

Alvaro Sahagun

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Graduate Fellowships

- MIT Alfred P. Sloan Scholarship 2020
- Self-Supported: full-tuition, fees, stipend, and healthcare for 5-years.
- GEM Full Fellow (Ph.D. Engineering Fellowship Program) 2019
- Self-Supported: full-tuition, fees, and stipend for 5-years at any GEM Member University.
 - Fellowship sponsorship by MIT Lincoln Laboratory.

Education

Massachusetts Institute of Technology (MIT), Cambridge, MA Anticipated May 2026
Doctor of Philosophy in Electrical Engineering

Massachusetts Institute of Technology (MIT), Cambridge, MA Anticipated May 2022
Master of Science in Electrical Engineering

University of Illinois at Chicago (UIC), Chicago, IL
Bachelor of Science in Electrical Engineering
Magna Cum Laude – Honors College
Cumulative GPA: 3.78/4.00 | Major GPA: 3.78/4.00

Journal Publications

Rughoobur, G., **Sahagun, A.**, Ilori, O. O. and Akinwande, A. I. (2020). Nanofabricated Low-Voltage Gated Si Field Ionization Arrays. *IEEE Transactions on Electron Devices*, <https://doi.org/10.1109/TED.2020.3001082>

Humayun, M., Sainato, M., Divan, R., Rosenberg, R., **Sahagun, A.**, Gundel, L., Solomon, P. and Paprotny, I. (2017). Effects of O₂ plasma and UV-O₃ assisted surface activation on high sensitivity metal oxide functionalized multiwalled carbon nanotube CH₄ sensors. *Journal of Vacuum Science & Technology A: Vacuum, Surfaces, and Films*, 35(6), p.061402, <https://doi/10.1116/1.4993579>

Conference Publications

Rughoobur, G., **Sahagun, A.**, and Akinwande, A. I. (2019), "Low Voltage Silicon Field Ionization Arrays," *International Vacuum Nanoelectronics Conference (IVNC)*, Cincinnati, OH, USA.

Sainato, M., **Sahagun, A.**, Divan, R., Stan, L., Humayun, M. T. and Paprotny, I. (2017), "Metal-oxide Nanocrystals/Carbon Nanotubes Heterostructure Sensors for Selective Sensing of Hydrocarbons (VOCs + CH₄)," *The 61st International Conference on Electron, Ion, and Photon Beam Technology and Nanofabrication (EIBPN)*, Orlando, FL, USA.

Research Experiences

Marvell Nanofabrication Laboratory – University of California--Berkeley, Berkeley, CA Nov. 2019 – Jan. 2020
Undergraduate Research Associate for Associate Professor Igor Paprotny, Ph.D. | NSF Supported

- Device fabrication for the UIC Micromechatronic Systems Laboratory's various research projects.
- Fabrication of redesigned silicon microtip arrays for field emission and field ionization under ambient conditions.

Center for Nanoscale Systems – Harvard University, Cambridge, MA June – Aug. 2019
Summer Research Intern for Senior Principal Scientist Jiangdong Deng, Ph.D.

- Designed and fabricated a polymer-based photonic wire bond (PWB) using 3D laser lithography to enable precise, low-loss coupling between optical fibers.
- Prepared glass substrates for PWB printing using a dicing saw, stripped optical fibers, and PDMS.
- Measured the dimensions of each prepared substrate using an optical profilometer to best customize the PWB CAD model in SolidWorks to fit each unique substrate.
- Conducted PWB printing trials to determine optimal writing parameters and stage alignments in the Nanoscribe to reduce PWB surface roughness, overexposure, underexposure, and misalignment.

Microsystems Technology Laboratories – MIT, Cambridge, MA

June – Aug. 2018

Summer Research Intern for Professor Akintunde Ibitayo Akinwande, Ph.D.

- Researched high current density silicon nanotip arrays to develop electron sources for X-ray generation and imaging.
- Simulated both field emission and Joule heating of silicon nanotip arrays by using Silvaco.
- Conducted the electrical characterization of silicon nanotip arrays for both field emission and field ionization under ultra-high vacuum ($\approx 10^{-9}$ Torr).
- Created a comprehensive study on the effects of pressure and helium, argon, and deuterium on the field ionization efficiency.

Micromechatronic Systems Laboratory – UIC, Chicago, IL

June 2017 – Present

Undergraduate Researcher for Associate Professor Igor Paprotny, Ph.D.

