

Aaron J. Pung, Ph.D.

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Education

Bachelor of Science:	Physics	Kansas State University	2008
Master of Science:	Optical Engineering	Univ. of North Carolina	2011
Doctorate of Philosophy:	Photonic Science	Clemson University	2013

Experience

Consultant – 02/2022 to Present

- Designed and developed an image processing algorithm to analyze multispectral *in vivo* imagery, enabling real-time identification of tumor cells inside living rats via ultraviolet fluorescence
- Devised alternative solutions for rearview motorcycle helmet optics, improving on state-of-the-art patented designs

Signal Processing Engineer – 10/2022 to Present

Slingshot Aerospace, Remote

- Developed a weather data analysis tool capable of leveraging machine learning to predict location-specific sensor metrics, resulting in a 30% increase in data collection and enhancing system safety
- Independently built a digital twin of the radio frequency (RF) environment for air-, land-, sea-, and space-based assets, expanding Slingshot's expertise into the RF domain
- Completed radiometric and polarimetric analysis of synthetically generated ground-to-space satellite observations, resulting in light curve estimates for AI and ML analysis pipelines
- Developed and validated satellite communication signal structures using Fibonacci and Galois algorithms, resulting in a 3X increase in detectable and decodable signals
- Designed custom lens arrays for novel telescope systems using ANSYS Zemax OpticStudio, providing cost-effective custom solutions for military contracts

RF Signal Processing Engineer – 09/2020 to Present

Space Dynamics Laboratory, Albuquerque, NM

- Conceptualized, validated, and submitted two sole-author patents for small satellite technology, resulting in miniaturized and modular solutions in atmospheric measurements
- Pioneered a technique to agnostically decimate, clean, and process high density spectro-temporal data in real time, improving efficiency and data usage by 250%.
- Established and optimized a platform-agnostic data pipeline for real-time ionosphere analysis, enabling nowcasts and forecasts of the ionosphere's topology
- Automated large scale data analysis from water-, air-, and ground-based RF and optical systems, drastically reducing the data-to-document time window
- Independently created a data-agnostic multi-purpose tool suite for RADAR signal analysis, providing real-time characterization and classification of passively collected signals
- Developed an automated routine to remotely evaluate and monitor RADAR systems, increasing overall efficiency by 300%

Optical Engineer / Computer Scientist - 01/2015 to 08/2020

Sandia National Laboratories, Albuquerque, NM

- Led modeling efforts to design and characterize electro-optic infrared sensors, resulting in a 2019 R&D100 Award for Nanoantenna-Enabled Detectors (NEDs)
- Assessed and improved sub-pixel tracking algorithms, increasing performance for on-orbit and ground-based detection systems
- Scraped and analyzed hyperspectral satellite imagery, providing validation for vegetation health models
- Established transparency and accountability in small and medium-sized software development teams, producing an 18% rise in efficiency
- Created new visualization techniques for space-, time-, and frequency-dependent data, reducing overall analysis time
- Merged high-fidelity CAD models, real-world material data, and orbital mechanics to estimate satellite attitude and location
- Spearheaded a multi-laboratory effort to improve electromagnetic shielding, increasing nuclear weapons safety

Postdoctoral researcher - 12/2013 to 12/2014

Clemson University, Clemson, SC

- Modeled lithographic material deposition and etching processes, enabling new micro-resonator designs
- Pioneered photonic component designs to produce optical vortex beams, leading to a prototype for laser communication through dense fog

Graduate research assistant - 12/2011 to 12/2013

Clemson University, Clemson, SC

- Invented single-material laser mirrors from ultra-low expansion glass, improving the overall stability of high-power laser systems
- Co-invented photonic nano-hairs, enabling simultaneous control over optical amplitude and phase
- Engineered simultaneous control of linear and rotational translation stages, resulting in a fully automated testing platform
- Mentored and trained incoming undergraduate and graduate students, enabling both to quickly contribute to cutting-edge research

Graduate research assistant - 08/2008 to 12/2011

University of North Carolina at Charlotte, Charlotte, NC

- Guided a multi-university collaboration to understand laser-induced thin film damage, cultivating new insights in material-energy interactions
- Developed tabletop component geometries to produce optical vortex beams, leading to a prototype for laser communication through dense fog and water
- Quantified repeatability and translation errors in micro-lithography systems, increasing the success rate of fabrication

Undergraduate research intern - 05/2006 to 08/2006

National Institute of Standards and Technology, Boulder, CO

- Modeled gravitational and thermal deformation of components in laser cavities, resulting in higher-fidelity physics models

- Assessed contamination effects in lithographic fabrication tools, increasing overall process reproducibility
- Improved spectral stability of diode lasers through iterative component design.

