

RAHIL VALANI

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EDUCATION

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

LIST OF PUBLICATIONS

- **Rahil N. Valani.** *Lorenz-like systems emerging from an integro-differential trajectory equation of a one-dimensional wave-particle entity*, Chaos 32, 023129 (2022). <https://doi.org/10.1063/5.0076162>
- **Rahil N. Valani.** *Anomalous transport of a classical wave-particle entity in a tilted potential*, Physical Review E (Letter) 105, L012101 (2022). <https://doi.org/10.1103/PhysRevE.105.L012101>
- **Rahil N. Valani,** David M. Paganin, A.C. Slim, T. Simula and Theodore Vo. *Unsteady dynamics of a classical particle-wave entity*, Physical Review E 104, 015106 (2021). <https://doi.org/10.1103/PhysRevE.104.015106>
- **Rahil N. Valani,** A.C. Slim and T. Simula. *Stop-and-go locomotion of superwalking droplets*, Physical Review E, 103, 043102 (2021). <https://doi.org/10.1103/PhysRevE.103.043102>
- **Rahil N. Valani,** Jack Dring, Tapio P. Simula and Anja C. Slim, *Emergence of superwalking droplets*, Journal of Fluid Mechanics **906**, A3 (2021). <https://doi.org/10.1017/jfm.2020.742>
- **Rahil N. Valani,** Anja C. Slim, Tapio P. Simula, *Superwalking Droplets*, Physical Review Letters **123**, 024503. (2019). <https://doi.org/10.1103/PhysRevLett.123.024503>
 - Focus story published in APS Physics <https://physics.aps.org/articles/v12/80>
 - Media article published in phys.org <https://phys.org/news/2019-07-droplets-liquid-surface.html>
 - Media article published in physicscentral.com <https://www.physicscentral.com/buzz/blog/index.cfm?postid=5353019309395046474>
 - Featured on ‘Tom Rocks Maths’ youtube channel for Maths outreach https://www.youtube.com/watch?v=RaqbTswDF9A&ab_channel=TomRocksMaths
- **Rahil N. Valani,** Anja C. Slim, *Pilot-wave dynamics of two identical, in-phase bouncing droplets*, Chaos **28**, 096114 (2018). <https://doi.org/10.1063/1.5032128> (Editor’s pick)
- **Rahil N. Valani,** Anja C. Slim, Tapio P. Simula, *Hong-Ou-Mandel-like two-droplet correlations*, Chaos **28**, 096104 (2018). <https://doi.org/10.1063/1.5032114>
- **Rahil N. Valani,** Andrew J. Groszek, Tapio P. Simula, *Einstein-Bose condensation of Onsager Vortices*, New Journal of Physics **20**, 053038 (2018). <https://doi.org/10.1088/1367-2630/aac0bb>

AWARDS and PRIZES

- Best presentation** in the ‘Dynamical systems methods in Natural Sciences’ symposium 2022
Nonlinear Science & Complexity (NSC) conference online 2022, Greece
- Award for research communication** 2022
Australasian Fluid Mechanics Society (AFMS) Retreat, University of Melbourne

Robert Street Doctoral Prize for best PhD thesis School of Physics and Astronomy, Monash University	2021
T.M. Cherry award for best student presentation at ANZIAM conference	2021
Postgraduate Publication Award by Faculty of Science, Monash University Awarded \$5000 for preparation and publication of PhD research	2020
2020 Norris Family Award for Outstanding Research Output by a Graduate Research Student Faculty of Science, Monash University	2020
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
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 a summer research project	2015

CONFERENCE PRESENTATIONS & TALKS

Bifurcations and dynamics in inertial particle focusing in curved ducts Nonlinear Science & Complexity (NSC) conference 2022	28 th Sep 2022 Online
Anomalous transport in a Lorenz-like system modelling the dynamics of a classical wave-particle entity (<i>Best presentation award in symposium</i>) Nonlinear Science & Complexity (NSC) conference 2022	27 th Sep 2022 Online
Inertial particle focusing in curved ducts Australasian Fluid Mechanics Society (AFMS) Retreat	18 th Jul 2022 University of Melbourne, Melbourne, Australia
Strange-attractor-driven matter 8 th Statistical Mechanics of Soft Matter Conference	15 th Jul 2022 Monash University, Melbourne, Australia
Inertial particle focusing dynamics in curved ducts NSW ANZIAM (Australian and New Zealand Industrial and Applied Mathematics) meeting	5 th Jul 2022 Virtual
<u>Superwalking Droplets & Generalised Pilot-Wave Dynamics</u> AFMS (Australasian Fluid Mechanics Society) Conversations in Fluids Seminar Series	24 th May 2022 Virtual

