

Vishal Sudhakar

I'm a physicist interested in learning and developing techniques in high-energy physics. In particular studying properties supermassive black holes such as their formation and growth through accretion of matter.

Phone: 762 344 9683

vishal.sudhakar@outlook.com

vsudhakar7@gatech.edu

Education

Bachelor of Science: Physics and Astrophysics

August 2020 – May 2023

Georgia Institute of Technology – Atlanta, GA

- **GPA: 4.0**
- Dean's List: Fall 2020, Spring 2021, Fall 2021, Spring 2022, Fall 2022, Spring 2023
- Faculty Honor: Fall 2020, Spring 2021, Fall 2021, Spring 2022, Fall 2022, Spring 2023

Associate of Science: Physics

August 2019 - May 2020

Dalton State College – Dalton, GA

- GPA: 4.0
- Dean's List: Fall 2019, Spring 2020

Udemy Course - Python for Machine Learning & Data Science Masterclass

Udemy Course - Artificial Intelligence A-Z™ 2023

Teaching Experience

Teaching Assistant – Optics | August 2022 – December 2022

Georgia Institute of Technology

- Holding office hours for students to ask questions about homework and class in general.
- Grading homework

Teaching Assistant – Electrodynamics | January 2022 – May 2022

Georgia Institute of Technology

- Holding office hours for students to ask questions about homework and class in general.
- Grading homework

Publications

William Stephenson, Vishal Sudhakar, James McNerney, Michael Czajkowski, and D. Zeb Rocklin. Rigidity percolation in a random tensegrity via analytic graph theory. [arXiv:2212.04004](https://arxiv.org/abs/2212.04004), December 2022 (**paper accepted in PNAS**)

Scholarships / Research Grants

Letson Scholarship (Summer 2022) for research work on Rigidity Percolation on a Generic Lattice

Research Experience

"Soft Excess" in X-ray Spectra of Active Galactic Nuclei (AGNs) | August 2022 – Current

Georgia Institute of Technology

- Performed numerical calculations using **Python** to extend range of the reXcor model grids.
- Used **X-Spec software** to fit and study a new developed theory of accretion disks for various observational **X-ray data of Type-I AGNs**.
- Used **Python** and subsequent packages such as **Pandas** and **NumPy** to analyze the best fit parameters of the model to learn about the distribution of accretion energy within the disks.
- **The paper will be published soon in the Monthly Notices of the Royal Astronomical Society journal.**

General Tensegrity Percolation | May 2022 – May 2023

Georgia Institute of Technology

- Extended the **rigidity percolation theory** of a square lattice structure to a general depleted triangular lattice structure with a mixture of rods, cables, and struts.
- Validated the developed theory to the general case by **analytical** and **numerical** techniques.
- Programmed an optimization problem of a linear and non-linear equation in Python and Mathematic to acquire simulation data.
- Utilised statistical methods like **Nonlinear Regression**, **Linear Fit**, etc. to further understand the significance of the data.
- Currently in the process of writing a first author paper.

Tensegrity Percolation | May 2021 – May 2022

Georgia Institute of Technology

- Studied the **rigidity percolation** of a square lattice structure with a mixture of rods and cables and struts.
- Applied **Graph Theory** to **mathematically model** the physical system.
- Utilised **Avalanche Statistics** to study the change in the system as cables are added at random points.
- Programmed simulations using **Mathematica** to compare the simulation data to the developed theory.
- Employed statistical methods like **Least Linear Fit** to further understand the cogency of the data.
- **Paper is published to PNAS journal.**

Programming Languages

Python	: proficient
Mathematica	: proficient
Java	: intermediate
C	: novice

Software Packages

X-spec	: proficient
keras	: proficient
scikit-learn	: proficient
numpy	: proficient

Relevant Classes

High-Energy Astrophysics (Graduate Level)

Cosmology

Quantum Mechanics I & II

Statistical Mechanics

Electrodynamics

Thermodynamics

Optics

Calculus III

Differential Equations

Linear Algebra

Object Oriented Programming