Conference Booklet

20th NZMASP 2025 - Tāmaki Makaurau | Auckland

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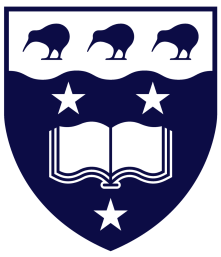

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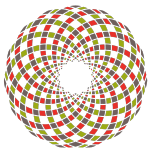

Te Pūnaha Matatini
Data ▪ Knowledge ▪ Insight

Contents

Programme

Tuesday 18th

Start	End	Presenter	Title	Chair
8:00	8:50		Registration	
9:00	9:10	Committee	Opening	
9:10	9:30	Anders Damgaard	Cracking Codes	Đorđe Mitrović
9:30	9:50	Kate Truman	Inferring evolutionary history using the Skyline Stratigraphic Range Fossilised Birth-Death model	
9:50	10:10	Md Azmir Ibne Islam	Dynamics induced by a heteroclinic network between five equilibria	
10:10	10:40		Morning Tea	
10:40	11:00	Alec van Helsdingen	Modelling Under-Dispersed but Clustered Whale Cues	Thomas Tawfik
11:00	11:20	Hamish McAlley	Influence of Forcing on Magnetohydrodynamic Turbulence	
11:20	11:30		Break	
11:30	11:50	Felix Shaw-Bell	Eigenmode approximations of the Fokker–Planck operator in tipping point systems	Nivedita Tewary
11:50	12:10	Adam Nachowitz	Provable Security of a Discrete Log-Based Digital Signature Scheme	
12:10	12:30	Nasrin Nikbakht	A Novel Methodological Framework for Inverse Problems Using Adaptive Spectral Inversion	
12:30	13:30		Lunch	
13:30	13:50	Shaowu Zheng	Arc-transitive graphs with large automorphism groups	Thomas Valentine
13:50	14:10	Wubetea Truneh	Active Particle Dynamics in a Triangular Duct	
14:10	14:20		Break	
14:20	15:20	**Dion O'Neale**	**Invited Talk**	Committee
15:20	15:50		Afternoon Tea	
15:50	16:10	Isaac Buhler	Fluid antennas and near field channels	Alec van Helsdingen
16:10	16:30	Ryan Thompson	Conjugacy of local homeomorphisms on totally-disconnected spaces	
16:30	16:50	Yuanyuan (Lydia) Li	Belief-Behavior Feedback, Cascades, and Optimal Platform Intervention	
16:50	17:00	Committee	Daily closing announcements	
17:00	19:00		Social Event at Old Government House	

Wednesday 19th

Start	End	Presenter	Title	Chair
9:00	9:10	Committee	Morning Announcements	
9:10	10:10	**Ben Stevenson**	**Invited Talk**	Committee
10:10	10:40		Morning Tea	
10:40	11:00	Travers Bloemsaat	Approaches to Gravitational Self-Forcing	Sebenele Thwala
11:00	11:20	Ofri Adiv	Nonlinear dynamics of coupled light-matter systems	
11:20	11:30		Break	
11:30	11:50	John McLachlan	Intersections of longest paths of connected graphs	Bobby Song
11:50	12:10	Vincent Lomas	Modelling the interaction between ethnicity and infectious disease transmission dynamics	
12:10	12:30	Nivedita Tewary	Cops and Robbers in Metric Spaces	
12:30	13:30		Lunch	
13:30	13:50	Lander Verlinde	The typical structure of sets with bounded sumset	Liam Gibson
13:50	14:10	You (Joe) Zhou	Spatiotemporal Epidemiological Statistical Modeling Based on Wastewater Surveillance Data	
14:10	14:20		Break	
14:20	15:20	**Astrid An Huef**	**Invited Talk**	Committee
15:20	15:50		Afternoon Tea	
15:50	16:10	Thomas Tawfik	Cosmological Wave Asymptotics in the direction of the Initial Singularity	Timotheus Keanu
16:10	16:30	Thomas Valentine	An online van der Waerden's theorem	
16:30	16:50	Elena Vasilieva	Monte Carlo Simulation of Light Transport in Turbid Media	
16:50	17:00	Committee	Daily closing announcements	
17:30	18:00		Roundtable Discussion	

Thursday 20th

Start	End	Presenter	Title	Chair
9:00	9:10	Committee	Morning Announcements	
9:10	9:30	Yiting Guo	Using WKB to construct wavelet based solution operator for the semiclassical Schrodinger equation	Kate Truman
9:30	9:50	Sebenele Thwala	Infinity, Cursed Energy, and Curved Space: A Mathematical Dive into Gojo's Powers	
9:50	10:10	Rezwana Razzaque	Heteroclinic Orbit Analysis of Traveling Wave Solutions in Dissipative Bona–Smith Systems	
10:10	10:40		Morning Tea	
10:40	11:00	Menik Hitihami Mudiyanselage Rasika (Rasika) Dilhani	Feature-Based Clustering of Simulated Time Series Using Ordinal Pattern Analysis	Amin Boumerdassi
11:00	11:20	Đorđe Mitrović	Closing Paths to Cycles in Symmetric Graphs	
11:20	11:30		Break	
11:30	11:50	Sarah Bird	Legendre polynomials for improved modelling of extended lactation curves in grazing dairy cows	Anders Damgaard
11:50	12:10	Timotheus Keanu	Construction of Local Kobayashi Points via a Generic Logarithm	
12:10	12:30	Andrew Tipton	Can mixtures of Gaussians have a saturated model?	
12:30	13:30		Lunch	
13:30	13:50	Mridul Biswas	Local-Global Principle	Md Azmir Ibne Islam
13:50	14:10	Sanaz Amani	Blenders and blender-like chaotic attractors in a three-dimensional Hénon-like diffeomorphism	
14:10	14:20		Break	
14:20	15:20	**Andrew Keane**	**Invited Talk**	Committee
15:20	15:50		Afternoon Tea	
15:50	16:10	Matthias Chan	Groups acting on trees and tree-like structures	Meghna Mistri
16:10	16:30	Liam Gibson	Can we just blame babies for everything? Nonlinear dynamics in agent-based models of academic publishing	
16:30	16:50	Baylee Verzyde	Seiberg-Witten Monopoles and Vortices	
16:50	17:00	Committee	Daily closing announcements	
18:00	19:00	**Henk Dijkstra**	**Public Lecture**	
19:30	22:00		Social Event at Dice & Fork	

Friday 21th

Start	End	Presenter	Title	Chair
9:30	9:40	Committee	Morning Announcements	
9:40	10:00	Jake Lyons	Generalised SIC-POVMs as Equi-Isoclinic Subspaces and their relation to Bell-Inequalities	Sam Doak
10:00	10:20	Oliver Gracewood	Isometries, Fixed Points, and Non-Positive Curvature	
10:20	10:40	Marc Lescano	An Introduction to Topological Quantum Computing	
10:40	10:50		Break	
10:50	11:50	**Jodie Hunter**	**Invited Talk**	Committee
11:50	12:40		Voting and Lunch	
12:40	13:00	Committee	Prize Giving and Closing	

Chapter 1

Important information

1.1 Contact numbers

For general, non-urgent enquiries, please contact us via our email: admin@nzmasp.org.nz

The conference organisers may be contacted using the details below:

- Sam Doak: 021 023 44734 or sdoa857@aucklanduni.ac.nz
- Davide Papapicco: 029 023 60739 or dpap666@aucklanduni.ac.nz
- Meghna Mistri 027 266 9834 or mmis819@aucklanduni.ac.nz

Other important contacts are:

- Auckland police station: 105 (111 for emergencies)
- Corporate Cabs Auckland: 0800 789 789
- 'Safe to talk' national sexual harm helpline: 0800 044 334 (or text 4334)

See Chapter 5 on our Code of Conduct for an anonymous reporting form link.

