

# Georgiy Sapunov

Updated March 14, 2023

**Email:** [sapunovgeorgiy@gmail.com](mailto:sapunovgeorgiy@gmail.com)    **Phone:** +7 (952) 391-3325    **Citizenship:** Russia

**ORCID:** [0000-0002-4314-2178](https://orcid.org/0000-0002-4314-2178)

**Web of Science Researcher ID:** [B-6288-2018](https://www.researcherid.org/B-6288-2018)

**Scopus ID:** [57191375972](https://scopus.org/scopus/authid/detail/authid=57191375972)

**Google Scholar ID:** [mwhiq-kAAAAJ](https://scholar.google.com/citations?user=mwhiq-kAAAAJ)

**Research interests**    Long wavelength vertical-cavity surface-emitting laser, Molecular beam epitaxy, III-V semiconductors on silicon, Nanowires

**Education**    **Alferov University**    Saint-Petersburg, Russia  
PhD in Physics of Condensed Matter    sep 2016 – jul 2021  
Thesis: "Molecular Beam Epitaxy of Gallium Nitride, Gallium Arsenide, and Gallium Phosphide Nanostructures on Silicon"  
Mentor: Bolshakov A. D.

**Saint-Petersburg Academic University**    Saint-Petersburg, Russia  
MS in Electronics and Nanoelectronics    sep 2014 – aug 2016  
Mentor: Bolshakov A. D.

**Tambov State Technical University**    Tambov, Russia  
BS in Nanotechnology    sep 2010 – aug 2014

**Honors and scholarships**    Grant for young scientists of universities and academic institutions located in Saint-Petersburg (Committee on Science and Higher Education)    2020

Scholarship of the Government of the Russian Federation in priority areas of modernization and technological development of the Russian economy (Government of the Russian Federation)    2019

Grant for university students located in Saint-Petersburg, graduate students of universities, industry and academic institutions located in Saint-Petersburg (Committee on Science and Higher Education)    2018

**Skills**    **Molecular beam epitaxy**  
GaAs, GaP and GaP(NAs) planar growth, GaN, GaAs, GaP nanowire growth on silicon substrate using a molecular-beam epitaxy system Veeco GEN-III

**Structure characterisation**  
Reflection high-energy electron diffraction, Atomic Force Microscopy, Raman and Photoluminescence spectroscopy.

Experience in Scanning and Transmission electron microscopy, Secondary ion mass spectrometry and X-ray diffraction data interpretation.

### **Data analysis and visualisation**

Python (NumPy, Pandas, Scikit-learn, Keras, Tensorflow, Matplotlib), Machine learning, Excel, OriginLab, Gwyddion.

### **Computer graphics**

Blender, Gimp, Inkscape.

### **Languages**

Russian (native), English (upper-intermediate), French (intermediate), Japanese (intermediate)

## **Work experience**

### **Changchun Institute of Optics, Fine Mechanics, and Physics**

#### **Bimberg Chinese-German Center for Green Photonics**

Postdoctoral researcher oct 2021 – present

- Study of Wafer Fused 1550 nm Vertical-Cavity Surface-Emitting Lasers, optimization for higher data transfer rate and energy efficiency.

### **Alferov University**

#### **Laboratory of Renewable Energy Sources**

Junior research assistant nov 2016 – aug 2021

Mentor: Bolshakov A.D.

- Study of GaN nanowire formation, morphology optimization for device implementation.
- Study of III-V nanostructure formation on silicon substrates, mainly GaP nanowires with GaP(NAs) heterojunctions.
- GaP(NAs) growth on silicon and sapphire, developing of III-V solar cells on silicon substrates.
- Design, growth and heterostructure optimization for device implementation, such as solar cells with carbon nanotubes as a top contact and flexible LED based on GaP(AsN) nanowires.

## **h-index**

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## **Q1 Publications**

### **Single-Mode High-Speed 1550 nm Wafer Fused VCSELs for Narrow WDM Systems**

Babichev A., Blokhin S., Gladyshev A., Karachinsky L., Novikov I., Blokhin A., Bobrov M., Maleev N., Andryushkin V., Kolodeznyi E., Denisov D., Kryzhanovskaya N., Voropaev K., Ustinov V., Egorov A., Li H., Tian S.C., Han S., Sapunov S., Bimberg D.

