Veome Kapil

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Education

Johns Hopkins University <div align="right">**Baltimore, MD**</div>
Doctor of Philosophy (Ph.D). in Physics <div align="right">*Expected: July 2026*</div>
Master of Arts (M.A.) in Physics <div align="right">*Aug 2023*</div>

Princeton University <div align="right">**Princeton, NJ**</div>
Bachelor of Arts (B.A.) in Physics (GPA: 3.74/4.0) <div align="right">*June 2021*</div>
Certificate in Applications of Computing <div align="right">*June 2021*</div>

Skills

- **Programming Languages**: Python, SQL, C++, Excel, Java, Unity, Mathematica
- **Data Science Tools**: TensorFlow, Scikit-learn, PyTorch, Pandas, NumPy, SciPy, Matplotlib, Geopandas, Shapely
- **Statistics**: Bayesian Inference, Model Selection, A/B Testing, Bootstrapping
- **Machine Learning**: Convolutional Neural Networks (CNNs), Regression Models, Time-domain signal processing, Feature Engineering, Deep Learning

Work Experience

Data Science Internship <div align="right">**Maryland New Directions, Baltimore, MD**</div>

Summer Data Science Intern <div align="right">*June 2024 – Sep 2024*</div>

- Used ML regression models to predict client reach for non-profit aimed at proving employment opportunities to impoverished Baltimore communities, recommending target areas to achieve a **45% increase** in the client base.
- Integrated US Census data with company databases, deploying automated A/B testing and visualization scripts to continuously monitor socio-economic and demographic trends among clients.
- Presented actionable insights to non-technical stakeholders, which resulted in a new program to improve training effectiveness and retention for the most vulnerable clients.

Graduate Teaching Assistant <div align="right">**Johns Hopkins University, Baltimore, MD**</div>

Head Teaching Assistant <div align="right">*Aug 2021 – Jun 2023*</div>

- Developed active learning modules for the undergraduate physics lab course, substantially increasing student engagement and lab report quality.
- Led weekly training sessions for 25 teaching assistants, improving teaching methodologies and collaboration.

Virtual Reality Research Internship <div align="right">**NeuroEquilibrium Diagnostic Systems, Jaipur, IND**</div>

Summer Intern <div align="right">*June 2016 – Aug 2016*</div>

- Developed Virtual Reality (VR) applications for rehabilitation of patients with neurological disorders.
- Communicated with a diverse team of neurologists, medical practitioners, and company executives to translate company requirements into practical and effective VR experiences.
- Operated in a self-directed environment, independently managing resources and workflows in the new VR division.

Research Experience

New tidal models for binary stellar simulations <div align="right">**Johns Hopkins University**</div>

Lead Author <div align="right">*Jan 2024 - Sept 2024*</div>

- Contributed to the open-source COMPAS code (C++) for simulating binary star systems, translating tidal dissipation models into simulation-ready formats.
- Developed data processing workflows to handle large-scale simulation outputs, leveraging statistical methods such as 2-sided KS tests to infer astrophysical trends.

Systematic Bias from Gravitational Waveform Modeling <div align="right">**Johns Hopkins University**</div>

Lead Author <div align="right">*Oct 2022 - Apr 2024*</div>

- Conducted a statistical study of current gravitational wave model accuracy for future detector applications, using time-domain signal processing and Fisher information matrices to unveil a predicted failure rate of **up to 20%**.
- Used Bayesian model inference and spline regression to determine a requisite improvement in model accuracy **by a factor of 10**, outlining specific improvements in a paper published in the peer-reviewed *Physical Review D* journal.

Calibration of Neutron Star Natal Kick Velocities   **Johns Hopkins University**

Lead Author   *Jan 2022 - Sept 2022*

- Determined optimal parameters for a new supernova model using Bayesian inference, performing model selection via KS tests to propose the model most compatible with astronomical observations.
- Statistically compared the new model to older supernova models, estimating **40% fewer** predicted observable binary neutron stars. Published findings in the prestigious *Monthly Notices of the Royal Astronomical Society* journal.

Using Gravitational Lensing to Constrain Dark Sector Interactions   **Princeton University**

Lead Author   *Aug 2021 - May 2021*

- Evaluated the SuperBIT telescope's potential in constraining Self Interacting Dark Matter (SIDM) cross-section, showcasing a **30% improvement** in constraining ability over Hubble Space Telescope.
- Collaborated within the interdisciplinary SuperBIT team, regularly communicating findings to diverse technical disciplines.
- Developed open-source code to apply generalized lensing analysis tools to n-body simulations of merging star clusters.

Improving Trajectory Reconstruction of Charged Particles at the LHC   **Princeton University**

OURSIP Summer Research Intern   *June 2020 - Aug 2020*

- Applied a Convolutional Neural Network (CNN) to distinguish between single and overlapping particle images from the Compact Muon Solenoid (CMS) detector at the LHC.
- Created 3D and 2D visualizations of overlapping particle trajectories that informed improvements in trajectory reconstruction at the CMS collaboration.

Talks and Presentations

- July 2020 – Talk at Princeton University: *"Shared Hits in the Compact Muon Solenoid Silicon Pixel Detector"*
- May 2021 – Thesis Defense at Princeton University: *"Analyzing the Gravitational Lensing Performance of SuperBIT to Constrain Dark Matter Self Interactions"*
- April 2022 – Talk at 1st "With a little help from my friends" Workshop, Johns Hopkins University: *"Population Synthesis with COMPAS"*
- July 2023 – Panelist at Gravitational-Wave Populations: What's Next Conference, University of Milano-Bicocca: *"Mind the Systematics. Is Waveform Calibration Impacting the Population?"*
- March 2024 – Talk at COMPAS Group Meeting, Monash University: *"Systematic Bias from Waveform Modeling in Next-Generation GW Detectors"*
- April 2024 – Talk at OzGrav Group Meeting, Swinburne University of Technology: *"Tidal Interactions in Binaries"*
- May 2024 – Talk at Villar Group Meeting, The Center for Astrophysics — Harvard & Smithsonian: *"Tidal Interactions in Binaries"*
- May 2024 – Talk at LIGO Lab Group Meeting, Massachusetts Institute of Technology: *"Tidal Interactions in Binaries"*
- August 2024 – Poster Presentation at XXXII General Assembly 2024, International Astronomical Union Institute: *"Calibration of Neutron Star Natal Kick Velocities to Isolated Pulsar Observations"*

Honors and Awards

- 2020-2021 – Allen G. Shenstone Prize in Physics, Princeton University