1.2 Accommodation

The accommodation we have organised is at Attic Backpackers from Monday 17th to the morning of Friday 21st November. The accommodation is at

4th floor/31 Wellesley Street West, Auckland Central, Auckland 1010
09 973 5887

Upon arrival please see reception to check-in to get a key to your assigned room. Bring valid ID such as a New Zealand driver's licence or an international passport.

1.3 Transport

If you are arriving in Auckland via the airport we recommend you use the SkyDrive bus, Uber, or Taxi (25-35 minutes), there is a public transport option but this involves many connections and will take over an hour. More information is available on the website.

SkyDrive bus tickets can be purchased here. The bus trip ends in the Auckland City CBD on Hobson Street, which is a 5 minute walk from Attic backpackers.

1.4 Venue

The conference will be held in building 303 at the University of Auckland's City Campus; from Attic backpackers it is a 10 minute walk.

The talks will be hosted in room 303-101, also called MLT3. To get there, enter building 303 from the entrance on 38 Princes Street. Walk straight through the entrance and take the elevators or the stairs to the first level. Room 101 will be in front of you to your right. There is a map available here

1.5 Morning and Afternoon Tea

Morning and afternoon tea will be organised in the common room of the fourth floor of building 303. Take the elevator or the stairs in front of the conference room, go to the fourth floor and walk past the reception.

As we are striving to have as little single use cups as possible, we kindly ask to bring your own cup and/or drinking bottle. Paper cups will be provided in case you are unable to do so.

1.6 Lunch

During registration all attendees will be provided with four $15 lunch vouchers to be used at university vendors for the four days of the conference. Each voucher must be used to make a single purchase.

There are options for dairy free, gluten free, vegan, vegetarian, and halal. Please see the list of vendors here for options based on your dietary requirements.

1.7 Information for presenters

Most attendees at NZMASP 2025 will be giving a presentation. Talks will be 15 minutes in length, followed by 5 minutes question time. Presentations by the plenary speakers will be 60 minutes in length (including question time). Refer to the programme in chapter 2 of this booklet to see when we have scheduled for your talk.

Tips for your presentation

- Keep it simple. Most of the audience will not be experts in your particular field. In fact, a large portion of your audience won't know more about your field beyond an undergraduate level, so please keep these people in mind.
- Less is more. You have limited time and your audience have limited attention; you may want to focus on a small aspect of your research and explain it well.
- Ensure that slides will be readable from the back of the room. Equations can take effort to read; use them when appropriate but don't go overboard.
- If you use videos or any non-standard tech, have them open and ready to go and have a back-up plan if it doesn't work.
- Practise your talk. Know what you are going to say, and how long it will take.
- Look at the audience, and make eye contact. Pause and take a breath between paragraphs or slides. Try to have fun :)
- Taking questions after the talk is important, but it is okay to not know all the answers. If you're stuck for an answer, say you don't know off the top of your head and follow up later.
- Acknowledge the people and organisations which have contributed to the work you present; supervisors, collaborators, funding etc.

Slides

We encourage presenters to upload their slides to the google drive folder using this link. (Please put your talk in the folder labeled with the day of your presentation.) If possible, please format your slides as a pdf and include animation files separately.

Presenters may also:

- bring their slides on a USB drive
- bring their own device if they want to use a specific program.

If presenters are bringing their slides on a USB or using their own device then please get in touch with a member of the committee in the break before the session with your talk.

Recording

We will not be recording any of the presentations. Participants are welcome to film/record their own talk if they so desire. Please do not make a recording of someone else's talk without their enthusiastic permission.

1.8 Information for session chairs

The conference organisers wish to thank all of the volunteer session chairs, as they greatly help with the running of the conference.

Role description

Session chairs are each in charge of a session involving 2-3 student speakers. Their main job is to introduce each speaker and let them know if they are running out of time. After each talk, they should ask the audience if there are any questions and have a question prepared themselves in case nobody from the audience asks one. The question can be something general, such as "how did you become interested in this topic" if a speaker's talk is outside the chair's expertise.

When introducing a speaker, please be mindful of their pronouns. If you are unaware of a person's pronouns, please use gender-neutral language when referring to them.

Chairs will be provided with a warning card to show speakers when they have three minutes and one minute remaining of their speaking time. The chair will ring a bell if a speaker has gone overtime.

1.9 Prizes

The NZMASP conference will award prizes to recognise the most outstanding student speakers. The prizes are voted for by the audience and a voting form will be made available at the end of the conference. While listening to the presentations, please keep a note of any talks you may wish to vote for. Towards the end of the conference, we will post a Google form to allow you to allocate your votes for each different category.

Rules and criteria

- You may not vote for yourself (please be impartial)

Prizes available

Overall prizes

- The Faculty of Science prize for the best overall student presentation
- The Faculty of Science prize for the second best overall student presentation
- The Faculty of Science prize for the third best overall student presentation

Study level prizes

- Prize for excellence at Masters level
- Prize for excellence at Honours level

Subject prizes for pure mathematics

- The New Zealand Mathematical Society (NZMS) prize

Subject prizes for applied mathematics and mathematical physics

- The Australian and New Zealand Industrial and Applied Mathematics (ANZIAM) prize

Subject prizes for pure, applied statistics, and data science

- The New Zealand Statistical Association (NZSA) prize

1.10 Social events

Tuesday 18th: Icebreaker boardgames night at Old Government House

This is an informal event to meet and socialise with postgraduate students from other universities. There will be boardgames, and pizza will be served.

Wednesday 19th: NZMASP roundtable

A roundtable discussion on the future of the NZMASP conference will be held at 5:30pm in 303-257.

Thursday 20th: Jane Street social event at Dice & Fork

A complementary social event will be held at Dice & Fork on Thursday 20th from 7:30pm to 10pm. Dice & Fork is a board game bar and restaurant at 210 Victoria Street West. It is a 25 minute walk from the University. The evening will begin with a pub quiz, and food and a bar tab will be provided. This event is exclusively sponsored by Jane Street.

Friday 21st: Prize-giving

During this awards ceremony, the conference organisers will thank the sponsors and plenary speakers and the committee will present prizes for outstanding student presentations. We will also hand over the reigns of the NZMASP conference to next year's committee.

Photos

Feel free to add any photos of your time at NZMASP 2025 to our shared Google Drive available at this link. A group photo will be taken at the end of the conference.

