Shomik Verma

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EDUCATION

Massachusetts Institute of Technology, Cambridge, MA……...*Expected Graduation: August 2026*
PhD in Mechanical Engineering

Imperial College London, UK……....*Graduated: October 2021*
MPhil in Materials Science

University of Cambridge, Cambridge, UK……...……...*Graduated: October 2020*
MPhil in Materials Science

Duke University, Durham, North Carolina, USA……..……..*Graduated: May 2019*
GPA: 3.96; BSE in Mechanical Engineering, Minors in Energy Engineering and Mathematics. Summa Cum Laude.

Clements High School, Sugar Land, Texas, USA……*Graduated: June 2015*
GPA: 4.0; Rank: 10/609 (Top 2%)

AWARDS AND ACHIEVEMENTS

General Academics

- 2019 NSF GRFP
- 2019 Marshall Scholar
- 2018 Goldwater Scholar
- 2018 Udall Scholar
- Duke Pi Tau Sigma (Mechanical Engineering Honor Society) Member and Co-President
- Duke Tau Beta Pi (National Engineering Honor Society) Member

Engineering

- Guinness World Record holder for most efficient prototype electric vehicle, with Duke EV's electric vehicle Eta (27,482 MPGe)
- Guinness World Record holder for most fuel-efficient prototype vehicle, with Duke EV's hydrogen fuel cell car (14,573 MPGe)
- Duke Grand Challenge Scholar
- Duke Pratt Research Fellow

RESEARCH EXPERIENCE

Research Assistant: MIT Atomistic Simulation & Energy Research Group……*September 2021 – Present*

- Working with Dr. Asegun Henry on multi-scale modeling of high-efficiency thermophotovoltaic systems.
- Analyzing sub-bandgap absorption in TPV cells with DFT to improve IR reflectivity.
- Designing a novel high-efficiency combustor with CFD and chemical reaction kinetics for TPV heat generation.

Research Assistant: Imperial College Walsh Materials Design Group……...*October 2020 – September 2021*

- Worked with Drs. Aron Walsh and David Scanlon on high-throughput virtual screening for photon conversion.
- Utilized active learning and excited state computational chemistry for candidate molecule suggestion.
- Generated a machine learning model to increase accuracy of ultrafast computational chemistry techniques.

Research Assistant: Cambridge University Functional Photoactive Materials Group……...*October 2019 – September 2020*

- Worked with Dr. Rachel Evans on performance analysis of 3D printed luminescent solar concentrators.
- 3D printed LSCs of various unconventional shapes and characterized their optical efficiency.
- Expanded the existing ray tracing software pvTrace to analyze efficiency of unconventionally shaped LSCs.

Research Assistant: Georgia Tech Nanoscale Thermal Radiation Lab……...*June 2019 – August 2019*

- Worked with Dr. Zhuomin Zhang in the Nanoscale Thermal Radiation Laboratory.
- Investigated a ceramic proppant as a solar absorber for a falling particle concentrating solar thermal plant.
- Conducted high temperature emissometry to determine near- and mid-IR emissivity of particles.

Research Assistant: Duke University Thermodynamics and Sustainable Energy Lab……..*January 2017 – May 2019*

- Worked with Dr. Nico Hotz at T-SEL, designed a concentrated solar collector for dry methane reforming.
- Developed a multiphysics model to determine various properties' influence on temperature and conversion.
- Fabricated a high-temperature solar selective absorption coating.

Research Assistant: Duke Gendell Center for Engineering, Energy, and the Environment……..*August 2017 – May 2019*

- Worked with Dr. Josiah Knight on PEM fuel cell optimization and integration into an electric vehicle.
- Optimization of various operational parameters such as temperature, pressure, humidity, purging, and short circuiting to increase efficiency while providing sufficient power output.
- Integrated PEM fuel cell with supercapacitor bank for load leveling and compared power vs. voltage regulation.
- Installed system in high-efficiency vehicle to test end-to-end efficiency.

Heat Transfer Engineering Intern: ExxonMobil Research and Engineering, Houston, TX……..*May – August 2017*

- Improved proprietary fired heater numerical model by updating convective finned tube heat transfer correlations.
- Designed horizontal cabin fired heater for vacuum distillation column in planned refinery.
- Conducted flame speed analysis for pre-mix aromatics combustor to determine causes of flashback.
- Developed a prediction tool for NO_x emissions as a function of fuel H_2 content to drive NO_x reduction.
- Modeled FCCU CO boiler to troubleshoot tube rupture and flow vaporization.

Research Intern: Schlumberger Carbon Services, Houston, TX……...*January – May 2015*

- Collaborated with industry professionals to evaluate sites for carbon sequestration suitability.
- Utilized CarbonSCORE software to determine the ideal site for storage out of several suitable sites.
- Compared depleted oil and gas reservoirs and deep saline formations in a case-by-case basis.
- Gained an understanding of several fundamental industry concepts related to carbon capture and sequestration.

Research Intern: Geostock Sandia LLC, Houston, TX……*January – May 2015*

- Analyzed seismic data, well logs, and previous scout ticket data to better determine conditions of wells.
- Created documents demonstrating production well integrity beyond the Area of Review around an injection well.
- With team, compiled well permit documents necessary for waste injection or carbon sequestration.

