ANKAN DUTTA

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MOTIVATION

I build soft multimodal sensors (pressure/tactile, strain-temperature decoupling, ultrasound-based material sensing) and biointerfaces (EEG/EMG) using soft materials synthesis, microfabrication, and multiphysics modeling. I'm seeking a postdoctoral position to translate these into multimodal tactile systems in robotics system and learn/implement AI-based perception and physics-informed design optimization.

SUMMARY

- NIH T32 Fellow ('23- '24), Diefenderfer Fellow ('24- '25), Fox Scholar ('25) and Leighton Riess Fellow ('25- '26).
- Founded NeuroXR – selected for NSF I-Corps National Team (Spring 2024 cohort).
- Author of 28 papers (5 in review) and 2 patent pending, and reviewer of 9 journals like npj Flexible Electronics.
- Led or contributed to three NIH proposals, two NSF proposals and two company-based proposals and collaborated with multiple universities across the US, China, India, South Korea, and Germany.
- Research featured in Technology Networks, Phys.org, EurekAlert!, TechXplore, TechExplorist, Mirage, AZOsensors, The Science Times, Scary Mommy, Wevolver, DailyMail, New York Post, Toledovuzz, Nanowerk.
- Personal achievements highlighted in EurekAlert!, Penn State News, Penn State News, Penn State News

EDUCATION

B.E. in Mechanical Engineering 2020

Jadavpur University *Kolkata, India*

Relevant Coursework: Solid Mechanics, Fluid Mechanics, Strength of Materials, Robotics, Control Systems

M.S. in Engineering Science 2023

The Pennsylvania State University *University Park, PA*

Relevant Coursework: NEMS/MEMS, Wearable Electronics, BioMEMS, Neural Interfaces, Cellular and Molecular Neuroscience, Neural Data Analysis, Nano Optoelectronics, Sound Waves in Fluids GPA: 4.00/4.00

Ph.D. in Mechanical Engineering Expected 2026

The Pennsylvania State University *University Park, PA*

Thesis Advisor: Prof. Huanyu Cheng (huanyu.cheng@psu.edu)

Broad Institute of MIT and Harvard *(Visiting Student)* *Cambridge, MA*

Supervisor: Prof. Giovanni Traverso (cgt20@mit.edu)

Dissertation Title: Understanding neural and tactile signatures during haptic sensation GPA: 4.00/4.00

RELEVANT SKILLS

Fabrication	Laser Etching/Ablation, Transfer Printing, Maskless Pattern Exposure, Mask Aligner, Evaporator, Wet Bench, Spin/Develop Bench
Characterization	FESEM, EDX, Dicing, Poling, Ultrasound: Pulse-echo, Cavitation, Rheological, Mechanical: Tensile, Compression, Adhesion, Semiconductor Analyzer, Electrochemical- AutoLab
Simulation	COMSOL Multiphysics (AC/DC, Chemical Species Transport, Structural Mechanics, Heat Transfer, Fluid Flow, Radio Frequency), KLM Simulation, Simulink, AutoCAD, NX
Programming	Python, MATLAB
Animal Handling	Swine Handling, Swine Blood Collection

RESEARCH EXPERIENCE

Graduate Visiting Student Aug 2025 - Present
Broad Institute of MIT and Harvard *Cambridge, MA*

- Developing ultrasound-responsive bioinks for in-situ sensing and stimulation.
- Analyzing the neural response during haptics sensation using mechanical and electrical stimulation.
- Developing ultrasound-based injector for delivering highly viscous or concentrated drug with high efficiency.