Anomalous transport of a classical wave-particle entity	10 th Feb 2022
ANZIAM (Australian and New Zealand Industrial and Applied Mathematics) Annual Conference	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 (<i>Best student presentation</i>)	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	7 th May 2019
Fluids Seminar Series	Monash University, Melbourne, Australia
Many droplet dynamics and superwalkers (<i>Best student talk</i>)	24 th Jul 2018
8 th Meeting on Hydrodynamic Quantum Analogs	Brown University, Providence, Rhode Island, USA
Many-droplet Hydrodynamic Quantum Analogs	22 th Sep 2017
Victorian ULtraCold Atoms Network (VULCAN) Workshop	Swinburne University, Melbourne, Australia
Einstein-Bose Condensation of Onsager Vortices	27 th Nov 2016
Conference on Optics, Atoms and Laser Applications (KOALA)	Monash University, Melbourne, Australia
A Numerical Study of Flow past a Forced Oscillating Cylinder	21 th Nov 2016
American Institute of Aeronautics and Astronautics (AIAA) Student Conference	Monash University, Melbourne, Australia

MENTORING

- *Jack Dring – Summer research project undergraduate student – Monash University – July 2019*
 - Worked on experiments of superwalking droplets and theoretical modelling of bouncing and walking droplets. This work led to a publication in the Journal of Fluid Mechanics
- *James Day – Summer research project undergraduate student – University of Adelaide – Dec 2020/Jan 2021*

- Worked on integrability of Lorenz-like dynamical systems emerging from the walking-droplet system and investigating a wave-particle entity in a harmonic potential
- *Joshua Perks – Summer research project undergraduate student – University of Adelaide – Jan 2021/Feb 2021*
 - Worked on dynamics and stability of a wave-particle entity in a sinusoidal potential

PROFESSIONAL RESEARCH WORK EXPERIENCE

University of Adelaide - Adelaide, SA

Feb 2021 - Current

ARC Grant Funded Postdoctoral Researcher

Key Responsibilities:

- Undertaking cutting edge research in mathematical analysis of particle dynamics in fluid flows inside curved ducts using analytical and computational tools. *This research will have potential application in 'liquid biopsy' – the isolation of circulating tumor cells (CTCs) from blood samples*
- Communicate the research outputs by publishing in high impact international journals and presenting at both national and international conferences

AMOG Consulting - Melbourne, VIC

Jun 2016 - Jul 2016

Vacation Student Engineer

Key Responsibilities:

- Developing flow charts to understand data flow of a cable simulator software
- Understanding and implementing analytical models for a cable/strand under tension and bending loads
- Investigating analytical models for enhancing wave energy production and performing numerical analysis in MathCAD and MATLAB

School of Mathematical Sciences - Monash University, Clayton, VIC

Jun 2015 - Feb 2017

Research Assistant

Key Responsibilities:

- Developing a mathematical model to perform quantitative study of a dynamical system of two bouncing droplets on a vibrating bath
- Working independently to analyze the numerical results obtained from MATLAB and verifying with analytical approximations and experiments
- Using effective communication skills to convey the work to colleagues and academics through clear explanations of unfamiliar concepts during group meetings

PROFESSIONAL TEACHING EXPERIENCE

Monash College - Melbourne, VIC

Feb 2019- Dec 2020

Teaching Professional

Courses: MCD4160 – Physics for Engineering, MCD1200 – Physics A

Key Responsibilities:

- Teaching Physics and Engineering to a class of diverse senior international diploma students
 - Conducting Lab session where I guide students in performing Physics experiments and help them connect the theoretical concepts to hands-on experiments
 - Occasionally conducting lectures and tutorials where I teach them theoretical concepts in Physics and Engineering
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Monash University - Melbourne, VIC

Mar 2017 – Dec 2020

Teaching Assistant

Courses: ECE3093 – Optimisation, Estimation and Numerical Methods (*Semester 1 – 2019*), MTH3360 – Fluid Dynamics (*Semester 1 – 2017 and 2018*) and PHS2061 and PHS2062 – 2nd year Physics (*Semester 1 and 2 – 2017*)

Key Responsibilities:

- Reviewing content covered in lectures and concepts that the students are struggling with
 - Identifying students' learning gaps and assisting them in understand and applying the concepts learned in lecture to solve problem set
 - Giving feedback to students on their work and help them become independent learners
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Teach Me Tutoring - Melbourne, VIC

Feb 2017- Current

Mathematics/Physics Tutor

Key Responsibilities:

- Assisting students one-on-one with high school Mathematics and Physics
 - Explain concepts to students and identifying and addressing their learning gaps
 - Help them develop good study habits and assist them in becoming independent learners
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VOLUNTARY WORK AND EXTRA-CURRICULAR ACTIVITIES

Various roles - Community Centre, Vermont, Melbourne, VIC

2017 - Current

Conducted Science Workshops for primary school students at the local community center.

- Create hands-on experiments and engaging content every second school holidays for these students.
 - Train youth volunteers to assist in conducting this session.
 - Managing the full program by working effectively with different teams
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Mathscraft workshops

2021 - Current

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