Volkan Gurses

Department of Electrical Engineering
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Research Interests

Integrated photonics, optoelectronics, quantum photonics, photonic-electronic integrated circuits for high-performance computing and quantum information processing

Education

California Institute of Technology, Pasadena, CA

Ph.D. in Electrical Engineering — Sep 2020 - Present
Ph.D. Minor in Physics

- Advisor: Prof. Ali Hajimiri

M.S. in Electrical Engineering, GPA: 4.06 / 4.00 — Sep 2020 - Jun 2022

- Advisor: Prof. Ali Hajimiri

Georgia Institute of Technology, Atlanta, GA

B.S. in Electrical Engineering, GPA: 3.94 / 4.00 — Aug 2016 - May 2020

- Research Thesis: Ultra-Sensitive Broadband Receiver for Longwave Radio Reception

Awards and Honors

- Carver Mead New Adventures Fund, Jan 2023 [Ann.]
- Google Ph.D. Fellowship Nominee, California Institute of Technology, Oct 2022
- Microsoft Research Ph.D. Fellowship Nominee, California Institute of Technology, Jul 2022
- R. David Middlebrook Graduate Fellowship, California Institute of Technology, Aug 2020
- Tau Beta Pi Fellowship, Tau Beta Pi, Apr 2020 [News] [Ann.]
- Caltech EAS Division Fellowship, California Institute of Technology, Mar 2020
- Roger P. Webb Undergraduate Research Award, Georgia Institute of Technology, Mar 2020 [Ann.]
- Eta Kappa Nu Innovation Scholarship, IEE-HKN Beta Mu Chapter, Feb 2020
- IEEE Microwave Theory and Techniques Society (MTT-S) Undergraduate/Pre-Graduate Scholarship, IEEE MTT-S, Feb 2020 [News] [Ann.]
- Radio Club of America Scholarship, Radio Club of America, Feb 2020
- AGU Fall Meeting Student Travel Grant, American Geophysical Union, Dec 2019 [Ann.]
- Opportunity Research Scholars Program Peer Review Award, Georgia Institute of Technology, Apr 2019 [Ann.]
- President's Undergraduate Research Award, Georgia Institute of Technology, Aug 2019 [Ann.] and Dec 2017 [Ann.]
- European Union Contest for Young Scientists (EUCYS), EIROforum CERN Special Donated Prize, Sep 2015 [News] [Ann.]
- Turkish Scientific and Technological Research Council (TUBITAK) National Secondary School Research Contest, First Prize in Physics, May 2015 [News]

Publications

Google Scholar: `https://scholar.google.com/citations?user=-JOOKBgAAAAJ`

Papers in Refereed Journals

B. V. Gurses, R. Fatemi, A. Khachaturian, A. Hajimiri. "Large-Scale Crosstalk-Corrected Thermo-Optic Phase Shifter Arrays in Silicon Photonics", *IEEE Journal of Selected Topics in Quantum Electronics*, **28**, 1-9 (2022) https://doi.org/10.1109/JSTQE.2022.3189965.

B. V. Gurses, K. T. Whitmore, and M. B. Cohen. "Ultra-sensitive broadband "AWESOME" electric field receiver for nanovolt low-frequency signals", *Review of Scientific Instruments*, **92**, 024704 (2021) https://doi.org/10.1063/5.003149.

Articles in Refereed Journals

B. V. Gurses "Enhancing spatiotemporal light modulators", *Nature Photonics*, **16**, 818-820 (2022). https://doi.org/10.1038/s41566-022-01087-8

Papers in Refereed Conferences

V. Gurses, D. Sarkar, A. Khachaturian, R. Fatemi. "A large-scale coherent imager with digital beamforming", in Proc. of *CLEO*, San Jose, CA, May 5-10, 2024.

V. Gurses, D. Sarkar, S. I. Davis, A. Hajimiri. "A photonic-electronic quantum coherent receiver for sub-shot-noise-limited optical links", in Proc. of *OFC*, San Diego, CA, March 24-28, 2024.

V. Gurses, S. I. Davis, E. Knabe, R. Valivarthi, M. Spiropulu, A. Hajimiri. "A compact silicon photonic quantum coherent receiver with deterministic phase control", in Proc. of *CLEO*, San Jose, CA, May 7-12, 2023.

V. Gurses, S. Davis, E. Knabe, R. Valivarthi, M. Spiropulu, A. Hajimiri. "Squeezed light detection with an integrated coherent optical receiver", presented at *APS March Meeting*, Las Vegas, NV, Mar. 5-10, 2023.

