Shyam Sunder

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Introduction

Driven by a deep passion for physics and strong programming skills, my enthusiasm lies at the heart of solving complex problems, particularly in statistical mechanics. While my programming skills are robust, my true devotion is to the world of physics. I am committed to utilizing my programming insight to push the boundaries of what is possible in this exciting discipline.

Education

IIT Madras **July. 2022 – May 2024**
MSc., Physics *Chennai, Tamil Nadu*

St. Stephen's College, Delhi University **July 2019 – May 2022**
BSc., Physics Honours *New Delhi, India*

Varddhman Mahaveer Open University **March 2017 – July 2017**
Certificate in Information Technology *Kota, Rajasthan*

Relevant Coursework

- Statistical Mechanics
- Quantum Mechanics 1&2
- Mathematical Physics
- Computational Physics
- Quantum Computation
- Atomic and Molecular Physics
- Condensed Matter Physics
- Electromagnetic Theory
- High Energy Physics

Projects

Self Propulsion of Active Droplet Under Chemical Reaction

- Showing Liquid-Liquid Phase Separation (LLPS) in Binary Fluid using *Active Model H*
- Implemented Spectral Method to solve coupled differential equations in three fields and simulate their dynamics in Python.
- Simulated the self-propulsion of an Active Droplet under a dilute chemical field and low Reynolds's number approximation.
- Calculated the velocity of moving droplet and its dependence on viscosity and activity parameter.

Self Propulsion of an Active Droplet without Crystalline Order

- Showed the self-propulsion of an active droplet using two interactive scalar fields.
- Calculated the velocity of moving droplet and its dependence on activity parameter and packing fraction.
- Extended the model to self-propulsion of an active droplet under vector field-dependent active stress.
- Extended the model into multiple droplets and verified Active-Crowley-like instability.

Monte Carlo Simulations

- Implemented *Metropolis Algorithm* to simulate the Ising Model in python.
- Verifying the phase-transition in the presence and absence of a magnetic field. Calculated the critical temperature for the 2-D and 3-D Ising models.
- Showed the temperature dependence of magnetic moment and susceptibility.
- Tested the model for various scales and verified scaling hypothesis.

Simulations for Ensembles

- **Micro-canonical Ensemble simulation**: Showed the Maxwellian distribution of velocity among hard spheres in a box with weak interactions. Used Newton's Laws to simulate the dynamics.
- **Leonard-Jones Fluid**: Did the simulation for hard-spheres in a box interacting through Leonard-Jones potential.
- **Canonical Ensemble simulation**: Applied the Thermostat method to fix the temperature of Leonard-Jones Fluid. Showed phase transition in the fluid.

Other Projects

- **N Body Problem**: Simulated gravitational N-Body problem in Python of the solar system. Taking the initial conditions from the NASA website, we were able to calculate things like Mercury's procession.

Technical Skills

Languages: Python, C++, HTML, CSS, JavaScript
Technologies/Frameworks: Linux, Latex, GitHub, WordPress, GUI
Skills(Beginner Level): Data Analysis, Deep Learning

Awards and Achievements

- INSPIRE Award by Department of Science and Technology, Government of India
- Meritorious Award by Department of Physics and Astrophysics by University of Delhi
- Merit Scholarship by Board of Secondary Education, Rajasthan

Leadership

The Poetry Society **Spring 2020 – Spring 2022**
General Secretory *St. Stephen's College*

- Organised Open mics and Open Poetry Discussions.
- Putting together a team and guiding people to edit the annual chapbook of the society: *Traverse*
- Built, designed and setup the society blog *Ellipses*.

Hobbies and Extra-curricular

- Running a literary blog consistently for about four years.
- Self-published two small short story books on Amazon Kindle.
- Interested in Poetry, Literature, and Linguistics.