Diptajyoti Mukherjee

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Education

Bachelor of Science | **Allegheny College**
August 2015 -- May 2019 | Meadville, PA
Major: **Physics** | Minors: **Computer Science & Economics**

- **Cumulative GPA**: 3.975 / 4.0
- **Coursework includes**: Scientific Computing & Numerical Analysis, Principles of Computer Organization, Machine Learning & Artificial Intelligence, Multivariable calculus, Differential Equations & Linear Algebra, Galactic Astrophysics & Cosmology, Stellar Astrophysics, Thermodynamics, Advanced Quantum Mechanics, Electricity & Magnetism, Physical Optics, Quantum Computing.

Research Experience

Senior Comprehensive Research Project | **Allegheny College**
August 2018 -- May 2019 | Meadville, PA

- Researching the formation and evolution of Runaway Collision Objects (RCOs) in Young Massive Clusters. In particular, investigating the presence of an Intermediate Mass Black Hole in the Orion Nebula Cluster.
- Simulations performed using a combination of stellar dynamics code 'NBODY6++GPU' & Smoothed Particle Hydrodynamics (SPH) code 'Starsmasher'.
- Exploring different gravitational dynamics and hydrodynamics coupling mechanisms using the Astrophysical Multipurpose Software Environment (AMUSE).

Co-Design Summer School | **Los Alamos National Laboratory**
June 2018 -- August 2018 | Los Alamos, NM

- Ran & analyzed the triple point problem using next generation continuum dynamics code FleCSALE on different HPC architectures, making use of MPI+X hybrid programming paradigms, and optimized its performance.
- Ported different interpolation schemes present inside tabular Equation of State (EOS) library EOSPAC, which is used by FleCSALE, to run on GPGPUs using CUDA C. Investigated the improvement in performance.
- Investigated & established a proof of concept for different machine learning algorithms like Kernel Ridge Regression and Random Forest to replace interpolation queries in EOSPAC.

LEAPS Fellow | **Leiden University**
June 2017 -- present | Leiden, The Netherlands

- Selected from over 450 applicants worldwide.
- Ran & analyzed a number of simulations with different resolutions using gravitational dynamics codes to investigate stellar interactions in the early solar system which would have affected the primordial debris disk. A paper is in preparation.
- Researched different types of integrators including different Gauss-Radau high order non-symplectic integrators, and Wisdom Holman symplectic integrators to minimize relative energy errors during runs.

- Investigated different N-Body codes to optimize performance on different systems including a 64 core 4 node cluster & a 19 node cluster. Researched different C compilers to optimize code performance further.

Independent Study student | **Allegheny College**
September 2016 -- May 2018 | Meadville, PA

- Renovated a three node cluster by testing different GPUs to optimize performance of SPH code 'Starsmasher'.
- Learnt CUDA and openMP for C to improve and maintain SPH code Starsmasher. Primary work involves debugging the code to make it run on different architectures and OSs.

Project Assistant | **Allegheny College**
May 2016 -- September 2016 | Meadville, PA

- Learnt Ruby on Rails and used it to build a picture sharing web app with a Postgres backend. Deployed web app on Heroku and used AWS S3 to store static elements. It was later used by students in a Communication Arts class.
- Researched optimal mobile-first UI.

Poster presentations

- "*Heating of Debris Disk using Stellar Encounters."* **April Meeting of the American Physical Society, Columbus.** April 2018.
- *"Optimizing Next Generation Hydrodynamics Code for Exascale Systems."* **Supercomputing 2018, Dallas.** November 2018

Talks

- *"Optimizing FleCSALE with EOSPAC for Exascale Systems."* Invited talk at **Los Alamos National Lab.** 26 July 2018.
- *"Exploring the Secular Evolution of the Solar System and Debris Disk in the Birth Cluster."* Talk at the **50th DPS meeting, Knoxville.** 23 October 2018.

Teaching experience

Physics 280 (Scientific Computing & Numerical Analysis) Lab TA | **Allegheny College**
January 2018 -- May 2018 & January 2019 -- May 2019 | Meadville, PA

- Helped students with different programming assignments, checked their algorithms and programs.

Physics 110 (Core Concepts in Physics I) Lab TA | **Allegheny College**
September 2017 -- December 2017 | Meadville, PA

- Helped students with the experiments, pre/post-lab assignments and checked their lab data.

Math 170 (Calculus II) Peer Tutor | **Allegheny College**
September 2015 -- December 2016 | Meadville, PA

- Recommended by the professor to help another student with the material taught in class.

Honors & Awards

Richard L. Brown Award in Physics | **Allegheny College**
May 2019

- Awarded for the best senior project in the Physics department.

Gateway Award | **Allegheny College**
October 2018

- Awarded $800 towards travel and conference costs for delivering a talk at the Division of Planetary Science Meeting 2018.

Junior Major Award in Physics | **Allegheny College**
May 2018

- Awarded for highest academic achievement within the Physics department.

Doane Scholar | **Allegheny College**
2015-16, 2016-17, 2017-18

- Awarded to 30 students from the college for obtaining the highest GPAs in their respective classes.

Distinguished Alden Scholar | **Allegheny College**
2015-16, 2016-17, 2017-18

- College's version of Dean's list. Awarded for outstanding academic performance.

International Scholarship | **Allegheny College**
2015-2019

- Recipient of a $27,500 merit scholarship awarded to international students at college.

Grants

- Granted 0.5 million CPU-hours on Dutch supercomputer Cartesius as co-investigator to perform N-Body simulations for LEAPS project.

Skills

Languages

- Native proficiency in English, Hindi & Bengali. Elementary proficiency in Spanish.

Computer Languages

- Python (advanced)
- C (advanced)
- Fortran 77, 90 (advanced)
- CUDA (advanced)
- C++ (intermediate)
- Java (intermediate)

Operating Systems

- Advanced proficiency in the UNIX operating system and command line environment. Proficiency in bash, csh and zsh.

Activities

President | **Astronomy Club**
December 2016 -- May 2019 | Meadville, PA

- Organized observing sessions and outreach programs. Involved in astrophotography pilot project.

Treasurer | **South Asian Club**
December 2016 -- May 2019 | Meadville, PA

- Organized cultural events like Diwali and Holi and managed finances.