

Sergey Balakirev

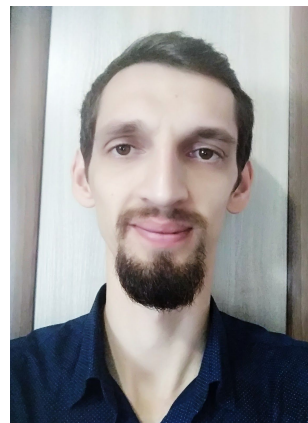
Researcher, *Research and Education Center "Nanotechnologies"*

Assistant Professor, *Department of Nanotechnologies and Microsystems*

*Institute of Nanotechnologies, Electronics and Equipment Engineering,
Southern Federal University, Taganrog – Rostov-on-Don, Russia*

Candidate of Sciences (Ph.D.), awarded on June 6, 2019

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SUMMARY

- Field of my current research is the formation of nanostructures by molecular beam epitaxy (MBE) for quantum computing and quantum cryptography.
- Ph.D. in Nanotechnology.
- 9 years of experience with MBE equipment.
- Analytical modeling (theory of nucleation and crystal growth), numerical modeling (finite-difference methods), stochastic simulation (Monte Carlo methods) using MATLAB, C++, MathCAD, Maple and other software.
- Author of more than 80 publications, 6 certificates of official registration of computer program, 2 patent applications.
- Winner of scientific conferences, competitions and scholarships ([my awards](#)).
- English language level is C1 ([certificate](#)).
- Interested in physics of low-dimensional systems, quantum mechanics, single photonics.

EDUCATION

September 2008 - August 2012

baccalaureate, specialty "Nanotechnologies",
Southern Federal University, Taganrog, Russia
[diploma with distinction](#)

September 2012 - August 2014

magistracy, specialty "Nanotechnologies and microsystems",
Southern Federal University, Taganrog, Russia
[diploma with distinction](#), [defended in English](#)

September 2014 - September 2018

postgraduate course, specialty "Electronics, radioengineering and communication systems",
Southern Federal University, Taganrog, Russia
[diploma with distinction](#)

EXTRA COURSES

- Training Course "Speed reading, super memory, mnemonics", Rostov-on-Don (2011)
- Winner in Program "Continuous search for promising employees among university students", Taganrog (2013)
- Electronic Course "Entrepreneurial education", online (2014)
- Summer School of Project Management, Taganrog (2014)
- Technical Forum "Breakpoint", Rostov-on-Don (2015)
- All-Russian Engineering Festival, Taganrog (2016)
- Series of Online Workshops "Information tools for authors of scientific publications", online (2017)
- 2nd European School on Crystal Growth, Varna, Bulgaria (2018)
- Certification of specialists in conducting a full cycle of testing nanotechnology products, Moscow (2019)

PROFESSIONAL EXPERIENCE

July 2010 - August 2010

Assistant engineer (trainee), JSC "Monocrystal", Stavropol, Russia

- Studying the process of growing synthetic sapphire for optoelectronic industry
- Basics of organizing work in a large factory
- 5S methodology to organize a workspace
- Introduction to the ISO standards

September 2010 - August 2014

Science student, Research and Education Center "Nanotechnologies", Taganrog, Russia

- Learning III-V semiconductor growth by MBE
- Development of an analytical model of InAs/GaAs quantum dot formation taking into account the arsenic pressure effect and carrying out theoretical studies
- Experimental studies of the formation of GaAs nanowires by self-catalyzed method
- Winner of 4 university scientific conferences

September 2014 - May 2015

Junior researcher, International Research Center "Intellectual Materials", Rostov-on-Don, Russia

- Learning Monte Carlo simulation methods
- Development of a kinetic Monte Carlo model of the GaAs/GaAs(001) growth taking into account the arsenic pressure effect
- Theoretical and experimental studies of the MBE growth of III-V semiconductor heterostructures
- Oral and poster presentations at 3 international conferences

