

# SIMEON I. BOGDANOV

Assistant Professor,  
Department of Electrical and Computer Engineering  
Nick Holonyak, Jr. Micro and Nanotechnology Laboratory  
University of Illinois at Urbana-Champaign,  
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## EDUCATION

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### **Ph.D. in Electrical Engineering**

Northwestern University, Evanston, IL Sep 2008 – Apr 2014  
*Research area:* Optoelectronics, Solid State Physics, Infrared Detection  
*Dissertation topic:* “Planar Engineering for Dark Current Suppression in Type-II InAs/GaSb Superlattice Photodiodes”  
*Research advisor:* Manijeh Razeghi

### **M.S. in Microelectronics**

Royal Institute of Technology, Stockholm, Sweden Sep 2007 - Aug 2008  
*Research area:* Optoelectronics, Solid State Physics, Infrared Detection  
*Thesis title:* “Fabrication, Characterization and Analysis of Type-II InAs/GaSb Superlattice Photodiodes”  
*Research advisor:* Alex Grishin

### **B.S. in Physics**

Ecole Polytechnique, Palaiseau, France Sep 2004 - July 2007  
*Research area:* Optics, Solid State Lasers, Condensed Matter Physics  
*Thesis title:* “A Decoy-State Protocol for the Implementation of Quantum Key Distribution”  
*Research advisor:* Anders Karlsson

## PROFESSIONAL EXPERIENCE

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**University of Illinois at Urbana-Champaign, Urbana, IL** Jan 2020 – present  
Assistant Professor of Electrical Engineering

**University of Illinois at Urbana-Champaign, Urbana, IL** Sep 2019 – Dec 2019  
Adjunct Assistant Professor of Electrical Engineering

**Purdue University, West Lafayette, IN** Apr 2014 – Dec 2019  
*Postdoctoral Research Associate* – Birck Nanotechnology Center  
Research topic: Plasmon-assisted single-photon sources and spin-based sensors  
*Research advisor:* Vladimir M. Shalaev

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**RESEARCH INTERESTS**

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1. Integrated quantum photonics
2. Nanophotonics, optical metamaterials and plasmonics
3. Semiconductor physics and optoelectronics

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**PUBLICATIONS**

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**Journal publications** (*h*-index = 15, 706 citations as of September 2020)

*Articles in preparation*

1. A. Solanki, **S.I. Bogdanov**, A. Rustagi, P. Debashis, N. Dilley, T.-T. Shen, Y.-P. Chen, J. Appenzeller, V.M. ShalaeV, A. Boltasseva and P. Upadhyaya, “Electrical switching of spin-magnon interaction at room temperature”, *in preparation*
2. **S.I. Bogdanov**, O.A. Makarova, A.S. Lagutchev, D. Shah, C.-C. Chiang, S. Saha, A.S. Baburin, I.A. Ryzhikov, I.A. Rodionov, A.V. Kildishev, A. Boltasseva and V.M. ShalaeV, “Deterministic integration of single nitrogen-vacancy centers into nanopatch antennas”, preprint available on *arXiv* at <http://arxiv.org/abs/1902.05996>

