Exponent®
Engineering & Scientific Consulting

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Professional Profile

Dr. Bergemann is an experimental physicist with a background in material and device characterization, optoelectronics, and a wide variety of sensors including a range of quantum sensors. His expertise includes technologies ranging from visible and IR image planes to single-photon detectors to wearable health monitors to robotic wheel trackers. Dr. Bergemann has worked at all stages of the product development process, from market exploration to fundamental research to testing sensors for mass production and formulation of factory test plans. He has also performed research and development with a range of nanomaterials and quantum sensors, including carbon nanotube photodetectors and diamond nitrogen vacancy center magnetometers. Along the way, he has developed expertise in noise characterization and analysis, electronic and optoelectronic test and characterization methods, photoluminescence, and data analysis and interpretation. Dr Bergemann's experience spans a range of industries, from space to defense to consumer electronics.

Prior to joining Exponent, Dr. Bergemann received his doctoral degree from the University of Michigan, where he studied electronic and optoelectronic properties of organic semiconductors and organic solar cells. He acted as the physics resource to an interdisciplinary group primarily composed of electrical engineers and materials scientists; they would develop improvements to devices and then Dr. Bergemann would determine the underlying principles that led to those improvements and then fold that understanding back into device design to form a roadmap for further improvement. During this time he gained experience in nanofabrication, thin film characterization, photoluminescence techniques, and the creation of new measurement and characterization techniques when necessary to answer questions about device operation. His skills in materials and device characterization and ability to communicate the results to people in other disciplines with wildly varying levels of scientific and technical knowledge resulted in significant improvements to device efficiency, underlying physical understanding, and seven patents.

After being granted his physics Ph.D. Dr. Bergemann has worked on a range of sensors and devices at every stage of the product development process from basic research to factory test plans. As a postdoc at Sandia National Laboratories he designed, fabricated, and tested biomimetic carbon nanotube single-photon detectors as part of a DARPA project to push the limits of single photon sensing. He has worked as a research scientist at Lockheed Martin Space on photodetectors at visible and IR wavelengths, including image plane checkout and characterization. He has also spent time at Amazon Lab126, working on wheel-tracking sensors for the Astro robot and user studies of health monitoring wearables. His most recent work before joining Exponent involved market research and patent formulation for a new magnetometer based on diamond nitrogen vacancy centers. As such, Dr. Bergemann is experienced with a wide variety of sensors and sensing modalities, experienced in characterization, troubleshooting, and determining what sensor is ideal for a given application. His broad base of experience, both in the commercial world and in volunteer teaching, has also given him the ability to effectively communicate complicated scientific and technical information to people at all levels of understanding.

Academic Credentials & Professional Honors

Ph.D., Physics, University of Michigan, 2015

M.S., Physics, University of Michigan, 2010

B.A., Physics, Harvey Mudd College, 2007

Prior Experience

Quantum Sensing Fellow, WISER, 2024-2025

Core Reviewer, Outlier AI, 2024-2025

Sensor Architect II, Sensors Group, Amazon Lab126, 2022

Research Scientist Senior, Lockheed Martin Space, 2019-2021

Postdoctoral Researcher, Materials Physics Group, Sandia National Laboratories, 2016-2019

Ph.D. Candidate, Physics, Optoelectronics Components and Materials Group, University of Michigan

Professional Affiliations

American Physical Society

Patents

US Patent US20130293082A1: Thermal Management of OLED Devices, November 2013 (Forrest SR, Bergemann KJ).

US Patent US20130240850A1: Ultra-High Efficiency Phosphorescent Organic Light Emitting Diodes Using Singlet Fission, September 2013 (Forrest SR, Zhang YI, Bergemann KJ).

US Patent US20160351836A1: Phosphorescent organic light emitting diodes using singlet fission material, December 2016 (Forrest SR, Zhang YI, Bergemann KJ).

US Patent No. 10,069,095: Organic Photosensitive Devices with Exciton-Blocking Charge Carrier Filters, September 4, 2018 (Forrest SR, Xiao X, Zimmerman JD, Bergemann K, Panda A, Lassiter B, Thompson ME, Bartynski AN, Trinh C).

US Patent US 20160254101 A1: Organic Photosensitive Devices with Exciton-Blocking Charge Carrier Filters, September 2016 (Forrest SR, Xiao X, Zimmerman JD, Bergemann K, Panda A, Lassiter B, Thompson ME, Bartynski AN, Trinh C).