Chapter 2

Speakers

2.1 Plenary Speakers

Prof. Dr. Astrid An Huef – Te Herenga Waka, Victoria University of Wellington

Astrid was born in Germany and lived there until her family emigrated when she was 13, first to New Zealand and then Australia. She earned Bachelor degrees in Computer Science and in Mathematics, and then an Honours degree in Mathematics, from the University of Newcastle in Australia. She then studied in the USA, earning a Master and a PhD in Mathematics from Dartmouth College in New Hampshire. After 2 years in a tenure-track position in Colorado, she wanted to go home, and was fortunate to get a permanent position at the University of New South Wales in Sydney. She was at UNSW until the end of 2009, when she took up a professorship at the University of Otago in Dunedin.

Dr. Andrew Keane – Coláiste na hOllscoile Corcaigh, University College Cork

Dr. Andrew Keane completed his undergraduate studies in Australia and Germany before beginning a PhD at the University of Auckland in New Zealand. Upon completing his PhD in Applied Mathematics in 2016, he became a postdoctoral researcher at the University of Auckland. Since August 2019, Dr. Keane is a lecturer in applied mathematics at University College Cork in Ireland. His research expertise lies in dynamical systems and applying its techniques to systems from various areas of application, in particular climate systems. Dr. Keane is interested in the application of dynamical systems theory to areas beyond mathematics and actively embraces the cross-fertilisation between disciplines. So far he has studied systems in the context of neural networks, electro-chemical oscillators, climate systems, evolutionary robotics and control theory. Methods and tools from dynamical systems have the ability to unravel complicated behaviour, allowing one to potentially explain, understand and predict important physical phenomena. Key topics of Dr. Keane's research are climate dynamics, delay differential equations, bifurcation theory and coupled oscillators.

Dr. Ben Stevenson – Waipapa Taumata Rau, University of Auckland

After completing my earlier degrees at the University of Auckland, I graduated with a PhD from the University of St Andrews, United Kingdom, in 2016. I remained at St Andrews for a research fellowship before returning to New Zealand in 2017. My research is in primarily in the field of ecological statistics. Ecologists must answer burning questions about animal populations to aid their conservation and wildlife management decision-making. For example, how many animals are there? How are they distributed in space? Is the population growing or shrinking? Is the distribution changing over time? If so, can we explain why? These are tricky questions to answer, partly because we can't possibly detect every single animal in the population: we are trying to count how many animals we never observed. Historically, data collection on wildlife surveys involved capturing, tagging, releasing, then recapturing and recognising animals. Modern technology has revolutionised the field, and now we can use instruments such as drones, video cameras, and microphones to detect individuals. Data collected using these new techniques, however, presents new and interesting statistical problems: although we are collecting more data than ever before, it is often unclear what we should be doing with it all, and how we could possibly process the data deluge with adequate swiftness. In my research, I develop new statistical methods and software to transform these data into estimates of population size, distribution, and trends over time, often with a focus on how we can do this at speed on computing equipment no more sophisticated than your laptop. In my spare time, I enjoy brewing beer and spending time with my pets: Cai (a dog); Nymphadora (a horse); Norna (a Shetland pony); and Brook, Barbara, Ann, Morag, Estella, Camilla, Maria, Martha, and Izzy (a flock of chickens).

Dr. Dion O'Neale – Nicholson Consulting

Dion is a Principal Data Scientist at Nicholson Consulting and a Principal Investigator at Te Pūnaha Matatini. With a background in Mathematics and Physics, Dion is interested in all things network science related. This has spanned from using networks for economic geography (to understand how scientific innovations cluster within regions leading to technological specialisation); archaeology (using networks of co-occurring obsidian artefacts to infer social networks in pre-European Aotearoa); through to behavioural ecology (using networks of species and traits to understand the mating systems of spiders). Much of his recent work has focused on how the structure of interaction networks between people affects the spread of infectious disease. Dion was a co-lead of COVID-19 Modelling Aotearoa where his team built a network representing the interactions between the 5 million individuals in Aotearoa.

Prof. Dr. Jodie Hunter – Te Kunenga ki Pūrehuroa, Massey University

I have broad research interests in Pasifika education and the teaching and learning of mathematics. Both in the UK and in New Zealand I have been involved in collaborative work with teachers and students across the country to facilitate change in their mathematics classrooms. My previous research while working at Plymouth University included a strong focus on developing early algebraic reasoning in primary classrooms. This included a focus on teacher professional development, classroom and mathematical practices, and student perspectives. Since my return to New Zealand I have a growing interest in the development of culturally responsive teaching for Pasifika students in the mathematics classroom. Central to this area is the need to consider the cultural, linguistic and social contexts of Pasifika students and to develop stronger home/community and school partnerships.

2.2 Student abstracts

2.2.1 Pure Mathematics

Mridul Biswas: *Local-Global Principle*
In number theory, a fundamental problem is to find rational solutions to Diophantine equations. An essential technique in studying such equations is to examine their solutions over completions of the rational numbers. In this talk, I will introduce this local–global principle and explain how local information can help us understand the existence (or failure) of rational solutions.

Matthias Chan: *Groups acting on trees and tree-like structures*
The theory of local action diagrams is a way to study groups acting on trees by looking at their local actions, that is, the action of vertex stabilizers on the neighbouring vertices. This theory gives a one-to-one correspondence between these local action diagrams and groups acting on trees with a certain independence property, called Property (P). In this talk we will show a similar construction known as graphs of group actions, which allows for a correspondence with a generalization of Property (P).

Anders Damgaard: *Cracking Codes*
Cryptography is reliant on certain mathematical problems being hard. We present a deceptively simple problem of linear algebra, and the current state-of-the-art algorithms for cracking the code(s).

Oliver Gracewood: *Isometries, Fixed Points, and Non-Positive Curvature*
Mathematics has a long tradition of investigating fixed-point results in a variety of settings. Our setting of choice is the CAT(0) space, a non-positively curved geodesic metric space. Simple analysis on the CAT(0) metric reveals some beautiful convex geometry and places helpful restrictions on isometries (fixed-point sets are convex, for example). We prove the Bruhat-Tits fixed point theorem and mention further fixed-point results.

Yiting Guo: *Using WKB to construct wavelet based solution operator for the semiclassical Schrodinger equation*
In this research, we are interested in using the WKB method to construct solutions $u(t,x) = U(t)f(x)$, where f is the initial condition and $U(t)$ is the solution operator that works for any initial function f. We will introduce an analysis/synthesis system to help us to construct the parametrix. The analysis/synthesis system decompose the initial condition into some synthesis functions, and we will apply the WKB method to solve for initial conditions determined by this system. This allows us to generate a parametrix of the solution operator adapted to that particular system of analysis/synthesis.

Timotheus Keanu: *Construction of Local Kobayashi Points via a Generic Logarithm*
In 2003, Kobayashi formulated the Iwasawa main conjecture for elliptic curves over the $\mathbb{Z}_p$-cyclotomic extension of $\mathbb{Q}$ with good supersingular reductions. One of the key steps was to construct a series of points satisfying some trace properties. We generalise this construction of points to certain base fields bigger than $\mathbb{Q}$ by utilising Fontaine's theory of p-divisible groups: using his framework of Honda system, we will be able to view the related smooth formal group schemes from the perspective of semi-linear algebra. This approach enables us to construct a generic logarithm/power series that gives generic points also satisfying similar trace conditions.