Graduate Research Assistant Aug 2021 - Present
The Pennsylvania State University *University Park, PA*

- Synthesized phase-transition semiconducting hydrogel and characterized as organic electrochemical transistors for through-hair EEG electrodes to understand brain response for neuroprosthetics.
- Optimized transducer design, characterized and fabricated 120-element very large Stretchable Ultrasound Matrix Array for transcranial imaging during blast to understand cavitation during Traumatic Brain Injury.
- Optimized MRI-compatible neural probe design to reduce electromagnetic heating, eddy current and image artifacts using COMSOL (*Heat Transfer in Biological Tissue, Electromagnetic Waves- Frequency Domain*).
- Simulated ionotropic pressure sensor (*Electrostatics, Transport of Diluted Species, Solid Mechanics*), adhesion-aided stretching (*Contact: Traction-Displacement Law*), magnetic soft robot (*Laminar Flow, Solid Mechanics, Magnetic Field*), encapsulation using nanofillers (*Transport of Diluted Species, Solid Mechanics*)
- Fabricated and characterized ultrasound array for multimodal material detection (static mode) and gesture recognition sensor (dynamic mode) contactlessly using electrostatic induction.
- Simulated adsorption-limited mechanism using COMSOL, fabricated and applied MXene-based multifunctional sensor system for anxiety monitoring using EMG, glucose level in AR/VR systems.

Undergraduate Researcher Aug 2018 – July 2021
Jadavpur University *Kolkata, India*

- Fabricated and modelled I-V characteristics of disorder governed Resistive Random Access Memory using Non-Equilibrium Green's Function and Many Body Localization (SERB Fellow)
- Developed statistical learning theory for Neural Networks using Riemannian Manifold
- Developed Actor-Critic path planning algorithm for Brain Computer Interface controlled wheel-chair

INDUSTRY EXPERIENCE

NSF INTERN Sept 2024 – Aug 2025
Actuated Medical *Bellefonte, PA*

- Fabricating Low-Intensity focused Ultrasound to reduce foreign body response after implant (SonoShield).
- Designing transducer for micron-scale ultrasonic vibration to improve insertion (NeuralGlider).

LEADERSHIP AND TEACHING EXPERIENCE

- Founded MEDhof and led a team of 35 doctors and 12 core members under MEDhof with a valuation of $150k.
- Entrepreneurial Lead for NeuroXR (selected for NSF ICorps Nationals) focusing on wearable sensors for XR.
- Served as a Teaching Assistant for two semesters, teaching Statics and Dynamics, and Strength of Materials.

