Santhan Chandragiri, Ph.D.

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Education

- **Postdoctoral Researcher, Biophysics**, University of Miami, USA (2022 - present)
- **Postdoctoral Researcher, Soft matter**, Indian Institute of Technology Madras, India (2021 - 2022)
- **M.S., Ph.D., Chemical Engineering**, Indian Institute of Technology Madras, India (2016 - 2021)
- **B.Tech, Chemical Engineering**, Sri Venkateswara University, Tirupathi, India (2010 - 2014)

Research Interests

- **Active matter** - Active nematic fluids, Active particles.
- **Marine biophysics** - Fluid flows around marine larvae and coral reefs.
- **Soft matter** - Coffee ring effect, colloidal interactions and dynamics.
- **Fluid dynamics** - Low Reynolds number flows, laminar flows.

Research Experience & Employment

- **Postdoctoral Research Fellow (2022 - present)**
  Department of Physics, University of Miami, USA.
  Advisor: Dr. Vivek N. Prakash

  Project 1: Effect of confinement on fluid flows generated by sea star and sea urchin larvae.

  Project 2: Trajectories of microswimmers in 3D channels.

  Project 3: Role of fluid flows around corals in improving feeding and growth rates.

  Project 4: Effect of PFAS chemicals on the development of sea urchin larvae.
  Collaborator: Dr. Cynthia A. Bradham (Boston University)

  Project 5: Relation between posture and fluid dynamics in acoels.
  Collaborator: Dr. Mansi Srivastava (Harvard University)

- **Postdoctoral Research Fellow (2021 - 2022)**
  Department of Chemical Engineering, Indian Institute of Technology Madras, India.
  Advisors: Dr. Sumesh P. Thampi and Dr. Basavaraj M. Gurappa

  Project 1: Role of substrate wettability on colloidal particle dynamics during coffee-ring formation.

  Project 2: Velocity field of colloidal particles in an evaporating sessile droplet.

- **Ph.D. Candidate (2016 - 2021)**
  Department of Chemical Engineering, Indian Institute of Technology Madras, India.
  Advisor: Dr. Sumesh P. Thampi

  Ph.D. Thesis: Flows, flow transitions and topological defects in active nematics [weblink]

  Committee: Dr. Abhijit P. Deshpande (IIT Madras), Dr. Basavaraj Madivala Gurappa (IIT Madras), Dr. Ethayaraja Mani (IIT Madras), Dr. P. B. Sunil Kumar (IIT Madras).
  Collaborators: Prof. Julia M. Yeomans (University of Oxford) and Dr. Amin Doostmohammadi (University of Copenhagen)

Publications

1. Bikram D Shrestha*, **Santhan Chandragiri***, Christian D Gibson, Nina R Couture, Melissa Ruszczyk, Vivek N Prakash. *"A universal hydrodynamic transition in confined marine invertebrate larvae"*
Nature Communications (under review) (2025)
arXiv preprint link: https://doi.org/10.48550/arXiv.2501.11744
∗Equal contribution

2. Alexandra T Lion, Sophie M Bodine, Kelley R McCutcheon, Mayank Ghogale, **Santhan Chandragiri**, Deema Abayawardena, Bikram D Shrestha, Abigail Descoteaux, Kathryn Alvarez, J'nesse A Balkman, Breelyn Cocke, Athula H Wikramanayake, Jennifer Schlezinger, Joyce Y Wong, Vivek N Prakash, Cynthia A Bradham. *"PFAS compounds PFOA and Gen X are teratogenic to sea urchin embryos"*
Developmental Biology Volume 525, September 2025, Pages 139-154 (2025).
https://doi.org/10.1016/j.ydbio.2025.06.004
Accepted for the cover, September 2025 issue. Link for cover

3. Melissa Ruszczyk, Skylar Rodriguez, Montale Tuen, Kylee Rux, **Santhan Chandragiri**, Maren Stickley, Brian K Haus, Andrew C Baker, Margaret W Miller, Prannoy Suraneni, Chris Langdon, Vivek N Prakash. *"Local alkalinity enhancement using artificial substrates increases survivorship of early-stage coral recruits"*
Communications Earth & Environment (under revision) (2025)
bioRxiv link: https://www.biorxiv.org/content/10.1101/2025.01.07.631763

4. Abigail E Descoteaux, Marko Radulovic, Mayank Ghogale, **Santhan Chandragiri**, Bikram D Shrestha, Deema Abayawardena, Athula Wikramanayake, Vivek N Prakash, Cynthia A Bradham. *"Alizarin red perturbs skeletal patterning and biomineralization via Catalase inhibition"*
Development (under revision) (2025)
bioRxiv link: https://www.biorxiv.org/content/10.1101/2025.07.03.663060

5. Melissa Ruszczyk, Patrick M Kiel, **Santhan Chandragiri**, Cedric M Guigand, Johnnie Xia, Owen Brown, Brian K Haus, Andrew C Baker, Margaret W Miller, Prannoy Suraneni, Chris Langdon, Vivek N Prakash. *"FlumeX: A modular flume design for laboratory-based marine fluid-substrate studies"*
HardwareX (Under revision) (2025)
SSRN preprint: http://dx.doi.org/10.2139/ssrn.5050355

