Hareesh Ashok Kumar

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Research Objective

A Physics graduate broadly interested in mechanobiology and non-equilibrium statistical physics, with good programming and experimental skills derived through projects in varied fields, looking to enter graduate school to start a research career in biophysics.

Education

Indian Institute of Science Education and Research (IISER), Kolkata *West Bengal, India*
Bachelor of Science(BS) and Master of Science(MS) *August 2017 - July 2022*
CGPA (Overall): 9.05/10.00, Physics Major

Awards & Achievements

Visiting Student Programme
Raman Research Institute (RRI), Bengaluru *2022*
- Selected to pursue a partially-funded research internship in the Soft Matter Department at RRI.

Innovation in Science Pursuit for Inspired Research (INSPIRE) Scholarship
Department of Science & Technology (DST), India *2017-2022*
- A scholarship to cover tuition fees and additional expenses for meritorious students pursuing undergraduate education in natural sciences in premier institutes.

Selected for Vijyoshi 2017
IISER Kolkata *Dec. 10 - 17, 2017*
- Attended an eight-day National Science Camp held at IISER Kolkata, with other INPSIRE scholars.

Research Experience

Raman Research Institute (RRI)- *Visiting Student Researcher* *Bengaluru, India*
Advisor: Prof Pramod Pullarkat *August 2022 - Present*
- Objective: to study membrane fluctuations on Giant Unilamellar Vesicles(GUVs) in non-equilibrium environments.
- Optimized the electro-formation technique to create lipid vesicles and used bacteria to create non-equilibrium environment surrounding the vesicles.
- Utilized fluorescence microscopy and phase-contrast microscopy to image the GUVs.
- Developed code for Vesicle contour detection and analysis using Python and MATLAB.

Indian Institute of Science (IISc)- *Master's Thesis Project* *Bengaluru, India*
Advisor: Prof C.M. Chandrashekar *June 2021 - May 2022*
- Thesis: "A Quantum Algorithmic Approach to the Unruh Effect"
- Tasked with designing a simulation protocol to model the Unruh effect, a result discovered in quantum field theory.
- Built a model to simulate quantum entanglement degradation caused by Unruh effect, using discrete-time quantum walk models.
- Implemented simulations with QuTiP(Python library for quantum dynamics) and minimized simulation run-time through parallel processing.
- Achieved A+(10/10), for final evaluation.

IISER Kolkata - *Nonlinear Dynamics Course Project* *Kolkata, India*

Advisor: Prof Pradeep Kumar Mohanty *October 2020-December 2020*

- Analyzed the impact of small immigration terms in the classical Lotka-Volterra(LV) system through Python simulations, for different prey-predator interactions.
- Developed a GUI using *Tkinter* module in Python, to generate phase plots of the LV system for user-input initial conditions.
- Verified stable co-existence of the predator-prey populations shown as a result of immigration terms.

National Institute of Advanced Studies(NIAS) - *Summer Intern* *Bengaluru, India*

Supervisor: Prof Janaki Balakrishnan *May 2018 - July 2018*

- Investigated and characterized a modified 1-D logistic map using Lyapunov exponents and bifurcation diagrams.
- Summarized different types of bifurcations in nonlinear systems.
- Wrote Python code to animate the changes in the bifurcation diagram of the system caused due to varying system parameters.
- Discovered stable period-doubling bubbles in the bifurcation diagrams in specific regions in the parameter space.

Skills

Languages	**Most experienced in** Python,MATLAB
	Some experience in C++, HTML
Softwares	**Most experienced** ImageJ, Origin, NumPy, QuTiP, MS Excel
	Some experience in Qiskit,Tkinter,scikit-image

Teaching Experience

CS1101: Introduction to Computer Programming *IISER Kolkata*

Teaching Assistant for 1st-year undergraduate course *January 2022 - April 2022*

- Tasked with handling queries/doubts from students regarding programming assignments during tutorials.
- Assisted instructor by regularly evaluating weekly assignments and relaying students' feedback.

Relevant Courses

- **Nonlinear Dynamics**, IISER Kolkata
- **Computational Physics**, IISER Kolkata
- **Biology Laboratory Courses**, IISER Kolkata
- **Biochemistry**, IISER Kolkata
- **Biophysics**, IISER Kolkata
- **Molecular Genetics**, IISER Kolkata
- **Deep Learning Specialization (Online courses, ongoing)**, Coursera

Extra-curricular Activities

- **Event-organizer for *Junkyard Wars*** during IISER Kolkata's Science Fest in March 2019- where participants were required to build working models to perform certain task(s). Coordinated different aspects of the event, including budget proposal and supervision of event setups.
- **Hobbies**: Gaming, Playing the guitar, Badminton