E. Knabe, **V. Gurses**, S. Davis, R. Valivarthi, L. Narvaez, N. Sinclair, A. Hajimiri, M. Spiropulu, "Software-based phase locking of squeezed light with balanced photodetection", presented at *APS March Meeting*, Las Vegas, NV, Mar. 5-10, 2023.

Y. Teng, S. Davis, **V. Gurses**, J.R. Vlimant, M. Spiropulu, "Phase Error Model for Quantum Multiphase Estimation", presented at *APS March Meeting*, Las Vegas, NV, Mar. 5-10, 2023.

B. V. Gurses, R. Fatemi, A. Khachaturian, A. Hajimiri. "Large-Scale Thermo-Optic Phase Shifter Array with Feedback Photodiodes", in Proc. of the *Frontiers in Optics + Laser Science*, Rochester, NY, Oct. 16-20, 2022. **(Emil Wolf Outstanding Student Paper Finalist)**

B. V. Gurses, A. Hajimiri. "Performance Limits of Sub-Shot-Noise-Limited Balanced Detectors", in Proc. of the *Frontiers in Optics + Laser Science*, Rochester, NY, Oct. 16-20, 2022.

E. Slevin, P. Singletary, K. T. Whitmore, **B. V. Gurses**, N. Opalinski, L. Thompson, M. Golkowski, M. B. Cohen, "Broadband VLF/LF Transmission from an Electrically-Small Structure via Time-Varying Antenna Properties," in Proc. of the *IEEE AP-S International Symposium on Antennas and Propagation*, Montreal, Canada, Jul. 5-10, 2020.

B. V. Gurses, K. T. Whitmore, and M. B. Cohen. "Electric Field Sensor Design for Longwave Radio Reception," in Proc. of the *IEEE SoutheastCON*, Huntsville, AL, Apr. 11–14, 2019.

Posters in Refereed Conferences

Y. Teng, S. Davis, **V. Gurses**, J.R. Vlimant, M. Spiropulu, "Phase Uncertainty Model for Realistic Quantum Multiphase Estimation", presented at *Quantum 2.0*, Denver, CO, Jun. 18-22, 2023.

B. V. Gurses, L. B. Wray, S. Deitke, and G. D. Durgin, "A 2.45 GHz Phased Array-Based Reader for Long-Range RFID Applications," presented at the *IEEE International Conference on RFID*, Orlando, FL, Oct. 2020. **(Best Poster Award)**

B. V. Gurses, K. T. Whitmore, and M. B. Cohen, "Ultra-Sensitive Broadband Remote Sensing Instrument for Longwave Radio Reception," presented at the *AGU Fall Meeting*, San Francisco, CA, Dec. 2019.

J. W. Jiang, S. Kotapati, K. Kim, **B. V. Gurses**, M. Alhassoun, and G. D. Durgin, "A 24 GHz Tag for Next-Generation RFID Systems," presented at the *IEEE International Conference on*

RFID, Phoenix, AZ, Apr. 2019.

Patents and Patent Applications

B. V. Gurses, S. I. Davis, M. Spiropulu, A. Hajimiri. "Quantum Phased Arrays". US Patent App, Serial Number 63/457,727, filed 4/6/2023

B. V. Gurses, A. Hajimiri. "Apparatus and Methods for Crosstalk-Corrected Thermo-Optic Phase Shifters". US Patent App, Serial Number 63/341,521, filed 5/13/2022

B. V. Gurses, A. Hajimiri. "Quantum Coherent Receiver". US Provisional Patent, Serial Number 63/457,727, filed 8/29/2023

B. V. Gurses, A. Hajimiri. "3D Programmable Neural Networks". US Provisional Patent, Serial Number 63/345,724, filed 5/25/2022

Research Experience

California Institute of Technology, Pasadena, CA

Graduate Researcher, Caltech Holistic Integrated Circuits Group Sep 2020 - Present

- **Integrated Quantum Optoelectronic Systems:** Developing large-scale photonic-electronic integrated systems for quantum computing, communications, and metrology. Realized the first wireless quantum information platform. Demonstrated coherent processing of quantum information with optoelectronic circuits.
- **Photonic-Electronic Transceivers and Processors:** Developing on-chip transceivers and transceiver-based photonic-electronic processors for communications and high-performance computing. Devised designs and a design framework for quantum-enhanced coherent optical transceivers.
- **Scalable Photonic and Optoelectronic Architectures:** Developed the largest (up-to-date) thermo-optic phase shifter array with monitor photodiodes and demonstrated scalable thermal crosstalk correction, enabling hardware error correction for photonic integrated systems.

