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Gazette

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- Reviews of books, particularly by Australian authors, or books of wide interest
- Classroom notes on presenting mathematics in an elegant way
- Items relevant to mathematics education
- Letters on relevant topical issues
- Information on conferences, particularly those held in Australasia and the region
- Information on recent major mathematical achievements
- Reports on the business and activities of the Society
- Staff changes and visitors in mathematics departments
- News of members of the Australian Mathematical Society

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Editorial

David and I welcome you to the first issue of the Gazette of the Australian Mathematical Society for 2023.

Although decades ago I used to speak about maths at about 40 high schools each year, I have not done so for a very long time. So when I was recently invited to speak at Wantirna College I was initially a bit hesitant, but I accepted. I spoke in their year 9/10 class called "The World of Maths". I thought my talk went quite well and the class teacher made some kind comments afterwards. But I was surprised to receive a copy of a note from one of the students which thanked the teacher for inviting me as I "explained how maths is used in everyday life". I mention this in the hope that others may be encouraged to visit and speak on maths at high schools.

Recently there has been much talk in education circles about ChatGPT. In fact I was asked by one person whether they should try to create a firewall to keep ChatGPT out. I was reminded of the time mathematics and other teachers tried to ban the use of calculators. I thought it might be useful to some here to include a reference to an article on how ChatGPT works, It is written by Stephen Wolfram. You can find it at https://writings.stephenwolfram.com/2023/02/what-is-chatgpt-doing-and-why-does-it-work

In case you think this does not impact seriously on mathematics, you should read the article: https://writings.stephenwolfram.com/2023/03/chatgpt-gets-its-wolfram-superpowers

We record that the 2023 Abel Prize, awarded by The Norwegian Academy of Science and Letters, was won by Luis A. Caffarelli of The University of Texas at Austin "for his seminal contributions to regularity theory for nonlinear partial differential equations including free-boundary problems and the Monge–Ampére equation". You can read about this and his work at https://abelprize.no/abel-prize-laureates/2023

In this issue of the Gazette, we record that Associate Professor David Ridout has won the inaugural Rodney Baxter Prize for Mathematical Physics! Congratulations to David who is an extremely deserving winner.

We are also pleased to include an article in this issue discussing the winners of the major prizes at the December 2022 meeting of the Australian Mathematical Society:

- Australian Mathematical Society Medal: Guoyin Li;
- The Szekeres Medal: Igor Shparlinski;
- Gavin Brown Prize: Mark Holmes and Edwin Perkins;
- The Mahony-Neumann-Room Prize: Satish K. Pandey and Vern I. Paulsen.

Congratulations also go to Michael Charles Mitchelmore OAM who was awarded on Australia Day an Order of Australia Medal in the general division for service to mathematics education, and to the community.

In this issue we have the President's Column, written by the new President of AustMS, Professor Jessica Purcell. Jessica says that she would like to see AustMS's reach and impact increase, both externally and internally. She addresses in her column first that she would like to see more PhD students join the Society and notes that "they pay no membership fees whatsoever". She asks that Supervisors "please double check that your students have become AustMS members, to take advantage of all this", that is those associated with being a member. Jessica asks "What can we do as a society so that mathematicians will want to continue and contribute as AustMS members even if their career takes them away from academia?" She observes that "The latest Australian Teacher Workforce data shows that up to 40 percent of maths school teachers did not receive a qualification in mathematics teaching." Jessica wrote her President's Column while participating in a research program at MATRIX and says "I have attended a few of its workshops, and it has been a huge pleasure to be able to participate in mathematical research programs here in Australia, with a mix of Australian and international participants." Jessica congratulated AMSI which recently received nearly $1M from the Federal Government's Women in STEM and Entrepreneurship (WiSE) grants program to expand their PhD internship program for women in STEM. This will deliver new opportunities for PhD students, and lead to increased diversity in STEM industries.

Tom Keegan, Executive Officer of MATRIX, records the research programs held at Creswick in the first three months of 2023. He also puts out a call for MATRIX Research Programs applications and reminds that anyone can apply to organise a MATRIX research program. The next deadlines for research program proposals in 2023–2025 is Friday, 22 September 2023. He also mentions the MATRIX-Simons Fellowship Program, the MATRIX-Simons Young Scholar Program, the MATRIX-Simons Collaborative Fund, the MATRIX-Simons International Family Fund, the MATRIX-Simons Travel Grant Scheme, and the MATRIX Family Fund.

