LENNOX KEEBLE

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Education

Princeton University   **Graduation: May 2025**
Bachelor of Science in Physics   *Princeton, New Jersey, USA*

- Relevant coursework: ORF309 Probability & Stochastic Systems, MAE502 Complex & Functional Analysis, PHY523 Introduction to General Relativity, PHY506 Advanced Quantum Mechanics & Quantum Computation, MAT321 Numerical Analysis and Scientific Computing.

Research Experience

Relativistic Hydrodynamics

- Completing a year-long senior thesis on numerically solving the BDNK equations on a two-sphere, with applications to neutron star mergers and gravitational dynamics in $(3+1)$D. The BDNK equations are causal, stable relativistic Navier-Stokes PDEs which model viscous, relativistic hydrodynamics to first-order in the gradient expansion. **Advisor: Prof. Frans Pretorius.**

Black Hole Photon Rings

- Ongoing project to infer black hole parameters from the inferred interferometric shape of the first photon ring (paper in preparation). **Collaborator: Dr. Alejandro Cárdenas-Avendaño.**
- Co-author of a photon ring science white paper for the planned Black Hole Explorer mission which is being proposed to NASA. **Publication:** *The Black Hole Explorer: Photon Ring Science, Detection and Shape Measurement.* arXiv:2406.09498 [gr-qc], Proceedings Volume 13092, Space Telescopes and Instrumentation 2024: Optical, Infrared, and Millimeter Wave; 130922D (2024).
- Completed a project in which my collaborators and I studied the impact of instrument noise and astrophysical fluctuations on measurements of the shape of the first black hole photon ring. **Publication:** *Assessing the impact of instrument noise and astrophysical fluctuations on measurements of the first black hole photon ring.* **A. Cardenas-Avendano, L. Keeble & A. Lupsasca.** Physical Review D 109, 124052, (2024). arXiv:2404.01083 [gr-qc].
- Assisted the creation of a pip-installable python package for Adaptive Analytical Raytracing (AART): python code which simulates high resolution black hole images and interferometric observables by analytically raytracing light rays in the Kerr geometry.
- Completed a semester-long Junior Project in the Fall 2022 semester on black hole photon ring measurements from high-resolution simulated black hole images. **Advisors: Prof. Frans Pretorius & Dr. Alejandro Cárdenas-Avendaño.**

Extreme-Mass-Ratio Inspirals

- Efficiently implemented the "Chimera": a numerical kludge scheme to compute gravitational waveforms from extreme-mass-ratio inspirals with a local, non-adiabatic treatment of the gravitational self-force as proposed by Sopuerta & Yunes (2011). A systematic comparison of these locally-self-forced waveforms to adiabatic and Teukolsky-based waveforms will be carried out (paper in preparation). **Collaborator: Dr. Alejandro Cárdenas-Avendaño.**

Black Hole Perturbation Theory

- Completed a second Junior Paper in the Spring 2024 semester which reviewed a derivation of the Teukolsky question and a scattering theory for solutions to the radial equation. **Advisor: Prof. Mihalis Dafermos.**

Conferences & Workshops

- Conference for Undergraduate Underrepresented Minorities in Physics (CU^{2}MIP), College Park, USA, 2024.
- American Physical Society April Meeting, 2024. Gave a 10-minute talk on photon ring shape measurements in the presence of noise and astrophysical fluctuations (PRD, 109, 124052). Received a travel grant from the APS Division of Gravitational Physics and funding from Princeton's Department of Physics.
- Taking it to the extreme: Symmetries and dynamics of extremal black holes, Princeton Center for Theoretical Science & Princeton Gravity Initiative, 2024.

Honors

- 2024 American Physical Society Division of Gravitational Physics Student Travel Award.
- Princeton Department of Physics Manfred Pyka Memorial Prize, 2022.
- British Physics Olympiad Round 1: Gold, British Physics Olympiad Senior Physics Challenge: Bronze, 2019.

Professional Experience

Investment Associate Intern   **Summer 2024**
Bridgewater Associates   *Westport, Connecticut, USA*

Summer Business Analyst   **Summer 2022**
McKinsey & Company   *San Francisco, California, USA*

Miscellaneous

Programming Languages: julia., Python, Mathematica & Slurm.
Web Links: Webpage, InSpire, Google Scholar, GitHub.