Nicholas A. Güsken

Department of Physics
& Institute for Photonic Quantum Systems
University of Paderborn
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EDUCATION

Stanford University, Stanford, CA, USA **09/2021 – 03/2025**
Postdoctoral Research Fellow, Material Science & Engineering
Advisor: Prof. Mark Brongersma
Fellowship: German National Academy of Science – Leopoldina

Imperial College London, London, UK **2016-2020**
PhD, Experimental Solid-State Physics.
Thesis: "Nanoplasmonics & Optoelectronics"
Advisors: Prof. Stefan Maier, Prof. Rupert Oulton
Awarded the Imperial College Best Thesis Prize 2020 in Solid State Physics

RWTH Aachen University, Aachen, Germany **2014-2016**
M.S. Physics
Thesis: "Growth and characterization of InAs/Nb and InAs/Al superconducting nanowire hybrid structures"
M.S. Economics
Thesis: "Regional Variations in Brazil's Electricity Demand and the Impact of the Economic and Political Crisis of the Mid-2010's"

Sorbonne, Paris, France **2013-2014**
M.S. Nanotechnology
Thesis: "Electrically induced domain wall propagation in (Ga,Mn)As tracks"

RWTH Aachen University, Aachen, Germany **2010-2013**
B.S., Physics

RESEARCH EXPERIENCE

Assistant Professor (W1, Tenure Track), Department of Physics, Paderborn University, Germany **04/2025**
Institute for Photonic Quantum Systems (PhoQs)

Postdoctoral Researcher, Gabelle Laboratory for Advanced Materials, Stanford **09/2021 – 03/2025**
Reconfigurable phase change meta surfaces for free-space emission control.
Active quantum emitter control and coupling in integrated hybrid waveguides.

Research Associate, Imperial College London, London, U.K. **3/2020 – 9/2020**
Plasmonic interactions with molecules and rare earth ions.
Advisor Prof. Rupert Oulton

Graduate Research Assistant, Imperial College London, London, UK **2016 – 2020**
Nanophotonics and Optoelectronics.
Plasmonic nanofocusing method for nonlinear interactions in a waveguide.
TiO_2 enhanced photodetection from TiN/Si junctions.
Purcell enhancement of Erbium emission in a hybrid waveguide platform.
Advisors: Prof. Stefan Maier, Prof. Rupert Oulton

Graduate Research Assistant, Research Center Jülich, Jülich, Germany **2015 – 2016**
Nb/InAs superconducting weak links in nanowire junctions.
Doping of VS grown InAs nanowires.
Advisor: Prof. Detlev Grützmacher, Prof. Thomas Schäpers

Graduate Research Assistant, Institut des NanoSciences de Paris – INSP, Paris, France **2014**
Spintronics: Electrically induced magnetic domain wall propagation.
Advisors: Dr. Catherine Gourdon & Dr. Laura Thevenard

Undergraduate Research Assistant, Fraunhofer Institute for Lasertechnology Aachen, Germany **2013**
Developing free space optical setups for laser experiments

Research Internship, Supercomputing Center Jülich, Germany **06/2010 - 08/2010**
Computational modelling (C, Python) of crowd movements
Advisor: Prof. Armin Seyfried

INDUSTRY EXPERIENCE

Scientific Advisor, Polariton Technologies c/o ETH Zurich, Zurich, CH **09/2021 – 09/2023**
Technical consulting of an RnD team and the management.
Plasmonic-Photonic hybrid circuits and components.
Supervision of MS and BS theses.

Senior RnD engineer, Teamlead, Polariton Technologies c/o ETH Zurich, Zurich, CH **10/2020 - 08/2021**
Lead of an RnD team in a spin-off company from ETH Zurich.
Simulation and design of integrated RF/photonic components.
Design (implemented a custom in-house PDK) of photonic-plasmonic integrated circuits.
for high speed opto-electrical modulation (> 110 GHz).
Team and project management, internal and external result delivery & hiring.
Strategized fabrication upscaling of photonic integrated circuits with foundries.

