

# Shivam Nitin Kajale

☎ (857) 880-6640 • ✉ skajale@mit.edu • 🌐 shivamkajale.github.io

I am a Ph.D. student in Prof. Deblina Sarkar's group at MIT Media Lab, with a background in electrical engineering and applied physics. My doctoral work focuses on **developing nanoelectronic devices using 2D magnetic materials and superconductors** to achieve energy efficient, beyond-CMOS computing devices. My core skills includes **cleanroom** nanofabrication processes, **materials characterization**, and electro-opto-mechanical **instrumentation and automation**.

## Education

---

**Present: Doctor of Philosophy (Ph.D.) student in Media Arts and Sciences**

Massachusetts Institute of Technology, Cambridge, MA

Specializations - **Nanoelectronics and Material Science**

**2023: Master of Science (S.M.) in Media Arts and Sciences**

Massachusetts Institute of Technology, Cambridge, MA

Thesis: Study of vdW magnetic materials for spintronic applications

**2020: Dual Degree (B.Tech+M.Tech) in Electrical Engineering**

Indian Institute of Technology Bombay, Mumbai, India

Thesis: Interaction of Surface Acoustic Waves and Magnetization

## Experiences

---

**Present: Research Assistant** — MIT, Cambridge, MA

*Guide: Prof. Deblina Sarkar*

- Designed first of its kind brain-inspired stochastic computing hardware using atomically thin magnetic materials for ultra-low energy-dissipation in AI applications
- Invented the first all-van der Waals device for field-free, electrical switching of van der Waals magnets above room temperature for scalable and energy-efficient computing
- Formulated theoretical models and performed simulations to study thermal effects of photovoltaic neural implants, and their application in non-surgical, wireless biphasic stimulation of the brain
- Developed an experimental protocol and built apparatus for fabrication of stable nanoscale devices using air-sensitive 2D magnetic materials

**2020: Digital Hardware Design Engineer** — Intel Corporation, Bangalore, India

- Design and verification of DFX logic of AI oriented graphics core in the Alder Lake SoC

**2018: Research Intern** — Purdue University, IN

*Guide: Prof. Pramey Upadhyaya*

- Built a simulation suite to study ferromagnetic nanoscale microwave source using LLG equation, driven by oscillating voltage, and induced Rabi oscillation in a qubit subjected to the nanomagnet's microwave field
- Developed a theoretical model for a room temperature voltage based driver for NV-centre qubits for quantum computing applications

**2017: Computer Vision Intern** — Superbolter™, Bangalore, India

- Designed and built a Python-based computer vision toolkit for a virtual reality interior designing platform

## Technical Skills

---

**Nanofabrication:** Photolithography, e-beam lithography, 2D dry-transfer, atomic layer deposition, E-Beam deposition, sputter deposition, pulsed laser deposition, reactive ion etching

**Characterisation:** SEM, AFM, PFM, XRD, Raman spectroscopy, Magneto-transport, MOKE, Transistor I-V

**Programming:** LabVIEW, Python, MATLAB, VHDL, Verilog, C++,  $\LaTeX$ , HTML

**Software:** COMSOL Multiphysics, Quantum Espresso, Cadence Virtuoso, Altera Quartus, OOMMF

## Awards & Achievements

---

- 2023:** Awarded the MIT-HPI **Design for Sustainability Grant** for the design of brain-inspired low-energy computing devices for AI applications
- 2022:** Delivered a talk at TEDxBoston's **Planetary Stewardship** forum, titled "A new race: making computation sustainable", creating awareness on the environmental impact of large scale AI and computation.
- 2022: Most Innovative Idea Award** at Nano-cybernetic Biotrek group's annual retreat.
- 2020:** Swastik Dhopte Memorial Award for securing **Rank 1** in Electrical Engineering - Microelectronics batch of 2020, IIT Bombay
- 2018:** Nominated as the **Indian delegate to the Metropolitan Environmental Resource Management (MERM)** camp at Chulalongkorn University (CU), Bangkok. Awarded **first prize** for focus report on **Indoor Air Pollution mitigation**
- 2015:** All India Rank (AIR) 296 in IIT JEE-Advanced out of 150 thousand candidates
- 2015:** 99.86 percentile in JEE-Mains amongst 1.3 million candidates
- 2014:** Awarded fellowship for pursuing research under Kishore Vaigyanik Protsahan Yojana (KVPY), with AIR 191, by Department of Science & Technology of the Government of India
- 2011:** Granted scholarship under National Talent Search Exam, by the Government of India

## Publications

---

- Kajale S.N., Nguyen T., Hung N.T., Li M., Sarkar D., "Field-free deterministic switching of all-van der Waals spin-orbit torque system above room temperature", **Science Advances**, 10, eadk8669 (2024)
- Kajale S.N., Nguyen T., Chao C.A., Bono D.C., Boonkird A., Li M., Sarkar D., "Current-induced deterministic switching of van der Waals ferromagnet at room temperature", **Nature Communications** 15, 1485 (2024)
- Kajale S.N., Hanna J., Jang K., Sarkar D., "Two-dimensional magnetic materials for spintronic applications", **Nano Research** 17, 743–762 (2024)
- Yadav S., Lee R., Kajale S., Joy B., Saha M., Bull Loey., Cao Sarah., Mitragotri S., Bono D., Sarkar D., "Non-surgical Bioelectronic Implant for Targeted Focal Brain Stimulation", 2024 (*under review at* **Nature Biotechnology**)
- Kajale, S.N., "Study of vdW Magnetic Materials for Spintronic Applications". 2023. MIT, M.S. Thesis
- Rustagi A., Kajale S.N., Upadhyaya P. "Manipulating quantum impurity spins via dynamical modes of nanomagnets", 2022 (*under review at* **Applied Physical Letters**)
- Verma S., Kajale S., Gomez-Bombarelli, R "Machine learning for accurate and fast bandgap prediction of solid-state materials", 2022 IEEE High Performance Extreme Computing Conference (**IEEE HPEC**), pp. 1-2, 2022
- Kajale S.N., Yadav S., Cai Y., Joy B., Sarkar D. "2D material based field effect transistors and nanoelectromechanical systems for sensing applications", **iScience**, Volume 24, Issue 12, 103513, 2021
- Rustagi A., Solanki A. B., Kajale S., Bogdanov S., Dilley N. R., Shen T., Debashis P., Chen Z., Appenzeller J., Chen Y., ShalaeV. M., Upadhyaya P. "Quantum-classical spin hybrids: leveraging spintronic tools for information processing applications", Proc. SPIE 11470, **Spintronics XIII**, 114702B, 2020
- Kajale, S.N., "Interaction of Surface Acoustic Waves and Magnetisation". 2020. IIT Bombay, M.Tech. Thesis

## Seminars and Conferences

---

- Jun, 2024:** Oral presentation at the 24th International Conference on the Science and Applications of Nanotubes and Low-Dimensional Materials (NT24), titled "Field-free deterministic switching of a van der Waals ferromagnet above room temperature"
- Jun, 2024:** Talk a delivered at the Spintronics Seminar series hosted by Trinity College Dublin
- Apr, 2024:** Seminar talk titled "Propelling van der Waals magnets towards energy-efficient spintronics" at the NanoBio Seminar Series
- Jan, 2024:** Poster presentation at the Microsystems Annual Research Conference (MARC) 2024