- Researched silicon microtip arrays enhanced with ultrananocrystalline diamond thin film to achieve low-voltage, high-output current density field emission and field ionization under ambient conditions.
- Conducted the Silicon wafer preparation, photolithography, DRIE, sputter deposition, diamond seeding, MPCVD, and characterization of the final device at the **Argonne National Laboratory Center for Nanoscale Materials**.
- Simulated the electric field strength of a single silicon micro-pillar using COMSOL.
- Tested the field emission and field ionization capabilities under atmospheric pressure (760 Torr) and high vacuum ($\approx 10^{-5}$ Torr) using a micromanipulator and picoammeter at the **University of California--Berkeley Swarm Lab** and **UIC Nanotechnology Core Facility**.

Center for Nanoscale Materials – Argonne National Laboratory, Lemont, IL

June 2017 – Jan. 2019

Undergraduate Research Associate for Associate Professor Igor Paprotny, Ph.D. | DOE Award

- Fabricated the initial test silicon microtip arrays enhanced with ultra-nanocrystalline diamond thin film for field emission and field ionization applications under ambient conditions.
- Conducted fabrication trials on test wafers to determine the optimal process parameters for the silicon microtip arrays.

Micromechatronic Systems Laboratory – UIC, Chicago, IL

June 2016 – June 2018

Undergraduate Research Assistant for Associate Professor Igor Paprotny, Ph.D.

- Researched multi-walled carbon nanotubes functionalized with zinc oxide nanocrystals to develop highly sensitive chemiresistive methane sensors (≈ 2 ppm CH₄ sensitivity).
- Assisted in designing the experimental setup, gas delivery system, and standard operating procedure.
- Helped prepare sensors, perform experiments, analyze data, and create data plots using OriginPro.
- Investigated the effects of UV (i-line) exposure on the rejuvenation efficiency of the sensors, and determined the optimal exposure time required for repeatable CH₄ sensing measurements.
- Trained two master students on the experimental procedure and supervised their early experiments.

Selected Presentations

Sahagun, A., Rughoobur, G., Karaulac, N., and Akinwande, A. I., "Characterization of Electron Emission and Field Ionization Using Gated Silicon Nanotip Arrays," *National SACNAS Conference*, Honolulu, HI, Oct. 31st – Nov. 2nd, 2019 (Poster)

Sahagun, A., Getega, D., Zhong, G., and Deng, J., "Photonic Wire Bonding by 3D Laser Lithography," *NNCI REU Convocation*, Cornell University, NY, Aug. 10th – 14th, 2019 (Oral & Poster)

Sahagun, A., Getega, D., Zhong, G., and Deng, J., "Photonic Wire Bonding by 3D Laser Lithography," *REU Symposium*, Harvard University, MA, Aug. 7th – 9th & 14th, 2019 (Oral)

Sahagun, A., Rughoobur, G., Karaulac, N., and Akinwande, A. I., "Characterization of Electron Emission and Field Ionization Using Gated Silicon Nanotip Arrays," *Annual MIT Summer Research Program (MSRP) Poster Session*, MIT, MA, Aug. 10th, 2018 (Poster)

Sahagun, A., Divan, R., Sumant, A., Pister, K., and Paprotny, I., "Low-voltage Ionizers for Environmental and Microrobotic Applications using Engineered Nanostructures," *Illinois LSAMP Symposium*, Lisle, IL, Feb. 23rd – 24th, 2018 (Poster)

Sahagun, A., Divan, R., Sumant, A., Pister, K., and Paprotny, I., "Low-voltage Ionizers for Environmental and Microrobotic Applications using Engineered Nanostructures," *Honors College Research Conference*, UIC, IL, Nov. 20th, 2017 (Poster)

Sahagun, A., Sainato, M., and Paprotny, I., "Metal-oxide Nanocrystals/Carbon Nanotubes Heterostructure Sensors for Selective Sensing of Hydrocarbons (VOCs + CH₄)," *University of Illinois Undergraduate Research Day: Posters Under the Dome*, Springfield, IL, April 25th, 2017 (Poster)

Sahagun, A., Sainato, M., and Paprotny, I., "Metal-oxide Nanocrystals/Carbon Nanotubes Heterostructure Sensors for Selective Sensing of Hydrocarbons (VOCs + CH₄)," *Honors College Research Symposium*, UIC, IL, Nov. 17th, 2016 (Poster)

Technical Skills

Qualified User | UIC Nanotechnology Core Facility, Argonne National Laboratory Center for Nanoscale Materials, MIT Microsystems Technology Laboratories, Harvard Center for Nanoscale Systems, University of California--Berkeley Marvell Nanofabrication Laboratory