Georgia Institute of Technology, Atlanta, GA

Undergraduate Researcher, Georgia Tech Electronics and Micro-Systems Lab Aug 2019 - Sep 2020

- **Folded Inductor-Based Wideband Ultra-Compact Passive Structures:** Devised and demonstrated a folded inductor-based design methodology for ultra-compact integrated mm-Wave passive structures for multi-band 5G wireless communications.

Undergraduate Researcher, Propagation Group Jan 2019 - May 2020

- **Phased Array Transceiver for Lunar Communications:** Developed an end-to-end 2.4 GHz phased array transceiver for extravehicular activity communications on the lunar surface.
- **24 GHz Semi-Passive RFID Tag:** Developed a 24-GHz semi-passive RFID tag to improve the bandwidth of RFID systems for tera-scale IoT/IoE applications.

Undergraduate Researcher, Low-Frequency Radio Group Jan 2017 - Sep 2020

- **Ultra-Sensitive Remote Sensing Instrument:** Developed an ultra-sensitive end-to-end electric field sensing system for low-frequency (<500 kHz) radio reception. The instrument is 20 dB more sensitive than state-of-the-art and has been deployed globally to form the AWESOME network, a receiver network for low-frequency radio science research and lightning geo-location.

Undergraduate Researcher, Plasma and Dielectrics Lab Jan 2017 - May 2018

- **Impulse Current Generator for Next-Generation Disconnect Switches:** Developed an impulse current generator to test the electrical contacts of high-speed disconnect switches.

Industry Experience

Micron Technology, Inc., Boise, ID

R&D Intern, HBM R&D Team May - Jul 2020

- Developed a data-visualization tool suite to extract and visualize data from DC validation tests on TSVs (through-silicon vias) of HBM (high-bandwidth memory) DRAM 3D ICs.

DRAM Product Engineering Intern, Data Analytics and Disposition Team May - Aug 2019

- Developed a new statistical disposition program to categorize and scrap DRAM wafers and dies of varying quality based on their probe/test data.

Teaching Experience

Georgia Institute of Technology, Atlanta, GA

Undergraduate Teaching Assistant Aug - Dec 2019

Teaching assistant of an undergraduate/graduate-level course (ECE 3043 – Circuits, Measurements, and Microelectronics Laboratory) in the Department of Electrical and Computer Engineering.

Academic Service

Reviewer

- Nature Photonics
- Optica
- Optica Quantum
- International Solid State Circuits Conference (ISSCC)
- IEEE Transactions on Geoscience and Remote Sensing

Journal editor

Georgia Institute of Technology, Atlanta, GA

The Tower Undergraduate Research Journal, Editor-in-Chief Aug 2019 - May 2020

Editor-in-Chief of Georgia Tech's primary research journal for undergraduates.

Board of Student Publications, Editor Aug 2019 - May 2020

Editor on the Board of Student Publications overseeing the production of student-led publications.

Outreach

California Institute of Technology, Pasadena, CA

IQIM Seminar Committee, Member Aug 2023 – Present

Organized events for Institute for Quantum Information and Matter seminars at Caltech.

California Institute of Technology, Pasadena, CA

Electrical Engineering Local Student Committee, Member Oct 2020 – Present

Organized academic and social events for the graduate students in Electrical Engineering.

Micron Technology, Inc., Boise, ID

Micron Foundation K-12 STEM Outreach Programs, Volunteer Lead May 2018 – Jul 2019

Organized and led Micron outreach events that saw the participation of more than 500 K-12 students.

Georgia Institute of Technology, Atlanta, GA

Student Activities Board for Undergrad Research, VP of Campus Relations Aug 2016 – May 2018

Organized info sessions, lab tours, and 1-to-1 tutoring sessions to promote undergraduate research.

Affiliations

- American Physical Society (APS), Member Dec 2020 – Present
- Society of Photo-optical Instrumentation Engineers (SPIE), Member Dec 2020 – Present
- Optica, Member Dec 2020 – Present
- Eta Kappa Nu Electrical Engineering Honor Society, Member Nov 2019 – Present
- Tau Beta Pi Engineering Honor Society, Member Nov 2019 – Present
- Sigma Xi Scientific Research Honor Society, Member Sep 2019 – Present
- Institute of Electrical and Electronics Engineers (IEEE), Student Member Sep 2016 – Present