Technical Consultant, Outsmart Insight, London, UK **2018**
Technical consultant for projects on high power laser development, forecasting

AWARDS & FELLOWSHIPS

Member of the "Junge Akademie – *Leopoldina*" **06/2025**
Member of Die Junge Akademie, elected through the Berlin-Brandenburg Academy of Sciences and Humanities (BBAW) and the German National Academy of Sciences - Leopoldina.

Recipient of the "Tenure Track Professorship" award from the Wübben Stiftung Wissenschafft **04/2025**
Early-Career award to promote Tenure Track Professorship Positions in Germany. ($1.1 million)

Recipient of the "NRW-Rückkehrprogramm" award from the German Government **11/2023**
Early-Career award to establish an independent research group. ($1.4 million)

Leopoldina Postdoctoral Fellowship - competitive research fellowship (<16% acceptance rate) awarded by the German National Academy of Science - Leopoldina funding for independent research abroad. ($100k) **2021-2023**

Solid state thesis prize - awarded annually by the physics department Imperial College London for the best doctoral thesis. ($300) **2020**

American Physical Society travel grant, CLEO conference 2019, USA, ($500) **2019**

Leverhulme Doctoral Scholarship, Scholarship from the Leverhulme trust to finance the PhD. ($30k p.a.) **2016 – 2020**

Deutschlandstipendium - Scholarship of the Education Fund of the Federal Ministry of Education and Research Germany awarded for outstanding achievements in physics. ($2000) **2016**

Listed on the Dean's List at RWTH Aachen University - Ranked in the upper 5% of the class out of 300 students in Economics. **2015**

Deutschlandstipendium - Scholarship of the Education Fund of the Federal Ministry of Education and Research Germany awarded for outstanding achievements at university in physics. ($2000) **2015**

CNRS Scholarship from Labex-MATISSE, French Research Council for research at the institute des Nanoscience Paris. ($3500) **2014**

European Union student exchange grant to support a research & study stay abroad. ($3500) **2013**

GRANT WRITING

Samsung Industry Grant (awarded, $200k), Stanford University, CA, USA **2022 – 2023**
Lead postdoctoral scientist in the grant proposal establishing electrically tunable phase change metasurfaces for beam steering applications.
PI: Prof. Brongersma.

JOURNAL PUBLICATIONS

1. S. Doshi, **N. A. Güsken,** J. Carlström, G. Dijk, S. Mohanty, B. Li, W. Cai, A. Salleo, N. A. Melosh, M. L. Brongersma "Cephalopod-inspired soft photonic skins with dynamic texture and color control", 2025, *in review at Nature* **2025**

2. S. Abdollahramezani, D. Omo-Lamai, G. Bosman, O. Hemmatyar, S. Dagli, V. Dolia, K. Chang, **N. A. Güsken**, H.C. Delgado, G. Boons, M. L. Brongersma, F. Safir, B. T. Khuri-Yakub, P. Moradifar, J. Dionne, "High-throughput antibody screening with high-quality factor nanophotonics and bioprinting", 2025, *in review at Nature Photonics* **2025**

3. A Lambertz, N. Lee, V. Shautsova, F. Xu, JH Song, **N.A. Güsken**, S. Selvin, M. Florescu, M. Brongersma, J. v.d. Groep, E. Alarcon-Llado, "Ultra-thin 4.8 µm c-Si solar cell with above 16 % efficiency using hyperuniform disordered light trapping", 2025, *in review at Advanced Photonics* **2025**

4. **N.A. Güsken** and M.L. Brongersma, "Electrifying the field of metasurface optics" Photon. Insights 3(4) C08, https://doi.org/10.3788/PI.2024.C08 **2024**

5. E. Otte, A.D. White, **N.A. Güsken**, J. Vučković, ML Brongersma "Tunable vector beam decoder by inverse design for high-dimensional quantum key distribution with 3D polarized spatial modes". *arXiv* preprint arXiv:2304.12296 **2023**