Undergraduate research assistant - 05/2005 to 05/2008

Kansas State University, Manhattan, KS

- Demonstrated the world's first optical fiber splice in a gas-filled environment
- Developed hardware-software interfaces, resulting in streamlined laser, vacuum, and motor control
- Investigated effects of atmospheric variation on melted optical fiber, leading to stronger, higher transmission splices

Patents

U.S. Patent Application, 65/535505, "Freeform Lightweight Eyewear System," Aug. 30, 2023.

U.S. Patent Application, 18/131806, "Slotted Eyewear System," April 6, 2023.

U.S. Patent US20230176261A1, "[Uniaxial Optical Multi-Measurement Imaging System](#)", Oct. 26, 2022

U.S. Patent US20230179843A1, "[Aperture Stop Exploitation Camera](#)," Sept. 28, 2022.

U.S. Patent US20230175952A1, "[Uniaxial Optical Multi-Measurement Sensor](#)," Dec. 2, 2021.

U.S. Patent 11761750, "[Multi-environment Rayleigh Interferometer](#)," Sep. 19, 2023

U.S. Patent 16369218, "[Optical Devices Enabled by Vertical Dielectric Mie Resonators](#)," May 5, 2021.

Publications (Journal)

Aaron J. Pung, "[Computational analysis of a scalable optically homogeneous free-space interferometer](#)," J. Opt. Soc. Am. A 40, 1789-1796 (2023)

Aaron J. Pung, "Capturing multiple full-scene images with a single camera via aperture stop exploitation," J. Opt. Soc. Am. A 39, 1456-1461 (2022).

M. Goldflam, E. M. Anderson, T. R. Fortune, J. F. Klem, S. D. Hawkins, P. Davids, S. Campione, **A. J. Pung**, P. Webster, P. Weiner, P. S. Finnegan, J. Wendt, M. Wood, C. Haines, W. T. Coon, J. Olesberg, E. A. Shaner, C. N. Kadlec, T. E. Beechem, M. B. Sinclair, A. Tauke-Pedretti, J. K. Kim, and D. W. Peters, "Nanoantenna-Enhanced Resonant Detectors for Improved Infrared Detector Performance". United States: N. p., 2020. Web.

S. Campione, **A. J. Pung**, L. K. Warne, W. L. Langston, T. Mei, and H. G. Hudson, "Validation of Shielded Cable Modeling in Xyce Based on Transmission-Line Theory," *Progress In Electromagnetics Research Letters*, Vol. 87, 51-57, 2019.

Pung, A.J.; Goldflam, M.D.; Burckel, D.B.; Brener, I.; Sinclair, M.B.; Campione, S. Enhancing Absorption Bandwidth through Vertically Oriented Metamaterials. *Appl. Sci.* 2019, 9, 2223.

S. Melgaard, N. K. Grady, N. Bikhazi, **A. J. Pung**, J. A. Mercier, "Microscale Transient Detection.", United States: N. p., 2017.

M. J. Byrd, **A. J. Pung**, E. G. Johnson, K. Lee, R. Magnusson, P. Binun, K. McCormick. "Wavelength Selection and Polarization Multiplexing of Blue Laser Diodes." *IEEE Photonics Technology Letters*, vol. 27, no. 20, 2015, pp. 2166–2169.

M. J. Byrd, R. H. Woodward, **A. J. Pung**, E. G. Johnson, K. J. Lee, R. Magnusson, P. Binun, and K. McCormick, "Blue Laser Diode Wavelength Selection With a Variable Reflectivity Resonant Mirror," *IEEE Photonics Technology Letters*, vol. 26, no. 23, pp. 2311–2314, Jan. 2014.