PUBLICATIONS

JOURNAL ARTICLES

- Biswas, M.A.S. §, **Dutta, A.**§, Das, S., Abdullah, A.M., Zhang, W., Zohra, F.T. and Cheng, H., 2026. Recent Advances in Laser-Induced Graphene-Based Gas Sensors: From Sensing Mechanisms to Biomedical Applications. *Advanced Science*, p.e21138.
- Yuan, Y., Chen, D., Li, J., Li, B., Abdullah, A.M., Zohra, F.T., Zhang, W., Zhang, X., Xin, X., Amidian, M.A., **Dutta, A.,** Shi, F., and Cheng, H., Three-dimensional shrinking electronics on freestanding and freeform curvilinear surfaces. *Sci. Adv.***11**, eaea8051(2025).
- Abdullah, A.M. §, Biswas, M.A.S. §, **Dutta, A.** §, Li, J., Das, S., Zhang, X., Zhang, W., Zohra, F.T., Moreno Calva, A., Gray, J.L. and Jabelli, H., 2025. In Situ Functionalized MXene on Porous Laser-Induced Graphene for Adsorption-Dominated Miniaturized Multifunctional Sensors. *ACS nano*, *19*(38), pp.33841-33856.
- Han, S., Shin, J.W., Lee, J.H., Li, B., Ko, G.J., Jang, T.M., **Dutta, A.**, Han, W.B., Yang, S.M., Kim, D.J. and Kang, H., 2025. Wireless, Multifunctional System-Integrated Programmable Soft Robot. *Nano-Micro Letters*, *17*(1), p.152.
- Zhang, W., Zhang, X., **Dutta, A.**, Lorestani, F., Biswas, M.A.S., Li, B., Abdullah, A.M. and Cheng, H., 2025. Hydrogel-based sweat chloride sensor with high sensitivity and low hysteresis. *Biosensors and Bioelectronics*, p.117805.
- Zhang, H., Yang, H., Xin, M., Wang, Z., Zhang, H., **Dutta, A.**, Cheng, H. and Yang, L., 2025. Thermoelectric Composites Based on Porous Laser-Induced Graphene and Ion Hydrogel. *ACS Applied Materials & Interfaces*, *17*(14), pp.21773-21784.
- Yang, L., Chen, X., **Dutta, A.**, Zhang, H., Wang, Z., Xin, M., Du, S., Xu, G. and Cheng, H., 2025. Thermoelectric porous laser-induced graphene-based strain-temperature decoupling and self-powered sensing. *Nature Communications*, *16*(1), p.792.
- Lorestani, F., Zhang, X., Ataie, Z., Kedzierski, A., Liu, Y., López, A., **Dutta, A.**, Kacala, K., Niu, Z., Sheikhi, A. and Cheng, H., 2025. A Granular Hydrogel-Enabled Wearable Electrochemical Biosensing Platform for Continuous Non-Invasive Sweat Lactate Detection. *Small*, p.2502655.
- Jang, T.M. §, Han, W.B. §, Han, S., **Dutta, A.**, Lim, J.H., Kim, T., Lim, B.H., Ko, G.J., Shin, J.W., Kaveti, R. and Kang, H., 2024. Stretchable and biodegradable self-healing conductors for multifunctional electronics. *Science Advances*, *10*(36), p.eadp9818.
- Hong, J.H.§, Lee, J.Y. §, **Dutta, A.** §, Yoon, S.L., Cho, Y.U., Kim, K., Kang, K., Kim, H.W., Kim, D.H., Park, J. and Cho, M., 2024. Monolayer, open-mesh, pristine PEDOT: PSS-based conformal brain implants for fully MRI-compatible neural interfaces. *Biosensors and Bioelectronics*, *260*, p.116446.
- **Dutta, A.**, Niu, Z., Abdullah, A.M., Tiwari, N., Biswas, M.A.S., Li, B., Lorestani, F., Jing, Y. and Cheng, H., 2024. Closely packed stretchable ultrasound array fabricated with surface charge engineering for contactless gesture and materials detection. *Advanced Science*, *11*(15), p.2303403.
- Ko, G.J., Naganaboina, V.R., Goda, E.S., **Dutta, A.**, Cheng, H. and Hwang, S.W., 2024. Towards Polymer Composite-Based Transient Electronic Systems. *Advanced NanoBiomed Research*, p.2400126.
- Ko, G.J. §, Kang, H. §, Han, W.B. §, **Dutta, A.** §, Shin, J.W., Jang, T.M., Han, S., Lim, J.H., Eom, C.H., Choi, S.J. and Ryu, Y., 2024. Materials and designs for extremely efficient encapsulation of soft, biodegradable electronics. *Advanced Functional Materials*, *34*(39), p.2403427.
- Cho, Y.U. §, Kim, K. §, **Dutta, A.**, Park, S.H., Lee, J.Y., Kim, H.W., Park, J., Kim, J., Min, W.K., Won, C. and Park, J., 2024. MRI-Compatible, Transparent PEDOT: PSS Neural Implants for the Alleviation of Neuropathic Pain with Motor Cortex Stimulation. *Advanced Functional Materials*, *34*(6), p.2310908.
- Lorestani, F., Zhang, X., Abdullah, A.M., Xin, X., Liu, Y., Rahman, M.M., Biswas, M.A.S., Li, B., **Dutta, A.**, Niu, Z. and Das, S., 2023. A highly sensitive and long-term stable wearable patch for continuous analysis of biomarkers in sweat. *Advanced Functional Materials*, *33*(52), p.2306117.
- Lee, J.Y. §, Shin, J. §, Kim, K. §, Ju, J.E. §, **Dutta, A.**, Kim, T.S., Cho, Y.U., Kim, T., Hu, L., Min, W.K. and Jung, H.S., 2023. Ultrathin crystalline silicon nano and micro membranes with high areal density for low-cost flexible electronics. *Small*, *19*(39), p.2302597.
- Yang, R., **Dutta, A.**, Li, B., Tiwari, N., Zhang, W., Niu, Z., Gao, Y., Erdely, D., Xin, X., Li, T. and Cheng, H., 2023.

