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## EDUCATION

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

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

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## EXPERIENCE / PROJECTS

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**Active Nematic Patterns on Manifolds**  
**Project**

Supervisor: [Dr. Vijaykumar Krishnamurthy](#)

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

- Simulating nematics with tensorial order parameter under the Landau - De Gennes framework using FEniCS.

*Aug 2022 – Present*

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**Quantification of mixing of two liquids in small-scale, low Re open flows**  
**Project**

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

**BITS Pilani**  
**Hyderabad Campus**  
Hyderabad, India

*Jan 2020 – Present*

- 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.
  - Tested various internal and external concentrations and geometry to mimic the experimental observations.
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## 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 at 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

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- **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*

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

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

*Dec 2019*

## PREPRINTS

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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

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- **Programming/Software:** Python, MATLAB, COMSOL Multiphysics, LaTeX
- **Activities:**
  - Captain of the University Ultimate Frisbee Team – led the South-Central Sectionals of the National Championship Series 2018, Played in the National College Ultimate Championship – 2019, and Played in the South Regionals of the National Championship Series 2022.
  - Part of the Physics Association and the Astronomy Club – conducting events and organising talks for the University.