Parth Bhargava

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EDUCATION

National University of Singapore *Aug 2024 – May 2028*

Bachelor of Science in Physics (Honors, Distinction) **GPA: 4.43**

COURSEWORK

Experimental Physics:

- Measured **carrier mobility** and type in semiconductors via **Hall effect**; cross-validated through **magnetoresistance analysis** ($R^2 > 0.99$); identified **intrinsic transition temperature**
- Determined **lattice constants** via **X-ray diffraction** with sub-2% accuracy; applied **structural fingerprinting** to identify unknown crystal phases; validated **Kramers theory** for bremsstrahlung cutoff
- Calibrated **Helmholtz field configuration**; validated **five independent scaling laws** ($R^2 > 0.997$); quantified uncertainty in field constant to **3.3%** through cross-method comparison
- Characterized **electron spin resonance** in paramagnetic systems; extracted **g-factors** and analyzed **hyperfine interactions**
- Analyzed **laser light propagation** through optical media; measured **diffraction patterns** and beam characteristics

Theoretical & Computational:

- **Mechanics:** Lagrangian and Hamiltonian formulations, coupled ODEs, variational principles
- **Electromagnetism:** Maxwell's equations, boundary-value problems, vector calculus
- **Quantum Mechanics:** Schrödinger equation, operator methods, eigenvalue problems
- **Mathematical Methods:** Linear algebra, ODEs/PDEs, Fourier analysis, complex analysis
- **Computation:** Python, Julia, C++; numerical methods, data analysis, visualization
- **Experimental Methods:** Statistical analysis, uncertainty propagation, calibration, regression

PROJECTS

Quantum Wavepacket Visualization *Jan 2025 – Mar 2025*

Developed interactive visualizations of quantum phenomena in Python

- **3D simulation** of a quantum wavepacket traversing a potential barrier
- **Quantum harmonic oscillator** dynamics

ACHIEVEMENTS

- **BITSAT: 321/390**, strong proficiency in Physics, Chemistry, and Mathematics
- **JEE Mains: 99.14 percentile** (Top 1% of 2 million candidates)
- **JEE Advanced Rank: 9112**, exceptional problem-solving abilities
- Awarded **Silver Medal** in International Aerospace Olympiad 2024
- **IISER Aptitude Test Rank: 357**

INTERESTS

- **Complex Systems & Nonlinear Dynamics:** Emergence, collective behavior, and how simple rules generate complex patterns across scales
- **Network Science & Information Theory:** Information flow, network structures, and connections between abstract mathematics and physical systems
- **Computational Modeling:** Simulation, geometric intuition, and bridging theoretical frameworks with numerical methods