3390/fluids8120315> **IF 1.9**

**2022**

**5. Связанные состояния непрерывного спектра в фотонных структурах**

К.Л. Кошелев, З.Ф. Садриева, А.А. Щербаков, Ю.С. Кившарь, А.А. Богданов, *Успехи Физических Наук* (2022) DOI: <https://doi.org/10.3367/UFNr.2021.12.039120> [Accepted] **IF 3.361**

**2021**

**6. Observation of Ultrafast Self-Action Effects in Quasi-BIC Resonant Metasurfaces**

I. Sinev, K. Koshelev, Z. Liu, A. Rudenko, K. Ladutenko, A. Shcherbakov, Z. Sadrieva, M. Baranov, T. Itina, J. Liu, A. Bogdanov, Yu. Kivshar. *Nano Letters* 21(20), 8848–8855 (2021) <https://doi.org/10.1021/acs.nanolett.1c03257> **Q1, IF: 11.189**

**7. Observation of an Accidental Bound State in the Continuum in a Chain of Dielectric Disks**

M.S. Sidorenko, O.N. Sergaeva, Z.F. Sadrieva, C. Roques-Carmes, P.S. Muraev, D.N. Maksimov, and A.A. Bogdanov *Phys. Rev. Applied* 15, 034041 (2021) <https://doi.org/10.1103/PhysRevApplied.15.034041> **Q1, IF: 4.985**

**8. Bound states in the continuum in periodic structures with structural disorder**

Maslova, E. E., Rybin, M. V., Bogdanov, A. A., & Sadrieva, Z. F. *Nanophotonics*, 10(17), 4313-4321 (2021) <https://doi.org/10.1515/nanoph-2021-0475> **Q1, IF: 8.449;**

**2020**

**9. Polarization-controlled selective excitation of Mie resonances in a dielectric nanoparticle on a coated substrate**

D.A. Pidgayko, Z.F. Sadrieva, K.S. Ladutenko, and A.A. Bogdanov, Phys. Rev. B 102, 245406 (2020) <https://doi.org/10.1103/PhysRevB.102.245406> Q1, IF: 3.836;

## 2019

### 10. Bound states in the continuum and Fano resonances in the strong mode coupling regime

A.A. Bogdanov, K.L. Koshelev, P.V. Kapitanova, M.V. Rybin, S.A. Gladyshev, Z. F. Sadrieva, K. B. Samusev, Y. S. Kivshar and M. F. Limonov, Advanced Photonics 1 (1), 016001 (2019) <https://doi.org/10.1117/1.AP.1.1.016001>

[The Editors-in-Chief Choice Award 2019]

[статья входит 1% самых цитируемых работ по физике согласно базе WoS]

### 11. Multipolar origin of bound states in the continuum

Z. F. Sadrieva and K. Frizyuk, M. Petrov, Yu. Kivshar, and A. Bogdanov, Phys. Rev. B 100, 115303 (2019) <https://doi.org/10.1103/PhysRevB.100.115303> Q1, IF: 4.036

### 12. Experimental observation of symmetry protected bound state in the continuum in a chain of dielectric disks

Z.F. Sadrieva, M.A. Belyakov, M.A. Balezin, P.V. Kapitanova, E.A. Nenasheva, A.F. Sadreev, A.A. Bogdanov, Phys. Rev. A 99, 053804 (2019) <https://doi.org/10.1103/PhysRevA.99.053804> Q1, IF: 2.907

### 13. Enhanced temperature-tunable narrow-band photoluminescence from resonant perovskite nanograting

E.Y. Tiguntseva and Z.F. Sadrieva, B.V. Stroganov, Y.V. Kapitonov, F. Komissarenko, Applied Surface Science 473, 419-424 (2019) <https://doi.org/10.1016/j.apsusc.2018.12.084> Q1, IF: 4.439

## 2018

### 14. Strong coupling between excitons in transition metal dichalcogenides and optical bound states in the continuum

K. L. Koshelev, S. K. Sychev, Z. F. Sadrieva, A. A. Bogdanov and I. V. Iorsh, Physical Review B 98 (16), 161113(R) (2018) <https://doi.org/10.1103/PhysRevB.98.161113> Q1, IF: 3.736

