Kartik Vishal Shah

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Objective

Here to maximize my potential of becoming a Research Professor.
On a quest to connect the unknown knowns and the known unknowns of the Universe.

Education

Indian Institute of Technology (BHU), Varanasi Nov 2020 - Present
B.Tech + M.Tech in Engineering Physics (Honours) (Class of 2025) *CGPA - 9.21/10.0*
Arya Gurukul International Junior College, Mumbai Jul 2017 - Oct 2019
Higher Secondary Certificate Examination (HSC) *88.31%*
Pawar Public School, Mumbai May 2017
Indian Certificate of Secondary Examination (ICSE) *96%*

Research Experience

Master's Thesis Project | IIT (BHU) Varanasi (India) Jan'24 - Present
Self-Assembled Nanostructures for Various Applications

- First batch of CVD and mechanically exfoliated hBN under EDX and Raman spectra revealed carbon impurities
- AP-CVD (on Cu foil & wet transferred on SiO_2) and mechanically exfoliated (on SiO_2) hBN will be characterized with SEM & FESEM, EDX, Photoluminescence, Raman Spectroscopy and Optical Microscopy.
- Currently electropolishing Cu foils and attempting to create clean AT-CVD and mechanically exfoliated hBN.

Contribution: Till now - Electropolishing; Attempting to fabricate hBN films with AP-CVD & mechanical exfoliaiton
Exposure: AP-CVD, Electropolishing, Mechanical Exfoliation, (Future - Wet Transfer Method, FESEM, PL)
Supervisor: *Dr. Avanish Parmar IIT (BHU), Dr. Jayeeta Lahiri BHU*

DAAD-WISE Scholarship | Ulm University (Germnay) May'24 - Jul'24
Analysis of Bulk Quantum Diamonds with Magnetic Nanoparticles (MNPs) *Report*

- Investigated the interaction between NV centers and superparamagnetic Fe_3O_4 MNPs for quantum sensing.
- Performed ODMR for pristine & varied nanogram concentrations of MNPs on NV centers.
- Curve fitted data for experimental frequencies and computated an array of theoretical Hamiltonian frequencies.
- Matched experimental & theoretical frequencies to calculate net magnetic field's magnitude and orientation.

Contribution: Ideated the project; ODMR for all samples; created solutions and drop-casted MNPs on NV centers.
Exposure: CW & pulsed ODMR; QUDI software; Python for Calculations; Curve Fitting; Data Processing; OriginPro
Supervisor: *Prof. Fedor Jelezko, Institute for Quantum Optics*

MITACS-GRI Scholarship | Toronto Metropolitan University (Canada) May'23 - Aug'23
Silicon Quantum Dots for Cancer Stem Cell Detection *Certificate*

- Worked with **Silicon SERS biosensors** and cancer samples for trace-level biomarker detection.
- Assisted in the fabrication of 300+ biosensors using laser ablation, optimizing parameters for nanosensors.
- Used Crystal Violet & Rhodamine 6G dyes to assess Enhancement Efficiency and RSD value via Raman peaks.
- Analyzed 600+ cancer & 300+ WBC samples with SERS biosensors, building a data library for stem cell detection.

Contribution: Manuscript in process; Tested 900+ biosamples with SERS; Assisted in fabrication of 300+ sensors.
Exposure: SERS; Raman Spectroscopy; Ultrashort Pulsed Laser Ablation; OriginPro; SpectraGryph; Data processing
Supervisor: *Dr. Bo Tan, Ultrashort Laser Nanomanufacturing Lab*

Honours Project | IIT (BHU) Varanasi (India) Jul'22 - Nov'23
Nanomaterials for Quantum Sensing *Report*

- Successfully fabricated mechanically exfoliated hexagoal Boron Nitride thin films (10-15 layers thickness).
- V_BO_2 defects were created using thermal annealling in presence of pure O_2 gas.
- Samples were characterized before and after thermal annealing with Raman spectroscopy and optical microscopy.
- Attempted to synthesize **L-Lysine coated BN QDs** using hydrothermal method for varied time durations.