Jake Lyons: *Generalised SIC-POVMs as Equi-Isoclinic Subspaces and their relation to Bell-Inequalities*
Symmetric Informationally Complete Positive Operator Valued Measures (SIC-POVMs) form a standardised set of measurements for a finite-dimensional quantum system. Specifically, a SIC-POVM is an equiangular basis for the set of linear operators on a finite dimensional complex Hilbert space and are the closest a POVM can be to an orthonormal basis for the set of linear operators. In the QBism programme in quantum mechanics, SIC-POVMs furnish a reformulation of the Born rule as an addition to classical probability theory. Furthermore, it is conjectured that all SIC-POVMs are generated by the orbit of the Weyl-Heisenberg group, or tensor products thereof. We show that a SIC-POVMs can be though of as the rank-1 case of complex equi-isoclinic tight fusion frames, and we generalise these to the arbitrary rank operational SIC-POVMs. We show that an infinite-family of these can be realised as the orbit of the symmetric group and sketch their importance for Bell-inequalities.

John McLachlan: *Intersections of longest paths of connected graphs*
In 1966, Gallai asked the question of whether all longest paths of a connected graph intersect. This question was answered negatively by Walther, and since then, many graphs for which all longest paths do not intersect have been discovered. In this talk, we will first present preliminary results regarding the related problem of whether every three longest paths intersect. Then, we will consider several classes of graphs with respect to Gallai's question. In particular, we will construct a picture surrounding the H-free graphs, for an arbitrary induced subgraph H.

Đorđe Mitrović: *Closing Paths to Cycles in Symmetric Graphs*
Given a class of graphs, for which integers $\ell \geq 0$ does it hold that in every graph of the class, every (induced) path of length at most ℓ closes to a (induced) cycle? We have recently obtained complete answers to these questions for the classes of finite vertex-transitive graphs and edge-transitive (non-star) graphs. In this talk, I discuss some of these results, as well as several families of counterexamples we constructed.

Adam Nachowitz: *Provable Security of a Discrete Log-Based Digital Signature Scheme*
Digital signatures are a cornerstone of modern cryptography, ensuring authenticity and integrity in digital communications. We present a security proof of the Schnorr digital signature scheme, constructed from the hardness of the discrete logarithm problem. We begin by introducing the notion of digital signatures, and Sigma protocols. We then outline a framework that relates the security of the scheme to the computational difficulty of solving discrete logarithms in a given cyclic group. By establishing this reduction, we demonstrate that any efficient forgery algorithm would imply an efficient solution to the discrete log problem, an outcome widely conjectured to be infeasible for classical computers.

Michael Ó Ceallaigh: *Functional Analysis and the Golden Age of Polish Mathematics*
In this talk we will look at how Poland came to produce revolutionary mathematics in the turbulent first half of the 20th century, focusing on the Lwów School of Mathematics, Stefan Banach and the birth of functional analysis. We discuss some of the mathematical theory developed during this period.

Nivedita Tewary: *Cops and Robbers in Metric Spaces*
Close to a hundred years ago, Richard Rado introduced a pursuit–evasion game known as the Lion and Man game, where a pursuer and an evader move within a closed unit disk. In the early 1980s, Nowakowski, Winkler, and Quilliot independently introduced the Cops and Robbers game on graphs, where multiple pursuers aim to capture a single evader. To investigate geometric and topological influences on pursuit–evasion, Mohar introduced a version of the game on geodesic metric spaces. We explore the extension of cops and robbers to subsets of n-dimensional euclidean space.

Ryan Thompson: *Conjugacy of local homeomorphisms on totally-disconnected spaces*
We introduce Deaconu-Renault systems, which are systems of local homeomorphisms on locally compact Hausdorff spaces. Two such systems are said to be conjugate if there is a homeomorphism between the underlying spaces that preserves the dynamics in a fairly rigid way. Each system naturally give rise to an object called an ample groupoid, which captures the dynamics of the system. To this groupoid one can associate its Steinberg algebra, which consists of compactly-supported continuous functions which take values in an arbitrary ring. We discuss the extent to which this algebra remembers the dynamics of the underlying systems.

Thomas Valentine: *An online van der Waerden's theorem*
Van der Waerden's theorem states that for any $r \in \mathbb{N}$, there exist arbitrarily long monochromatic arithmetic progressions in any r-colouring of $\mathbb{Z}_n$ as $n \to \infty$. A well known extension of this result is on random subsets $Q \subseteq \mathbb{Z}_n$, where if each element is chosen independently with probability $p = \Omega(n^{-1/2})$, then every r-colouring of Q contains a monochromatic 3-term arithmetic progression with high probability as $n \to \infty$. We introduce an online variant of this classical problem, where random integers are appended to Q one at a time, and coloured immediately before the next is given. We show that under this online model, there exists a constant $\alpha > 0$ such that any colouring strategy gives a monochromatic 3-term arithmetic progression with high probability when $|Q| = \Theta(n^{1/2-\alpha})$. Joint work with Rajko Nenadov, Miloš Stojaković and Lander Verlinde.

Lander Verlinde: *The typical structure of sets with bounded sumset*
The doubling factor of a finite set of integers A is defined as the ratio $\lambda = |A+A|/|A|$. The classical Freiman-Rusza result states that A is contained in a generalised arithmetic progression of size $f(\lambda)|A|$ and dimension $d(\lambda)$. The current best bound on $d(\lambda)$ is polynomial in λ, and the best bound on $f(\lambda)$ is exponential in λ. We refine this by showing that whenever $\lambda = o(k^{1/4})$ we have that for a random set $A \subseteq [n]$, chosen uniformly among all sets of size k and doubling factor λ, with high probability A is contained in an arithmetic progression of size $(1+o(1))\lambda k/2$. This constitutes a step towards a qualitative strengthening of a conjecture of Alon, Balogh, Morris and Samotij. Joint work with Rajko Nenadov.

Baylee Verzyde: *Seiberg-Witten Monopoles and Vortices*
The Seiberg-Witten equations are a system of partial differential equations arising from physics, but they have been used extensively in mathematics to construct topological invariants for 3-manifolds and 4-manifolds. It was proved in 1997 by Mrowka, Ozsvath and Yu that these equations are closely related to another system of equations from physics called the vortex equations, which turn out to be much easier to solve. In this presentation I will introduce the Seiberg-Witten equations from both a physical and a mathematical viewpoint, and I will discuss their relationship to the vortex equations.

Shaowu Zheng: *Arc-transitive graphs with large automorphism groups*
This talk focuses on arc-transitive graphs with large automorphism groups. The goal is to find new families of graphs of fixed valency for which the size of the automorphism groups grows exponentially in the number of vertices. We begin with a brief overview of known results for the p-valent (with p prime) and 4-valent cases, contrasting polynomial and exponential growth. We then turn to the 6-valent case and reduce the problem to several key cases; in particular, when a minimal normal subgroup is not semiregular, the normal quotient is 3-valent, from which concrete local structure and further properties follow.

