Vishal Sudhakar

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

Education

Bachelor of Science: Physics [concentration in Astrophysics**] | August 2020 – May 2023**
Georgia Institute of Technology – Atlanta, GA

- **Current 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 | November 2022 – May 2023

Udemy Course - Artificial Intelligence A-Z™ 2023: Build an AI with ChatGPT4 | January 2023 - Current

Georgia Highschool Diploma | August 2018 - May 2019
Dalton High School – 1500 Manly St, Dalton, GA 30720

- **Honors Award**: AP Calculus BC, AP Physics, AP Chemistry and Spanish
- Member of Drama Club, Mock Trial Club

Ontario Secondary School Diploma | August 2015 - May 2018
Gordon Graydon Memorial Secondary School – 1490 Ogden Ave, Mississauga, ON Canada

- **Program**: International Business and Technology (IBT)

Work 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 McInerney, Michael Czajkowski, and D. Zeb Rocklin. Rigidity percolation in a random tensegrity via analytic graph theory. arXiv e-prints, page arXiv:2212.04004, December 2022

Research Experience

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

- Using X-Spec to fit and study a new developed theory of accretion disks for various observational X-ray data of AGNs
- Using *Python* and subsequent packages such as *Pandas* and *NumPy* to analyze the best fit parameters in order to learn about the nature of accretion disks of AGNs.
- Using Georgia Tech PACE computer to run simulation of our theory
- Helping write a paper to be published soon

General Tensegrity Percolation | May 2022 – May 2023
Georgia Institute of Technology

- Extending the knowledge about the rigidity percolation of a square lattice structure to a general depleted triangular lattice structure with a mixture of rods, cables, and struts
- Programming an optimization problem of a linear and non-linear equation in *Mathematic* to acquire simulation data
- Validating the developed theory to the general case by using simulation data
- Utilising statistical methods like Nonlinear Regression, Linear Fit, etc. to further understand the significance of the data
- Discussing implications of data on a weekly basis with the professor and team
- Currently in the process of writing a first author paper

Reinventing Lectures | January 2023 – May 2023
Georgia Institute of Technology

- Developing process through which professors and teachers around the world can create visually appealing and entertaining lectures to share with communities who do not have access to education
- Creating a prototype using past Modern Optics lectures of the process to demonstrate to philanthropic organizations who can expand this initiative around the world
- Presenting research at ETOP conference

Tensegrity Percolation | May 2021 – May 2022
Georgia Institute of Technology

- Studied the percolation of a square lattice structure with a mixture of rods and cables and with cables only
- 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
- Worked closely with the professor and a fellow peer discussing the validity of the simulations and theory
- Employed statistical methods like Least Linear Fit to further understand the cogency of the data
- Preprint published on arXiv and paper submitted to PNAS in which I'm second author

Analysis of Metals in Chrysopogon Zizanioides | August 2019 – December 2019
Dalton State College

- Analyzed the concentration of Potassium and Magnesium macro-nutrients using ICP-OES
- Prepared replicates of root and stem samples of Chrysopogon Zizanioides by digesting the samples with acids in a microwave digestor for analysis
- Prepared concentrations standards of Potassium and Magnesium for the device to detect the base levels of the metals
- Presented my data and conclusions at a SURS conference.

Scholarships/ Research Grants

- Letson Scholarship (Summer 2022)

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

Programming Skills	Level
Python	proficient
Mathematica	proficient
Java	intermediate
C	novice

General Skills

- Mathematical Simulation
- Data Analysis
- Drawing
- Painting