6. **N.A. Güsken**; Fu, M.; Zapf, M.; Nielsen, M.; Dichtl, P.; Roeder, R.; Maier, S.A.; Clark, A.; Ronning, C.; Oulton, R.F. "Emission enhancement of Erbium in a reverse nanofocusing waveguide". *Nature Communications 14, 2719, 2023* **2023**

7. Fu, M.; Mota, M.; Xiao, X.; Jacassi, A.; **Güsken, N.A**.; Chen, Y.; Xiao, H.; Li, Y.; Riaz, A.; Maier, S.A.; Oulton, R.F. "Near-unity Raman β -factor of surface-enhanced Raman scattering in a waveguide". *Nature Nanotechnology. 17, 1251–1257, 2022* **2022**

8. Sistani, M.; Bartmann, M.G.; **Güsken, N.A.**; Oulton, R.F.; Keshmiri, A.; Luong, M.A.; Robin, E.; Hertog, M.I.; Lugstein, A.; "Plasmon-Driven Hot Electron Transfer at Atomically Sharp Metal-Semiconductor Nanojunctions", *ACS photonics* 7 (7), 1642-1648, 2020 **2020**

9. Sistani, M.; Bartmann, M.G.; **Güsken, N.A.**; Oulton, R.F.; Keshmiri, A.; Luong, M.A.; Robin, E.; Hertog, M.I.; Lugstein, A.; "Stimulated Raman Scattering in Ge nanowires", *J. Phys. Chem. C 2020, 124, 25, 13872–13877* **2020**

10. Sistani, M.; Bartmann, M.G.; **Güsken, N.A.**; Oulton, R.F.; Keshmiri, H.; Seifner, M.S.; Barth, S.; Fukata, N.; Luong, M.A.; Hertog, M.I. den; et al. "Nanoscale Aluminum Plasmonic Waveguide with Monolithically Integrated Germanium Detector". *Appl. Phys. Lett.* 115, 161107 (2019) **2020**

11. **Güsken, N.A.;** Lauri, A.; Li, Jacassi, A; Y.; Matsui, T.; Doiron, B.; Bower, R.; Regoutz, A.; Mihai, A.; Petrov, P. K.; Oulton, R. F.; et al. "IR hot carrier based photodetection in titanium nitride oxide thin film-Si junctions"". *MRS Advances* , Volume 5 , Issue 35-36: Electronic, Photonic and Magnetic Materials , 2020, pp. 1843 - 1850 **2020**

12. **Güsken, N.A**.; Lauri, A.; Li, Y.; Matsui, T.; Doiron, B.; Bower, R.; Regoutz, A.; Mihai, A.; Petrov, P. K.; Oulton, R. F.; et al. "TiO2−x -Enhanced IR Hot Carrier Based Photodetection in Metal Thin Film–Si Junctions". *ACS Photonics* 2019, 6 (4), 953–960. **2019**

13. **Güsken, N.A.**; Rieger, T.; Mussler, G.; Lepsa, M. I.; Grützmacher, D. "Influence of Te-Doping on Catalyst-Free VS InAs Nanowires". *Nanoscale Res. Lett*. 2019, 14 (1), 179. **2019**

14. **Güsken, N.A.**; Nielsen, M. P.; Nguyen, N. B.; Maier, S. A.; Oulton, R. F. "Nanofocusing in SOI-Based Hybrid Plasmonic Metal Slot Waveguides". *Opt. Express* 2018, 26 (23), 30634. **2018**

15. Shautsova, V.; Sidiropoulos, T.; Xiao, X.; **Güsken, N.A.**; Black, N.C.G.; Gilbertson, A.M.; Giannini, V.; Maier, S.A.; Cohen, L. F.; Oulton, R.F. "Plasmon Induced Thermoelectric Effect in Graphene". *Nature Communications*. 2018, 9 (1), 5190. **2018**

