Eric Yu

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Education

University of Illinois at Urbana-Champaign — May 2024
BS in Physics, BS in Mathematics
Minor: Computer Science
GPA: 3.97/4.00

Grants and Awards

National Center for Supercomputing Applications SPIN Fellowship ($12600) 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

Presentations

E. Yu, Antonios Tsokaros, Milton Ruiz, Koji Uryū. "Self-gravitating neutron star-disks in general relativity." April 2024, APS April Meeting, NCSA Annual Student Research Conference, UIUC Undergraduate Research Symposium (slides)

E. Yu. "Gravitational waves from black holes surrounded by massive accretion disks." July 2023, UIUC STEM Career Exploration and Symposium (poster)

E. Yu, N. Aldrees, & J. Doppelt. "3D visualizations of tilted black holes with self-gravitating accretion disks." April 2023, UIUC Undergraduate Research Symposium (poster)

Research Experiences

Undergraduate/Graduate Research Assistant — June 2023 - Present
National Center for Supercomputing Applications — Urbana, IL
Mentored by Professor Antonios Tsokaros

- Develop an addition to *COCAL* (Compact Object CALculator, a code that computes initial data for a variety of astrophysical systems) 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
- First-authored "The Illinois Numerical Relativity Visualization Primer", a 75-page manual for visualizing numerical relativity data

Lead Undergraduate Research Assistant — June 2021 - July 2024
Illinois Relativity Group — Urbana, IL
Mentored by Professor Stuart L. Shapiro

- Lead 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 50,000-line VisIt CLI-based code
- Developed a set of *Python*/*Bash*/*C++* scripts that extract and visualize gravitational waveforms from numerical relativity simulation data using a new and more intuitive contour plot rendering technique
- 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 presented at 2 symposiums, and featured in 4 Phys. Rev. articles and CASC 2023

Published Visualizations

J. Bamber, A. Tsokaros, M. Ruiz, & S. L. Shapiro. "Jetlike structures in low-mass binary neutron star merger remnants." 2024, Phys. Rev. D **110**, 024046, arXiv:2405.03705

M. Ruiz, A. Tsokaros, & S. L. Shapiro. "General relativistic magnetohydrodynamic simulations of accretion disks around tilted binary black holes of unequal mass." 2023, Phys. Rev. D **108**, 124043, arXiv:2302.09083

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

Coursework

Physics: Classical Mechanics, Electrodynamics, Quantum Mechanics, Statistical Mechanics, General Relativity

Mathematics: Multivariable Calculus, Statistics and Probability, Linear Algebra, Differential Equations, Differential Geometry, Abstract Algebra, Real Analysis

Computer Science: Data Structures, Machine Learning, Numerical Analysis

Skills

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