*IEEE Photonics Technology Letters (IF: 2.486), 2023.*

#### **Work function tailoring in gallium phosphide nanowires**

Sharov V., Alekseev P., Fedorov V., Nestoklon M., Ankudinov A., Kirilenko D., Sapunov G., Koval O., Cirlin G., Bolshakov A., Mukhin I.

*Applied Surface Science (IF: 6.182), 2021.*

#### **Tailoring Morphology and Vertical Yield of Self-Catalyzed GaP Nanowires on Template-Free Si Substrates**

Fedorov V.V., Berdnikov Y., Sibirev N.V., Bolshakov A.D., Fedina S.V., Sapunov G.A., Dvoretckaia L.N., Cirlin G., Kirilenko D.A., Tchernycheva M., Mukhin I.S.

*Nanomaterials (IF: 5.719), 2021.*

#### **XRD Evaluation of Wurtzite Phase in MBE Grown Self-Catalyzed GaP Nanowires**

Koval O.Y., Fedorov V.V., Bolshakov A.D., Eliseev I.E., Fedina S.V., Sapunov G.A., Udovenko S.A., Dvoretckaia L.N., Kirilenko D.A., Burkovsky R.G., Mukhin I.S.

*Nanomaterials (IF: 5.719), 2021.*

#### **Single GaN Nanowires for Extremely High Current Commutation**

Shugurov K., Mozharov A., Sapunov G., Fedorov V., Tchernycheva M., Mukhin I.

*Physica Status Solidi – Rapid Research Letters (IF: 2.975), 2021.*

#### **Structural and optical properties of self-catalyzed axially heterostructured GaPN/GaP nanowires embedded into a flexible silicone membrane**

Koval O.Y., Fedorov V.V., Bolshakov A.D., Fedina S.V., Kochetkov F.M., Neplokh V., Sapunov G.A., Dvoretckaia L.N., Kirilenko D.A., Shtrom I.V., Islamova R.M.

*Nanomaterials (IF: 5.719), 2020.*

#### **Structural and optical characterization of dilute phosphide planar heterostructures with high nitrogen content on silicon**

Koval O.Y., Fedorov V.V., Kryzhanovskaya N.V., Sapunov G.A., Kirilenko D.A., Pirogov E.V., Filosofov N.G., Serov A.Y., Shtrom I.V., Bolshakov A.D., Mukhin I.S.

*CrystEngComm (IF: 3.269), 2020.*

**Hydrogen passivation of the n-GaN nanowire/p-Si heterointerface**

Shugurov K. Yu., Mozharov A. M., Bolshakov A. D., Fedorov V. V., Sapunov G. A., Shtrom I. V., Uvarov A. V., Kudryashov D. A., Baranov A. I., Mikhailovskii V. Yu., Neplokh V. V., Tchernycheva M., Cirlin G. E., Mukhin I. S.  
*Nanomaterials* (IF: 5.719), 2020.

**Synthesis and optical characterization of GaAs epitaxial nanoparticles on silicon**

Sapunov G. A., Fedorov V. V., Koval O. Y., Sharov V. A., Dvoretckaia L. N., Mukhin I. S., Bolshakov A. D.  
*Crystal Growth & Design* (IF: 4.089), 2019.

**Effects of the surface preparation and buffer layer on the morphology, electronic and optical properties of the GaN nanowires on Si**

Bolshakov A. D., Fedorov V. V., Shugurov K. Yu., Mozharov A. M., Sapunov G. A., Shtrom I. V., Mukhin M. S., Uvarov A. V., Cirlin G. E., Mukhin I. S.  
*Nanotechnology* (IF: 3.584), 2019.

**Effective suppression of antiphase domains in GaP (N)/GaP heterostructures on Si(001)**

Bolshakov A. D., Fedorov V. V., Koval O. Y., Sapunov G. A., Sobolev M. S., Pirogov E. V., Kirilenko D. A., Mozharov A. M., Mukhin I. S.  
*Crystal Growth & Design* (IF: 4.089), 2019.

**Droplet epitaxy mediated growth of GaN nanostructures on Si(111) via plasma-assisted molecular beam epitaxy**

Fedorov V. V., Bolshakov A. D., Kirilenko D. A., Mozharov A. M., Sitnikova A. A., Sapunov G. A., Dvoretckaia L. N., Shtrom I. V., Cirlin G. E., Mukhin I. S.  
*CrystEngComm* (IF: 3.269), 2018.