16. **Güsken, N.A.**; Rieger, T.; Zellekens, P.; Bennemann, B.; Neumann, E.; Lepsa, M. I.; Schäpers, T.; Grützmacher, D. "MBE Growth of Al/InAs and Nb/InAs Superconducting Hybrid Nanowire Structures". *Nanoscale* 2017, 9 (43), 16735–16741. **2017**

17. Thevenard, L.; Boutigny, B.; **Güsken, N.A**; Becerra, L.; Ulysse, C.; Shihab, S.; Lemaître, A.; Kim, J.-V.; Jeudy, V.; Gourdon, C. "Spin Transfer and Spin-Orbit Torques in in-Plane Magnetized (Ga,Mn)As Tracks". *Phys. Rev*. B 2017, 95 (5), 054422. **2017**

PATENTS

1. **Loss mitigation of plasmonic waveguides**, WO appl. No. : WO2024056150A1 **2024**
Inventors: **NA Güsken**, Florin Püntener, W. Heni
filed with Polariton Technologies c/o ETH Zurich., CH

2. **Phase Change Metasurface for beam steering applications,** US Patent App. 63/602,488 **2024**
Inventors: **NA Güsken**, JH Song, MY Lee, JZ Park, M. Brongersma
filed with Samsung Electronics co. & Stanford University

3. **Guided Mode Resonance tuning via Phase Change materials**, patent pending **2023**
Inventors: JH Song, **NA Güsken**, MY Lee, JZ Park, M. Brongersma
filed with Samsung Electronics co. & Stanford University

4. **Schottky-barrier type infrared photodetector**, US Patent App. 17/600,810 **2022**
Inventors**: NA Güsken**, A Lauri, Y Li

PEER REVIEWED CONFERENCE PUBLICATIONS & ABSTRACTS

1. E. Otte, **N.A. Güsken**, et al. "Structured light: From singular and quantum optics to nanophotonics," Proc. SPIE PC13004, Nonlinear Optics and its Applications 2024, PC1300403 https://doi.org/10.1117/12.3022846 **2024**

2. E. Otte, **N.A. Güsken**, et al. " Structured light meets functional nanostructures for encoding and decoding information" Proc. SPIE PC12901, Complex Light and Optical Forces XVIII; PC129010C https://doi.org/10.1117/12.3010030 **2024**

3. **N.A. Güsken**, JH. Song, A.I. Khan, M. Lee, X. Wu, Y. Wang, JH. Park, E. Pop, M. Brongersma, "Electrically controlled beam steering from a Sb2Se3 phase change material metasurface", Photonics West **2024**

4. **N. A. Güsken**, M. Fu, M. Zapf, Michael P. Nielsen, Paul Dichtl, Robert Röder, Stefan A. Maier, Carsten Ronning, Mark L. Brongersma, Rupert F. Oulton, "Strong emission enhancement of rare earth quantum emitters in an integrated waveguide nano de-focusing platform", breaking news post-deadline talk, MRS Fall, Boston **2023**

5. W. Heni, P. Habegger, E. De Leo, M. Destraz, N. Meier, N. D. Medico, V. Tedaldi, C. Funck, A. Langenbach, H. Duran, **N. A. Güsken**, J. Leuthold, C. Hoessbacher, B. Baeuerle, "Plasmonic PICs — Terabit Modulation on the Micrometer Scale," in European Conference on Optical Communication (ECOC) 2022, Basel, CH **2022**

6. **N. A. Güsken**, M. Fu, M. Zapf, Michael P. Nielsen, Paul Dichtl, Robert Röder, Stefan A. Maier, Carsten Ronning, Mark L. Brongersma, Rupert F. Oulton, "Fluorescence enhancement of Er3+-ions using reverse hybrid plasmonic nano-focusing", CLEO 2022, San Jose, USA **2022**