Equipment | RCA Clean, Spin Coater, PVD (Sputter, Thermal, & E-Beam), CVD, LPCVD, ALD, i-stepper, Mask & Maskless Aligner, DRIE, Wet Etch, CPD, SEM, Nanoscribe, Plasma Asher, Raman Spectroscopy, Ellipsometer, Profilometer (Contact & Optical), Four-Point Probe, Micromanipulator, Picoammeter, Wire Bonder, 3D Printing, PDMS, Laser Cutter, CNC Mill

Software | Novice proficiency in C, C++, Python, MATLAB, OriginPro, COMSOL, Silvaco, Cadence, L-Edit, SolidWorks

Language | Professional working proficiency in Spanish

Selected Awards, Recognitions, & Honors

IEEE-HKN Outstanding Student Award – Iota Lambda Chapter	2020
UIC Chancellor's Student Service Award	2018, 2019, 2020
Hispanic Scholarship Fund Scholar	2017, 2018, 2019, 2020
UIC Chancellor's Undergraduate Research Award	2016, 2017, 2018, 2019
HACU Leader-in-Residence Scholar	2019
UIC Engineering Alumni Association Scholar	2019
SHPE Undergraduate Scholar	2019
Tau Beta Pi Scholar	2018
ExxonMobil LOFT Engineering Fellow	2018
Sigma Xi (Scientific Research Honor Society)	2018
Phi Kappa Phi (Honor Society)	2018
UIC L@s GANAS Research Fellow	2017

Leadership Activities

Eta Kappa Nu – Iota Lambda 2019 – 2020

Co-Founder | President

- Reestablished the UIC chapter after being inactive for +7 years and inducted 51 new members since spring 2019.
- Collaborated and partnered with UIC engineering student organizations to provide CAD, computer programming, and PCB workshops to help students strengthen their industry-desired skills, planned future community outreach activities, and hosted internship and graduate school panels.

Tau Beta Pi – Illinois Zeta 2018 – 2019

District 8 Conference Chair

- Assisted in organizing the 2019 Tau Beta Pi District 8 Conference at UIC.
- Secured room reservations, ordered food, planned the social events, invited the welcome speakers, recruited volunteers, designed and ordered the promotional conference items given to the attendees.

Society for Advancement of Chicanos/Hispanics and Native Americans in Science 2017 – 2020

Co-Founder | Vice President

- Created and lead various monthly research-related workshops, graduate student panels, and faculty-led seminars.
- Held seminars on topics such as "How to Find Undergraduate Research Opportunities," "How to Apply to Fellowships and Scholarships," "What Is Graduate School and Is It Right for You," "Elevator Pitches," "Best Practices When Presenting Research," and "Imposter Syndrome in Higher Education."

Society of Hispanic Professional Engineers

2016 – 2020

High School Outreach Program Co-chairman (2016 – 2017) | Undergraduate Peer Mentor (2018 – Present)

- Mentored high school students from Whitney Young Magnet High School and Benito Juarez Community Academy.
- Exposed the students to different engineering disciplines and encouraged them to pursue higher education in STEM through interactive activities and outside collaborations with Google and the Chicago Engineering Design Team.
- Served as a peer mentor to multiple first-year, transfer, and upperclassmen engineering students at UIC.

Honors College Advisory Board

2016 – 2018

Academics Committee

- Collaborated with the UIC Honors College faculty and staff to revamp the introductory honors curriculum to better prepare current and future students for success in their college careers.

Volunteer Experiences**Honors College – UIC, Chicago, IL**

2018 – 2020

Ambassador

- Helped welcome the class of 2023, class of 2024, and transfer students into the UIC and Honors College community.
- Outreached to incoming and prospective students, answered their questions, and lead recruitment events.
- Helped students adjust to the UIC environment by leading start-of-semester activities, speaking at honors freshman orientation seminars, and organizing events to build community and facilitate professional networking.

Honors College – UIC, Chicago, IL*STEM Tutor*

- Tutored Calculus (I, II, III), Diff. Eq., C (Programming), & Discrete and Cont. Signals and Systems Aug. – Dec. 2018
- Tutored Calculus (I, II, III), Diff. Eq., Linear Algebra, Physics (Mechanics), & Circuit Analysis Jan. – May 2018
- Tutored Academic Writing (I, II), Calculus (I, II, III), Physics (Mechanics), Logic Design, & Intro ECE Jan. – May 2017

MEDLIFE – Riobamba, Ecuador

Dec. 2016

Mobile Clinic Volunteer

- Fundraised over \$1,400 to attend a humanitarian mission trip to Riobamba, Ecuador.
- Set up a mobile clinic and helped with the diagnosis and treatment of 656 cases in four rural communities.
- Provided +700 low-income individuals access to proper medical care and helped to build a bathroom at a children's center in Alausí Canton, Ecuador.