

Jaydev Singh Rao

Curriculum Vitae

Undergraduate Student
IISER Bhopal (India)
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Interests

- Statistical physics and Complex Systems
- Computational Physics and Numerical Computing
- Open Source Scientific Software

Education

- 2019 – 2024 **Indian Institute of Science Education and Research**, Bhopal, India
*Bachelor and Master of Science (BS-MS), Department of EECS*¹
CPI (current): 9.60/10.0
- 2017 – 2019 **Kendriya Vidhyalaya**, Udaipur, Rajasthan, India
*AISSCE*², *Central Board of Secondary Education*
Performance: 92.0%

Research Experience

- 2021 – 2022 **Spin-systems and properties of their inter-configuration distances**
Supervisor: Prof. Markus Heyl, Theoretical Physics III, University of Augsburg, Germany
- Studied the theory of phase transitions in classical spin systems, mainly the Ising model and the XY model. Also implemented cluster based Monte-Carlo algorithm for these above models to study the critical point and the finite size effects.
 - Used the Monte-Carlo generated configurations to study the behavior of nearest neighbor distances around the critical point and explored the possibility of characterizing the critical point using these distances.
 - Derived probabilistic bounds which, along with numerical results helped in relating the behavior of such distances to the structure factors of the individual configurations.
 - Studied the theory of the quantum XY model and its solution using fermionic mapping. Also explored the possible application of previous results on this model using quantum Monte-Carlo.
- 2022 **Higher order susceptibilities in 3-state Potts model with applications to the QCD critical point**
Supervisor: Prof. Rajiv Gavai, Dept. of Physics, IISER Bhopal, India
- Implemented numerical simulation of 3-state potts model using cluster based Wolff Monte-Carlo algorithm. Also performed extensive analysis of the benefits of the cluster based algorithm near the critical point in contrast to Metropolis algorithm.
 - Analyzed the behaviour of higher order susceptibilities i.e. higher cumulants of the mean magnetization, in the critical region.
 - Explored the possibility of studying the crossover phenomena in this model using these higher order susceptibilities for applications in characterizing the QCD critical point using this model.

¹Electrical Engineering and Computer Science

²All India Senior School Certificate Examination

2021 **Simulating the Maki-Thompson model on a network**

Supervisor: Prof. Kundan Kandhway, Dept. of EECS, IISER Bhopal, India

- Studied the theory of stochastic propagation of information through a population, particularly the Maki-Thompson model.
- Implemented the Maki-Thompson model on a network as a set of coupled differential equations for each node.
- Numerically studied the dependence of rumor spreading on the degree distribution of nodes and the interaction rates determining the flow through edges.

Other Experience

June – Sept **Open Source Contributor**, *The Julia Programming Language*.

2022 Contributed to the open source molecular dynamics library **Molly.jl** by implementing multi-threaded *Replica Exchange Molecular Dynamics (REMD)* algorithms. This project was funded by *Google Summer of Code 2022*. [Project Link](#).

Positions of Responsibility

April–July **Teaching Assistant**, *IISER Bhopal*, Introduction to Programming, ECS102.

2022 Duties included guiding first year undergraduate student through *programming labs* and *invigilation* during exams.

Achievements and Honors

2022 Selected for **Google Summer of Code** for funding of an open source software project.

Software Skills

PROGRAMMING LANGUAGES: Julia, Python, C

SCIENTIFIC SOFTWARES: Mathematica, Matlab

OTHERS: HPC, \LaTeX , Bash scripting, Git & GitHub