2.2.2 Applied Mathematics

Ofri Adiv: *Nonlinear dynamics of coupled light-matter systems*
Interactions between many-body atomic systems and light have received much attention, both recently and in the past, due in part to advances in quantum technologies. More specifically, within models of such light-matter systems, the Dicke model has long been a focus of research for its applicability to a range of scenarios and for the quantum phase transitions it exhibits. It describes the interaction between an ensemble of atoms and light in an optical cavity, and, at a critical value of the light-matter coupling, undergoes a quantum phase transition to superradiance where the atoms emit collectively into the cavity. We continue this line of research by investigating a pair of atomic ensembles confined to two separate optical cavities, which couple to one another through the exchange of photons. We do so with a view towards quantum information processing, where networks of coupled quantum subsystems, such as atomic ensembles, can influence each other so that their interactions can be tailored. Our analysis is rooted in dynamical systems theory and centers around the differential equations that govern the evolution of quantum-mechanical expectations. In this framework behaviours of the quantum system correspond to different dynamical objects, and their bifurcations to quantum phase transitions. This translation allows us to paint a detailed dynamical picture, revealing periodic behaviour, quasiperiodic oscillations, chaotic dynamics, and their organisation in phase space.

Sanaz Amani: *Blenders and blender-like chaotic attractors in a three-dimensional Hénon-like diffeomorphism*
We investigate a three-dimensional Hénon-like map in the regime with a chaotic attractor interspersed by periodic windows. We show that, throughout this regime, there exists a transitive invariant set (chaotic attractor or hyperbolic set), which exhibits the carpet property: the relevant invariant manifolds behave as geometric objects of higher dimension.

Travers Bloemsaat: *Approaches to Gravitational Self-Forcing*
With the approaching arrival of the Laser Interferometer Space Antenna (LISA), so are the potential measurements of gravitational waves emitted by small bodies spiralling into massive black holes. Hence, accurately calculating what these waveforms will look like is of high interest. For accurate waveforms, we need to accurately know the gravitational force that the small body exerts on itself. However, due to the extreme mass ratio of the bodies, the use of standard full numerical simulations can be difficult. Instead, one can use perturbation theory to determine at different orders of perturbation the self-force that the small body experiences. Over the past thirty years, numerous approaches have been developed to find the approximate self-force being exerted. In this talk, we will look at the mathematical ideas involved in finding the self-force, the challenges in obtaining them, and the differences between some of these approaches.

Isaac Buhler: *Fluid antennas and near field channels*
Fluid Antennas (FAs) allow a single antenna to move within a region and exploit spatial variations in channel power. This work investigates the performance of FAs in near-field (NF) channels compared with far-field (FF) channels. Using a comlex Gaussian (Rayleigh fading) approximation of the ray-based channel we derive an expression for the channel derivative variance, which quantifies fluctuations of the received signal and directly determines the level-crossing rate (LCR) and high-SNR probability. We find that this variance is a function of the angular spread of incoming paths: specifically, it is the power-weighted variance of angular projections onto the derivative direction. In NF, this variance depends on antenna position. Simulation results corroborate the analysis, showing that specific scenarios result in better NF performance, but these must be contrived and are not representative of usual operation. These findings establish a mathematical connection between angular spread and FA performance, clarify the impact of NF propagation, and provide a foundation for further analysis of ray-based channels.

Liam Gibson: *Can we just blame babies for everything? Nonlinear dynamics in agent-based models of academic publishing*
Consistent drivers of gender gaps in academia are citation bias, homophily, and parental leave. Using Poisson processes to model research publications and random network evolution to model scientific collaboration, we examine the relative impacts of citation bias, homophily, and parental leave on productivity and early-career research metrics for tenured positions and grant awards.

Md Azmir Ibne Islam: *Dynamics induced by a heteroclinic network between five equilibria*
We consider a spatially extended system of the non-transitive game 'Rock-Paper-Scissors-Lizard-Spock'. The system has a heteroclinic network comprising several heteroclinic cycles. Diffusion in one dimension in the system leads to travelling wave solutions, which are periodic orbits in a travelling frame of reference. We find a large number of different types of periodic solutions. Some of these solutions are very straightforward, and originate from Hopf bifurcations. However, some are complicated and there are complex transitions between them. In this talk, we will discuss these new periodic orbits and describe their interaction.

Marc Lescano: *An Introduction to Topological Quantum Computing*
In 2008, Alexander Kitaev and Chris Laumann discovered a fault-tolerant quantum computing model —topological quantum computing. The model is predicated upon a quasiparticle called an anyon, which is a two dimensional extension of fermions and bosons - exhibiting exotic spin statistics. The mathematical habitat of these particles is called a unitary modular tensor category (UMTC), encapsulating the representation of the adiabatic exchange operation of such particles in what is called, the braid group. This dissertation introduces the physical and mathematical realisation of anyons, other quantum computing models using adiabaticity and holonomy to give intuition and motivation on how UMTCs model the braiding of anyons to yield fault-tolerant topological quantum computations. Here, we show the usage of Fibonacci anyons and Ising anyons as examples of how one may form quantum gates and make a universal topological quantum computer.

Vincent Lomas: *Modelling the interaction between ethnicity and infectious disease transmission dynamics*
Mathematical models of how an epidemic spreads through a population are important to inform policy decisions about public health interventions. Despite the relevance to disease spread, many models do not include important variables such as socioeconomic status and ethnicity. Here we investigate the first Omicron wave of COVID-19 in Aotearoa New Zealand with a model that splits the population into 10 groups relating to an individual's disease and vaccination status as is typical of compartmental models. We then further split the population into 4 ethnicity groups, corresponding to the main ethnicity classifications in Aotearoa: Māori, Pacific, Asian, and European/Other. We used this model to estimate how much contact rates would need to differ between ethnicities in order to explain observed differences in infection rates. We did this with three different assumptions about how many contacts occur with and between groups: (1) people mix with all ethnicities equally; (2) people are more likely to mix with others in the same ethnicity group; and (3) people are more likely to mix with others living in the same geographical area. From this, we estimated that Māori, Pacific, and Asian contact rates were 1.08-2.46, 1.50-3.89, and 0.80-0.92 times

the European rates, respectively. We then found that the disparity in ethnic contact rates was sufficient to explain the majority of the observed disparity in infection rates by ethnicity, while preference for interacting with your own ethnic group and differences in vaccination rates between ethnicities explained comparatively less of the observed disparity. We then briefly dive into a model that allows us to combine ethnicity with other factors.

Yuanyuan (Lydia) Li: *Belief-Behavior Feedback, Cascades, and Optimal Platform Intervention*
Digital platforms face a persistent challenge in managing behavior-driven content diffusion and curbing misinformation. This paper develops a dynamic theoretical framework in which individuals choose to support, reject, or ignore content based on a Logit utility shaped by evolving private beliefs and platform incentives. Through local social learning, beliefs update via neighbors' observable actions, creating a feedback loop that links micro behavior and collective belief dynamics. We show that this mechanism endogenously generates self-reinforcing behavioral cascades, where weak incentives or early random actions can lock the network into a dominant behavioral state—supportive, neutral, or rejecting—regardless of factual accuracy.

