

Mit Kotak

<https://mitkotak.github.io>

Champaign, Illinois, United States

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Education

University of Illinois at Urbana-Champaign, Champaign, IL

Bachelor of Science in Engineering Physics

Senior Thesis: 'A case study on the effectiveness of graph APIs'

Advisor: **Dr. Andreas Klöckner**

Minors: **Computational Science and Engineering, Statistics**

GPA: overall 3.90/4.0

Dean's List: Fall 2019, Spring 2020, Fall 2020, Spring 2021

August 2019-Present

Graduation: May 2023

Parkland College, Champaign, IL

Associate in General Studies

GPA: overall 4.0/4.0;

Dean's List: Fall 2020

Summer 2020-Fall 2020

Received: May 2021

Presentations

Efficiently Executing NumPy on GPUs via the CUDAGraph API. (UIUC URS 202)

Task Graph Parallelism on GPUs via CUDAGraphs. (CEESD AST Review 202)

Research Experience

Center for Exascale-enabled Scramjet Design

Dr. Andreas Klöckner

May 2021-Present

Worked on *Efficient execution of array dataflow graphs on GPU hardware*.

- **Co-designed and Co-developed a multi-layered framework** with a graduate student for executing data flow graphs on GPUs via an array-based programming interface.
 - Extended *PyCUDA*, a python-based GPU scripting language, to provide runtime code generation for NVIDIA's *CUDAGraph* API.
 - Implemented a *CUDAGraph* backend for *Pytato*, a lazy-evaluating array interface that lowers n -d array programs to computation graphs.
 - Developed a *CUDAGraph* backend for *Arraycontext*, an array abstraction for mapping *numpy*-like operations onto *CUDAGraph* driver API calls.
- **Benchmarked a speedup of upto 5x** for Finite-Element based Discontinuous Galerkin Operators.
- **Presented results** at semestrial lab funding reviews (CEESD AST Review 202) and annual undergraduate research symposium (UIUC URS 202).
- **Senior Thesis: Modeling the performance** of CUDAGraph API's runtime scheduler through a set of microbenchmarks and writing the paper.

Center for Theoretical Astrophysics

Dr. Stuart L. Shapiro

June 2021-Present

Worked on *3D Visualization of Relativistic Magnetohydrodynamics*.

- **Led a team of 4 undergraduates** to create 3D visualizations of neutron stars, black hole binaries and black holes disks using a *VisIt-CLI* based software package across 6 supercomputing clusters .
- **Spearheaded** the usage of isosurface shell rendering (5-10 times faster than the conventional volume rendering) for visualizing the density profile.
- **Co-developed a set of Python scripts** for efficiently measuring the circumference of a black hole disk at a given density.
- **Visualizations featured** in 2 *Phys. Rev. Journal* articles, *CASC 2023* and *department news website*.
- **Applied for and received** undergraduate research support grants for summer research (RSG 2022, RSG 2023).

CyberGIS Center

Dr. Anand Padmanabhan

March 2022-Present

Worked on *CyberGIS-Compute: Geospatial Middleware for Simplifying Access to High-Performance Computing*.

- **Provided continued software support** for a *Python*-based GUI and *Typescript*-based *RESTful* API server.

- **In progress:** Integrating the *CyberGIS-Compute* framework with **CVMFS** (Cern Virtual Machine File System).

National Center for Supercomputing Applications

August 2022-Present

Dr. Antonios Tsokaros

Worked on *High Performance Computing for Magnetized Neutron Stars*.

- **In progress:** Developing the *Einstein Toolkit* and *COCAL* code to perform full magnetohydrodynamics (GRMHD) simulations of magnetized NSs and examine their astrophysical signatures in a variety of scenarios.
- **In progress:** Writing a 50-60 page manual for 3D visualizations in numerical relativity.

Published
Visualizations

What happens when Black Holes collide ?

Mit Kotak, Eric Yu, Jinghan Huang, Jing Zhou, Milton Ruiz, Antonios Tsokaros, Lunan Sun, Stuart L. Shapiro

Coalition for Academic Scientific Computation 2023 Brochure, Page 14

Available at <https://casc.org/researchpub/brochures/>

Self-gravitating disks around rapidly spinning, tilted black holes: General relativistic simulations

Antonios Tsokaros, Milton Ruiz, Stuart L. Shapiro, Vasileios Paschalidis

Physical Review Letters, Vol. 128, Iss. 6 — 11 February 2022

Available at doi.org/10.48550/arXiv.2209.04454. Also at [arXiv:2209.04454](https://arxiv.org/abs/2209.04454)

Magnetohydrodynamic simulations of self-consistent rotating neutron stars with mixed poloidal and toroidal magnetic fields

Antonios Tsokaros, Milton Ruiz, Stuart L. Shapiro, and Kōji Uryū

Physical Review Letters, Vol. 128, Iss. 6 — 11 February 2022

Available at doi.org/10.48550/arXiv.2111.00013. Also at [arXiv:2111.00013](https://arxiv.org/abs/2111.00013)

Grants/Awards

2021 Philip J. and Betty M. Anthony Undergraduate Summer Research Award – \$3,000

2022 Office of Undergraduate Summer Research Support Grant – \$2,000

2022 1st place in UIUC Image of Research Competition — \$300

2022 National Center for Supercomputing Applications Student Pushing Innovation (**SPIN**) – \$7,200

2023 Office of Undergraduate Summer Research Support Grant – \$1,000

Work
Experience

Office of Undergraduate Research

March 2021-Present

Undergraduate Research Ambassador

- Held **one-to-one peer mentoring sessions** with **40+ undergraduates**, Led "Getting Started with Research" workshops and helped organize the annual undergraduate research symposium (latest one had 500 presenters).
- **Developed a chatbot** that could answer commonly asked questions regarding finding research opportunities.

Illinois Technology Services

March 2020-March 2022

Data and Technology Innovation Group - Student Success Team

- **Built several machine learning models** to predict students at risk of performing poorly in core classes. Average recall: 90%. Average precision: 90%
- **Experimented with Random Forest, SVM, KNN, Gradient Boosting classifiers.** Assembled sparse feature matrices, bucketed class categories, and up sampled some classes to improve accuracy by 60%.
- **Built a web interface** where academic advisors can view the predicted performance of students in core classes. Helped advisors understand courses other than prerequisites that determine student success.

Illinois ATLAS Teaching and Learning with Technology

January 2021-July 2021

Department of Economics & School of Literatures, Culture & Linguistics

- **Implemented job application bot** using Selenium, BeautifulSoup and Django for the Department of Economics.
- **Analyzed data for 11 departmental websites** using Google Analytics API & Python packages (*pandas*, *Numpy*) for the School of Literatures, Culture & Linguistics.