

EDUCATION

Doctor of Philosophy in Physics Monash University, Australia Thesis title: Superwalking Droplets and Generalised Pilot-Wave Dynamics Supervisors: Assoc. Prof. Anja Slim, Assoc. Prof. Tapio Simula, Prof. Kristian Helmerson	2017 – 2020
Dual Degree: Bachelor of Aerospace Engineering (Honours) and Bachelor of Science Monash University, Australia Majors: Aerospace Engineering, Physics, Mathematics Thesis title: A numerical study of flow past a forced oscillating circular cylinder at low Reynolds number	2012 – 2016 GPA/WAM=3.861/86.879

AWARDS & PRIZES

Research/Academic Excellence
➤ 2024 Edward N. Lorenz Early Career Award by the American Institute of Physics (AIP) journal Chaos - 2025
➤ Robert Street Doctoral Prize for best PhD thesis presented by the School of Physics and Astronomy, Monash University - 2021
➤ Postgraduate Publication Award by Faculty of Science, Monash University - awarded \$5000 (AUD) for preparation and publication of PhD research – 2020
➤ 2020 Norris Family Award for Outstanding Research Output by a Graduate Research Student by the Faculty of Science, Monash University - 2020
➤ JL William Postgraduate Top Up Scholarship - \$5000 (AUD) per year, awarded to high achieving PhD students - 2017
➤ Best in School Award – School of Physics and Astronomy at Monash University - awarded for achieving highest score in 3 rd year Physics undergraduate units - 2016
➤ Dean's List for Outstanding Academic Achievement - awarded for 4 consecutive years, awarded to students achieving an average of 85% or above in that year – 2012-16
➤ Australian Mathematical Science Institute (AMSI) Summer Research Scholarship - awarded \$500 (AUD) per week for 6 weeks to undertake an undergraduate summer research project - 2015

Research Communication

➤ The QJMAM Travel Fund for Applied Mathematics to attend MATRIX workshop in Creswick, Australia - 2025
➤ Travel award from The CASS Foundation to present at the Society of Industrial and Applied Mathematics Dynamical Systems (SIAMDS23) conference in Portland, USA – 2023
➤ Best presentation award in the 'Dynamical systems methods in Natural Sciences' symposium at the Nonlinear Science & Complexity (NSC) conference (online) – 2022
➤ Award for research communication for poster presentation at the Australasian Fluid Mechanics Society (AFMS) Retreat, University of Melbourne – 2022
➤ T.M. Cherry award for best student presentation at ANZIAM conference (online) - 2021
➤ Runner-up for 3-minute thesis (3MT) competition in the Faculty of Science, Monash University - 2019
➤ Best student presentation award at the 8 th Meeting on Hydrodynamics Quantum Analogs, Brown University, Rhodes Island, USA - 2018

Outreach

➤ First place in Maths Outreach & Third place in Maths Art for the CARMA-Matrix Maths Art/Poster Competition – 2022
➤ Second place in Maths Outreach for the CARMA-Matrix Maths Art/Poster Competition – 2023

LIST OF PUBLICATION

Publication list can be found at: <https://rahilvalani.com/publications/>

GRANTS/FUNDING

- **Awarded Leverhulme-Peierls fellowship** at the University of Oxford
- **Awarded** (did not accept) an Australian Research Council Discovery Early Career Research Award (DECRA) DP250100435 (2025-2028) – Attractor-driven matter (465,331 AUD)
- **Partner Investigator** on Australian Research Council Discovery Project DP240101089 (2024-2027) - Mathematics to underpin and drive novel inertial microfluidic technologies (454,573 AUD)

PROFESSIONAL RESEARCH POSITIONS

University of Oxford – Oxford, UK Leverhulme-Peierls fellow at Rudolf Peierls Centre for Theoretical Physics	Apr 2024 – Current
University of Adelaide - Adelaide, SA ARC Grant Funded Postdoctoral Researcher	Feb 2021 – Apr 2024
School of Mathematical Sciences - Monash University, Clayton, VIC Research Assistant	Jun 2015 - Feb 2017

PROFESSIONAL TEACHING POSITIONS

University of Oxford – Oxford, UK Tutor	Jan 2025- Current <u>Courses:</u> B1 Fluids
The University of Adelaide - Adelaide, SA Course coordinator	Feb 2023- Jun 2023 <u>Courses:</u> APP MTH 4046 – Chaos with applications Honours/Masters course
Monash College - Melbourne, VIC Teaching Professional	Feb 2019- Dec 2020 <u>Courses:</u> MCD4160 – Physics for Engineering, MCD1200 – Physics A
Monash University - Melbourne, VIC Teaching Assistant <u>Courses:</u> ECE3093 – Optimisation, Estimation and Numerical Methods (<i>Semester 1 – 2019</i>), MTH3360 – Fluid Dynamics (<i>Semester 1 – 2017 and 2018</i>) and PHS2061 and PHS2062 – 2 nd year Physics (<i>Semester 1 and 2 – 2017</i>)	Mar 2017 – Dec 2020