Iontronic pressure sensor with high sensitivity over ultra-broad linear range enabled by laser-induced gradient micro-pyramids. *Nature communications*, *14*(1), p.2907.

- Xue, Y. §, Wang, Z. §, **Dutta, A.**, Chen, X., Gao, P., Li, R., Yan, J., Niu, G., Wang, Y., Du, S. and Cheng, H., 2023. Superhydrophobic, stretchable kirigami pencil-on-paper multifunctional device platform. *Chemical Engineering Journal*, *465*, p.142774.
- Yang, L., Yan, J., Meng, C., **Dutta, A.**, Chen, X., Xue, Y., Niu, G., Wang, Y., Du, S., Zhou, P. and Zhang, C., 2023. Vanadium oxide-doped laser-induced graphene multi-parameter sensor to decouple soil nitrogen loss and temperature. *Advanced Materials*, *35*(14), p.2210322.
- **Dutta, A.** and Cheng, H., 2023. Pathway of transient electronics towards connected biomedical applications. *Nanoscale*, *15*(9), pp.4236-4249.
- Niu, G., Wang, Z., Xue, Y., Yan, J., **Dutta, A.**, Chen, X., Wang, Y., Liu, C., Du, S., Guo, L. and Zhou, P., 2022. Pencil-on-paper humidity sensor treated with NaCl solution for health monitoring and skin characterization. *Nano letters*, *23*(4), pp.1252-1260.
- Yang, L., Liu, C., Yuan, W., Meng, C., **Dutta, A.**, Chen, X., Guo, L., Niu, G. and Cheng, H., 2022. Fully stretchable, porous MXene-graphene foam nanocomposites for energy harvesting and self-powered sensing. *Nano Energy*, *103*, p.107807.
- Choudhury, S., **Dutta, A.** and Ray, D., 2021. Chaos and complexity from quantum neural network. A study with diffusion metric in machine learning. *Journal of High Energy Physics*, *2021*(4), pp.1-33.

BOOK CHAPTERS

- **Dutta, A.** and Cheng, H., 2024. Mechanics of Transient Electronics. *Mechanics of Flexible and Stretchable Electronics*, pp.453-471.
- Zhou, H. §, **Dutta, A.** § and Cheng, H., 2024. Mechanics, structure, and materials science of transfer printing. In *Transfer Printing Technologies and Applications* (pp. 3-36). Elsevier.
- **Dutta, A.,** Abdullah, A.M., Biswas, M.A.S., Das, S., Zhu, J., Lin, Y. and Cheng, H., 2024. Micro-and nanostructured semiconductor materials for flexible and stretchable electronics. In *Comprehensive Semiconductor Science and Technology, Second Edition: Volumes 1-3* (pp. V3-493). Elsevier.

PREPRINTS

- **Dutta, A.**, Biswas, M.A.S., Meng, L., Gerhard, E., Calva, A.M., Zhang, W., Abdullah, A.M., Joharji, L., Che, Y., Yang, J. and Cheng, H. 2025. Synergy of a Complimentary Ionic Biogel Network for Through-Hair Neurohaptics. (Under Review – *Nature Materials* https://doi.org/10.21203/rs.3.rs-5829714/v1)
- **Dutta, A.** and Rakshit, A., 2020. Geometry perspective of estimating learning capability of neural networks. *arXiv preprint arXiv:2011.04588*.
- Guha, R., Sengupta, A. and **Dutta, A.**, 2020. Sewage pooling test for SARS-CoV-2. *arXiv preprint arXiv:2005.07269*.