*Published articles*

3. Z. Kudyshev\*, **S.I. Bogdanov\***, T. Isacsson, A. Boltasseva and V.M. ShalaeV, “Rapid single-photon emitter classification with neural networks”, *Adv. Quant. Techn.*, **3**, 2000067 (2020), \* = equal contribution. **Highlighted in *Purdue News*, *Science Daily*, *ScienMag*, *Phys.org* and *Eurekalert* (AAAS)**
4. M.Y. Shalaginov, **S.I. Bogdanov**, A.S. Lagutchev, A. Boltasseva and V.M. ShalaeV, “On-chip microwave-spin-plasmon interface”, *ACS Photonics*, **7**, 2018 (2020)
5. C.-C. Chiang, **S.I. Bogdanov**, O. Makarova, X.Xu, S. Saha, D. Shah, Z.O. Martin, D. Wang, A.S. Lagutchev, A.V. Kildishev, A. Boltasseva and V.M. ShalaeV, “Chip-compatible quantum plasmonic launcher”, *Adv. Opt. Mater.*, **8**, 2000889 (2020)
6. **S.I. Bogdanov**, O.A. Makarova, X. Xu, Z. Martin, A.S. Lagutchev, M. Olinde, D. Shah, S.N. Chowdhury, A.R. Gabidullin, I.A. Ryzhikov, I.A. Rodionov, A.V. Kildishev, S.I. Bozhevolnyi, A. Boltasseva, V.M. ShalaeV and J.B. Khurgin, “Plasmonic nanocavities coupled to strongly radiative antennas enable ultrafast quantum photonics”, *Optica*, **7**, 463 (2020) – **among top 10 downloads in *Optica* in May 2020. Highlighted in *Kommersant***
7. N. Sveskul, N.Titova, E.M. Baeva, A.V. Semenov, A.V. Lubenchenko, S. Saha, H. Reddy, **S.I. Bogdanov**, E.E. Marinero, V.M. ShalaeV, A. Boltasseva V.S. Khrapai, A.I. Kardakova, and G.N. Goltsman, “Superconductivity Behavior in Epitaxial TiN Films Points to Surface Magnetic Disorder”, *Phys. Rev. Applied*, **12**, 054001 (2019)
8. **S.I. Bogdanov**, A. Boltasseva and V.M. ShalaeV, “Overcoming quantum decoherence with plasmonics”, *Science*, **364**, 532 (2019)
9. **S.I. Bogdanov**, M.Y. Shalaginov, A.S. Lagutchev, C.-C. Chiang, D. Shah, A.S. Baburin, I.A. Ryzhikov, I.A. Rodionov, A. Boltasseva and V.M. ShalaeV, “Ultrabright and ultrafast room-temperature anti-bunched emission from a nitrogen-vacancy center in a diamond nanocrystal”, *Nano Letters*, **18**, 4837 (2018) – **selected for coverage in *Optics and***

**Photonics News Dec. 2018 issue as “one of the most exciting peer-reviewed articles of the year in Optics”, Highlighted in *Izvestiya***