MENTORING & SUPERVISION

- Jack Dring – Summer research undergraduate student – Monash University – July 19
- James Day – Summer research undergraduate student – University of Adelaide – Dec 20/Jan 21
- Joshua Perks – Summer research undergraduate student – University of Adelaide – Jan 21/Feb 23
- Runze Xu – Summer research undergraduate student – University of Adelaide – Dec 23/Jan 24
- Simranjeet Dahia – Summer research undergraduate student – University of Adelaide – Dec 23/Jan 24
- Oliver Preest – Undergraduate research project – University of Oxford – Sep 24/May 25

PRESENTATIONS & TALKS

Dynamics of an active wave-particle entity in a non-smooth potential	9 th Dec 2025
Euromech Colloquium on Recent Advances in Non-smooth Dynamics	University of Exeter, UK
Nematic order from phase synchronization of shape oscillations	4 th Dec 2025
Slender and Active conference, Institute of Physics (IOP)	University of Edinburgh, UK
Hamiltonian formalism for active particles in channel flow	20 th Nov 2025
3 rd London workshop on Active Matter	Kings College London, UK
Nonlinear dynamics of a microswimmer in channel flows	22 th Sep 2025
Oxford-Japan Symposium on Cell Behaviors	Mathematical Institute, Oxford
Nonlinear dynamics of passive and active particles in microchannel flows (Invited)	24 th Jul 2025
Melbourne Mathematical Biology Seminar	University of Melbourne, Australia
Nonlinear dynamics of particle-fluid interactions (Invited)	15 th Jul 2025
MATRIX workshop on slow viscous flows with interfaces	Creswick, Australia
Attractor-driven matter	24 th Jul 2025
NODYCON 2025	Online
Nonlinear dynamics of passive and active particles in channel flows (Invited)	20 th Jun 2025
Mathematical Biology and Ecology Seminar Series, Mathematical Institute	University of Oxford, UK
Asymmetric Limit Cycles within Lorenz Chaos Drive Uphill Motion for an Active Particle	12 th May 2025
SIAMDS25 (Society of Industrial and Applied Mathematics Dynamical Systems) Conference	Denver, USA
Active wave-particle entities	28 th Apr 2025
2 nd London Workshop on Active Matter	London, UK
Intermittent migration of a cell cluster in a confluent tissue (Poster)	25 th Mar 2025
Institute of Physics, Physics of Life conference	Harrogate, UK
Intermittent migration of a cell cluster in a confluent tissue	20 th Mar 2025
American Physical Society's Global Physics Summit	Anaheim, USA
Anomalous transport of a memory-driven active particle (Poster)	19 th Mar 2025
American Physical Society's Global Physics Summit	Anaheim, USA
Nonlinear dynamics of passive and active particles in channel flows (Invited)	3 rd Feb 2025
Mathematical Modelling for Biology, Health, and Environment Seminar Series	Queens Mary University of London, UK
Attractor-driven matter	17 th Sep 2024
Nonlinear dynamics in Electronic Systems (NDES) 2024	Graechen, Switzerland
Tipping phenomena in inertial focusing of particles	5 th Sep 2024
Metastability & Tipping conference 2024	Leicester, UK
Lorenz-like systems and active wave-particle entities	26 th Aug 2024
Nonlinear Science & Complexity (NSC) conference 2024	Online
Active particle motion in Poiseuille flow through rectangular channels	23 rd May 2024
EUROMECH Colloquium on Nonlinear Dynamics at Zero Reynolds Number	London, UK
Tipping phenomena in inertial focusing and separation of particles	14 th Feb 2024
ANZIAM (Australian and New Zealand Industrial and Applied Mathematics) Conference	Adelaide Hills, Australia
Attractor-driven matter	13 th Jan 2024
Days of Applied Nonlinearity and Complexity (DANOC) 2024	Online
Inertial particle focusing in curved ducts: Bifurcation and dynamics (Invited)	5 th July 2023
Physics of Fluid Cassyni Seminar Series	Online
Inertial particle focusing in curved ducts: Bifurcation and dynamics	16 th May 2023
SIAMDS23 (Society of Industrial and Applied Mathematics Dynamical Systems) Conference	Portland, USA
Inertial particle focusing in curved ducts: Bifurcation and dynamics	9 th Feb 2023
ANZIAM (Australian and New Zealand Industrial and Applied Mathematics) Annual Conference	Cairns, Australia
Attractor-driven matter	8 th Feb 2023
ANZIAM (Australian and New Zealand Industrial and Applied Mathematics) Annual Conference	Cairns, Australia
Inertial particle focusing in curved ducts: Bifurcation and dynamics	22 nd Nov 2022
75 th Annual Meeting of the American Physical Society's Division of Fluid Dynamics	Indianapolis, USA
Inertial particle focusing dynamics in curved ducts	16 th Nov 2022
Statistics and Mathematical Modelling in Combination Conference (SMMC 2022)	Melbourne, Australia

