Charles J. Carver

Email | Google Scholar | ORCID | LinkedIn

I am a 2019 NSF Fellow at Columbia University with 5+ years of experience designing end-to-end laser communication and sensing systems. My interdisciplinary academic and industry research fuses knowledge from optics, networking, embedded systems, computer vision, signal processing, and robotics. I am motivated to apply my leadership qualities, clear communication skills, technical expertise, and scientific creativity to all aspects of my research, engineering, and consulting career.

EDUCATION

Columbia University — New York, NY
Doctor of Philosophy, Computer Science — Sep 2022* – Expected Jun 2024
- Advised by Dr. Xia Zhou (research) and Dr. Shree Nayar (secondary)
- NSF Fellowship
- 4.26 GPA

Dartmouth College — Hanover, NH
Master of Science, Computer Science — Sep 2018 – Jun 2022*
- Advised by Dr. Xia Zhou
- NSF Fellowship, M.S. Class Marshal, Vice President of Grad. Student Council
- 3.93 GPA

Fordham University — Bronx, NY
Bachelor of Science, Physics (Minor, Mathematics) — Sep 2014 – May 2018
- Advised by Dr. Christopher Aubin (research)
- Victor F. Hess Award for best record of achievement in Physics
- 3.70 GPA, *magna cum laude*

*Transferred doctoral programs with advisor.

HONORS & AWARDS

Best Demo Award, *ACM MobiCom*	Oct 2023
Second Place Winner, *ACM MobiCom Student Researcher Competition*	Oct 2023
M.S. Class Marshal, *Dartmouth College Commencement*	Jun 2022
Grand Prize Winner, *Dartmouth Innovation and Technology Festival*	May 2022
Best Paper Award, *USENIX NSDI*	Feb 2020
Best Demo Award, *ACM HotMobile*	Feb 2020
Victor F. Hess Award, *Fordham University Department of Physics*	May 2018
Best Poster Runner-Up, *NYIT 8th Annual Cybersecurity Conference*	Sep 2017

FELLOWSHIPS & GRANTS

National Science Foundation, DGE-2036197 (NSF-GRFP), $49,000	2022 – 2024
Association for Computing Machinery, SIGMOBILE Travel Grant, $1,110	2022
National Science Foundation, GRFP-1840344 (NSF-GRFP), $92,000	2019 – 2022
Dartmouth College, Guarini School of Graduate and Advanced Studies Fellowship, $32,510	2018 – 2019
National Science Foundation, CNS-1559652 (NSF-REU), $7,800	2017

RESEARCH INTERESTS

Mobile systems.	Networking.	Light communication and sensing.
Embedded computing.	Computer vision.	Aerial, ground, and underwater robotics.
Fiber-optic sensing.	Energy-efficient networking.	Nanophotonic and quantum materials.

RESEARCH EXPERIENCE

Columbia University, Department of Computer Science New York, NY

NSF Fellow Sep 2022 – Present

- Advised by Dr. Xia Zhou (research) and Dr. Shree Nayar (secondary).
- Leading two multi-university collaborations investigating Gbps laser networking and mW-level power delivery for mobile systems.
- Designing novel optical/electronic systems, CV algorithms for neuromorphic cameras, and 3D-printed CAD prototypes.
- Published twice in highly selective conferences (14–18% acceptance rates) and twice in premier (top 1–2%) *Nature* journals.
- Funded by National Science Foundation Grant Nos. DGE-2036197 and CNS-1552924.

Google, Network Hotspots Team Mountain View, CA

Research Intern; Student Researcher May 2023 – Apr 2024

- Advised by Dr. Hamid Bazzaz.
- Built production SQL modules to correlate application latency and network utilization using terabytes of data per day.
- Performed Python data analysis to measure impact on internal and production applications, including ML stack.
- Presented findings during Google-wide Technical Infrastructure engineering reviews and co-authored in-progress manuscript.