PUBLICATIONS

- *Machine learned calibrations to high-throughput molecular excited state calculations*. **S. Verma**, M. Rivera, D. O. Scanlon, A. Walsh. *ChemRxiv,* January 2022. (submitted)
- *Thermophotovoltaic efficiency of 40%.* A. LaPotin, K. L. Schulte, M. A. Steiner, K. Buznitsky, C. C. Kelsall, D. J. Friedman, E. J. Tervo, R. M. France, M. R. Young, A. Rohskopf, **S. Verma**, E. N. Wang, A. Henry. *arXiv.* Nov. 2021 (submitted)
- *A Study of Energy Losses in the World's Most Fuel-Efficient Vehicle*. P. Grady, G. Chen, **S. Verma**, A. Marellapudi, N. Hotz. *IEEE Vehicle Power and Propulsion Conference (VPPC),* October 2019.
- [Best Paper Award] *Numerical modeling and design optimization of a concentrated solar thermal collector for dry methane reforming*. **S. Verma**, N. Hotz. COMSOL Conference, October 2018.

POSTERS

- [3rd Place Poster Award] *Finite element modeling of a concentrated solar collector for hydrogen production*. **S. Verma**, N. Hotz. Duke University Energy Conference, November 2018.
- *Design and optimization of the hydrogen fuel cell drivetrain of the world's most fuel-efficient vehicle.* **S. Verma**, G. Chen, J. Knight, N. Hotz. Duke University Energy Conference, November 2018.
- *Optimizing and fabricating a high-temperature selective absorption coating for a concentrated solar thermal collector.* **S. Verma**, Q. Xiao, N. Hotz. NC Energy Conference, April 2018.
- *Improving fired heater modeling by updating external heat transfer correlations for finned tube banks.* **S. Verma**, H.S. Lee, H. Ayala. ExxonMobil Research and Engineering Project Expo, August 2017.

PROFESSIONAL EXPERIENCE

Teaching Assistant: Duke University Pratt School of Engineering……*August 2016 – May 2019*

- TA for EGR 201 (Statics and Mechanics of Materials) in the Civil and Environmental Engineering Department.
- Held office hours, grading, and supervising physical labs involving tension, torsion, and buckling tests.
- Led recitation section to review concepts and work through practice problems.

Engineering Intern: National Park Association, Salta, Argentina (DukeEngage)……..*June – August 2016*

- Interned at environmental conservation/engineering nonprofit in Salta, Argentina.
- Built various structures at a nature reserve (toll booth, barrier, bird-watching station, improved viewpoints).
- Planned installation of solar water heaters for impoverished families to promote cultural/ecological tourism.

LEADERSHIP ACTIVITIES

Duke Energy Club: President

- Coordinated various energy opportunities (projects, industry connections, undergraduate research, energy club mixers, guest speaker events) to provide unique opportunities in energy for undergraduates.
- Led projects in developing data visualization tool for energy consumption and analyzing thermal insulation per building at Duke to drive future energy efficiency improvements and conservation campaigns.
- Interfaced with graduate energy clubs and Duke Energy Initiative to promote undergraduate participation in energy, and organize events for Duke University's annual Energy Week Conference.

Duke Electric Vehicles: Co-President, Hydrogen Fuel Cell Vehicle Team Lead

- Led development of a hybrid H2 vehicle using a fuel cell with supercapacitor storage.
- Created carbon fiber-based electric vehicles from scratch.
- Used SolidWorks/CAM to design and machine sprocket, steering components, and dynamometer parts.

Duke Smart Home: Co-President, Team Lead, 2016-2017 Resident

- Managed projects and providing technical assistance with 3D modeling and FEA/CFD analysis.
- Led the Smart Shelters project to build sustainable shelters for refugees and the homeless with basic amenities including electricity through solar panels and hot water through solar water heaters.
- Developed external relations; providing information about the Smart Home and acquiring external sponsorships.

Duke Sangeet (Indian classical music club): President

- President of Indian classical music group and tabla (classical percussion instrument) performer.
- Organized several performances per year, showcasing members of the club as well as outside artists.
- Initiated first annual concert (Sangeet Sargam) performing 7 pieces.

Duke Pi Tau Sigma (Mechanical Engineering Honor Society): Co-President

- Managed annual induction process of top 25% of each mechanical engineering class.
- Organized sophomore welcome dinner to introduce new mechanical engineers to opportunities in the major.
- Supported new initiatives including faculty recognition awards and seed grants for individual projects

SERVICE ACTIVITIES

Grid Alternatives: Volunteer

- Installed solar panels for Chemehuevi Native American tribe (2016), Fresno (2017), and LA (2018) communities.
- Learned about the concrete impacts the solar panels have on the livelihood by freeing up income for education, healthy food, and improving quality of life.

Bihar Association of North America: Youth Activity Leader

- Coordinated with Executive Committee for annual Academic Fest to write middle school mathematics tests.
- Tutored middle school mathematics students in TMSCA (Texas Math and Science Coaches Association) events including Number Sense, Calculator, Mathematics, and Science.
- Delivered opening speech at Academic Fest as alumnus and volunteered at Academic Fest.

SKILLS

- Experience with various computational materials science techniques including DFT and its approximations.
- Strong command of Python and MATLAB. Experience in Java, C++, C#, HTML/CSS, XML, Mathematica.
- Extensive familiarity with SolidWorks and COMSOL.
- Trained on various experimental techniques/equipment: vacuum pumps, Fourier transform IR spectrometer, UV/Vis spectrometer, sputtering, plasma-enhanced chemical vapor deposition, profilometer, rapid annealing, scanning electron microscopes.
- Skilled in 3D printing, machining, and laser cutting.
- Professional proficiency in Spanish; conversational proficiency in Hindi.