Bifurcations and dynamics in inertial particle focusing in curved ducts	7 th Nov 2022
SA ANZIAM Meeting 2022	Adelaide, Australia
Anomalous transport in a Lorenz-like system (Best presentation award in symposium)	27 th Sep 2022
Nonlinear Science & Complexity (NSC) conference 2022	Online
Inertial particle focusing in curved ducts	18 th Jul 2022
Australasian Fluid Mechanics Society (AFMS) Retreat	University of Melbourne, Melbourne, Australia
Strange-attractor-driven matter	15 th Jul 2022
8 th Statistical Mechanics of Soft Matter Conference	Monash University, Melbourne, Australia
Inertial particle focusing dynamics in curved ducts	5 th Jul 2022
NSW ANZIAM (Australian and New Zealand Industrial and Applied Mathematics) meeting	Virtual
<u>Superwalking Droplets & Generalised Pilot-Wave Dynamics (Invited)</u>	24 th May 2022
AFMS (Australasian Fluid Mechanics Society) Conversations in Fluids Seminar Series	Virtual
Bifurcations and dynamics in inertial focusing of particles in curved rectangular ducts	7 th Feb 2022
ANZIAM (Australian and New Zealand Industrial and Applied Mathematics) Annual Conference	Virtual
Bifurcations in inertial focusing of particles in curved rectangular ducts	9 th Dec 2021
16th International Conference on Dynamical Systems Theory and Applications (DSTA)	Virtual
Superwalking droplets (Best student presentation)	1 st Feb 2021
ANZIAM (Australian and New Zealand Industrial and Applied Mathematics) Annual Conference	Virtual
Stop-and-go motion of Superwalking droplets	14 th Dec 2020
Statistical Mechanics of Soft Matter Meeting	Virtual
Emergence of Superwalking droplets	24 th Nov 2020
73rd Annual Meeting of the American Physical Society's Division of Fluid Dynamics	Virtual
Superwalking droplets	17 th Dec 2019
Statistical Mechanics of Soft Matter Meeting	University of Adelaide, Adelaide, Australia
Superwalking droplets	6 th Dec 2019
Australian Institute of Physics Summer Meeting	RMIT, Melbourne, Australia
Superwalking droplets	26 th Nov 2019
72nd Annual Meeting of the American Physical Society's Division of Fluid Dynamics	Seattle, USA
Superwalking droplets (Invited)	7 th
May 2019	
Fluids Seminar Series	Monash University, Melbourne, Australia
Many droplet dynamics and superwalkers (Best student talk)	24 th Jul 2018
8 th Meeting on Hydrodynamic Quantum Analogs	Brown University, Providence, Rhode Island, USA

SCIENCE OUTREACH

Gallery of fluid motion posters & videos 2019-2022

I created videos and posters about my research that are accessible to the general public and visually aesthetic.

Videos: [Superwalking droplets](#), [DIY superwalking droplets](#), [Inertial particle focusing in curved ducts](#)

Posters: [Superwalking droplets](#), [Fun with superwalking droplets](#), [Inertial particle focusing in curved ducts](#)

Mathscraft workshops Nov 2021

Assisted as a Mathematician at the workshop to provide school maths teachers an experience of doing maths like a research mathematician

Youtube outreach video Nov 2021

I was interviewed by **Dr. Tom Crawford (University of Oxford)** for my PhD work on superwalking droplets. The video is uploaded on his **Maths outreach channel 'Tom Rocks Maths'**: <https://youtu.be/RaqbTswDF9A>

Biophysics impact day – Oxford Physics June 2025

Interactive activity showing active matter with superwalking droplets and Boids flocking algorithm for Grade 10 students during Biophysics impact day 2025 at University of Oxford