L. N. Taylor, A. K. Brown, **A. J. Pung**, E. G. Johnson, J. J. Talghader.. "Continuous-Wave laser damage of uniform and nanolaminate hafnia and titania optical coatings." *Optics Letters*, vol. 38, no. 21, 2013, p. 4292.

A. J. Pung, S. R. Carl, I. Raghu Srimathi, E. G. Johnson. "Method of Fabrication for Encapsulated Polarizing Resonant Gratings." *IEEE Photonics Technology Letters*, vol. 25, no. 15, 2013, pp. 1432–1434.

I. Raghu Srimathi, **A. J. Pung**, Y. Li, R. C. Rumpf, E. G. Johnson.. "Fabrication of metal-Oxide nano-Hairs for effective index optical elements." *Optics Express*, vol. 21, no. 16, 2013, p. 18733.

Y. Li, I. Raghu Srimathi, R. H. Woodward, **A. J. Pung**, M. K. Poutous, R. K. Shori, E. G. Johnson. "Guided-Mode Resonance Filters for Wavelength Selection in Mid-Infrared Fiber Lasers." *IEEE Photonics Technology Letters*, vol. 24, no. 24, 2012, pp. 2300–2302.

Z. A. Roth, P. Srinivasan, M. K. Poutous, **A. J. Pung**, R. C. Rumpf, E. G. Johnson. "Azimuthally Varying Guided Mode Resonance Filters." *Micromachines*, vol. 3, no. 4, 2012, pp. 180–193.

A. J. Pung, M. K. Poutous, R. C. Rumpf, Z. A Roth, E. G. Johnson, "Two-Dimensional guided mode resonance filters fabricated in a uniform low-Index material system." *Optics Letters*, vol. 36, no. 16, 2011, p. 3293.

Menelaos K. Poutous, **Aaron J. Pung**, Pradeep Srinivasan, Zachary A. Roth, and Eric G. Johnson, "Polarization selective, graded-reflectivity resonance filter, using a space-varying guided-mode resonance structure," *Opt. Express* 18, 27764-27776 (2010).

Publications (Conference)

Jones, Scott, Peter Shagnea, David Fiske, **Aaron Pung**. "DEEP: A Proliferated LEO PNT Situational Awareness Threat Monitor." *Advancing Positioning, Navigation and Timing (PNT)*, 15 June 2023, <https://www.ion.org/jnc/abstracts.cfm?paperID=12270>. Accessed 21 Aug. 2023.

A. Pung, "Multi-image Generation via Apertuer Stop Exploitation" *2022 Optics, Photonics, and Lasers*, Remote, 2022.

Obenberger, K., **Pung, Aaron J.**, Dao, Eugene V., Fallen, Christopher T. (2021, December 13-17). Leveraging Natural and Anthropogenic HF Noise as an Ionospheric Sounder [Conference presentation]. AGU Fall Meeting, New Orleans, LA, United States.

A. Tauke-Pedretti, M. Goldflam, J. Kim, E. Anderson, T. Fortune, J. Klem, S. Hawkins, P. Davids, S. Campione, **A. Pung**, P. Webster*, P. Weiner, P. Finnegan, J. Wendt, M. Wood, C. Haines, M. Sinclair, W. Coon, J. Olesberg, E. Shaner, C. Kadlec, T. Beechem, D. Peters, 2019, 'Nanoantenna-enabled Detector Arrays for High-Efficiency in the Long Wavelength Infrared', MSS Parallel Conference (Passive, BSD, and M&D), Orlando, FL. MD4A09.

D. Peters, M. Goldflam, S. Campione, P. Finnegan, J. Kim, M. Sinclair, **A. Pung**, C. Alford, W. Coon, A. Tauke-Pedretti, J. Wendt, M. Wood, P. Weiner, S. Hawkins, P. Davids, L. Warne, E. Anderson, T. Fortune. (2018). *Resonant Ultrathin Infrared Detectors Enabling High Quantum Efficiency*. 1-3. 10.1109/RAPID.2018.8509017.

