

Mohammad Babar

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EDUCATION

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- **University of Michigan** Ann Arbor, MI
PhD in Mechanical Engineering
Advisor: Dr. Venkatasubramanian Viswanathan
Present
 - **Carnegie Mellon University** Pittsburgh, PA
MS in Mechanical Engineering; GPA: 4.0/4.0
Aug 2019 - Dec 2022
Courses: Energy Storage and Systems, Advanced Thermodynamics, Molecular Simulation of Materials, Numerical Methods, Machine Learning for Mech. Eng. and AI, Bayesian Machine Learning, Intro. to Quantum Mechanics, Solid State Physics
Teaching Assistantship: Undergraduate Fluid Mechanics (2 semesters)
 - **Indian Institute of Technology** Delhi, India
Bachelor of Mechanical Engineering; GPA: 9.24/10.0
Aug 2015 - May 2019
Teaching Assistantship: Linear Algebra and Differential equations (2 semesters)

SKILLS SUMMARY

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- **Languages:** Python, Julia
 - **Tools:** Quantum Espresso, GPAW, Gaussian 09, FEniCS, MATLAB, SolidWorks, Mathematica, Adobe Illustrator

SELECTED PUBLICATIONS

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1. Twisto-electrochemical activity volcanoes in Trilayer Graphene (*In Review*)
M Babar, Z Zhu, R Kurchin, E Kaxiras, V Viswanathan
arXiv preprint arXiv:2306.00028. Under review in Physical Review Letters 2023
 2. Anomalous interfacial electron-transfer kinetics in twisted trilayer graphene caused by layer-specific localization
K Zhang, Y Yu, S Carr, **M Babar** et al.
ACS Central Science 2023
 3. Effect of disorder and doping on electronic structure and diffusion properties of $\text{Li}_3\text{V}_2\text{O}_5$
M Babar, H Hafiz, Z Ahmad, B Barbiellini, A Bansil, V Viswanathan
Journal of Physical Chemistry C, 126, 37, 15549–15557 2022
 4. Tunable angle-dependent electrochemistry at twisted bilayer graphene with moiré flat bands
Y Yu, K Zhang, H Parks, **M Babar** et al.
Nature Chemistry 14 (3), 267-273 2022
 5. An accurate machine learning calculator for the lithium-graphite system
M Babar, HL Parks, G Houchins, V Viswanathan
Journal of Physics: Energy 3 (1), 014005 2020

CURRENT PROJECTS

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1. **Local electrochemical response of twisted bilayer graphene**
Capturing electrochemical signature of flat bands and resolving domain signals in twisted bilayer graphene by scanning nanopipette over the moiré supercell. Incorporating local density of states in the Gerischer model to obtain steady state voltammograms as a function of twist angle. Solving coupled Poisson and Nernst-Planck equations in FEniCS PDE solver. Manuscript in revision.
 2. **Predicting anionic redox in lithium rich transition metal cathodes**
Studying the lithium-rich binary system as cathodes for increasing capacity via anionic (oxygen) redox by substituting 3d transition metals. Validating and characterizing redox orbitals using Compton scattering spectroscopy through collaborators in Japan. Awarded ONR 2023 grant to conduct research for three years.

HONORS AND AWARDS

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- Won best poster award at American Physical Society GERA Energy workshop March 2023
 - Accepted proposal for Office of Naval Research Award to probe anionic redox in Li-rich cathodes Feb 2023
 - Won best poster award at Pittsburgh Quantum Institute conference September 2022
 - Won conference travel award from Pittsburgh Quantum Institute May 2022
 - Selected to attend Topological Matter School 2021 August 2021
 - Won best poster award CMU MechE symposium March 2021
 - Ranked in top five among 75 students in Undergraduate Mechanical Engineering branch August 2019
 - Won Merit Award for three consecutive undergraduate semesters May 2019