Hamish McAlley: *Influence of Forcing on Magnetohydrodynamic Turbulence*
Magnetohydrodynamic fluctuations, like other waves, dissipate energy through turbulent flow. There is a cascade of energy from large scale fluctuations being transformed into smaller scales until they become small enough that viscosity is able to dissipate the energy as heat. In the solar wind, these fluctuations are driven mainly by shear forces and pick-up ions. Presented will be a comparison of the evolution of flow and its energy under varying shear forces.

Nasrin Nikbakht: *A Novel Methodological Framework for Inverse Problems Using Adaptive Spectral Inversion*
Inverse problems are concerned with the recovery of spatially varying properties of a source or scatterer, denoted by p, within a bounded domain. Such problems have important applications in radar, medical imaging, and geophysical exploration. However, inverse problems are typically ill-posed, often lacking stability, uniqueness, or even the existence of a solution. Furthermore, in practical scenarios, observational data are frequently noisy, incomplete, or inconsistent, which makes direct inversion highly unstable.

To address these challenges, we employ the Adaptive Spectral Inversion (ASI) method, a spectral regularization technique designed to stabilize the solution by projecting the problem onto a truncated eigenfunction basis. In this study, we introduce a novel methodological framework for applying ASI to the recovery of the parameter p. To the best of our knowledge, this approach has not previously been investigated in this context. Our results demonstrate the robustness of ASI in accurately and stably recovering p, even in the presence of noise and incomplete data.

Felix Shaw-Bell: *Eigenmode approximations of the Fokker-Planck operator in tipping point systems*
The Fokker–Planck operator describes the time evolution of the probability density function of random variables governed by stochastic differential equations (SDEs). In the context of tipping point systems with stochastic forcing, we use the Fokker–Planck framework to quantify the risk of tipping as a bifurcation parameter is slowly varied. This work focuses specifically on bifurcation-induced tipping with noise, rather than rate-induced or purely noise-induced tipping. Since the Fokker–Planck equation for such systems is rarely analytically solvable, we instead consider cases where the slowly varying parameter allows the system's probability density to be well approximated by the leading eigenmodes of the Fokker–Planck operator. A linear perturbation approximation of the leading eigenmode is developed, providing an avenue for approximate analytical descriptions of tipping dynamics in systems that otherwise require fully numerical treatment.

Thomas Tawfik: *Cosmological Wave Asymptotics in the direction of the Initial Singularity*
Analysing linear systems of wave equations has proved to be relevant in understanding cosmological spacetimes. In particular, understanding the global properties of solutions of such systems and their asymptotics represents an important step towards having a complete picture of what could have occurred in the distant past of our universe. In this context, this talk first investigates the asymptotics of such wave equations in the direction of the initial spacetime singularity of the corresponding cosmological backgrounds. Then, as an application, the past asymptotics of two scalar linear wave equations, which represent two physically interesting systems, are derived.

Wubetea Truneh: *Active Particle Dynamics in a Triangular Duct*
This study investigates the dynamics arising from an idealised model of a spherical active particle immersed in fluid flow through an equilat eral triangular duct. Utilising the general Hamiltonian formulation of Harding et al. (2025, preprint) we describe the equations of motion, analyse equilibrium points and their stability, and classify trajectories based on their initial position. Motion within an equilateral triangular duct is an interesting case to examine as the Poiseuille flow is described by a cubic polynomial. In addition to previously identified trajectory types, including central and vertical swinging, tumbling, off-centred trapping, and wandering, we observe some exotic orbits within the triangular geometry. We also examine the chaotic behaviour by utilis ing Poincar´e maps and Lyapunov exponents over a range of parameter values and initial conditions. This work enhances the broader under standing of microswimmer motion in a case where the fluid flow has a straightforward closed form description.

Sebenele Thwala: *Infinity, Cursed Energy, and Curved Space: A Mathematical Dive into Gojo's Powers*
What if anime superpowers could be modelled using the mathematics of spacetime? In this talk, we will explore how the abilities of Gojo Satoru from the anime and manga series Jujutsu Kaisen, namely, his Limitless technique and Domain Expansion, can be understood through the lens of conformal geometry and conformal compactification. Using tools from differential geometry, general relativity, we will reinterpret Gojo's attraction and repulsion techniques as conformal rescalings of space, and his annihilation ability as a curvature singularity. We then look at how we can frame his Domain Expansion, Unlimited Void, as a conformal compactification of infinite informational space into a finite perceptual domain, analogous to Penrose diagrams in relativity. This talk will be a fun and hopeful attempt at blending the physics that has consumed my life for the last two and a half years, with my favourite character from a fictional world and show how conformal methods can always offer an elegant way of modelling space, perception and causality, even in fiction.

Rezwana Razzaque: *Heteroclinic Orbit Analysis of Traveling Wave Solutions in Dissipative Bona–Smith Systems*
The dissipative Bona–Smith system, a Boussinesq-type water wave model, provides a framework to study traveling wave solutions influenced by nonlinearity, dispersion, and dissipation. In our work, we present a numerical study of the system through its traveling wave reduction, which gives rise to a four-dimensional dynamical system. The analysis of the associated eigenvalues plays a central role in distinguishing between oscillatory and monotone shock wave profiles: as the dissipation parameter increases, the eigenvalues reveal a transition from a saddle-focus to a saddle equilibrium. I will discuss how this change shapes the wave structure and demonstrate finite-difference simulations that capture the resulting profiles.

Elena Vasilieva: *Monte Carlo Simulation of Light Transport in Turbid Media*
DThe propagation of light in turbid media such as biological tissue is governed by the Radiative Transfer Equation (RTE), an integro-differential equation that accounts for scattering, absorption, and emission. The RTE provides a rigorous mathematical description of radiative energy balance but is analytically intractable for realistic media due to its high dimensionality and the complexity of the scattering phase function. This motivates the use of numerical methods to approximate its solutions.

The Monte Carlo (MC) method offers a powerful stochastic approach by representing light as discrete photon packets undergoing probabilistic scattering, absorption, and reflection events. Rooted in statistical mechanics and probability theory, MC simulations approximate solutions to the RTE through repeated random sampling, with outcomes determined by the medium's optical properties such as absorption coefficient μa, scattering coefficient μs, and anisotropy factor g. In this research, I employ the Ne(u)ralMC framework, which integrates classical Monte Carlo principles with hardware-accelerated optimisation tailored for Apple's M-series processors. By leveraging parallelisation and unified memory design, Ne(u)ralMC enables high-fidelity photon transport simulations with significantly reduced computational time and energy consumption, making large-scale spectral modelling feasible. The biomedical application driving this work is the diagnosis and treatment of melanoma. Early detection remains a challenge due to the variable presentation of malignant lesions, while therapies such as photodynamic therapy (PDT) are limited by uncertainties in tissue optical response. Using Monte Carlo simulations, I investigate spectral reflectance signatures of melanoma and explore advanced modalities such as twisted light beams carrying optical angular momentum. This in silico approach, combined with machine learning pipelines trained on simulated spectra, provides a pathway toward non-invasive diagnostics and optimised PDT protocols, ultimately contributing to improved patient outcomes.

