Rishabh **Solanki**

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Research Interests

Compact objects, Supernovae, Accretion disks, Magnetohydrodynamics (MHD), numerical simulation, AI/machine learning, general relativity, Application of computational methodologies to data-intensive astrophysics.

Education

University of Massachusetts Dartmouth *MA, USA*

M.S. in Physics, GPA 4.0 *Sep. 2021 - expected May 2023*

- Thesis: *Comparison between an alpha disk and a magnetized model for a white dwarf merger evolution*
  Advisor: Professor Robert Fisher

University of Petroleum and Energy Studies *Dehradun, India*

B.S. in Aerospace Engineering, GPA 3.0 *Jul. 2014 - May 2018*

- Undergraduate thesis: *N-body simulations using Monte Carlo methods*
  Advisor: Professor Ugur Guven

Research Experience

Graduate Research Assistant *MA, USA*

UMass Dartmouth *Sep. 2021 - present*

- Led a research effort to explore the evolution of magnetized White Dwarf mergers using fully Magnetohydrodynamics solution and comparing it with the alpha disk perscription (Shakura and Sunyaev, 1973).
- Developed and implemented modules in FLASH to simulate the merger evolution.
- Implemented astrophysical fluid dynamics by structuring calls to equation of state unit in FLASH.
- Reduced the spread of contact discontinuity in self similar standard tests such as Sod shock tube and BrioWu to 3 cells (Δx=1/512) by implementing a novel steepening algorithm based on Piecewise Parabolic Method (PPM) which led to a more resolved solution.
- Optimized the flow and architecture of various numerical solvers to provide faster run time.
- Rearchitected, refactored, and documented microphysics modules, enhancing and extending core capabilities and enabling new kinds of stellar models.
- Proficient in distributive computing and massively parallel programming including MPI and multi-threading. Modeled large scale simulations which used thousands of cores to achieve realistic outcomes closely matching to the observations.

Research Intern *Dehradun, India*

Instruments Research and Development Establishment *Aug. 2018 - Sep. 2019*

- Modeled and reduced the noise from the light curve data using gaussian processes.
- Developed and built upon existing code in Java and Python to obtain centroidal shift which led to refined modelling of refractive index parameter and improved the angular resolution from 3 arc-sec to 20 milliarc-sec.
- Led migration of image processing codes to Git/GitHub, facilitating easier integration into signal processing pipelines.

Undergraduate Research Assistant *Dehradun, India*

University of Petroleum and Energy Studies *Sep. 2017 - Aug. 2018*

- Developed a machine learning based Java applet that trained itself in real-time on orbital data which led to a predictive model for collision detection. Reduced runtime by 30% by implementing error-based step size control.
- Optimized the raw data set for better feature recognition which resulted in more accurate and precise collision predictions.

Skills

Frameworks	FLASH, yt, Git
Programming	Fortran , Python, Java
HPC	MPI, Open MP, TACC-Stampede2, Carnie(UMass Dartmouth)
Languages	English (fluent), Hindi (native)

Publications

1. *"Comparison between an alpha disk and a magnetized model for a white dwarf merger evolution",* **Solanki, R.**, Mudalige, P., Fisher, R., Ugalino, M., Federrath, C. *(In Preparation)*

Teaching

Graduate Teaching Assistant *MA, USA*

UMass Dartmouth *Sep. 2021 - present*

- Prepared and led weekly lectures, review sessions, and lab experiments for classes consisting of 100+ students in the undergraduate series, Physics for Science and Engineering.
- Graded exams and problem sets, working with professors to assign final grades.

Coursework

Physics	Classical Mechanics, Electromagnetism, Quantum Mechanics, Statistical Thermodynamics, General Relativity
Astronomy	Stellar Structures, Orbital Mechanics
Mathematics	Calculus, Differential Equations, Linear Algebra, Complex Analysis

Conferences/Workshops

XSEDE HPC Workshop: BIG DATA and Machine Learning *Virtual*

Participant *Aug 30, 2022*

- Insights into the use of Machine learning and Big Data in large distributed systems.

Virtual Astronomy Software Talks (VAST) *Virtual*

Partcipant *Sep. 2022- Jun. 2023*

- The VAST seminar series puts Astronomy softwares in the spotlight, allowing developers to share their libraries and projects with the community.

Extracurricular Activities

Hikes, Piano, Badminton, Chess, Website Design (UIX)