### 15. High-Q supercavity modes in subwavelength dielectric resonators

Mikhail V Rybin, Kirill L Koshelev, Zarina F Sadrieva, Kirill B Samusev, Andrey A Bogdanov, Mikhail F Limonov, Yuri S Kivshar, Physical review letters, Vol.119, No. 24, pp.243901 (2017) <https://doi.org/10.1103/PhysRevLett.119.243901> Q1, IF: 9.161

[статья входит 1% самых цитируемых работ по физике согласно базе WoS]

## 2017

**16. Transition from Optical Bound States in the Continuum to Leaky Resonances: Role of Substrate and Roughness**

Sadrieva Z.F., Sinev I.S., Koshelev K.L., Samusev A., Iorsh I.V., Takayama O., Malureanu R., Bogdanov A.A., Lavrinenko A.V., ACS Photonics - 2017, Vol. 4, No. 4, pp. 723-727 <https://doi.org/10.1021/acsp Photonics.6b00860> Q1, IF: 7.143

**17. Single-mode channel optical waveguides formed by the glass poling**

Valentina Zhurikhina, Zarina Sadrieva, Andrey Lipovskii, Optik, Vol.137,pp.203-208 (2017) <https://doi.org/10.1016/j.ijleo.2017.03.006>

IF: 1.914

**18. Light outcoupling from quantum dot-based microdisk laser via plasmonic nanoantenna**

E.I. Moiseev, N.V. Kryzhanovskaya, Yu.S. Polubavkina, M.V. Maximov, M.M. Kulagina, Yu.M. Zadiranov, A.A. Lipovskii, I.S. Mukhin, A. Mozharov, F.E. Komissarenko, Z.F. Sadrieva, et.al, ACS Photonics, vol. 4 (2), pp. 275–281 (2017) <https://doi.org/10.1021/acsp Photonics.6b00552> Q1, IF: 7.143

**2015**

**19. Mode selection in InAs quantum dot microdisk lasers using focused ion beam technique**

Bogdanov A.A., Mukhin I.S., Kryzhanovskaya N.V., Maximov M.V., Sadrieva Z.F., Kulagina M.M., Zadiranov Y.M., Lipovskii A.A., Moiseev E.I., Kudashova Y.V., Zhukov A.E. Optics Letters - 2015, Vol. 40, No. 17, pp. 4022-4025 <https://doi.org/10.1364/OL.40.004022> Q1, IF: 3.776

**2014**

**20. Ultrasmall microdisk and microring lasers based on InAs/InGaAs/GaAs quantum dots**

Maximov M.V., Kryzhanovskaya N.V., Nadtochiy A.M., Moiseev E.I., Shostak I.I., Bogdanov A.A., Sadrieva Z.F., Zhukov A.E., Lipovskii A.A., Karpov D.V., Laukkanen J., Tommila J. Nanoscale Research Letters - 2014, Vol. 9, No. 1, pp. 657 IF: 4.703

**2013**

**21. Формирование канальных оптических волноводов при поляризации стекла**

(In Russian) Журихина В.В., Садриева З.Ф. Научно-технические ведомости Санкт-Петербургского государственного политехнического университета. Физико-математические науки - 2013. - Т. 1. - № 182. - С. 105-111

**CONFERENCE TALKS**

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**2022**

**1. Influence Of Structural Disorder On Bound States In The Continuum In Periodic Bilayer Array Of Dielectric Rods**

Scientific Conference With International Participation “Yenisey photonics – 2022” (Krasnoyarsk, Russia) [oral]

**2021**

**2. Accidental bound state in the continuum in a chain of dielectric disks**

VI International Conference on Metamaterials and Nanophotonics MetaNano 2021 (St Petersburg, Russia) [oral]

**3. Accidental bound state in the continuum in a chain of dielectric disks**

CLEO/Europe Conference on Lasers and Electro-Optics/Europe - European Quantum Electronics Conference, 2021 (online) [oral]

