
EDUCATION

Ph.D. in **Physics**
(currently pursuing)

**University of California
Merced**
California, USA
2023 – Present

M.Sc. **Physics** and B.E. **Mechanical Engineering** (Integrated) with **Thesis**
CGPA: 7.862/10.0

**BITS Pilani
Hyderabad Campus**
Hyderabad, India
2017 – 2022

EXPERIENCE / PROJECTS

Single Microtubule Rotation Project

**University of California
Merced**
Merced, CA

Supervisor: [Prof. Ajay Gopinathan](#)

Aug 2023 - Present

- Quantifying the rotational dynamics of Microtubules gliding on lipid bilayer by analysing movies from experiments
- Explaining the observations of individual Microtubules exhibiting transverse rotation just because of motor proteins walking along the filaments

Active Nematic Patterns on Manifolds Project (**Long-Term Visiting Students Program**)

**International Centre for
Theoretical Sciences
(ICTS-TIFR)**
Bengaluru, India

Supervisor: [Dr. Vijaykumar Krishnamurthy](#)

Aug 2022 – June 2023

- Aim to build a covariant framework for active nematic flows on arbitrary geometries.
- Simulating active nematic flows using Landau-De Gennes theory with a traceless, symmetric, second-rank tensor order parameter.

Quantification of mixing of two liquids in small-scale, low Re flows Project – [**preprint**]

**BITS Pilani
Hyderabad Campus**
Hyderabad, India

Supervisors: [Dr. Meenakshi Viswanathan](#) and [Dr. Aravinda N. Raghavan](#)

Jan 2020 – Dec 2022

- Quantified two different flow fields: An Oscillatory flow (in the presence of a Tear-Drop shaped obstacle), and a flow with an entrained vortex (due to a pair of baffles), using the Okubo-Weiss parameter (Q) distinguishing the stretched and rotational parts of the flow.
 - Established that the stirring due to the Tear-drop obstacle and baffles gave rise to a sequence of stretch, rotation and stretch, which sharpened the concentration gradient leading to higher mixing.
 - Attempting to connect the topological features of the flow, Q and the onset of chaotic behaviour to quantify mixing in small-scale open flows.
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Growth Dynamics of Filamentous Fungal Biofilms

Thesis (*Remote Work*) – [[pdf](#)]

Supervisor: [Dr. Aravinda N. Raghavan](#)

BITS Pilani
Hyderabad Campus
Hyderabad, India

Jan 2022 – May 2022

- Worked with the team involved in studying the properties of filamentous fungal biofilms – used in treating industrial effluents.
- Simulated a mesoscopic biofilm growth model with five main components: active part density, inactive part density, tip density, and internal and external concentration.

Coupling of Electrophysiology and Mechanics of Heart Muscle

Thesis (*Remote Work*) – [[pdf](#)]

Supervisor: [Dr. Yong Wang](#)

**Max-Planck Institute for
Dynamics and Self-
organization (MPI-DS)**
Gottingen, Germany

Aug 2021 – Dec 2021

- Worked as part of the group whose aim is to build an Engineered Heart Muscle patch to treat diseased hearts.
- Simulated a coupled model of an excitable domain where an electrical impulse propagates, and deforms the domain in its wake – using COMSOL.
- Focussed on one-way coupling where the electrophysiology (FitzHugh Nagumo model) dictates how the domain deforms (hyperelastic material model) and not vice versa.

SCHOOLS & WORKSHOP

○ **Bangalore School on Statistical Physics – XIII**

- Pattern Formation in Biology
- Statistical Physics of Long-range Systems

**International Centre for
Theoretical Sciences
(ICTS TIFR)**
Bangalore, India
July 2022

○ **FINESSE Workshop: Hands-On Interferometer Modelling**

**Inter-University Centre for
Astronomy and Astrophysics
(IUCAA)**
Pune, India
Dec 2019

PREPRINTS

1. **Kumar, A.**, Vishal, P., Meenakshi, V., & Narayanan, R.. (2022). Spatially resolved stretching-rotation-stretching sequence in flow topology as elementary structure of fluid mixing. <https://doi.org/10.48550/arXiv.2210.12171>

SKILLS & ACTIVITIES

- **Programming/Software:** Python, MATLAB, COMSOL Multiphysics, LaTeX
- **Activities:**
 - Captain of the University Ultimate Frisbee Team – played tournaments from 2018-2022.
 - Part of the Physics Association and the Astronomy Club – conducting events and organising talks for the University.