10. S.K.H. Andersen, **S.I. Bogdanov**, Y. Xuan, O. Makarova, M.Y. Shalaginov, A. Boltasseva, V.M. Shalaev and S. Bozhevolnyi, “Hybrid plasmonic bullseye antennas for efficient photon collection”, *ACS Photonics*, 5, 692 (2018)
11. O.A. Makarova, M.Y. Shalaginov, **S.I. Bogdanov**, U. Guler, A. Boltasseva, A.V. Kildishev and V.M. Shalaev, “Patterned multilayer metamaterial for fast and efficient photon collection from dipolar emitters”, *Opt. Lett.* 42, 3968 (2017)
12. **S.I. Bogdanov**, M.Y. Shalaginov, P. Kapitanova, J. Liu, M. Ferrera, A. Lagutchev, P. Belov, J. Irudayaraj, A. Boltasseva and V. Shalaev, “Spin contrast in Purcell-enhanced nitrogen-vacancy center ensembles in nanodiamonds”, *Phys. Rev. B* 96, 035146 (2017) – **a figure from this article is featured in the review by Hopper et al. *Micromachines*, 9, 437 (2018)**
13. **S.I. Bogdanov**, M.Y. Shalaginov, A. Boltasseva and V.M. Shalaev, “Material platforms for integrated quantum photonics” *Opt. Mat. Exp.* 7, 111 (2017) – **2794 views in 6 months following publication, regularly among top 10 monthly downloads in Optics Materials Express**
14. M. Razeghi, A. Haddadi, A.M. Hoang, G. Chen, **S.I. Bogdanov**, S.R. Darvish, F. Callewaert, P.R. Bijjam and R. McClintock, “Antimonide-based type-II superlattices: a superior candidate for the third generation of infrared imaging systems” *J. of Elec. Mat.* 43(8), 2802 (2014)
15. G. Chen, A.M. Hoang, **S.I. Bogdanov**, A. Haddadi, S.R. Darvish and M. Razeghi, “Effect of sidewall surface recombination on the quantum efficiency in a  $Y_2O_3$  gated type-II InAs/GaSb long-infrared photodetector array” *Appl. Phys. Lett.* 103, 223501 (2013).
16. G. Chen, A.M. Hoang, **S.I. Bogdanov**, P.R. Bijjam, B.-M. Nguyen and M. Razeghi, “Investigation of impurity in type-II InAs/GaSb superlattices via capacitance-voltage measurement” *Appl. Phys. Lett.* 103, 033512 (2013).
17. G. Chen, E.K. Huang, A.M. Hoang, **S.I. Bogdanov**, S.R. Darvish and M. Razeghi, “Surface leakage investigation via gated type-II InAs/GaSb long-wavelength infrared photodetectors” *Appl. Phys. Lett.* 101, 213501 (2012).
18. M. Razeghi, A. Haddadi, A.M. Hoang, E.K. Huang, G. Chen, **S.I. Bogdanov**, S.R. Darvish, F. Callewaert and R. McClintock “Advances in antimonide-based Type-II superlattices for infrared detection and imaging at center for quantum devices” *Infrared Physics and Technology*, 59, 41 (2012).
19. B.M. Nguyen, G. Chen, A.M. Hoang, S. Abdollahi Pour, **S.I. Bogdanov**, and M. Razeghi, “Effect of contact doping on superlattice-based minority-carrier unipolar detectors” *Appl. Phys. Lett.* 99, 033501 (2011).
20. **S.I. Bogdanov**, B.M. Nguyen, A.M. Hoang and M. Razeghi, “Surface leakage current reduction in long wavelength infrared type-II InAs/GaSb superlattice photodiodes” *Appl. Phys. Lett.* 98, 183501 (2011).
21. B.M. Nguyen, **S.I. Bogdanov**, S. Abdollahi Pour, and M. Razeghi, “Minority electron unipolar photodetectors based on type II InAs/GaSb/AlSb superlattices for very long

wavelength infrared detection,” *Appl. Phys. Lett.* 95, 183502 (2009) – **109 citations as of November 2019**

22. S. Abdollahi Pour, B.M. Nguyen, **S.I. Bogdanov**, E.K. Huang, and M. Razeghi, “Demonstration of high performance long wavelength infrared type II InAs/GaSb superlattice photodiode grown on GaAs substrate,” *Appl. Phys. Lett.* 95, 173505 (2009).
23. B.M. Nguyen, D. Hoffman, E.K. Huang, **S.I. Bogdanov**, P.Y. Delaunay, M. Razeghi and M.Z. Tidrow, “Demonstration of midinfrared type-II InAs/GaSb superlattice photodiodes grown on GaAs substrate,” *Appl. Phys. Lett.* 94, 223506 (2009).