Contribution: Mechanically exfoliated hBN films; Introduced O_2 defects; Characterized samples.
Exposure: Mechanical Exfoliation; Thermal Annealing; Optical Microscopy; UV-vis Spectroscopy; Zetasizer; DLS.
Supervisor: *Dr. Avanish Parmar IIT (BHU), Dr. Jayeeta Lahiri BHU, Dr. Rajeev Singh IIT BHU*

Publications, Conferences & Posters

- **Manuscript in Preparation :** Ishita Shreshtha, **Kartik Shah**, Srilakshmi Premachandran, Ashok Dhinakaran, Bo Tan, Krishnan Venkatakrishnan "Label-Free Silicon SERS Sensor for Trace Level Detection of Methylated DNA"
- **International Conference :** Advanced Materials for Better Tomorrow (AMBT'23) : Poster Presentation
- **Inter IIT Tech Meet 11.0 :** Represented IIT BHU in Engineers' Conclave event with Poster Presentation. Received **special mention** among 200+ member teams from premier engineering colleges of India.

Interests & Skills

Interests : Experimental Quantum Optics (Diamond NVs, 2D materials & defects, Heterostructures & Moire lattices, Ultracold atoms & BEC, etc.), Quantum Sensing, Nanoelectronics, Nanotechnology.
Technical Tools : Python, C Language, Jupyter Notebook Python, QUDI, OriginPro 8.5, Wire 5.5, SpectraGryph 1.2, Curve Fitting, Data Processing, Adobe Illustrator 2023, Microsoft Excel and Word, BioRender, Paint 3D.
Experimental Tools : cw & pulsed ODMR, Raman spectroscopy, AP-CVD, Mechanical Exfoliation, Electropolishing, UV-Vis Spectroscopy, Biosensing, Laser Ablation, Zetasizer, DLS, Thermal Annealing, Optical Microscopy.
Soft Skills : Organization, Oration, Leadership, Content Writing, Problem Solving, Communication, Multitasking.

Relevant Coursework

- **Physics Courses :** Quantum Physics **(A*)**, Quantum Electronics **(A)**, Atomic and Molecular Spectroscopy **(A)**, Biophysical Techniques **(A)**, Advanced Condensed Matter Physics **(A-)**, Mathematical Methods **(A-)**.
- **Material Science Courses :** Advanced Materials and Characterisation Techniques **(A)**
- **External Courses :** Quantum Detectors and Sensors (ongoing) by Dr. Zubin Jacob ECE, Purdue University
- **Certified Courses :** Data Science (Basics) using Python by Microscoft x InMovidu Tech (Certificate)

Honours and Achievements

- **7,817 Rank** in Joint Engineering Examinations (Advanced) out of 1.2 Million candidates all over India.
- **DAADWISE'24 scholarship :** selected from 6K+ outstanding Indian students for summer internship in Germany
- **MITACS GRI'23 scholarship :** selected from a pool of 30K+ students across the world to do a collaborative research internship in Toronto Metropolitan University, Canada
- Selected for the **EUMIND'16 Cultural Exchange Program** from my school to the Netherlands.

Position of Responsibility

Department UnderGraduate Committee 2022-23-24
Physics Department, IIT BHU *Varanasi*
- **Department Representative :** Selected by all professors for two years in a row, I assisted the committee in the smooth handling of departmental academic affairs and coordinated with Academic Affairs, Student Parliament.

Head of Vertical, Member 2022-23-24
Research & International Relations Cell, IIT BHU *Varanasi*
- **Lead** the Knowledge Drive Vertical on research and further studies. Member of GSAS Fall'23 scholarship, assisting students with overseas Masters/Ph.D. admissions, & member of the AMA team hosting alum and guest sessions.

Co - Convenor 2022-23
Jigyasa Physics Fest, IIT BHU *Varanasi*
- **Revived** a Physics fest (last held-2017); organized seminars with eminent professors and Physics competitions.

Extra-Curricular Achievements

- Mentored a team of 20+ members in Aagman'21, securing **1st Place** in both Group Dance & Group Music events.
- **1st Position** in Natraj Group Dance competition in KashiYatra'22
- **1st Position** in Jhankaar Dance Competition in Cult Week'23.
- **2nd Position** among 100+ teams in a Mock Trading Event of BASH 3.0 .

References

Prof. Fedor Jelezko Ulm University, Germany
Dr. Bo Tan Toronto Metropolitan University, Canada
Dr. Avanish Parmar Indian Institute of Technology (BHU), India
Dr. Jayeeta Lahiri Banaras Hindu University, India
Dr. Rajeev Singh Indian Institute of Technology (BHU), India