Eric Yu

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Education

University of Illinois at Urbana-Champaign Aug. 2020 - May 2024
BScience in Physics, BS in Mathematics
Minor: Computer Science
Average unweighted GPA: 3.97/4.0

Grants and Awards

National Center for Supercomputing Applications SPIN Internship ($9600) Fall 2023
Office of Undergraduate Research Research Support Grant ($1750) March 2023
Ralph O. Simmons Undergraduate Research Scholarship ($3000) May 2022
Lorella M. Jones Summer Research Award ($3000) May 2021

Research Experiences

Rotating Neutron Stars surrounded by Tori June 2023 - Present
National Center for Supercomputing Applications, UIUC
Mentored by Professor Antonios Tsokaros

- **In progress: Developing** *COCAL* code that solves the initial value problem in numerical relativity for a rotating neutron-star surrounded by a self-gravitating gaseous disk for an upcoming paper.
- **In progress: Parallelizing** existing *COCAL* code that computes initial data for various astrophysical objects (rotating neutron stars, black holes with accretion disks) in full three dimensions.

Scientific Visualization of Numerical Relativity Simulations June 2021 - Present
Illinois Relativity Group, UIUC
Mentored by Professor Stuart L. Shapiro

- **Led a team of 5 undergraduates** to create 3D visualizations on supercomputers of neutron stars, black hole disks, and binary black holes using an internally developed and maintained VisIt CLI-based code.
- **In progress: Designing and implementing** a major update to the group's internal codebase that will allow for the visualization of a larger variety of astrophysical systems and features.
- **Developed a set of *Python*/*Bash*/*C++* scripts** that extract and visualize gravitational waveforms from numerical relativity simulation data.
- **Devised and implemented** a new and more intuitive rendering technique that visualizes gravitational wave data using a surface plot on the equatorial plane.
- **Co-developed a set of *Python* scripts** that can measure the proper circumference of black holes, neutron stars, and accretion disks in curved spacetime.
- **Visualizations featured** in 3 Phys. Rev. D articles and CASC 2023.
- **Applied for and received** undergraduate summer research support grant (RSG 2023).

Posters

"Gravitational Waves from Black Holes Surrounded by Massive Accretion Disks"

- July 2023: STEM Career Exploration and Symposium, University of Illinois at Urbana Champaign (pdf)

"3D Visualizations of Tilted Black Holes with Self-Gravitating Accretion Disks"

- April 2023: Undergraduate Research Symposium, University of Illinois at Urbana Champaign (pdf)

Published Visualizations

M. Kotak, E. Yu, J. Huang, J. Zhou, M. Ruiz, A. Tsokaros, L. Sun, & S. L. Shapiro. "What happens when Black Holes collide?" CASC 2023 Brochure p14

A. Tsokaros, M. Ruiz, S. L. Shapiro, & V. Paschalidis. "Self-gravitating disks around rapidly spinning, tilted black holes: General relativistic simulations." 2022, Phys. Rev. D 106, 104010, arXiv:2209.04454

A. Tsokaros, M. Ruiz, S. L. Shaprio, & Kōji Uryū. "Magnetohydrodynamic simulations of self-consistent rotating neutron stars with mixed poloidal and toroidal magnetic fields." 2021, Phys. Rev. Lett. 128, 061101, arXiv:2111.00013

Relevant Coursework

Physics: Classical Mechanics, Electromagnetism, Quantum Mechanics, Statistical Mechanics (Fall '23), General Relativity (Fall '23)

Mathematics: Multivariable Calculus, Differential Equations, Linear Algebra, Statistics and Probability, Differential Geometry, Abstract Algebra (Fall '23), Real Analysis (Fall '23)

Computer Science: Data Structures, Machine Learning, Numerical Analysis

Skills

- Programming languages: Python, Bash, C++, Java, Fortran
- Libraries: NumPy, Matplotlib, Scipy, Pytorch, Pandas
- Operating systems: Mac OS, Linux, Windows
- Software: LaTeX, Git, VisIt