### Conference proceedings

1. **S.I. Bogdanov**, O.A. Makarova, X. Xu, A.S. Lagutchev, D. Shah, A.R. Gabidullin, I.A. Ryzhikov, I.A. Rodionov, A.V. Kildishev, S.I. Bozhevolnyi, A. Boltasseva, V.M. Shalaev and J.B. Khurgin, “Enhancing the performance of coupled cavity-antenna plasmonic nanostructures for ultrafast quantum photonics” CLEO, San Jose, CA (2020), *OSA Technical Digest*, FM4C.3
2. C.-C. Chiang, **S.I. Bogdanov**, O.A. Makarova, X. Xu, S. Saha, D. Shah, D. Wang, A.S. Lagoutchev, A.V. Kildishev, A. Boltasseva and V.M. Shalaev, “A quantum plasmonic launcher for integrated ultrafast single-photon sources”, CLEO, San Jose, CA (2020), *OSA Technical Digest*, FTh4D.4
3. **S.I. Bogdanov**, O.A. Makarova, A.S. Lagutchev, D. Shah, C.-C. Chiang, A. Baburin, I.A. Ryzhikov, S. Saha, I.A. Rodionov, A. Boltasseva and V.M. Shalaev, “Spin Coherence in Single NV Centers Coupled to Controllably Assembled Nanopatch Antennas”, CLEO, San Jose, CA (2019), *OSA Technical Digest*, FM1M.6
4. O.A. Makarova, **S.I. Bogdanov**, X.Xu, D. Shah, A.S. Baburin, I.A. Ryzhikov, S. Saha, I.A. Rodionov, A.V. Kildishev, A. Boltasseva and V.M. Shalaev, “Controlled Assembly of an Ultrafast Single-Photon Source”, CLEO, San Jose, CA (2019), *OSA Technical Digest*, FM1M.5
5. **S.I. Bogdanov**, S. Saha, M.Y. Shalaginov, N. Kinsey, A.S. Lagutchev, A. Boltasseva and V.M. Shalaev, “Hybrid plasmon-dielectric platform for high-speed on-chip quantum nanophotonics”, Nanometa 7<sup>th</sup> International Topical Meeting on Nanophotonics and Metamaterials, Seefeld, Austria (2019)
6. **S.I. Bogdanov**, M. Shalaginov, A. Lagutchev, C. Chiang, D. Shah, A. Baburin, I. Ryzhikov, I. Rodionov, A. Boltasseva, and V. Shalaev, “Ultrabright Room-Temperature Emission from Single Plasmon-Enhanced Nitrogen-Vacancy Centers in Diamond”, CLEO, San Jose, CA (2018), *OSA Technical Digest*, FTu4E.6
7. **S.I. Bogdanov**, M. Shalaginov, A. Akimov, A. Lagutchev, J. Liu, D. Woods, M. Ferrera, P. Kapitanova, P. Belov, J. Irudayaraj, A. Boltasseva, and V. Shalaev, “Spin Contrast of Purcell-Enhanced Nitrogen-Vacancy Centers in Diamond”, CLEO, San Jose, CA (2017), *OSA Technical Digest*, FW4H.3

8. O. A. Makarova, M. Y. Shalaginov, **S.I. Bogdanov**, U. Guler, A. Boltasseva, A. V. Kildishev, V. M. Shalaev, Patterning metamaterials for fast and efficient single-photon sources, *SPIE Proceedings*, vol. 10112, p.1011208 (2017)
9. J. Ndukaife, B. Isaacoff, M. Shalaginov, **S.I. Bogdanov**, A. Nnanna, J. Biteen, M. Segev, V. Shalaev, and A. Boltasseva, Massive Parallel Positioning of Nanodiamonds on Nanophotonic Structures, CLEO, San Jose, CA (2017), OSA Technical Digest, FTu3H.1
10. M.Y. Shalaginov, **S.I. Bogdanov**, J. Liu, A. Lagutchev, A.V. Kildishev, D. Peroulis, J.M. Irudayaraj, A. Boltasseva and V.M. Shalaev, "Effect of photonic density of states on spin-flip induced fluorescence contrast in diamond nitrogen-vacancy center ensembles" (Presentation Recording)", *SPIE Proceedings*, San Diego, CA Vol. 9544, p.95440O (2015)
11. M. Y. Shalaginov, **S.I. Bogdanov**, P. V. Kapitanova, A. S. Lagutchev, A. V. Kildishev, P.A. Belov, A. Boltasseva, V. M. Shalaev, "Merging metamaterials with quantum photonics", 9th International Congress on Advanced Electromagnetic Materials in Microwaves and Optics, p. 283, (2015)
12. D. Hoffman, B.M. Nguyen, E.K. Huang, P.Y. Delaunay, **S.I. Bogdanov**, P. Manurkar, M. Razeghi, and V. Nathan, "The importance of band alignment in VLWIR type-II InAs/GaSb heterodiodes containing the M-structure barrier," *SPIE Proceedings*, San Jose, CA Vol. 7222 p. 722215 (2009).
13. P.Y. Delaunay, B.M. Nguyen, D. Hoffman, E.K. Huang, P. Manurkar, **S.I. Bogdanov** and M. Razeghi, "Background limited performance of long wavelength infrared focal plane arrays fabricated from M-structure InAs/GaSb superlattices," *SPIE Proceedings*, San Jose, CA Vol. 7222 p.72220W (2009).
14. B.M. Nguyen, S. Abdollahi Pour, **S.I. Bogdanov** and M. Razeghi "Minority electron unipolar photodetectors based on Type II InAs/GaSb/AlSb superlattices for very long wavelength infrared detection," *SPIE Proceedings*, San Francisco, CA Vol. 7608 p. 760825-1 (2010).
15. M. Razeghi, B.M. Nguyen, P.Y. Delaunay, E.K. Huang, S. Abdollahi Pour, P. Manurkar and **S.I. Bogdanov**, "State-of-the-art type-II antimonide-based superlattice photodiodes for infrared detection and imaging," *SPIE Proceedings*, San Diego, CA Vol. 7467, p. 74670T-1 (2009)
16. M. Razeghi, B.M. Nguyen, P.Y. Delaunay, S. Abdollahi Pour, E.K.W. Huang, P. Manurkar, **S.I. Bogdanov**, and G. Chen "High operating temperature MWIR photon detectors based on Type II InAs/GaSb superlattice," *SPIE Proceedings*, San Francisco, CA Vol. 7608, p. 76081Q-1 (2010)