- A. Pung** *et al.*, "Parametric Analysis of Vertically Oriented Metamaterials for Wideband Omnidirectional Perfect Absorption" *2018 IEEE International Symposium on Antennas and Propagation & USNC/URSI National Radio Science Meeting*, Boston, MA, 2018.
- D. B. Burckel, **A. J. Pung** and S. Campione, "Challenges and opportunities in modeling and optimization of 3D optical metasurfaces," *2018 International Applied Computational Electromagnetics Society Symposium (ACES)*, Denver, CO, 2018.
- W. Langston, J. Kotulski, R. Coats, R. Jorgenson, S. Blake, S. Campione, **A. Pung**, and B. Zinser, "Massively parallel frequency domain electromagnetic simulation codes", *2018 International Applied Computational Electromagnetics Society Symposium (ACES)*, Denver, CO, 2018.
- D. Anderson, A. Bapst, J. Coon, **A. Pung**, M. Kudenov, "Supervised non-negative tensor factorization for automatic hyperspectral feature extraction and target discrimination", Proc. SPIE 10198, Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XXIII, 101980Q (5 May 2017).
- J. Baghdady, M. Byrd, W. Li, K. Morgan, **A. Pung**, K. Miller, E. Johnson, "Spatial multiplexing for blue lasers for undersea communications", Proc. SPIE 9459, Ocean Sensing and Monitoring VII, 945905 (6 July 2015).
- E. G. Johnson, J. Baghdady, M. Byrd, W. Li, K. Morgan, **A. Pung**, K. Miller. "Space division multiplexing of blue lasers for undersea communications." *2015 IEEE Photonics Conference (IPC)*, 2015.
- M. Byrd, J. Baghdady, **A. J. Pung**, E. Johnson, K. Lee, R. Magnusson, P. Binun, K. McCormick, "Design and fabrication of a resonant mirrors for locking blue laser diodes", Proc. SPIE 9374, Advanced Fabrication Technologies for Micro/Nano Optics and Photonics VIII, 93740Z (13 March 2015).
- A. Pung**, I. Raghu Srimathi, Y. Li, E. Johnson, M. D. Shinn, K. J. Lee, R. Magnusson, J. Talghader, L. Taylor, L. Shah, M. Richardson, "High-power laser testing of 3D meta-optics", Proc. SPIE 8885, Laser-Induced Damage in Optical Materials: 2013, 88850K (14 November 2013).
- A. J. Pung**, I. Raghu Srimathi, Y. Li, E. G. Johnson. "Fabrication method for encapsulation of low-Index, narrowband guided-Mode resonance filters." *2013 IEEE Photonics Conference*, 2013.
- I. Raghu Srimathi, **A. J. Pung**, E. G. Johnson. "Optical nano-Hairs for micro-Optical applications." *2013 IEEE Photonics Conference*, 2013.
- Eric G. Johnson, Yuan Li, Indumathi Raghu Srimathi, Ryan H. Woodward, Menelaos K. Poutous, **Aaron J. Pung**, Martin Richardson, Lawrence Shah, Ramesh Shori, Robert Magnusson, "Resonant optical devices for IR lasers", Proc. SPIE 8599, Solid State Lasers XXII: Technology and Devices, 85991G (1 April 2013).
- A. J. Pung**, M. K Poutous, R. C. Rumpf, Z. A. Roth, E. G. Johnson, "Fabrication of optically monolithic, low-index guided mode resonance filters", Proc. SPIE 8249, Advanced Fabrication Technologies for Micro/Nano Optics and Photonics V, 82490F (8 February 2012).
- Lawrence Shah, R. Andrew Sims, Pankaj Kadwani, Christina C. C. Willis, Joshua B. Bradford, Zachary Roth, **Aaron Pung**, Menelous Poutous, Eric G. Johnson, Martin Richardson, "Integrated 100 W thulium fiber MOPA system", Proc. SPIE 8381, Laser Technology for Defense and Security VIII, 83810Z (7 May 2012).
- I. Raghu Srimathi, M. K. Poutous, **A. J. Pung**, Y. Li, R. H. Woodward, E. G. Johnson, R. Magnusson. "Mid-Infrared Guided-Mode Resonance reflectors for applications in high power laser systems." *IEEE Photonics Conference 2012*, 2012.