US Patent US 20160020418 A1: Stable Organic Photosensitive Devices with Exciton-Blocking Charge Carrier Filters Utilizing High Glass Transition Temperature Materials, January 2016 (Forrest SR, Burlingame Q, Xiao X, Bergemann KJ, Panda A, Zimmerman JD, Lassiter BE, Thompson ME, Bartynski AN, Trinh C).

Publications

Bergemann KJ, Leonard F. Room-Temperature Phototransistor with Negative Photoresponsivity of 108 A W−1 Using Fullerene-Sensitized Aligned Carbon Nanotubes. Small, in press.

Bergemann KJ, Forrest SR. Measurement of exciton diffusion lengths in optically thin organic films. Applied Physics Letters 2011; 99(24):243303.

Bergemann KJ, Krasny R., Forrest SR. Thermal Properties of Organic Light-Emitting Diodes. Organic Electronics 2012; 13(9):1565-1568.

Bergemann KJ, Liu X, Panda A, Forrest SR. Singlets Lead to Photogeneration in C60-based Organic Heterojunctions. Physical Review B July 2015; 92(3):035408.

Bergemann KJ, Amonoo JA, Song B, Green PF, Forrest SR. Surprisingly High Conductivity and Efficient Exciton Blocking in Fullerene: Wide-Energy-Gap Small Molecule Mixtures. Nano Letters May 2015; 15(6): 3994-3999.

Xiao X, **Bergemann KJ,** Zimmerman JD, Lee K, Forrest SR. Small-Molecule Planar-Mixed Heterojunction Photovoltaic Cells with Fullerene-Based Electron Filtering Buffers. Adv. Energy Mater. May 2014; 4(7).

Bartynski AN, Trinh C, Panda A, **Bergemann KJ,** Lassiter BE, Zimmerman JD, Forrest SR, Thompson ME. A Fullerene-Based Organic Exciton Blocking Layer with High Electron Conductivity. Nano Letters 2013; 13(7):3315-3320.

Xiao X, Zimmerman JD, Lassiter BD, **Bergemann KJ,** Forrest SR. A hybrid planar-mixed tetraphenyldibenzoperiflanthene/C70 photovoltaic cell. Applied Physics Letters 2013; 102(7):073302-073302-4.

Wei G, Xiao X, Wang S, Sun K, **Bergemann KJ,** Thompson ME, Forrest SR. Functionalized Squaraine Donors for Nanocrystalline Organic Photovoltaics. ACS Nano 2011; 6(1):972–978.

Presentations

Bergemann KJ. Functionalized Carbon Nanotube Phototransistors with Sub-Femtowatt Sensitivity at Room Temperature. Oral presentation, Symposium B03 – Carbon Nanotubes – From Fundamentals to Devices, 235th ECS Meeting,2019.

Bergemann KJ. Fullerene-sensitized carbon nanotube array phototransistor with responsivity of 108 A/W. Oral presentation, Advanced Photon Counting Techniques XIII, SPIE Defense + Commercial Sensing, 2019.

Bergemann KJ. Fullerene-Sensitized Carbon Nanotube Array Phototransistor with Responsivity Exceeding 107 A/W. Oral presentation, Symposium B03 – Carbon Nanotubes – From Fundamentals to Devices, 233rd ECS Meeting, 2018.

Bergemann KJ. Fullerene-Sensitized Carbon Nanotube Array Phototransistor with Responsivity Exceeding 107 A/W. Oral presentation, Symposium B03 – Carbon Nanotubes – From Fundamentals to Devices, 233rd ECS Meeting, 2018.

Bergemann KJ. Thermal Modeling of OLEDs. Oral presentation, Center for Energy Nanoscience 2012 Annual Meeting.

Bergemann KJ. Fullerene:Blocker Exciton Filter. Poster presentation, Symposium Y: Physics of Organic and Hybrid Organic-Inorganic Solar Cells, 2013 MRS Fall Meeting and Exhibit.

Bergemann KJ. Non-Idealities in Electrostatically Doped Carbon Nanotube Diodes. Poster presentation, Symposium W: Carbon Nanomaterials, 2012 MRS Fall Meeting and Exhibit.