Google, Optical Networking Technologies Team Mountain View, CA

Research Intern; Student Researcher Jun 2021 – May 2023

- Advised by Dr. Tad Hofmeister.
- Directed investigation into optical polarization sensing of anthropic and seismic activity over terrestrial fiber-optic networks.
- Constructed a real-time Python pipeline for collecting and preprocessing gigabytes per day of fiber polarization data.
- Assisted in designing database schema for efficient, long-term data collection using Google's infrastructure.
- Authored manuscript (*Nature Comms. Eng.*) quantifying sensing fidelity and implications on network health/seismic monitoring

Dartmouth College, Department of Computer Science Hanover, NH

Graduate Research Assistant; NSF Fellow Sep 2018 – Jun 2022

- Advised by Dr. Xia Zhou.
- Led two multi-department collaborations exploring wireless, laser-based networking and 3D sensing between AUVs and UAVs.
- Prototyped PCBs for embedded systems, programmed end-to-end software stacks, and implemented experimental optical setups.
- Published six manuscripts in highly selective conferences (18–28% acceptance rates), one in top 4% *Springer* journals.
- Contributed three invited publications to one IEEE networking conference and two ACM magazines; filed two U.S. patents.
- Received three awards (including Best Paper Award and Best Demo Award), five press articles, ≥85 citations.
- Funded by National Science Foundation Grant Nos. GRFP-1840344 and CNS-1552924.

Fordham University, Department of Physics Bronx, NY

Research Assistant Sep 2017 – May 2018

- Advised by Dr. Christopher Aubin.
- Created lightweight Python framework for SU(2) gauge theory (two-color Quantum Chromodynamics) simulations.
- Enabled future student researchers to leverage optimized simulation framework on memory-constrained commodity devices.

New York Institute of Technology, Department of Computer Science New York, NY

NSF REU Fellow May 2017 – Sep 2017

- Advised by Dr. Ziqian Dong (primary) and Dr. N. Sertac Artan (secondary).
- Investigated secure phone-to-phone screen communication and passive indoor localization using ambient light.
- Published twice in selective IEEE conferences (30% acceptance rate).
- Awarded second place for best poster and received ≥19 combined citations.
- Funded by National Science Foundation Grant No. CNS-1559652.

PUBLICATIONS

Peer-reviewed conference, journal, and workshop submissions:

[1] **Charles J. Carver**, Toma Itagaki, Kechen Liu, Megan G. N. Manik, Zachary Englhardt, Vikram Iyer, and Xia Zhou. "Demonstration of laser power delivery for mobile microrobots." In *Proceedings of the 10th Workshop on Micro Aerial Vehicle Networks, Systems, and Applications*. 2024. DOI.

[2] **Charles J. Carver** and Xia Zhou. "Polarization sensing of network health and seismic activity over a live terrestrial fiber-optic cable." *Nature Communications Engineering*. 2024 (To Appear). Preprint.

[3] Xiaoxin Wang, **Charles J. Carver**, Nicholas R. Shade, Eric R. Fossum, Xia Zhou, and Jifeng Liu. "High-efficiency, low-speckle contrast white laser lighting via multi-stage scattering and photon recycling." *Nature Light: Science & Applications*. 2024 (With Reviewers). Preprint.

[4] **Charles J. Carver**, Hadleigh Schwartz, Qijia Shao, Nicholas Shade, Joseph Lazzaro, Xiaoxin Wang, Jifeng Liu, Eric Fossum, and Xia Zhou. "Catch me if you can: laser tethering with highly mobile targets." In *Proceedings of the 21st USENIX Conference on Networked Systems Design and Implementation*. 2024. DOI. Artifacts: Video. Press: 1. **Best demo award and 2nd place SRC winner at ACM MobiCom '23.**

[5] Alberto Quattrini Li, **Charles J. Carver**, Qijia Shao, Xia Zhou, and Srihari Nelakuditi. "Communication for underwater robots: recent trends." *Springer Current Robotics Reports*. 2023. DOI.

