

CONTACT

PhD Candidate
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EDUCATION

- **PhD, Physics**, (2021-present)
University of Miami
Advisor: Prof. Vivek Prakash

CGPA: 3.94

Collaborators
 - Prof. Takashi Mikawa, University of California, San Francisco
 - Dr. Reiko Asai, Kumamoto University, Kumamoto, Japan
- **BS MS Dual Degree (Physics)**, (2015-2020)
Indian Institute of Science Education and Research (IISER) Tirupati, India
Dissertation Topic: Bacteria motility in porous media.
Advisor: Prof. Dileep Mamapallil

RESEARCH INTERESTS

- Biophysics, Tissue Mechanics, Microfluidics and Soft Matter Physics.

PUBLICATIONS

1. Reiko Asai, **Shubham Sinha**, Vivek N. Prakash and Takashi Mikawa, *Live-imaging with quantitative analysis of cellular flows to visualize left-right asymmetry during early chick embryo development* **CYTOLOGIA**, 90.3 (2025): 145-146.
(<https://doi.org/10.1508/cytologia.90.145>)
#This publication was selected by the editors to appear as the **journal's cover image**.
2. Reiko Asai*, **Shubham Sinha***, Vivek N. Prakash and Takashi Mikawa, *Bilateral cellular flows display asymmetry prior to left-right organizer formation in amniote gastrulation* **Proceedings of the National Academy of Sciences**, 122(6), e2414860122 (2025).
(<https://doi.org/10.1073/pnas.2414860122>)
*Equal contribution
3. Reiko Asai, Vivek N. Prakash, **Shubham Sinha**, Manu Prakash, and Takashi Mikawa, *Coupling and uncoupling of midline morphogenesis and cell flow in amniote gastrulation*, **eLife** 12, RP89948 (2023) (<https://doi.org/10.7554/eLife.89948.3>)
4. Catherine Tom, **Shubham Sinha**, Nidhi Joshi, and Ravi Kumar Pujala, *Tuning aerogel properties for aerospace applications*, **Aerospace Polymeric Materials**, 1-28 (2022)
(<https://doi.org/10.1002/9781119905264.ch1>)
5. Akanksha Agarwal, **Shubham Sinha**, Raju Mukherjee, and Dileep Mampallil, *Dynamics of Bacterial Deposition in Evaporating Drops*, **Physics of Fluids**, 32, 093308 (2020)
(<https://doi.org/10.1063/5.0024078>)

6. Dileep Mampallil, Meenakshi Sharma, Ashwini Sen, and **Shubham Sinha**, *Beyond the coffee-ring effect: Pattern formation by wetting and spreading of drops*, **Physical Review E**, 98, 043107 (2018). (<https://doi.org/10.1103/PhysRevE.98.043107>)

HONORS AND AWARDS

- **Graduate Student Award** (2025), Department of Physics, University of Miami: For research accomplishments, academic performance, and enthusiastic participation in departmental activities.
- **Summer Doctoral Micro-Grant** (2025), Graduate School, University of Miami: For research support to doctoral students during the summer.
- **Media Coverage**, *University of Miami News* (2025): "Illuminating the beginnings of animal development."
- **Outstanding Graduate Research or Scholarship Award** (2024) (Finalist), Graduate School, University of Miami: To graduate students distinguished in scholarly or research pursuits in a University of Miami graduate program.
- **Dean's Summer Research Fellowship** (2024), College of Arts and Sciences, University of Miami: Highly competitive award given based on the proposed research and academic performance of the student.
- **INSPIRE Fellowship**, Government of India (2015-2020): A fellowship by the Department of Science and Technology to talented students in Science.

