

EDUCATION

- New York University** - Tandon School of Engineering & Courant Institute New York City, NY
B.S. in Applied Mathematics & Physics, Quantum Technology — **GPA: 4.00/4.00** Aug 2022 – May 2026
- **Relevant Coursework:** Honors Numerical Analysis, Linear & Nonlinear Optimization, Mathematics of Quantum Computing, Quantum Mechanics, Quantum Programming, Advanced Linear Algebra, Probability & Statistics, Data Structures & Algorithms, Differential Equations, Complex Analysis, Computational Physics, Mathematics of Finance
 - **Study Abroad:** NYUAD – Abu Dhabi (Astroparticle & Computational Physics), VinUniversity – Hanoi (Digital Twin for Smart Cities), Hanyang University – Seoul (UN SDGs & Korean Language)
 - **Activities & Societies:** NYU Engineering Honors, Society of Undergraduate Physics, Muslim Student Association (President)

PROFESSIONAL EXPERIENCE

- NYU Plasma Physics Group, Courant** | *New York City, NY* | Optimization Researcher Jan 2025 – Present
- Designed a Stage-1, gradient-free Augmented Lagrangian boundary-shape optimizer in Python (Simsopt + VMEC), enforcing constraints via multiplier/penalty updates and optimizing over 3 core metrics (aspect ratio, mean iota, quasisymmetry residuals).
 - Maintained reproducibility and coordinated changes with Git using a structured feature-branch workflow.
 - Leveraged parallel computing on NYU Greene to run VMEC evaluations and parameter scans with `mpirun` on 48 cores.
 - Investigated a stochastic optimization/robustness pipeline: drew 16 coil/shape perturbation samples and evaluated 256 out-of-sample trials to model manufacturing error; tracked a mean-flux objective at the 10^{-6} scale.
- NYU Applied Physics Lab, Tandon** | *New York City, NY* | Quantum Optics Researcher Jun – Aug 2025
- Built and aligned an optical system with a 405 nm laser, β -barium borate (BBO) crystal, and polarization filtering to generate and isolate down-converted, quantum-entangled photons.
 - Applied spectrometer, infrared camera, power meter, and photomultiplier tube measurements, performing statistical analysis to determine SPDC efficiency below 10^{-9} (probability per pump photon).
 - Integrated hardware and data acquisition workflows to optimize photon detection and link results to nonlinear optical theory.
- Pickle** | *New York City, NY* | Data Science & Engineering Intern Nov 2024 – May 2025
- Analyzed user behavior and job liquidity for Pickle, a healthcare job platform, leveraging SQL and Pandas to build customer-facing tools and guide data-driven decisions.
 - Worked in Hex, Sanity, Posthog, and Supabase to design data visualizations and analyze data quality.
 - Collaborated remotely with the Pickle team and CTO to interpret 20,000+ monthly data entries across 5,700+ registered users, communicating key insights to guide decisions.
 - Developed 4 new dashboards to track metrics such as user and job liquidity, salary statistics, and location/device usage – increasing internal reporting by 200% (from 2 to 6 dashboards) and enhancing data visibility for cross-functional teams.
- UT Southwestern Medical Center** | *Dallas, TX* | Modeling Intern Jun – Aug 2024
- Researched cardiovascular function using mathematical modeling techniques in MATLAB.
 - Reduced heart volume-tracking runtime from 8 hours to 5 minutes by updating PDE solutions using Conda/Docker.

PROJECTS & PUBLICATIONS

- **SCUDEM — SIMIODE International Math Modeling Competition (Nov 2024):** Modeled the impact of mood and messaging on vaccination behavior using differential equations and data-driven parameters (MATLAB).
- **Quantum Algorithm Applications — NYCHAQ 2nd Place & NYU Tandon Quantum Hackathon (Sep 2023–Sep 2024):** Leveraged variational quantum algorithms (VQE & QAOA) for portfolio optimization, computing covariance matrices in polylog time and evolving Hamiltonians to minimize risk. Developed a quantum approach to the bin-packing problem for supply chain packaging optimization, reducing transport-related carbon emissions (Python, Qiskit).
- **Computational Physics — NYU Abu Dhabi (Jan – May 2023):** Applied numerical methods to solve differential equations, build pseudo-random number generators, and use scikit-learn for ML in physics problems (Python, Matplotlib).
- **CMR Phase Detection — Heidelberg University (Jan 2021 – Mar 2022):** Published research on deep learning-based deformable image registration for Cardiac Magnetic Resonance (CMR): arxiv.org/abs/2209.05778.

LEADERSHIP & EXTRACURRICULAR

- **Global Leaders and Scholars in STEM (GLASS):** Awarded \$10,000 annually; professional development scholarship program at NYU Tandon. Undergraduate honors thesis on optimization schemes for stellarator fusion, in accordance with UN Sustainable Development Goals. engineering.nyu.edu/student/hamza-hussain.
- **NYU Designing for Creative Physical Computing:** Created an interactive mural with Arduino-based physical computing techniques for elementary school education; presented at the Tandon Research Excellence Exhibit.
- **Drum Corps International, BAC:** Toured/performed nationwide (90+ shows, 150k+ live viewers); taught 1000+ students.

SKILLS

Programming: Python (Pandas, NumPy, Matplotlib, scikit-learn), SQL, Quantum Computing (Qiskit)

Tools: Arduino, CAD (SOLIDWORKS), MATLAB, Statistical Data Analysis, LaTeX, Generative AI, Mathematica