[6] **Charles J. Carver**, Qijia Shao, Samuel Lensgraf, Amy Sniffen, Maxine Perroni-Scharf, Hunter Gallant, Alberto Quattrini Li, and Xia Zhou. "Sunflower: locating underwater robots from the air." In *Proceedings of the 20th Annual International Conference on Mobile Systems, Applications and Services*. 2022. DOI. Artifacts: Video, Presentation. Press: 1, 2, 3, 4. **Grand prize winner at the '22 Dartmouth Innovation and Technology Festival.**

[7] Vimal Kakaraparthi/Qijia Shao, **Charles J. Carver**, Tien Pham, Nam Bui, Phuc Nguyen, Xia Zhou, and Tam Vu. "FaceSense: sensing face touch with an ear-worn system." In *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies*. 2021. DOI.

[8] **Charles J. Carver**, Zhao Tian, Hongyong Zhang, Kofi M. Odame, Alberto Quattrini Li, and Xia Zhou. "AmphiLight: direct air-water communication with laser light." In *Proceedings of the 17th USENIX Conference on Networked Systems Design and Implementation*. 2020. DOI. Artifacts: Presentation. Press: 1. **Best paper award.**

[9] Zhao Tian, **Charles J. Carver**, Qijia Shao, Monika Roznere, Alberto Quattrini Li, and Xia Zhou. "PolarTag: invisible data with light polarization." In *Proceedings of the 21st International Workshop on Mobile Computing Systems and Applications*. 2020. DOI. **Best demo award.**

[10] **Charles Carver**, Shela Wu, Adriana Rogers, Matthew Stafford, N. Sertac Artan, and Ziqian Dong. "Indoor localization through visible light characterization using front-facing smartphone camera." In *Proceedings of the 2017 IEEE 14th International Conference on Mobile Ad Hoc and Sensor Systems*. 2017. DOI.

[11] Matthew Stafford, Adriana Rogers, Shela Wu, **Charles Carver**, N. Sertac Artan, and Ziqian Dong. "TETRIS: smartphone-to-smartphone screen-based visible light communication." In *Proceedings of the 2017 IEEE 14th International Conference on Mobile Ad Hoc and Sensor Systems*. 2017. DOI. **Best poster runner-up at NYIT 8th Annual Cybersecurity Conference.**

Peer-reviewed demo submissions:

[1] **Charles J. Carver**, Hadleigh Schwartz, Qijia Shao, Nicholas Shade, Joseph P. Lazzaro, Xiaoxin Wang, Jifeng Liu, Eric R. Fossum, and Xia Zhou. "Catch me if you can: demonstrating laser tethering with highly mobile targets." In *Proceedings of the 29th Annual International Conference on Mobile Computing and Networking*. 2023. DOI. Artifacts: Video.

[2] **Charles J. Carver**, Qijia Shao, Samuel Lensgraf, Amy Sniffen, Maxine Perroni-Scharf, Hunter Gallant, Alberto Quattrini Li, and Xia Zhou. "Sunflower: locating underwater robots from the air: video." In *Proceedings of the 20th Annual International Conference on Mobile Systems, Applications and Services*. 2022. DOI. Artifacts: Video.

[3] Zhao Tian, **Charles J. Carver**, Qijia Shao, Monika Roznere, Alberto Quattrini Li, and Xia Zhou. "Demo: PolarTag – invisible data with light polarization." In *Proceedings of the 21st International Workshop on Mobile Computing Systems and Applications*. 2020. DOI.

Invited publications:

[1] **Charles J. Carver**, Zhao Tian, Qijia Shao, Hongyong Zhang, Kofi M. Odame, Alberto Quattrini Li, and Xia Zhou. "Air-water communication and sensing with light." In *Proceedings of the 2022 14th International Conference on Communication Systems & Networks*. 2022. DOI.

[2] **Charles J. Carver**, Zhao Tian, Hongyong Zhang, Kofi M. Odame, Alberto Quattrini Li, and Xia Zhou. "AmphiLight: direct air-water communication with laser light." *GetMobile: Mobile Computing and Communication*. 2020. DOI.