6. Ryan R Keogh, **Santhan Chandragiri**, Benjamin Loewe, Tapio Ala-Nissila, Sumesh P Thampi, Tyler N Shendruk. *"Helical flow states in active nematics"*
Physical Review E 106 (1), L012602 (2022)
https://doi.org/10.1103/PhysRevE.106.L012602

7. Dinesh Parthasarathy*, **Santhan Chandragiri***, Sumesh P Thampi, Parag Ravindran, Madivala G Basavaraj. *"An experimental and theoretical study of the inward particle drift in contact line deposits"*
Soft Matter, 18(12), 2414-2421 (2022)
https://doi.org/10.1039/D2SM00142J
*Equal contribution

8. **Santhan Chandragiri**$^{+}$, Amin Doostmohammadi^{+}, Julia M Yeomans^{+}, Sumesh P Thampi^{+}. *"Flow states and transitions of an active nematic in a three-dimensional channel"*
Physical Review Letters 125, no. 14: 148002. (2020)
https://doi.org/10.1103/PhysRevLett.125.148002
$^{+}$Corresponding author

9. **Santhan Chandragiri**, Amin Doostmohammadi, Julia M Yeomans, Sumesh P Thampi. *"Active transport in a channel: stabilisation by flow or thermodynamics"*
Soft Matter 15, no. 7: 1597-1604. (2019)
https://doi.org/10.1039/C8SM02103A

Manuscripts under preparation:

1. **Santhan Chandragiri**, Bikram D Shrestha, Katherine Alvarez, Vivek N Prakash. *"Fluid flows around the spherical marine larvae under squeeze confinement"* for **Physical Review Letters** (2025)
2. **Santhan Chandragiri**, Bikram D Shrestha, Vivek N Prakash. *"Experimental and numerical techniques to study the fluid flows around marine larvae under squeeze confinement"* for **Journal of Experimental Biology** (2025)
3. **Santhan Chandragiri**, Amin Doostmohammadi, Julia M Yeomans, Sumesh P Thampi. *"Fluid flow properties around topological defects in 2D active nematics"* for **Soft Matter** (2025)
4. **Santhan Chandragiri**, Dinesh Parthasarathy, Sumesh P Thampi, Parag Ravindran, Madivala G Basavaraj. *"Velocity of colloidal particles inside an evaporating sessile droplet"* for **Soft Matter** (2025)

Conferences

- *Flow fields of spherical and non-spherical ciliated marine larvae under squeeze-confinement*
  Vivek N Nagendra Prakash, **Santhan Chandragiri**, Bikram D Shrestha, Maren Stickley, Katherine M Hardy, Keri O'Neil, Margaret W Miller, Andrew Baker, Melissa Ruszczyk
  American Geophysical Union, Ocean Sciences Meeting, New Orleans, Louisiana, USA (2024)
- *Physicochemical dynamics of substrates for enhanced coral growth in laminar flow conditions*
  Melissa Ruszczyk, **Santhan Chandragiri**, Wasiu Alimi, Owen Brown, Patrick M Kiel, Johnnie Xia, Clara Haughey-Gramazio, Maren Stickley, Andrew Baker, Margaret W Miller, Chris Langdon, Prannoy Suraneni, Vivek Nagendra Prakash
  American Geophysical Union, Ocean Sciences Meeting, New Orleans, Louisiana, USA (2024)
- *Squeeze-confinement induced vorticity amplification in ciliated marine larvae*
  Vivek Nagendra Prakash, Bikram D Shrestha, **Santhan Chandragiri**, Melissa Ruszczyk
  APS, Division of Fluid Dynamics, Washington D.C., USA (2023)
- *Effects of squeeze-confinement on flow fields around morphologically complex ciliated larvae*
  Bikram Shrestha, **Santhan Chandragiri**, Melissa Ruszczyk, Vivek Nagendra Prakash
  APS, Division of Fluid Dynamics, Washington D.C., USA (2023)
- *Effects of 3D confinements on the trajectories of microswimmers*
  Santhan Chandragiri, Bikram Shrestha, Vivek Nagendra Prakash
  APS, Division of Fluid Dynamics, Washington D.C., USA (2023)
- *Modeling the effects of confinement on fluid dynamics of micro-swimmers*
  Santhan Chandragiri, Bikram D. Shrestha and Vivek N. Prakash.
  Society for Integrative and Comparative Biology (SICB), Austin, Texas, USA (2023)
- *Active nematic fluids in 3D channels*
  Chandragiri Santhan, Amin Doostmohammadi, Julia M. Yeomans, and Sumesh P. Thampi.
  4th International Conference on Soft Materials (online, December 2020)
- *Fluid flow properties around +1/2 topological defects*
  Chandragiri Santhan, Amin Doostmohammadi, Julia M. Yeomans, and Sumesh P. Thampi.
  CompFlu -2020. (Online, 2020)
- *Flow states and transitions of 3D active nematics*
  Chandragiri Santhan, Amin Doostmohammadi, Julia M. Yeomans, and Sumesh P. Thampi.
  CompFlu -2019, Indian Institute of Science Education and Research Bhopal (IISERB), Bhopal, India (2019)
- *Active nematics in 3D channels*
  Chandragiri Santhan, Amin Doostmohammadi, Julia M. Yeomans, Sumesh P. Thampi
  28th International Conference on Discrete Simulation of Fluid Dynamics (DSFD), JNCASR, Bangalore, India (2019)
- *Active nematics in channels*
  Chandragiri Santhan, Amin Doostmohammadi, Julia M. Yeomans, Sumesh P. Thampi
  5th International Soft Matter Conference, Edinburgh, United Kingdom (2019)

