SUDAT KHAN

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EDUCATION

Stony Brook University (B.S. Physics/Astronomy) Aug. 2020- May 2024 (expected)

Relevant Courses: Stars and Radiation, Intermediate E&M I, Intermediate Classical Mechanics, Waves and Optics, Exoplanets, Introduction to Partial Differential Equations, Modern Physics, Introduction to Modern Astrophysics, Computational Physics in Fortran and C++, Multivariable Calculus with Linear Algebra, Differential Equations with Linear Algebra

Stuyvesant High School (Advanced Regents Diploma with Honors) Sept. 2016- Jun. 2020

HONORS/ AWARDS

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

CLASS PROJECTS

Stony Brook University (AST 390: Exoplanets) Spring 2022

Department of Physics and Astronomy, Dr. Philip J. Armitage GitHub Repository

- For our final project, my groupmates and I decided to simulate the eccentricity time evolution of Neptune, Pluto and Orcus using the REBOUND python code. Pluto and Orcus in particular are trans-Neptunian objects (known as Plutinos) that are in a 2:3 orbital resonance with Neptune around the Sun.
- We aimed to collect simulation data using REBOUND and plotted the eccentricity of all three bodies over a maximum time scale.
- With this data we hoped to conclude the stability of the orbits over a significant time period and see if they fall out of resonance.

RESEARCH EXPERIENCE

Stony Brook University (Undergraduate Research and Creative Activities), Jun. 2022- Aug. 2022

Department of Physics and Astronomy,

Undergraduate Student Researcher, Dr. Philip J. Armitage

- Continuing mentorship under Dr. Philip J. Armitage and through Stony Brook University's URECA summer program, I further pursued an independent computational astrophysics research project by using the smoothed particle hydrodynamics code PHANTOM/SPLASH
- In particular, the project consisted of two Jupiter-mass planets being modeled as polytropic objects colliding from a set radius. This collision was analyzed and compared to mathematical estimates that would assume a perfectly inelastic collision
- This collision system was also simulated orbiting a Sun-mass star (modeled as a sink particle) to observe how the debris from the collision forms a disk and to analyze its properties such as density and mass
- While committing myself to this project, I was also able to gain experience in using high-performance computing clusters and used Stony Brook University's SeaWulf Cluster to run my simulations

Stony Brook University (Independent Introductory Research in Astrophysics), Sept. 2021- May 2022

Department of Physics and Astronomy,

Undergraduate Student Researcher, Dr. Philip J. Armitage

- Under the mentorship of Dr. Philip J. Armitage, I gained the ability to understand astrophysics research papers in topics such as Circumplanetary Disk Formation and Tidal Disruptions events caused by Black Hole binaries
- Self-taught a smoothed particle hydrodynamics Fortran code called PHANTOM (developed by Dr. Daniel J. Price) that creates astrophysical fluid dynamics simulations such as supernovae blasts and disk accretions

- In addition, I learned how to use SPLASH, a visualization and plotting tool for smoothed particle hydrodynamics simulations
- Developed my computational astrophysics skills in areas such as algorithm development to create simple models such as sedov blast waves (a uniform density supernovae blast), planet collisions, tidal disruption events and simple accretion disks

Flatiron Institute at Simons Foundation, Jul. 2019- Sept. 2019
Center for Computational Astrophysics, GitHub Repository
High School Student Researcher, Dr. Francisco Villaescusa-Navarro

- Under the mentorship of Dr. Francisco Villaescusa-Navarro, I took the initiative to understand the fundamentals of machine learning and convolutional neural networks using Pytorch
- I also participated in simple training tasks such as building a neural network capable of recognizing images of numbers
- Through this experience I was able to learn a valuable skill used daily in computational astrophysics that I plan to implement in future projects

EXTRACURRICULARS

TeenHacks LI, Jul. 2019- Nov. 2019
TeenHacks LI Fall 2019 Hackathon,
Coordinator of Workshops and Activities for the Programming Team

- Planned educational/informative workshops for TeenHacks LI Hackathon
- Specifically took the initiative to create a Python with Scientific Applications Workshop
- Outreach to mentors and judges and coordinating for the day
- Able to sharpen and drastically improve collaboration and leadership skills

SKILLS

Programming/Markup: Python 3 (NumPy, Matplotlib, REBOUND), MATLAB, Fortran 2008 (PHANTOM, SPLASH), C++, LaTeX
Office Suite: Microsoft Word, Microsoft PowerPoint, Microsoft Excel