January 2016 - December 2016

Grant contractor, Russian Fund for Basic Research project #16-37-60033 entitled "Study of the physical and technological processes of the MBE formation of contacts to active regions of III-V nanoheterostructures for promising elements of nanoelectronics and photonics with lateral transfer of charge carriers", Taganrog, Russia

- Theoretical studies of the MBE growth of GaAs on surfaces with different orientation
- Supervision of 2 students' projects on Monte Carlo simulation of the GaAs growth
- Poster presentations at 3 international conferences

January 2017 - December 2018

Grant contractor, Project of the President Council #MK-2629.2017.8 entitled “Research and development of structural and technological solutions for creating active elements of single and nanophotonics based on III-V nanoheterostructures with quantum dots”, Taganrog, Russia

- Theoretical and experimental studies of fabrication of single- and nanophotonic devices based on III-V heterostructures with quantum dots
- Oral and poster presentations at 4 international conferences

July 2015 - until now

Grant contractor, Russian Science Foundation project #15-19-10006 entitled “Epitaxial heterostructures with regular arrays of self-organized III-V nanostructures”, Taganrog, Russia

- Development of a novel analytical-Monte Carlo model of In/GaAs nanostructure formation by droplet epitaxy considering the temperature influence on the critical thickness of droplet formation.
- Theoretical and experimental studies of the MBE growth in the InAs/AlGaAs droplet epitaxial system
- Oral talk and two poster presentations at the 20th European Conference on Molecular Beam Epitaxy in Munich, Germany (February, 2019)
- Defense of a Ph.D. thesis entitled “Development and research of the technological basis for the synthesis of self-organized In(As)/AlGaAs nanostructures by droplet epitaxy for nanophotonic devices”

February 2018 - until now

Grant manager, Innovation Promotion Fund Project “UMNIK” entitled “Development of heterostructures for single photonic emitters used in quantum cryptographic systems”, Taganrog, Russia

- R&D project aimed at a further commercialization
- Development of heterostructures for single photonic emitters used in quantum cryptographic systems

February 2018 - until now

Assistant professor, Department of Nanotechnologies and Microsystems, Southern Federal University, Taganrog, Russia

- Teaching 10 disciplines (practical and laboratory lessons):
 - Physics and technology of low-dimensional systems
 - Methods of analysis and control of nanostructured materials and systems
 - Micro- and nanoelectronics
 - Micro- and nanotechnologies in electronics
 - Processes of micro- and nanotechnologies
 - Technology of nanostructured materials, micro- and nanosystems
 - Electron and ion beam technologies
 - Plasma processes of nanotechnologies
 - Engineering and computer graphics
 - Biomedical nanotechnologies
- Secretary of the Department of Nanotechnologies and Microsystems
- Support of electronic tests using Moodle learning management system