CONFERENCES AND SEMINARS

- **Biomolecules on the Beach**, University of Miami (11-12 May 2026)
Poster: *Motility dynamics in a simple marine animal*
- **Graduate + Postdoctoral Research Symposium**, University of Miami (March 2026)
Poster: *Motility dynamics in a simple marine animal*
- **Workshop: Mechanobiology Of Tissue Morphogenesis and Disease/B165**, International University of Andalusia (UNIA), Baeza, Spain (October 2025)
Poster: *Asymmetry in bilateral cellular flows prior to left-right organizer formation in early chick embryo development*
- **Graduate + Postdoctoral Research Symposium**, University of Miami (March 2025)
Oral Talk: *Cell movements display left-right asymmetry in early chick embryo development*
- **APS March Meeting** (2024), Minneapolis, Minnesota
Oral Talk: *Bilateral cellular flows initiate left-right asymmetry during early gastrulation in amniotes.*
(<https://meetings.aps.org/Meeting/MAR24/Session/K38.6>)
- **Invertebrate Neuroscience Meeting** (June 2023)
Oral Talk: *Cell flows in a developing chick embryo*

RESEARCH EXPERIENCE

PhD Projects

Motility dynamics in Trichoplax adhaerens, (2025-present)

Prakash Lab, University of Miami

Advisor: Dr. Vivek N. Prakash

Summary: We aim to understand the collective cell movements in a model animal system called *Trichoplax Adhaerens* (*T. Adhaerens*) and quantify the underlying biophysical mechanisms that govern morphological properties, like shape, area, trajectory, and speed.

Cellular flows during early chick embryo development, (2022-2025)

Prakash Lab, University of Miami

Advisor: Dr. Vivek N. Prakash

Collaborators: Dr. Takashi Mikawa, University of California, San Francisco, Dr. Rieko Asai, Kumamoto University, IRCMS, Kumamoto, Japan.

Summary: We studied the cellular flow in the early stage of development (polonaise movements) of the chicken embryo. These coordinated cellular movements during the formation of the primitive streak were quantified using the Particle Image Velocimetry (PIV) technique. We found that the bilateral cell movements display LR asymmetry prior to the LR organizer formation in amniotes. This project led to publications in *PNAS* (2025), *CYTOLOGIA* (2025) and *eLife* (2023).

Master's Thesis

Bacteria Motility in Porous Media, (2019-2020)

Microfluidics Group, Indian Institute of Science Education and Research Tirupati, India.

Advisor: Dr. Dileep Mampallil

Summary: We made two-dimensional porous media by filling microchannels with colloidal particles. We studied bacterial dynamics in this confinement generated between the colloidal particles. The swimming velocity, tumbling frequency, and entrapment time of bacteria were studied under different confinements. This project led to publication in *Phys. Fluids* (2020).

Undergraduate Internships

Applied Thermodynamics, (Summer 2018)

Indian Institute of Science Education and Research Tirupati, India.

Advisor: Dr. Raghunath O Ramabhadran

Summary: The project aimed to understand the fundamentals of thermodynamics and its applications in chemical reactions. Thermodynamics of ideal gas reactions, heterogeneous systems and phase transitions were investigated.

Drop Bouncing on a Super-hydrophobic Surface, (Fall 2017)

Microfluidics Group, Indian Institute of Science Education and Research Tirupati, India.

Advisor: Dr. Dileep Mampallil

Summary: We studied the impact and spreading of water drops on powder layers. The experiments involved high-speed imaging of the dynamics of the drop edge. Similar measurements were also performed on super-hydrophobic surfaces. A collaborative project on the coffee-ring effect got published in *Physical Review E* (2018).

Structural and Magnetic Characterisation of Barium Doped Cobalt Ferrite, (Summer 2017)

Indian Institute of Technology Patna, India

Advisor: Dr. Manoranjan Kar

Summary: Barium doped Cobalt ferrite nanoparticles were synthesised using citrate sol-gel method. The structural analysis done using XRD showed the phase purity of spinel structure. The magnetic characterisation was done using VSM and the analysis showed the reduction in saturation magnetisation and coercivity due to the substitution of non-magnetic Ba^{+2} with Co^{+2} and also reduced magnetocrystalline anisotropy.

Introduction to Solid State Physics, (Summer 2016)

Indian Institute of Science Education and Research Tirupati, India.