**Dopant-stimulated growth of GaN nanotube-like nanostructures on Si(111) by molecular beam epitaxy**

Bolshakov A. D., Mozharov A. M., Sapunov G. A., Shtrom I. V., Sibirev N. V., Fedorov V. V., Ubyivovk E. V., Tchernycheva M., Cirlin G. E., Mukhin I. S.  
*Beilstein journal of nanotechnology* (IF: 3.114), 2018.

**Q2 Publications**

**Theoretical modeling of the self-catalyzed nanowire growth: nucleation- and adsorption-limited regimes**

Bolshakov A. D., Mozharov A. M., Sapunov G. A., Fedorov V. V., Dvoretckaia L. N., Mukhin I. S.  
*Materials Research Express* (IF: 1.929), 2017.

### Q3 Publications

#### **1550 nm range high-speed single-mode vertical-cavity surface-emitting lasers**

Blokhin S. A., Babichev A. V., Karachinsky L. Ya., Novikov I. I., Blokhin A. A., Bobrov M. A., Kuzmenkov A. G., Maleev N. A., Andryushkin V. V., Bougrov V. E., Gladyshev A. G., Denisov D. V., Voropaev K. O., Zhumaeva I. O., Ustinov V. M., Li H., Tian S. C., Han S. Y., Sapunov S. A., Egorov A. Yu., Bimberg D.

*Semiconductors (IF: 0.674), 2022.*

#### **Micro lens-enhanced substrate patterning and MBE growth of GaP nanowires**

Bolshakov A. D., Dvoretckaya L. N., Fedorov V. V., Sapunov G. A., Mozharov A. M., Shugurov K. Yu., Shkoldin V. A., Mukhin M. S., Cirlin G. E., Mukhin I. S.

*Semiconductors (IF: 0.674), 2018.*

#### **Self-catalyzed MBE-grown GaP nanowires on Si(111): V/III ratio effects on the morphology and crystal phase switching**

Fedorov V. V., Bolshakov A. D., Dvoretckaya L. N., Sapunov G. A., Kirilenko D. A., Mozharov A. M., Shugurov K. Yu., Shkoldin V. A., Cirlin G. E., Mukhin I. S.

*Semiconductors (IF: 0.674), 2018.*

#### **Effect of the conductive channel cut-off on operation of $n^+ - n - n^+$ GaN NW-based Gunn diode**

Mozharov A. M., Vasiliev A. A., Komissarenko F. E., Bolshakov A. D., Sapunov G. A., Fedorov V. V., Cirlin G. E., Mukhin I. S.

*Semiconductors (IF: 0.674), 2018.*

#### **Core-shell III-nitride nanowire heterostructure: negative differential resistance and device application potential**

Mozharov A. M., Vasiliev A. A., Bolshakov A. D., Sapunov G. A., Fedorov V. V., Cirlin G. E., Mukhin I. S.

*Semiconductors (IF: 0.674), 2018.*

### Q4 Publications

#### **Two approaches to two-stage growth of GaP nanowires**

Berdnikov Y., Fedorov V. V., Sibirev N. V., Bolshakov A. D., Fedina S. V., Sapunov G. A., Dvoretckaya L. A., Mukhin I. S.

*2022 International Conference Laser Optics (ICLO), 2022.*

#### **Self-consistent modeling of MBE self-catalyzed GaAs nanowire growth**

Fedina S. V., Koryakin A. A., Fedorov V. V., Sapunov G. A., Mukhin I. S.

*Journal of Physics: Conference Series (IF: 0.547), 2021.*

**Processes of formation of epitaxial arrays of self-catalytic GaP nanowires on Si (111)**

Fedina S. V., Fedorov V. V., Berdnikov Y. S., Sapunov G. A., Mukhin I. S.  
*Journal of Physics: Conference Series (IF: 0.547), 2021.*

**Epitaxial synthesis of single-domain gallium phosphide on silicon**

Sapunov G. A., Koval O. Yu., Fedorov V. V. Bolshakov A. D.  
*Journal of Physics: Conference Series (IF: 0.547), 2020.*

**Controllable antiphase domain density in dilute nitride GaPN/GaP heterostructures on silicon**

Fedorov V. V., Bolshakov A. D., Koval O. Yu., Sapunov G. A., Sobolev M. S., Pirogov E. V., Kirilenko D. A., Mozharov A. M., Mozharov A. M., Mukhin I. S.  
*Journal of Physics: Conference Series (IF: 0.547), 2020.*