### Other scientific publications

1. M.Y. Shalaginov, R. Chandrasekar, **S.I. Bogdanov**, Z. Wang, X. Meng, O.A. Makarova, A. Lagutchev, A.V. Kildishev, A. Boltasseva and V.M. Shalaev "Hyperbolic metamaterials for single-photon sources and nanolasers", *Quantum Plasmonics*, p. 97 Springer Int. Publ. (2016)
2. **S.I. Bogdanov** and M. Razeghi, "Des atomes aux dispositifs quantiques", *La Jaune et la Rouge, Journal de l'Ecole Polytechnique*, 702, (2015)

3. M. Shalaginov, **S.I. Bogdanov**, V. Vorobyov, A. Lagutchev, A. Kildishev, A. Akimov, A. Boltasseva and V. Shalaev “Enhancement of Single-Photon Sources with Metamaterials”, *From Atomic to Mesoscale*, World Scientific Review, p. 123 (2015)

## HONORS AND AWARDS

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- 2018 - Best Presentation Award, OSA IONS Midwest Conference, (Purdue University, USA)
- 2018 - Preparing Future Faculty Scholarship (Stony Brook University, USA) - \$700
- 2018 - Postdoc Travel Grant Award for Professional Conference (Purdue University, USA) - \$500
- 2017 - The Graduate School Postdoc Travel Grant (Purdue University, USA) - \$440
- 2016 - The Graduate School Postdoc Travel Grant (Purdue University, USA) - \$440
- 2015 - Best Poster Award and Travel Fellowship, Metamaterials Science and Technology Workshop, (San Diego, USA) - \$1 000
- 2015 - Best Poster Award, Enrico Fermi Summer School in Complex Photonics, (Varenna, Italy) - €300
- 2013 - Cabell Terminal Year Fellowship (Northwestern University) – full final year tuition and stipend funding
- 2011 - Dow Sustainability Innovation Student Challenge Award (Chicago, USA) - \$10 000, received by the team consisting of C. Wilmer, T. Phan, **S.I. Bogdanov** and E. Hoxha
- 2011 - 3<sup>rd</sup> place, Scientists Without Borders Global Malnutrition Challenge Prize (InnoCentive, USA) - \$1 000, received by the team consisting of C. Wilmer, T. Phan, **S.I. Bogdanov** and E. Hoxha
- 2009 - Shared 1<sup>st</sup> place Nature.com Clean Water Distribution Challenge Prize (InnoCentive, USA) - \$4 000, received by the team consisting of C. Wilmer, T. Phan and **S.I. Bogdanov**
- 2008 - Finalist, Diversity Challenge (Academic Search, Sweden)
- 2004 - Scholarship for Outstanding International Students (Ecole Polytechnique Foundation, France)
- 2001 - Honorable Mention, National Mathematics Competition (France)
- 2000 - 3<sup>rd</sup> place, Olympiades Academiques de Mathematiques (France)