[3] **Charles J. Carver**, Tianxing Li, and Xia Zhou. "Lighting the way to wireless efficiency." *XRDS: Crossroads, The ACM Magazine for Students*. 2019. DOI.

PATENTS

"Localizing underwater robots from the air," ***C Carver**, Q Shao, A Quattrini Li, X Zhou* — U.S. Patent 18209941

"Speckle-suppressing lighting system," *X Wang,* ***C Carver**, E Fossum, J Liu, X Zhou, N Shade* — U.S. Patent 17953129

TECHNICAL SKILLS

Languages – Python, C/C++, MATLAB, SQL, Bash, Verilog, PHP, JavaScript, HTML, CSS.
Technologies – Zemax, Autodesk (CAD/EDA), SPICE, Vivado, Git/GitHub, Jupyter, Photoshop, LaTeX, gnuplot.
Frameworks – NumPy, Pandas, Dask, Matplotlib, OpenCV, SciPy, Scikit-learn, Tensorflow.
Hardware – Arduino, Raspberry Pi, OpenMV, NVIDIA Jetson, AMD FPGAs, ROS-based systems.
Prototyping – Analog/digital circuit design, PCB design, 3D-printed CAD modeling.

LEADERSHIP & ACTIVITIES

MS Applicant Reviewer, *Columbia University* — Mar 2023 – Jun 2023
PhD Pre-Applicant Review Program, *Columbia University* — Nov 2022 – Dec 2022
REU Alumni Panel, *New York Institute of Technology* — Jul 2022
REU Alumni Panel, *New York Institute of Technology* — Jul 2021
Vice President, *Dartmouth Graduate Student Council* — May 2021 – May 2022
- Co-Chair of Benefits Ad-Hoc Committee
- Co-Chair/Co-Founder of Alumni Representation Ad-Hoc Committee
- Co-Chair/Co-Founder of Housing Ad-Hoc Committee
- Voting Member on College's Ad-Hoc Council of Work-Life Issues
- Graduate Representative on Board of Trustees Student Liaison Committee
- Graduate Representative on Jed Foundation Exploratory Committee
- Legislator for External Affairs Standing Committee

Wellness Coach, *Dartmouth Wellness Center* — Sep 2020 – Jun 2022
Web Co-Chair, *ACM MobiSys '21* — Dec 2020 – Jul 2021
CS Department Representative, *Dartmouth Graduate Student Council* — Sep 2020 – May 2021
- Voting Member on Student Life Committee

Mentor, *New York Academy of Sciences STEMU Program* — Nov 2018 – May 2019
Head of IT, *Fordham University Department of Physics* — Sep 2017 – May 2018
Tutor, *Fordham University Department of Physics* — Sep 2015 – May 2018

INVITED TALKS

University of Pennsylvania, *Department of Electrical and Systems Engineering* — Feb 2024
Fordham University, *Department of Physics* — Dec 2020
Dartmouth College, *Department of Computer Science* — Nov 2020
University of New Hampshire, *Department of Physics* — Oct 2019

TEACHING EXPERIENCE

Columbia University, Department of Computer Science — New York, NY
Topics in Mobile Computing, *Head Teaching Assistant* — Sep 2023 – Dec 2023

Dartmouth College, Department of Computer Science — Hanover, NH
Introduction to Programming and Computation, Head Teaching Assistant — Mar 2019 – Jun 2019

Software Design and Implementation, Head Teaching Assistant — Jan 2019 – Mar 2019
Discrete Mathematics in Computer Science, *Teaching Assistant* — Sep 2018 – Nov 2018

Fordham University, Department of Physics — Bronx, NY
Thermodynamics and Statistical Mechanics, *Grading Assistant* — Jan 2018 – May 2018

Fordham University, Department of Mathematics — Bronx, NY
Calculus II, *Grading Assistant* — Sep 2017 – May 2018
Finite Mathematics, *Grading Assistant* — Sep 2016 – May 2017

Fordham University, Department of Physics — Bronx, NY
Physics I Lab, *Lab Assistant* — Sep 2016 – Dec 2016

REFERENCES

Available upon request.