Y. Li, R. H. Woodward, I. Raghu Srimathi, **A. J. Pung**, M. K. Poutous, E. G. Johnson, R. K. Shori. "2.78 μm fluoride glass fiber laser using guided mode resonance filter as external cavity mirror." *IEEE Photonics Conference 2012*, 2012.

A. Pung, I. Raghu Srimathi, Y. Li, E. Johnson, M. D. Shinn, K. J. Lee, R. Magnusson, J. Talghader, L. Taylor, L. Shah, M. Richardson, "High-power laser testing of 3D meta-optics", Proc. SPIE 8885, Laser-Induced Damage in Optical Materials: 2013, 88850K (14 November 2013).

A. J. Pung, I. Raghu Srimathi, Y. Li, E. G. Johnson. "Fabrication method for encapsulation of low-Index, narrowband guided-Mode resonance filters." *2013 IEEE Photonics Conference*, 2013.

I. Raghu Srimathi, **A. J. Pung**, E. G. Johnson. "Optical nano-Hairs for micro-Optical applications." *2013 IEEE Photonics Conference*, 2013.

L. Shah, A. Sims, P. Kadwani, C. Willis, J. Bradford, Z. Roth, **A. Pung**, M. Poutous, E. Johnson, M. Richardson, "Integrated 100-W polarized narrow linewidth thulium fiber MOPA system", Proc. SPIE 8237, Fiber Lasers IX: Technology, Systems, and Applications, 82371M (16 February 2012).

A. Pung, M. K. Poutous, Z. A. Roth, E. G. Johnson. "Fabrication of Low Contrast Homogenous Guided Mode Resonance Filters." *CLEO:2011 - Laser Applications to Photonic Applications*, 2011, doi:10.1364/cleo_at.2011.jtui24.

M. Poutous, Z. Roth, K. Buhl, **A. Pung**, R. Rumpf, E. Johnson, "Correlation of fabrication tolerances with the performance of guided-mode-resonance micro-optical components", Proc. SPIE 7205, Advanced Fabrication Technologies for Micro/Nano Optics and Photonics II, 72050Y (24 February 2009).

Acknowledgments

S. Campione, L. K. Warne, and W. L. Langston, "Multipole-Based Cable Braid Electromagnetic Penetration Model: Magnetic Penetration Case," *Progress In Electromagnetics Research C*, Vol. 102, 1-11, 2020.

S. Campione *et al.*, "Penetration Through Slots in Cylindrical Cavities Operating at Fundamental Cavity Modes," in *IEEE Transactions on Electromagnetic Compatibility*. 2020.

Awards

UK Science and Technology Cooperation Award (Project Team, Space Dynamics Lab)	2024
Employee Recognition Award (Sandia National Laboratories)	2020
R&D100 Award	2019

Editorial Boards / Reviewer

SPIE – <i>Optical Engineering</i>	Reviewer, 2019 – Present
MDPI – <i>Materials / Symmetry / Applied Sciences / Micromachines</i>	Reviewer, 2019 – Present
SciencePG - <i>Optics</i>	Editorial Board, 2020 – Present
Journal of Nanotechnology in Diagnosis and Treatment	Editorial Board, 2020 – Present
Journal of Imaging	Reviewer Board, 2020 – Present

Conference chair/committees

SPIE – Adv. Fab. Tech. for Micro/Nano-Optics and Photonics	2015 - Present
OPL – Multi-dimensional Applications of Photonics, Optics, and Lasers	2022

Volunteerism

Letters to a Pre-Scientist	2015 – Present
Sigma Pi Sigma	2016 – Present
International Society of Optics & Photonics (SPIE)	2016 – Present
Optical Society of America (OSA)	2018 – Present
Civil Air Patrol (CAP) (Squadron commander)	2017 – 2023
New Mexico Museum of Natural History and Science	2019 – 2023
American Red Cross	2020 – 2023