## FUNDRAISING ACTIVITIES AND UNIVERSITY SERVICE

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1. Extensive experience in drafting winning research and equipment grant proposals (four instrumentation proposals resulting in total awarded funds of **\$623k**; nine research proposals with total awards in excess of **\$1.8M**)
2. Leading member of the local organizing committee of the Purdue Quantum Center 2015 Kickoff Conference hosting 36 world leading faculty members in the area of Quantum Physics, scientific journal editors and Department of Defense program managers, as well as over 200 attendees

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**SELECTED MEDIA COVERAGE**

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1. *EurekaAlert* (AAAS), “New machine learning-assisted method rapidly classifies quantum sources” (09/10/2020)
2. *Kommersant Nauka*, Разгон до сотен терагерц. Улучшены параметры самого яркого источника одиночных фотонов. (“Speedup into the terahertz range – improving the performance of the brightest single-photon sources”, in Russian, 08/25/2020)
3. *Izvestia*, Science News, “На всех квантит: усовершенствована технология связи по оптоволокну” (“Enough for all: improvement in optical fiber communication technology”, in Russian, 12/01/2020)
4. *Optics and Photonics News*, “Single NV centers produce 30 million photons per second at room temperature” (12/01/2018)
5. *Purdue News*, “Toward unhackable communication: single particles of light could bring about the quantum internet”, (10/16/2018), reposted by [phys.org](http://phys.org) and [nanowerk.com](http://nanowerk.com)
6. *The New York Academy of Sciences*, “Innovating on a shoestring” (04/15/2011)
7. *Scientists Without Borders*, “The power of teamwork” (05/18/2011)
8. *Northwestern News*, “Students excel in maternal health care challenge” (09/06/2011)

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**INVITED TALKS**

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1. **SPIE Optics and Photonics**, Active Photonic Platforms XII, 11461-56, San Diego, CA (2020)
2. **SPIE Optics and Photonics**, Spintronics XIII, 11470-70, San Diego, CA (2020)
3. **SPIE FOCUS, Northwestern University**: Light and Matter Conference, Evanston, IL, (2019)
4. **City University of New York**, Advanced Science Research Center, Photonics Initiative, colloquium, New York City, NY (2019)
5. **University of Iowa**, Department of Physics and Astronomy, colloquium, Iowa City, IA, (2019)
6. **Virginia Commonwealth University**, Department of Electrical and Computer Engineering, colloquium, Richmond, VA, (2019)
7. **University of Illinois at Urbana-Champaign**, Department of Electrical and Computer Engineering, colloquium, Urbana, IL (2019)
8. **University of Nebraska**, Department of Electrical and Computer Engineering, colloquium, Lincoln, NE, (2019)
9. **Old Dominion University**, Department of Physics and Astronomy, colloquium, Norfolk, VA (2019)
10. **SPIE Photonics West**, Quantum Sensing and Nano Electronics and Photonics XVI, 10926-54, San Francisco, CA (2019)
11. **IEEE Summer Topical Meeting Series**, Quantum Networks, WD3.1, Waikoloa, HI (2018)
12. **City College of New York**, Department of Physics, seminar, New York City, NY (2018)
13. **Argonne National Laboratory**, Center for Nanoscale Materials, seminar, Lemont, IL (2018)
14. **8<sup>th</sup> International Conference on Lasers, Optics and Photonics**, Las Vegas, NV (2017)
15. **Russian Quantum Center**, seminar, Skolkovo, Russia (2017)
16. **SPIE Photonics West**, Quantum Sensing and Nano Electronics and Photonics XIII, 9755-49, San Francisco, CA (2016)

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## CONTRIBUTED CONFERENCE TALKS