Advisor: Dr. Sudipto Dutta

Summary: The project aimed to study the crystal structure, characterisation techniques, and the energy states in a crystal. A brief study on the structure of Graphene and its energy states was also performed.

MENTORSHIP

Undergraduate

- Mia Yim, B.S. BSMAS in Marine Science/Physics, University of Miami (Jan – July, 2026).
- Soaiba Nuzhat, B.S. Computer Science, Columbia University (May – July, 2025)
NSF REU in Physical Sciences Fellow, UM Department of Physics.

TEACHING

At the University of Miami

• **Fall 2021**

1. University Physics 1: PHY 201 (Dr. Joshua Gundersen), **Grader**, 43 students
2. College Physics 1: PHY 101 (Dr. Mohammadjavad Farrokhi), **Grader**, 75 students
3. College Physics 2 PHY 102 (Dr. Mohammadjavad Farrokhi), **Grader**, 75 students

• **Spring 2022**

1. College Physics Lab 1 (106 1O), **TA**, 16 students
2. Collage Physics Lab 1 (106 1S), **TA**, 15 students

• **Fall 2023**

1. College Physics Lab 1 (106 4B), **TA**, 18 students
2. Collage Physics Lab 1 (106 4E), **TA**, 17 students

• **Spring 2024**

1. College Physics Lab 1 (106 5O), **TA**, 17 students
2. Intermediate Electricity and Magnetism II: PHY 351/651 (Dr. Fulin Zuo), **Grader**, 12 students

• **Fall 2024**

1. University Physics 3 Lab (PHY 225 4B), **TA**, 18 students
2. University Physics 3 Lab (PHY 225 4G), **TA**, 16 students

• **Spring 2025**

1. College Physics Lab 2 (108 7A), **TA**, 17 students
2. College Physics Lab 2 (108 7D), **TA**, 18 students

• **Fall 2025**

1. College Physics Lab 1 (106 5N), **TA**, 18 students
2. College Physics Lab 1 (106 5P), **TA**, 17 students

• **Spring 2026**

1. College Physics Lab 1 (106 5N), **TA**, 7 students
2. University Physics 1: PHY 201 (Dr. Vivek Prakash), **Grader**, 41 students
3. University Physics 3: PHY 233 (Dr. Fulin Zuo), **Grader**, 30 students

GRADUATE
COURSEWORK

- | | |
|------------------------------|---|
| 1. Quantum Mechanics I | 7. Quantum Theory I |
| 2. Quantum Mechanics II | 8. Quantum Theory II |
| 3. Classical Mechanics I | 9. Biological Physics I |
| 4. Statistical Mechanics I | 10. Introduction to Astrophysics |
| 5. Electromagnetic Theory I | 11. Introduction to Quantum Computation |
| 6. Electromagnetic Theory II | 12. Oral Communications |

TECHNICAL
SKILLS

- **Computational:** Particle Image Velocimetry (PIV), Particle Tracking, CompuCell3D, Python, MATLAB, Image analysis (ImageJ), Origin, Latex

- **Experimental:** Fluorescence Microscopy, Stereo Microscopy, 3D printing, Soft-lithography (UV), Contact angle measurement, spin coating, Oxygen plasma glass-polymer bonding, XRD, NMR
- **Undergraduate experimental training:** PCR, Plasmid isolation, Gel electrophoresis, Thin Layer Chromatography, Column Chromatography, Recrystallization, Rotor evaporator.

OUTREACH

- Physics/Biology workshop for First Star Academy students (K–12), Department of Physics, University of Miami (December 2021)
- Physics Fun: Public outreach event at University of Miami (March 2024), Demonstration: Vortex Ring Generator
- Physics/Biology workshop for First Star Academy students (K–12), Department of Physics, University of Miami (Summer 2024)
- Physics/Biology workshop for First Star Academy students (K–12), Department of Physics, University of Miami (Summer 2025)
- Magic by Science: K-12 outreach program at Jack D. Gordon Elementary School (January 2026)
- Physics Fun: Public outreach event at University of Miami (March 2026) Demonstration: Vortex Ring Generator

REFERENCES

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