**Synthesis and characterization of GaPN/GaP heterostructures grown on silicon (001)**

Koval O. Yu., Sapunov G. A., Fedorov V. V.  
*Journal of Physics: Conference Series (IF: 0.547), 2020.*

**Conductive AFM study of the electronic properties of individual epitaxial GaN nanowires**

Sharov V., Bolshakov A. D., Fedorov V. V., Shugurov K. Yu., Mozharov A. M., Sapunov G. A., Mukhin I. S.  
*IOP Conference Series: Materials Science and Engineering, 2019.*

**Growth and optical properties of GaPN/GaP heterostructure nanowire array**

Koval O. Yu., Sapunov G. A., Fedorov V. V., Mukhin I. S.  
*Journal of Physics: Conference Series (IF: 0.547), 2019.*

**Synthesis and optical properties study of GaAs epitaxial nanoparticles on silicon**

Sapunov G. A., Koval O. Yu., Sharov V., Dvoretckaya L. N., Mitin D. M., Bolshakov A. D.  
*Journal of Physics: Conference Series (IF: 0.547), 2019.*

**GaN-nanowire/Si solar cell: numerical modeling, fabrication and characterization**

Shugurov K. Yu., Mozharov A. M., Sapunov G. A., Fedorov V. V., Bolshakov A. D., Cirilin G. E., Mukhin I. S.  
*Journal of Physics: Conference Series (IF: 0.547), 2019.*

**Influence of hydrogen plasma passivation on electrical and spectral characteristics of GaN nanowires/Si solar cells**

Shugurov K. Yu., Mozharov A. M., Fedorov V. V., Bolshakov A. D., Sapunov G. A., Mukhin I. S.

*Journal of Physics: Conference Series (IF: 0.547), 2018.*

**GaN nanostructures grown on Si(111) by PA-MBE via droplet epitaxy: SEM and HRTEM study**

Sapunov G. A., Fedorov V. V., Bolshakov A. D., Mozharov A. M., Dvoretck-aia L. N., Kirilenko D. A., Sitnikova A. A., Mukhin I. S.

*Journal of Physics: Conference Series (IF: 0.547), 2018.*

**GaN nanowires on Si(111) substrates via molecular beam epitaxy: growth, electronic and optical properties**

Bolshakov A. D., Fedorov V. V., Sapunov G. A., Mozharov A. M., Dvoretck-aia L. N., Shugurov K. Yu., Shkoldin V., Shtrom I. V., Mukhin M. S., Cirlin G. E., Mukhin I. S.

*Journal of Physics: Conference Series (IF: 0.547), 2018.*

**Epitaxial GaN nanotripods: morphology and crystal structure**

Sapunov G. A., Bolshakov A. D., Fedorov V. V., Mozharov A. M., Kirilenko D. A., Sitnikova A. A., Mukhin I. S.

*Journal of Physics: Conference Series (IF: 0.547), 2018.*

**Influence of interface layer preparation on the electrical and spectral characteristics of GaN/Si solar cells**

Shugurov K. Yu., Mozharov A. M., Sapunov G. A., Fedorov V. V., Bolshakov A. D., Mukhin I. S.

*Journal of Physics: Conference Series (IF: 0.547), 2018.*

**Effect of Ga seeding layer on formation of epitaxial Y-shaped GaN nanoparticles on silicon**

Fedorov V. V., Bolshakov A. D., Mozharov A. M., Sapunov G. A., Shtrom I. V., Kirilenko D. A., Sitnikova A. A., Mukhin I. S.

*Journal of Physics: Conference Series (IF: 0.547), 2017.*

**Modeling the semiconductor devices with negative differential resistance based on nitride nanowires**

Mozharov A. M., Komissarenko F. E., Bolshakov A. D., Fedorov V. V., Sapunov G. A., Cirlin G. E., Mukhin I. S.

*Journal of Physics: Conference Series (IF: 0.547), 2017.*

**Synthesis of GaN nanowires on Si (111) substrates by molecular beam epitaxy**

Bolshakov A.D., Sapunov G.A., Mozharov A.M., Cirlin G.E., Shtrom I.V., Mukhin I.S.

*Journal of Physics: Conference Series (IF: 0.547), 2016.*

Patent

Growth of GaN nanotubes, activated with Si dopant on Si substrates with a thin AlN buffer layer

RU 2 711 824 C1

2020