2.2.3 Statistics

Sarah Bird: *Legendre polynomials for improved modelling of extended lactation curves in grazing dairy cows*
Extended lactation (EL), where cows are milked beyond the standard 305-day lactation (SL) period, has been proposed as a strategy to reduce the workload of farmers and the number of non-replacement calves on New Zealand dairy farms. However, not all animals are suitable for an EL and selection methods formed through the modelling of individual cow lactation curves are required to support the selection of animals suited to EL to support EL systems. Modelled lactation curves can be used to understand the patterns in milk production of an animal or herd, and the characteristics most suitable for EL. Traditional parametric curve models of milk production such as those of Wood, Wilmink and Dijkstra perform well for SL but fail to describe milk production patterns typical in pasture-based EL systems. This study compared both traditional and Legendre polynomial approaches to model daily milk production for 2,300 EL grazing cows on commercial dairy farms in New Zealand. Model performance was evaluated through goodness of fit statistics and biologically relevant predictions. Results indicated that Legendre polynomial models provide an improved representation of EL compared with traditional models, particularly due to their ability to capture the presence of a second peak in milk production during the second spring of the lactation. This second peak and

the variation in curve shapes were not able to be captured by the traditional models for SL or EL in housed animals. Applying Legendre polynomial models when determining persistency and total milk yield for an EL could provide a framework to assess an animal's suitability for the system.

Menik Hitihami Mudiyanselage Rasika (Rasika) Dilhani: *Feature-Based Clustering of Simulated Time Series Using Ordinal Pattern Analysis*
Ordinal pattern analysis has emerged as a promising alternative to analysing time series data, providing a robust and computationally efficient approach. Ordinal pattern analysis is used in this research to analyse simulated time series under Autoregressive (AR), Moving Average (MA), and Autoregressive Moving Average (ARMA) models. It involves converting time series data into a sequence of symbols that represent ordering relationships among data points within specific time windows. Then, the Shannon entropy and the Statistical Complexity are computed from the histogram of symbols. The method detects small differences between models and sample sizes. This study presents a simulation-based experiment into time series clustering using ordinal pattern analysis. The primary research focus was on identifying the distinguishing characteristics of AR, MA, and ARMA models through ordinal pattern features. Simulated time series were generated with two series lengths (n = 500 and n = 1000), using parameter values chosen to satisfy the stationarity and invertibility conditions of the models. The experimental design included several variants for each AR, MA, and ARMA model type, with each model representing a distinct parameter setting (Table 1). To ensure model accuracy, 100 independent replications were performed for each model configuration. Ordinal patterns were extracted to compute entropy and complexity. Features were analyzed in the entropy–complexity plane for model discrimination. ARMA(1,1) shows two distinct clusters. AR coefficients -0.8 and 0.8 produce lower entropy and higher complexity. Coefficients 0.1 and -0.1 yield higher entropy and lower complexity. ARMA(2,2) shows overlapping groups across all four models. Clear separation appears by sample size, with larger samples forming more stable clusters. (Figures 1 and 2). The findings highlight the effectiveness of feature-based clustering of time series, which uses Shannon entropy and complexity to characterize intrinsic differences among models. The simulation framework further validates the method's reliability under varying structural and stochastic configurations. This research establishes a foundation for applying ordinal pattern analysis to unsupervised time series grouping, with potential applications in data rich domains such as finance, engineering, and bioinformatics.

Andrew Tipton: *Can mixtures of Gaussians have a saturated model?*
The (univariate) Gaussian mixture model is the classic solution when the observed data has more than one mode. It is well-known that its likelihood function has singularities and therefore the maximum likelihood estimator does not exist. Because these singularities occur in regions of the parameter space that aren't meaningful, a natural question arises: are the singularities an inherent vice of this model? Can we re-pose the optimization problem and eliminate them? What does a perfect (saturated) model even look like? Do mixtures admin a measure akin to deviance? This talk will explore the questions, even though the answer remains elusive for now.

Kate Truman: *Inferring evolutionary history using the Skyline Stratigraphic Range Fossilised Birth-Death model*
A popular class of models for inferring evolutionary histories are Fossilised Birth-Death (FBD) models, which explicitly incorporate fossil information as well as molecular data from extant (present-day) species. In macroevolution, FBD models are used to infer how closely related species are, and diversification rates estimated from the resulting phylogenetic tree. The diversification rates of speciation, extinction and sampling describe the frequency of birth, death and fossil sampling events respectively. We can include multiple samples with different ages from the same species in a phylogenetic tree. The period of time between the oldest and youngest fossil of each species is known as a stratigraphic range. We implement the skyline Stratigraphic Range Fossilised Birth-Death (skyline SRFBD) model in BEAST2, a popular phylogenetic software for conducting Bayesian analysis. This model is a variant of FBD which uses stratigraphic ranges, and as a skyline model it uses piecewise-constant diversification rates. We expect that the SRFBD model will result in less bias than a standard FBD model, as the duration of each species is taken into account. We conduct an analysis of crocodilians using BEAST2 and compare the results to a SRFBD model with constant diversification rates, which is less biologically realistic.

Alec van Helsdingen: *Modelling Under-Dispersed but Clustered Whale Cues*
Many whale species emit cues or calls, whose times can be modelled as a realisation of a temporal point process. The event times are usually strongly clustered, with long periods of silence followed by a rapid burst of cues. Conversely, at shorter time scales the cues are more evenly spaced (under-dispersed) than expected by an inhomogeneous Poisson process. The Hawkes process can be used to model the clustering by assuming that cues self-excite future cues, but this does not account for underdispersion.

Motivated by this example, we have developed a framework for incorporating under-dispersion and over-dispersion into the Hawkes process. Poisson processes assume that the integral of the intensity function between two points comes from an exponential distribution. We instead assume that the distribution is Weibull, which has the exponential as a special case. In a further extension, we also use mixtures of two Weibull distributions. This gives more flexibility and a better fit.

We demonstrate our model on the cues of an individual sperm whale, confirm our intuition that the cues are under-dispersed, and quantify the relationship between the cue rate and covariates.

You (Joe) Zhou: *Spatiotemporal Epidemiological Statistical Modeling Based on Wastewater Surveillance Data* Wastewater-based epidemiology (WBE) offers a unique and proactive approach to public health surveillance. Compared with traditional case reporting and epidemiological surveys, wastewater data provide earlier and more comprehensive indicators of community infection dynamics by capturing both symptomatic and asymptomatic cases and reflecting population-level trends in near real time. Despite these advantages, the noisy and convoluted nature of wastewater signals—arising from heterogeneous sampling schedules, variable shedding behaviors, and environmental degradation—poses substantial challenges for reliable modeling and statistical inference. The study comprises two main components. The first is a state-space model (SSM) grounded in a semi-parametric renewal process with a convolution-based infection kernel formulated under a Markovian structure. Using Particle Markov Chain Monte Carlo (PMCMC) methods for latent-state inference, this framework enables joint estimation of hidden infection dynamics and key epidemiological parameters such as the effective reproduction number and the instantaneous transmission rate. The second component addresses the spatial dimension of transmission. Many existing studies analyze aggregated case or death time series without considering spatial context, which limits their usefulness for understanding community-level dynamics or guiding local interventions. In contrast, wastewater data are inherently spatial, reflecting infection patterns across distinct catchments. Incorporating this spatial structure through spatio-temporal statistical modeling allows key parameters to be inferred at community scales, capturing transmission heterogeneity and supporting targeted public health responses. By linking catchment geography, sewage networks, and population mobility, wastewater surveillance can further inform network-based models that reveal hierarchical spread and spatial connectivity in infectious disease dynamics.