UNDER REVIEW

- **Dutta, A.**, Biswas, M.A.S., Gerhard, E., Das, M., Meng, L., Zhang, W., Li, W., Calva, A.M., Pathak, S., Yang, J.Y., Yin, J., Meyet, J., Poudel, B., Abdullah, A.M., Che, Y., Chuang, C.H., Yang, J., Wang, S., Hu, X., Das, S., Cheng, H. Controlling thermoreversibility and conductivity in ionic biogels using phase thermodynamics. (*Nature Materials*, Under Review)
- Xiao, Y., Zhu, J., **Dutta, A.,** Song, C., Zhang, Y., Huang, C., Zhang, S., Qiu, D., Yang, H., Hu, T., Bi, P., Huang, Z., Gao, M., Pan, T., Yang, J., Lin, Y., Cheng, H. Liquid Metal-based Spatial-variant Stretchable Electronics via Single-step Programmable Transfer Printing. (Science Advances, Under Review)
- Zhang, W., Xin, X., Wang, Y., Zhang, X., Zhang, S., Yuan, Y., Xia, S., Abdullah, A., Zohra, F., Li, B., Yang, J.-Y., **Dutta, A.**, Liu, Z., Lima, A., Yan, S., Zhong, J., Chuang, C.-H., Cheng, H. In situ formed, customizable, on-skin dry electrodes with robust skin and device connection for wireless electrophysiological monitoring and HMI.

(Science Advances, Under Review)

- Biswas, M. A. S. §, **Dutta, A.** §, Das, S., Abdullah, A. M., Zhang, W., Zohra, F. T., Cheng, H. Recent advances in laser-induced graphene-based gas sensors: from sensing mechanisms to biomedical applications. (Advanced Science, Under Review)
- Zhu, J., Liu, Z., Li, B., **Dutta, A.**, Xiao, Y., Zhao, F., Hu, Z., Huang, Z., Zhang, X., Meeks, J., Bi, P., Zhang, S., Zhong, J., Qiu, D., Gao, M., Song, C., Lin, Y., Cheng, H. Eliminating the Stretchability–linearity Trade-off in Wearable Strain Sensors via Dual Conductive Networks. (Nature Communication, Submitted)

PROJECTS

Entrepreneurial Lead Oct 2023- Present

NeuroXR: Bidirectional Neural Communication for Extended Reality Technologies *University Park, PA*

- The project aims to develop a wearable sensor for XR headsets that collects biomedical data of the trainee to significantly improve surgical training quality by introducing bidirectional communication, feedback mechanisms, and interaction dynamics.

Founder Nov 2016 – Jan 2019

medhof.com *Kolkata, India*

- A medical startup that provides a distributed patient-centered medical home facility. We worked on point-of-care medical technologies like ECG-based e-textiles and collected real-time medical data points.

AWARDS & ACHIEVEMENTS

- Awarded SERB Fellowship (DST, India) at the IACS (2021) and Jadavpur University, India (2020).
- Winner at Techstars Startup CoVID-19 Challenge, India Chapter for QUICKSOLUTIONS (2020).
- Awarded Engineering Scholarship (2021) from College of Engineering, Penn State.
- Awarded Leighton Riess Scholarship (’23, ‘24) from Center for Biodevices, Penn State.
- Awarded NIH T32 CDNE Fellowship supported by Center for Neural Engineering, Penn State (2023).
- Selected for NSF I-Corps National Program for NeuroXR- sensors for AR/VR for surgery training (2024).
- Selected for NSF INTERN program, collaboration with Actuated Medical (2024).
- Awarded Diefenderfer Graduate Fellowship in Entrepreneurship (2024).
- Awarded Fox Scholar (18 out of 600 graduate students) from Graduate School, Penn State (2025).
- Awarded Leighton Riess Fellowship from Center for Biodevices, Penn State (2025).
- Awarded NSF Travel Award for Future Faculty Symposium, Society for Engineering Science (2025).
- Awarded Society for Engineering Science, Best Poster for Scientific Merit (2025).
- Nominated for Best Poster, Material Research Society (MRS, Fall 2025)