**4. Practical class in COMSOL [invited]**

The third School on Advanced Light-Emitting and Optical Materials (SLALOM), June 28-30, (2021), Vladivostok, Russia

**2020**

**5. Transformation of bound state in the continuum into a resonant state in disordered structure**

V International Conference on Metamaterials and Nanophotonics MetaNano 2020 (St Petersburg, Russia) [oral]

**2019**

**6. Bound states in the continuum supported by two-layered wires structure**

IV International Conference on Metamaterials and Nanophotonics MetaNano 2019 (St Petersburg, Russia) [oral]

**7. Multipole analysis of bound states in the continuum supported by a periodic array of spheres**

The 13th International Congress on Artificial Materials for Novel Wave Phenomena METAMATERIALS-2019, Rome, Italy [oral]

**2018**

**8. Strong coupling between excitons in transition metal dichalcogenides and optical bound states in the continuum**

Nanophotonics and Micro/Nano Optics International Conference NANOP-2018, Rome, Italy [poster]



**9. Effect of finite lateral size of dielectric grating on optical bound state in the continuum**

III International Conference on Metamaterials and Nanophotonics MetaNano 2018, Anapa, Russia [poster]

**10. Bound state in the continuum supported by a low refractive index contrast waveguide in a woodpile structure**

III International Conference on Metamaterials and Nanophotonics MetaNano 2018, Anapa, Russia [poster]

**11. Photoluminescence behaviour of nanoimprinted halide perovskite at low temperatures**

SPIE Photonics Europe 2018, Strasbourg, France [poster]

**2017**

**12. Photoluminescence behavior of nanoimprinted halide perovskite at low temperatures**

II International Conference on Metamaterials and Nanophotonics MetaNano 2017, Vladivostok, Russia [oral]

**13. Destruction of Symmetry Protected Optical Bound State in the Continuum by High-Index Substrate and Roughnesses**

Nanophotonics and Micro/Nano Optics International Conference NANOP-2017, Barcelona, Spain [poster]

**14. High-Q microresonators based on bound states in the continuum for lasers**

International Conference “International Winter School on Physics of Semiconductors 2017 [poster]

**TEACHING EXPERIENCE**

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**Scientific practice of schoolchildren,  
Faculty of Physics, ITMO University**  
Project Leader

2021 - present

**Faculty of Physics,  
ITMO University, St.Petersburg, Russia**

2020 - present

Lecturer, “Numerical modeling in optics and photonics” (English-language program)

**Department of Nanophotonics and Metamaterials,  
ITMO University, St.Petersburg, Russia**

April 2019

Assistant to Lecturer, Numerical modelling

**Department of Nanophotonics and Metamaterials,  
ITMO University, St.Petersburg, Russia**

September 2015 - December  
2015

Graduate Teaching Assistant, Mathematical Methods in  
Physics

September 2016 - December  
2016

## **OTHER RELEVANT EXPERIENCE**

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### ***WORK EXPERIENCE***

**St.Petersburg Peter the Great Politechnical  
University**

September 2012 - September  
2015

Engineer

**Department of Nanophotonics and Metamaterials,  
ITMO University, St.Petersburg, Russia**

from December 2015

Engineer

### ***VOLUNTEERING***

**Department of Nanophotonics and Metamaterials,  
ITMO University, St.Petersburg, Russia**

2016 - 2018

responsible for scientific seminars and meetings

**I - IV International Conference on Metamaterials and Nanophotonics “METANANO”** from 2015

Volunteering in organisation committee

**Faculty of Photonics and Optical Information,  
ITMO University, St.Petersburg, Russia** 2017 - 2018

Secretary of the State Examination Board

**Doctoral Summer School on Nanophotonics and Metamaterials** 2017-2019  
(<https://metalab.ifmo.ru/school/>)

Technical Committee Chair

**INTERNATIONAL INSTITUTE "PHOTONICS AND OPTICAL INFORMATION TECHNOLOGY",  
ITMO University, St.Petersburg, Russia** April 2019 - December 2023

PhD student curator