Sudat Khan

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Education

STONY BROOK UNIVERSITY

B.S. Physics
B.S. Astronomy
Aug. 2020 - May 2024 (expected)

Coursework

UNDERGRADUATE

Stars and Radiation (AST 341)
Intermediate E&M I (PHY 301)
Intermediate Classical Mechanics (PHY 303)
Special Topics in Astrophysics and Cosmology: Exoplanets (AST 390)
Waves and Optics (PHY 300)
Computational Physics in Fortran and C++ (PHY 277)
Modern Physics (PHY 251)

Skills

PROGRAMMING/MARKUP

Python 3 (NumPy, Matplotlib, Pandas, REBOUND) • MATLAB • Fortran 2008 (PHANTOM, SPLASH) • C++ • LaTeX

MISCELLANEOUS

Bash • Microsoft Office Suite • Git • HPC Cluster

Honors

DEAN'S LIST

Stony Brook University
Fall 2020, Spring 2021, Fall 2021
Awarded each fall and spring semester to undergraduate students who constitute the top 20 percent of their class

Memberships

American Astronomical Society (AAS) • American Physical Society (APS) • Society of Physics Students (SPS)

Research Experience

UNDERGRADUATE RESEARCH AND CREATIVE ACTIVITIES

Department of Physics & Astronomy, Stony Brook University
Undergraduate Student Researcher, Dr. Philip J. Armitage
Jun. 2022 – Aug 2022 **Repository**

- 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 and visualization tool 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 central 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, temperature 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

INDEPENDENT INTRODUCTORY RESEARCH IN ASTROPHYSICS

Department of Physics & Astronomy, Stony Brook University
Undergraduate Student Researcher, Dr. Philip J. Armitage
Sep. 2021 – May 2022

- 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 along with 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

Class Projects

ECCENTRICITY TIME EVOLUTION OF PLUTINOS (AST 390)

Department of Physics & Astronomy, Stony Brook University
Spring 2022 **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 that are in a 2:3 orbital resonance with Neptune around the Sun (known as Plutinos)
- 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