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1. **SPIE Optics and Photonics**, Plasmonics: Design, Materials, Fabrication, Characterization, and Applications, 11462-16, San Diego, CA (2020)
2. **Conference on Lasers and Electro-Optics**, FM4C.3, San Jose, CA (2020)
3. **Conference on Lasers and Electro-Optics**, FTh4D.4, San Jose, CA (2020)
4. **Conference on Lasers and Electro-Optics**, FM1M.6, San Jose, CA (2019)
5. **Conference on Lasers and Electro-Optics**, FTu4E.6, San Jose, CA (2018)
6. **SPIE Optics and Photonics**, Quantum Nanophotonics, 10359-20, San Diego, CA (2017)
7. **Conference on Lasers and Electro-Optics**, FW4H.3, San Jose, CA (2017)
8. **SPIE Optics and Photonics**, Metamaterials, Metadevices, and Metasystems, 9918-81, San Diego, CA (2016)
9. **SPIE Optics and Photonics**, Metamaterials, Metadevices, and Metasystems, 9544-16, San Diego, CA (2015)

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## CAMPUS AND DEPARTMENTAL TALKS

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1. “Plasmon-enhanced quantum emitters for ultrafast quantum photonics”, IQUIST seminar, University of Illinois, (2020)
2. “Ultrabright sub-nanosecond emission from single nitrogen-vacancy centers in nanodiamonds” OSA IONS Conference, Purdue University, West Lafayette, IN (2018)
3. “Material platforms for integrated quantum photonics”, NSAC conference, Purdue University, West Lafayette, IN (2016)
4. “Practical nanophotonics: new approaches and material platforms”, 10<sup>th</sup> anniversary celebration of Birck Nanotechnology Center, Purdue University, West Lafayette, IN (2016)

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## RESEARCH EXPERTISE AND TECHNICAL SKILLS

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Optical characterization techniques, including time-resolved single-photon counting, optical and Fourier spectroscopy, optically detected magnetic resonance. Cryogenic electrical characterization techniques such as sensitive current-voltage and capacitance-voltage measurements, spectral noise characterization and photodetector quantum efficiency measurements. Structural device characterization via scanning electron microscopy, optical profilometry and atomic force microscopy. A wide variety of semiconductor device processing techniques including lithography, wet and dry etching, e-beam, and thermal evaporation as well as plasma-enhanced chemical vapor deposition (PECVD). Packaging techniques, for instance flip-chip bonding, underfilling, substrate removal and polishing. Electromagnetic simulation with analytical and numerical methods using software tools such as COMSOL Multiphysics and Matlab. Large-scale experimental setup automation and data acquisition via Labview, Matlab and microcontroller programming.

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## RESEARCH EXPERIENCE AND ACCOMPLISHMENTS

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**Purdue University, West Lafayette, IN**

Apr 2014 – present

Birck Nanotechnology Center

*Postdoctoral Research Associate* – Birck Nanotechnology Center



Research topic: Plasmon-assisted single-photon sources and spin sensors

1. **Demonstrated the world's brightest room-temperature quantum emitter:** a nitrogen-vacancy center in diamond enhanced by a plasmonic nanoantenna, with a detected photon rate of over 30 million counts per second
2. **Demonstrated coherent spin dynamics from a single nitrogen-vacancy center deterministically coupled to a plasmonic nano-patch antenna.** Showed that the spin coherence time of nitrogen-vacancy centers in nanodiamonds is preserved even in direct proximity to metal nanostructures.
3. **Demonstrated record-high fluorescence lifetime shortening of 3500 times** at room temperature in nanodiamond-based nitrogen-vacancy centers by deterministically coupling to plasmonic nanoantennas.
4. Designed, acquired and assembled the experimental setup for optical characterization of quantum emitters, including a home-built confocal scanning microscope interfaced with an atomic force microscope a femtosecond excitation laser source and picosecond-scale photon correlation capability
5. Developed an autonomous algorithm for a large-area identification and characterization of quantum emitters randomly dispersed on a substrate, analyzing one emitter per minute and able to locate emitters with user-specified properties
6. Constructed an experimental setup for coherent manipulation of single electron spins in diamond color centers with applications in quantum information processing and nanoscale magnetometry
7. Designed and supervised the assembly of an experimental setup for optical characterization of rare-earth ion fluorescence for studies of quantum dynamics in many-body systems
8. Measured the effect of Purcell enhancement on spin-flip induced fluorescence contrast of nitrogen-vacancy centers in nanodiamonds