7. H.Mardoyan, F. Jorge, M. Destraz, B. Duval, B. Bitachon, Y. Horst, K. Benyahya, F. Blache, M. Goix, E. D. Leo, P. Habegger, N. Meier, N. D. Medico, V. Tedaldi, C. Funck, **N.A. Güsken**, J. Leuthold, J. Renaudier, C. Hoessbacher, W. Heni, B. Baeuerle, "Generation and transmission of 160-Gbaud QPSK Coherent Signals using a Dual-Drive Plasmonic-Organic Hybrid I/Q modulator on Silicon Photonics", Optical Fiber Communication Conference (OFC) 2022, San Diego, USA **2022**

8. **N. A. Güsken**, M. Fu, M. Zapf, Michael P. Nielsen, Paul Dichtl, Robert Röder, Stefan A. Maier, Carsten Ronning, Mark L. Brongersma, Rupert F. Oulton, "Strongly enhanced quantum emitter fluorescence from a single nano-de-focusing waveguide", APS March Meeting, Chicago, USA **2022**

9. C. Hoessbacher, B. Baeuerle, E. D. Leo, N. D. Medico, H. Duran, **N.A. Güsken**, P. Habegger, W. Heni, and N. Meier, "Progress and Challenges of Plasmonics for Efficient and High-Speed Optical Communications", CLEO, San Jose, USA **2021**

10. B. Doiron, **N.A Güsken**, A. Lauri, Y. Li, A. Mihai, T. Matsui, R. Bower, L. Huettenhoffer, A. Regoutz, S. D. Forno, S.Fearn, P. K Petrov, E. Cortés, L.F Cohen, N. Alford, J. Lischner, P. Petrov, S. A Maier, R. F Oulton "Hot carrier optoelectronics with titanium nitride", CLEO, San Jose, USA **2020**

11. **Güsken, N.A;** Nielsen, M. P.; Nguyen, N. B.; Maier, S. A.; Oulton, R. F. "Efficient four wave mixing and low-loss in-coupling in plasmonic waveguides", CLEO, San Jose, USA **2019**

12. **Güsken, N.A.;** Shautsova, V.; Sidiropoulos, T.; Xiao, X.; Black, N. C. G.; Gilbertson, A. M.; Giannini, V.; Maier, S. A.; Cohen, L. F.; Oulton, R. F. "Plasmonic photothermo-electric effect in graphene", CLEO, San Jose, USA **2019**

CONFERENCE PRESENTATIONS

1. "Phase Change Material based re-configurable metasurfaces" **2025**
   Seminar, Friedrich-Schiller-Universität Jena, Jena, Germany

2. "Electrically controlled beam steering from a Sb_2Se_3 phase change material metasurface" **2024**
   SPIE Photonics West, San Francisco, USA

3. "Strong emission enhancement of rare earth quantum emitters in an integrated waveguide nano de-focusing platform", *Breaking News talk*, MRS Fall, Boston, USA **2023**

4. "Emission enhancement of erbium in a reverse nanofocusing waveguide" **2023**
   META, Paris, France

5. Presentation by collaborator Eileen Otte: "Tailored focal fields for the analysis of dipolar nano-emitters", SPIE Photonics West, San Fransico, USA **2023**

6. "Fluorescence enhancement of Er^{3+}-ions using reverse hybrid plasmonic nano-focusing", **2022**
   CLEO 2022, San Jose, USA

7. "Emitter control on the nanoscale", poster presentation, Gordon's conference GRC, Maine, USA **2022**

8. "Manipulation of Er^{3+}-ion fluorescence by controlled modal coupling on the nanoscale" **2022**
   MRS Spring 2022, Hawaii, USA

9. "Strongly enhanced quantum emitter fluorescence from a single nano-de-focusing waveguide" **2022**
   APS March meeting 2022, Chicago, USA

10. "IR Hot Carrier Based Photodetection in Metal Thin Film–Si Junctions", **2020**
    SPIE Photonics West, San Fransico USA

11. "TiO_{2-x} enhanced IR hot carrier based photodetection in metal thin film-Si junction" **2019**
    MRS Fall, Boston, USA