- *Active nematics in 2D confinements*
  Santhan Chandragiri, Amin Doostmohammadi, Julia M. Yeomans, Sumesh P. Thampi
  CompFlu, Indian Institute of Technology Madras, Chennai, India (2017)

Invited Seminars

- **Physics colloquium**
  Confinement induced vortex generation in ciliated marine larvae, Department of Physics, University of Miami, USA (November 2024).
- **Invertebrate Neuroscience Meeting**
  Confinement-induced vortex generation in ciliated marine larvae, Department of Biology, University of Miami, USA (May 2024).
- **Modern Physics Honors Seminar**
  Effect of geometrical constraints on active fluid flows, University of Miami, USA (November 2022).
- **Invertebrate Neuroscience Meeting**
  Role of the aspect ratio of 3D channels on the occurrence of active fluid flows, University of Miami, USA (November 2022).

Workshops Attended

- **Soft and Active Matter**, University of Hyderabad - 2018.
- **Stochastic Thermodynamics, Active and Driven Systems**, ICTS Bangalore - 2017.

Teaching Assistant Roles

- **Fluid and Particle Mechanics, IITM** January - May (2018 & 2019)
- **Momentum transfer & Mechanical Operations lab, IITM** July - November (2017 & 2018)
- **Chemical Engineering Thermodynamics, IITM** July - November 2019
- **Hydrodynamics of Complex Fluids, IITM** January - May 2020

Mentoring Roles

Ph.D. students: (co-advising)
- Bikram D Shrestha - Department of Physics, University of Miami (2022 - 2025).

Undergraduate students: (co-advising)
- Katherine Alvarez - Department of Physics, University of Miami (summer intern, 2024).
- J'nesse Balkman - Department of Physics, University of Miami (summer intern, 2024).
- Breelyn Cocke - Department of Physics, University of Miami (summer intern from NAU, Arizona, 2024).
- Siddarth Sambamoorthy - Department of Chemical Engineering, IIT Madras (intern from NIT Trichy, 2019).
- Sreejith Santhosh - Department of Chemical Engineering, IIT Madras (intern from Department of Physics, IIT Madras, 2019).

Honors & Awards

- **Early Career Research Award**, Institute for Data Science and Computing (IDSC) - University of Miami, October 2023.
- **Post Doctoral Equivalent Fellowship** at IIT Madras after the completion of PhD.
- 5 year scholarship during PhD by clearing GATE (Graduate Aptitude Test in engineering).
- Finished B.Tech with **first class with distinction** from the department of Chemical Engineering, SVU College of Engineering.

Skills & Expertise

- **Programming**: C, C++, MATLAB
- **Tools & Frameworks**: LaTeX, Ludwig (open source lattice Boltzmann code), COMSOL, Particle Image Velocimetry (PIV), Image analysis (ImageJ)
- **Experimental**: Microscopy, high-speed imaging, wet bench techniques, marine invertebrate larval culture, spawning, and live imaging experiments.

Other Activities

- **Teaching Assistant Training Program (TATP), IITM** - one day workshop on becoming a good teaching assistant.
- **Teaching Assistant Certificate Program (TACP), IITM** - a semester-long program on obtaining the training and credentials for a good teaching assistant.
- Volunteer in outreach activities - introducing research to high school students at IITM and University of Miami
- Part of a program, **1Lab - 1School (IITM)** that worked on bringing awareness of science in government schools around Chennai, India.

References

1. **Prof. Vivek N. Prakash** (Postdoc advisor)
   Assistant Professor, Department of Physics,
   University of Miami, FL, USA.
   Phone: +1 (305) 284-7121
   E-mail: vprakash@miami.edu
2. **Prof. Cynthia A. Bradham** (Collaborator during postdoc)
   Associate Professor, Department of Biology,
   Boston University, MA, USA.
   Phone: +1 (617) 358-5212
   E-mail: cbradham@bu.edu
3. **Prof. Sumesh P. Thampi** (Ph.D. advisor)
   Associate Professor, Department of Chemical Engineering,
   Indian Institute of Technology Madras, Chennai, India
   Phone: +91 44 2257 4179
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4. **Prof. Amin Doostmohammadi** (Collaborator during Ph.D.)
   Associate Professor, Department of Physics,
   Niels Bohr Institute, University of Copenhagen, Denmark
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5. **Prof. Basavaraj Madivala Gurappa** (Collaborator during Ph.D. and postdoc)
   Professor, Department of Chemical Engineering,
   Indian Institute of Technology Madras, Chennai, India.
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