**Northwestern University, Evanston, IL**

Sep 2008 – Apr 2014

Robert R. McCormick School of Engineering and Applied Science

*Graduate Research Assistant* – Center for Quantum Devices

Research topic: Type-II InAs/GaSb Superlattice Photodiodes

1. **Demonstrated the highest sensitivity in superlattice photodetectors operating at 10  $\mu\text{m}$**
2. Designed a wide bandgap p-n junction photodetector featuring reduction of all bulk dark current mechanisms while preserving quantum efficiency
3. Proposed a shallow etch based processing technique for several orders of magnitude surface leakage current suppression in  $\text{SiO}_2$  passivated long wavelength infrared photodiodes
4. Developed an experimental technique for in-plane minority carrier diffusion length measurement
5. Fabricated world's first type-II superlattice shallow etch microjunction detectors operating in mid-wavelength infrared range
6. Fabricated a state-of-the-art long wavelength infrared type-II superlattice based focal plane array
7. Studied the quality of  $\text{SiO}_2$  passivation in type-II superlattice photodetectors depending on device parameters and dielectric deposition conditions
8. Demonstrated long term thermal stability of type-II superlattice photodetectors up to 350°C

**Royal Institute of Technology, Stockholm, Sweden**

Apr 2007 - Jul 2007

School of Communication and Information Technology

*Summer Research Intern* – Anders Karlsson group

Research topic: Quantum Key Distribution in Quantum Cryptography

Installed and tested the non-linear frequency down-conversion setup as part of implementation of a decoy-state protocol for quantum key distribution

**TEACHING AND MENTORING EXPERIENCE**

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**Purdue University**, West Lafayette, IN (2015 - present)

1. Supervised a female undergraduate student during an electromagnetic simulation project, resulting in her first-author publication in *Optics Letters*.
2. Supervised a female undergraduate student during the development of atomic force microscope-based manipulation techniques applied to nanodiamond and metal nanocube particles. **The project has resulted in the world's first demonstration of inter-substrate transfer of a pre-characterized single-photon emitter followed by its deterministic integration into a plasmonic gap nanoantenna.**
3. Supervised two undergraduate students during the programming of an automated setup for optical fluorescence scanning and location of single-photon emitters.

**Northwestern University**, Evanston, IL (Winter 2012- Spring 2013)*Graduate student mentor*

Trained two graduate students and one undergraduate student in processing and characterization of single photodiodes and integrated arrays

*Teaching Assistant*

1. Prepared course slides and teach lectures to a class of graduate and undergraduate students
2. Reviewed course material with students during office hours on an individual basis
3. Supervised and managed six lab projects to provide students with deeper understanding of concepts taught in class
4. Corrected homework assignments with emphasis on teaching students clear and concise scientific communication

*Outreach activity*

Held educational activities designed to teach children about light and lasers in the framework of Northwestern SPIE chapter's outreach to Evanston middle schools.

**High School Jean Rostand**, Mantes-la-Jolie, Ile-de-France, France (9/04-04/05)*Physics and Mathematics Teacher*

1. Taught Physics and Mathematics to several classes of 10th-12th grade students
2. Reviewed course material with students during office hours on an individual basis

## **PROFESSIONAL AFFILIATIONS AND SERVICE TO PROFESSION**

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Member of the Optical Society of America

Member of the IEEE Photonics Society

Reviewer: *Nature Communications, Optica, Nano Letters, Optics Letters, Optics Express, Journal of the American Chemical Society, Photonics Research, Applied Physics Letters, Nanophotonics, Optics Materials Express*

## **LANGUAGES**

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1. Russian, native
2. French, full command
3. English, full command
4. Swedish, intermediate
5. German, basic