Chapter 3

Sponsors

The conference organisers wish to acknowledge the sponsors of NZMASP 2025, as without their generosity this conference would be impossible.

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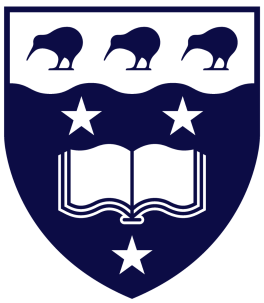

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The University of Auckland Faculty of Science is New Zealand's leading centre for scientific research and education, fostering innovation across a wide range of disciplines. With world-class researchers and facilities, the Faculty is dedicated to advancing knowledge and addressing global challenges through science. The organisers gratefully acknowledge the Faculty's support in sponsoring this conference and its commitment to promoting scientific collaboration. See their website.

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The New Zealand Mathematical Society

The New Zealand Mathematical Society (Inc.) is the representative body of professional mathematicians in New Zealand, and was founded in 1974. Its aims include promotion of research in the mathematical sciences, the development, application and dissemination of mathematical knowledge within New Zealand, and effective cooperation and collaboration between mathematicians and their colleagues in New Zealand and in other countries. Find out more at their website.

The New Zealand Statistical Association

The NZ Statistical Association, founded in 1948, is New Zealand's only association for professional statisticians. For a fuller description of the aims and activities of the NZSA, and background to this page, visit their aims and activities page.

Australia and New Zealand Industrial and Applied Mathematics

ANZIAM (Australia and New Zealand Industrial and Applied Mathematics) is a division of The Australian Mathematical Society (AustMS). Their members are interested in applied mathematical research, mathematical applications in industry and business, and mathematics education at tertiary level. The New Zealand Branch of ANZIAM aims to promote Applied and Industrial Mathematics in New Zealand. See their website.

Te Pūnaha Matatini

Te Pūnaha Matatini – the meeting place of many faces – is the Aotearoa New Zealand Centre of Research Excellence for complex systems. Visit their website to find out more.

Chapter 4

Code of Conduct

The following Code of Conduct is designed for the NZMASP conference, however the same principles detailed below also apply to our Discord server. We want the server to be a safe and friendly environment for New Zealand Post-graduate Mathematics and Statistics students to connect, socialise and support each other. The current committee reserves the right to issue warnings or remove any messages we view to be discriminatory, harassment, or in poor taste. Failure to head warnings may result in being banned from the server.

All participants in the NZMASP 2025 conference are required to agree to the code of conduct as a condition of registration.

The NZMASP organising committee is committed to a professional, open, productive, and respectful exchange of ideas. These aims require a community and environment that fosters inclusion, provides mutual respect, and embraces diversity.

The NZMASP conference is dedicated to providing a harassment-free conference experience for everyone, regardless of gender, gender identity and expression, sexual orientation, disability, physical appearance, body size, race, age or religion. We do not tolerate harassment of conference participants or staff in any form. Conference participants violating these rules may be sanctioned or expelled from the conference without a refund at the discretion of the conference organisers.

Harassment includes, but is not limited to:

- Verbal comments that reinforce social structures of domination related to gender, gender identity and expression, sexual orientation, disability, physical appearance, body size, race, age or religion.
- Sexual images in public spaces
- Deliberate intimidation, stalking, or following
- Harassing photography or recording
- Sustained disruption of presentations or other events
- Inappropriate physical contact
- Unwelcome sexual attention
- Advocating for, or encouraging, any of the above behaviour

4.1 Enforcement

Participants asked to stop any harassing behaviour are expected to comply immediately. If a participant engages in harassing behaviour, event organisers retain the right to take any actions to keep the event a welcoming environment for all participants. This includes warning the offender or expulsion from the conference with no refund. Event organisers may take action to redress anything designed to, or with the clear intention of, disrupting the event or making the environment hostile for any participants. We expect participants to follow these rules for the duration of the conference, including at the conference venue, accommodation and all conference-related social activities.

4.2 Reporting

If someone makes you or anyone else feel unsafe or unwelcome, please report it as soon as possible. Harassment and other code of conduct violations reduce the value of our event for everyone. We want you to be happy at our event. People like you make our event a better place.

If you're not sure if something you have seen or experienced should be reported, please contact a member of the organising committee for an informal discussion on the issue using the contact details in the contact information section below. You can make a report either personally or anonymously.

4.2.1 Anonymous Report

You can make an anonymous report here. We can't follow up an anonymous report with you directly, but we will fully investigate it and take appropriate action.

4.2.2 Personal Report

You can make a personal report by contacting a member of the organising committee in person or via the contact details listed in the programme.

Messages can also be sent to admin@nzmasp.org.nz, please be aware that this is a communal committee address which all of the committee have access to.

When making a personal report, our committee members will ensure you are safe and cannot be overheard. They may involve other committee members to ensure your report is managed properly. Once safe, we'll ask you to tell us about what happened. This can be upsetting, but we'll handle it as respectfully as possible, and you can bring someone to support you. You won't be asked to confront anyone and we won't tell anyone who you are. We will consult you before taking any action based on your report. Our team will be happy to help you contact local law enforcement, local support services, provide escorts, or otherwise assist you to feel safe for the duration of the event. We value your attendance.

Chapter 5

Statement on diversity and equity

The New Zealand Mathematics and Statistics Postgraduate (NZMASP) conference intends to provide an open platform for all postgraduate students in mathematics and statistics to present their research and grow their collaborative networks; however, we recognize that these fields exhibit some of the lowest levels of diversity of gender, race and culture in academia. The organising committee for the 2025 NZMASP conference will seek to address these inequities based on the following guiding principles:

- While an ideal goal would be for the level of attendance of women, people with marginalised gender identities, people with disabilities and people from racial or cultural minorities to be representative of the New Zealand population as a whole, we acknowledge that this is currently unrealistic due to the historic and ongoing inequity in our field.
- Since we can't control who comes to the conference, our mission is to make the conference welcoming to all attendees, particularly if they identify with or belong to under-represented groups.

With this in mind, the NZMASP organising committee is addressing, and will address, these issues by:

- Establishing a good process for handling all forms of discrimination and harassment – please refer to our code of conduct for details,
- Regularly having discussions about cultural inclusion,
- Incorporating Maori language into conference addresses,
- Promoting the normalisation of women in STEM fields through the gender diversity of our invited speakers list,
- Bringing disabled access to the forefront of our planning efforts, particularly with regards to the conference venue and accommodation provider,
- Meeting the needs of attendees with disabilities that are not already catered for (such as the hearing impaired) on a flexible basis,
- Offering a variety of accommodation options which take people's preferences into account. In particular, while the primary mode of accommodation provided by the conference is shared, this can be adjusted to cater for different group and individual requirements,
- Offering support and flexible options for attendees travelling with children,
- Catering to a variety of dietary requirements including Halal, vegan, vegetarian and food allergies.