SELECTED PUBLICATIONS

1. Balakirev, S. V., Solodovnik, M. S., Eremenko, M. M., Konoplev, B. G., & Ageev, O. A. (2019). Mechanism of nucleation and critical layer formation during In/GaAs droplet epitaxy. *Nanotechnology*, 30, 505601. DOI: 10.1088/1361-6528/ab40d6.
2. Balakirev, S. V., Solodovnik, M. S., & Ageev, O. A. (2018). Hybrid Analytical–Monte Carlo Model of In/GaAs (001) Droplet Epitaxy: Theory and Experiment. *Physica Status Solidi (B)*, 255(4), 1700360. DOI: 10.1002/pssb.201700360.
3. Ageev, O. A., Solodovnik, M. S., Balakirev, S. V., Mikhaylin, I. A., & Eremenko, M. M. (2017). Monte Carlo simulation of the kinetic effects on GaAs/GaAs (001) MBE growth. *Journal of Crystal Growth*, 457, 46-51. DOI: 10.1016/j.jcrysgro.2016.05.039
4. Ageev, O. A., Solodovnik, M. S., Balakirev, S. V., & Eremenko, M. M. (2016). Kinetic Monte Carlo simulation of GaAs (001) MBE growth considering the V/III flux ratio effect. *Journal of Vacuum Science & Technology B*, 34(4), 041804. DOI: 10.1116/1.4948514.
5. Ageev, O. A., Balakirev, S. V., Solodovnik, M. S., & Eremenko, M. M. (2016). Effect of interaction in the Ga–As–O system on the morphology of a GaAs surface during molecular-beam epitaxy. *Physics of the Solid State*, 58(5), 1045-1052. DOI: 10.1134/S1063783416050024
6. Ageev, O. A., Solodovnik, M. S., Balakirev, S. V., & Mikhaylin, I. A. (2016). Monte Carlo investigation of the influence of V/III flux ratio on GaAs/GaAs (001) submonolayer epitaxy. *Technical Physics*, 61(7), 971-977. DOI: 10.1134/S1063784216070021.
7. Lisitsyn, S. A., Balakirev, S. V., Avilov, V. I., Kolomiytsev, A. S., Klimin, V. S., Solodovnik, M. S., Konoplev, B. G. & Ageev, O. A. (2018). Study of Nanoscale Profiling Modes of GaAs Epitaxial Structures by Focused Ion Beams. *Nanotechnologies in Russia*, 13(1-2), 26-33. DOI: 10.1134/S199507801801007X.
8. Balakirev, S. V., Solodovnik, M. S., Mikhaylin, I. A., Eremenko, M. M., & Ageev, O. A. (2018, December). Analytical–Monte Carlo model of the growth of In nanostructures during droplet epitaxy on the triangle-patterned GaAs substrates. In *Journal of Physics: Conference Series* (Vol. 1124, No. 2, p. 022001). IOP Publishing. DOI: 10.1088/1742-6596/1124/2/022001.
9. Solodovnik, M. S., Karenkikh, O. G., Balakirev, S. V., Petrov, S. I., Ryzhuk, R. V., Alexeev, A. N., & Ageev, O. A. (2018, December). MBE formation of self-catalyzed GaAs nanowires using ZnO nanosized films. In *Journal of Physics: Conference Series* (Vol. 1124, No. 8, p. 081024). IOP Publishing. DOI: 10.1088/1742-6596/1124/8/081024.
10. Ageev, O. A., Balakirev, S. V., Bykov, A. V., Gusev, E. Y., Fedotov, A. A., Jityaeva, J. Y., Il'in, O. I., Il'ina, M. V., Kolomiytsev, A. S., Konoplev, B. G., Krasnoborodko, S. U., Polyakov, V. V., Smirnov, V. A., Solodovnik, M. S. & Zamburg, E. G. (2016). Development of new metamaterials for advanced element base of micro-and nanoelectronics, and microsystem devices. In *Advanced Materials*, vol. 175 (pp. 563-580). Springer, Berlin. DOI: 10.1007/978-3-319-26324-3_40.

VOLUNTEER WORK

January 2013 – February 2013

Volunteer, Nordic Combined World Cup Stage, Novorossiysk, Russia

January 2014 – February 2014

Volunteer, Sochi 2014 Olympic Winter Games, Sochi, Russia

April 2014 – April 2014

Volunteer, Russian Startup Tour, Taganrog, Russia

SOCIAL WORK

September 2008 – June 2014

Group leader

November 2008 – August 2010

Deputy chairman of the trade union committee at the faculty

September 2010 – June 2013

Student council chairman at the faculty

SKILLS

Hard skills:

- Planning and conducting experiments
- Statistical and graphical analysis of data
- Analytical modeling and computer simulation
- Academic writing
- Public speaking
- Foreign languages (English - C1 level, Spanish - B1 level)
- Engineering software and computer languages (MATLAB, C++, MathCAD, Maple, OriginPro, AutoCAD, LabVIEW)
- Common software (Windows OS, Microsoft Office, Git, LaTeX)

Soft skills:

- Verbal, written and personal communication
- Ability to work under minimal supervision
- Ability to work under pressure
- Organization
- Planning and scheduling
- Teamwork
- Conflict resolution
- Critical thinking
- Decision making
- Time management
- Self-motivation
- Adaptability
- Creativity

CONTACTS

Please do not hesitate to contact me in any convenient way.

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RESEARCHER PROFILES

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