12. "Plasmonic photo-thermo-electric effect in graphene", CLEO, San Jose, USA **2019**

13. "Nonlinear optics: Efficient four wave mixing and low-loss coupling in plasmonic waveguides" **2019**
    CLEO, San Jose, USA

14. "Plasmonic hybrid gap waveguides - a platform for sensing, detection and electro-optical modulation", poster presentation at the 300th Faraday Discussion, London, Royal Society of Chemistry, UK **2019**

15. "MBE growth of Al/InAs and Nb/InAs superconducting hybrid nanowire structures" **2016**
    German Physical Society (DPG) annual meeting 2016, Regensburg, Germany

INVITED TALKS

1. **Swiss NanoConvention,** Fribourg, CH **2022**
   "Enhancing Silicon Photonics: Plasmonic Terabit Modulation on the Micrometer Scale"

2. **Swiss Photonics Seminar**, Zurich, CH **2021**
   "Photonics & Plasmonics - building blocks of the communication network & how to simulate them"

3. **Photonics West SPIE**, San Francisco, USA **2020**
   "Dielectric nanoantennas applied: ultrafast non-linearities and photocatalysis"
   On behalf of Prof. Stefan Maier

4. **London Plasmonics Forum**, Kings College London, London, UK **2019**
   "Si-compatible IR hot-carrier based photodetection"

TEACHING

Guest Lecturer, Stanford University, Stanford, USA **2022**
Substitute for Prof. Mark Brongersma in his absence for the course "Nanophotonics"
Prepared, added and lectured own teaching content.

Lecture Contributions, Imperial College London, London, UK **2020**
Assisted with lecture content on nanofcusing and integrated photonics for Prof. Oulton.

Teaching Assistant, Imperial College London, London, UK **2017 – 2019**
Tutoring third year physics students and guiding experiments in solid state physics.

Junior Lecturer/Teacher, Junior University Wuppertal, Wuppertal, Germany **2008 - 2009**
Taught 10-14 year old pupils the basics of mechanics via the construction of catapults.

MENTORSHIP

Supervision of PhD students, Stanford University, Stanford, USA **since 2022 – present**
Supervision of a PhD candidate with a project on directional thermal emission
Induction into fabrication, simulations & measurements. Theory discussions.

Supervision of Msc & Bsc students, ETH Zurich, Imperial College London **2019 – 2021**
Supervision of Msc and Bsc thesis projects (5 in total) of students in Nanophotonics and nonlinear optics. Simulations & Theory.

Laboratory manager - Nanophotonics laboratory, Imperial College London, London. **2018 – 2020**
Eight users. Maintenance/Organization of fs and CW laser sources, electrical and optical equipment.
Group: Prof. Rupert Oulton

SERVICE & OUTREACH

Postdoctoral organization committee, Stanford University, USA **2022 – 2025**
Organization of plenary talks and outreach events at the Gabelle Laboratory for Advanced Materials (GLAM).

Covid-19 Rapid Synthesis of Best Evidence, NHS - Imperial College London, UK **2020**
Worked with the medical department supporting the National Health trust (NHS) to establish a platform answering Covid-19 related questions based on the current scientific literature.

Conference organization, OSA student chapter, London, UK **2020**

Part of the Imperial organization committee of the first photonics online meetup (POM) with over 1000 participants worldwide. http://photonicsonlinemeetup.org/.

Active member in the optical society of America, OSA student chapter, UK **2018 – 2020**

The group organized scientific talks & outreach events at Imperial College London.

Head of the group, Amnesty International University group RWTH Aachen, Germany **2012 - 2013**

Organization of charity events such as concerts and exhibitions in a group of 30 members to raise money for human rights related work.

Peer-Reviewed for: Nature Communications, ACS Photonics, Advanced Materials, Optica: i) Optics Express, ii) Optics Materials Express, Nature Scientific Reports, AIP Advances