In her report in this issue, Deborah Jackson, Honorary Secretary AustMS, calls for nominations and provides the rules for the Society's prizes and awards including the 2023 Australian Mathematical Society Medal, the 2023 Gavin Brown Prize, and the 2023 George Szekeres Medal. She reminds members that the sixty-seventh annual meeting of the Society will be held in Brisbane at the University of Queensland, December 4th to December 8th, 2023 and that ProfessorArtem Pulometov will be the conference director. She also called for Applications for AMSI-AustMS Scientific Workshop Funding. Finally she listed the new Fellows of AustMS.

Anthony Henderson and Ole Warnaar report on the sixth annual Simon Marais Mathematics Competition (SMMC) held on Saturday 15 October 2022. Participation in the East division returned to pre-COVID levels in India and Singapore, though not yet elsewhere, with a total of 825 students from 48 universities competing. India overtook Australia to be the country with the greatest number of universities in the competition, as well as the largest number of students. Anthony and Ole express gratitude to the Marais family, Philipp Hofflin, and the Stonehage-Fleming Charitable Foundation for their ongoing financial support of the competition. You can read the detailed report in this issue of the Gazette.

The Gazette editors are happy to consider Letters to the Editors for possible inclusion in the Gazette. In this issue we have a Letter from Masoud Kamgarpour reporting inspirations from Lisa Piccirillo's talk "Can we communicate mathematics better?" at the 2022 AustMS meeting.

We have included in this issue a report by C.T. Lenard and T.M. Mills on "Demand for teachers in Victorian government schools, 2021–2022". They say "The mid-term review of Australia's decadal plan for mathematical sciences in Australia emphasised the critical importance of having well-qualified mathematics teachers in our schools (Decadal Plan Steering Committee, 2022, pp. 13–14). However, in recent times, there has been considerable media attention paid to the issue of the supply of teachers in Australia. Our article deals with an aspect of the demand side of the issue, namely the number of opportunities for teachers in Victorian government schools, especially mathematics teachers."

Peter Donovan writes for us an interesting article on Heron's Formula and the 3-dimensional Pythagoras Theorem.

You are encouraged to test yourself on the Puzzle Corner prepared by Peter Higgins, this week asking How slow can you bowl a cricket ball, and to enjoy the fourth "Fun with Mathematics", on Base 7 identities, written by Geoff Campbell.

As usual the News section reports on activities at Australian universities. This includes Seminars, PhD completions, Awards and other Achievements, Appointments, Departures, Promotions, Conferences and Courses.

Sadly one activity of the Gazette is to publish Obituaries of Australian mathematicians. This issue we include an obituary written by Tony Bracken and Vincent Hart of Emeritus Professor Ludvik Bass of the University of Queensland. Even though I knew Ludvik, I was truly surprised by some information it includes.

David and I hope you enjoy this issue of the Gazette.

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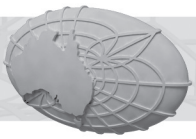
Sid Morris retired after 40 years as an academic. He received BSc (Hons) from UQ in 1969 and PhD from Flinders in 1970. He held positions of Professor, Department Head, Dean, Deputy Vice-Chancellor, CAO and CEO. He was employed by the universities: Adelaide, Ballarat, Flinders, Florida, La Trobe, UNE, UNSW, UQ, UniSA, Tel-Aviv, Tulane, Wales, and Wollongong. He was Editor of *Bull. AustMS* and *J. Research & Practice in IT*, and founding Editor of *AustMS Lecture Series* and *J. Group Theory*. He has been on the AustMS Council for 25 years and its Vice-President. He received the Lester R. Ford Award from the MAA. He has published 170 journal papers and 4 books for undergrads, postgrads and researchers, plus 2 online books, 1 translated into 8 languages and supplemented by YouTube videos and a Facebook group of 10,000 members. In 2016 he was ordained as a Rabbi. In 2020 he published the 4th edition of his 1,000-page book *The Structure of Compact Groups*. He enjoys spending time with his three grandchildren.



President's Column

Jessica Purcell*

This is my first column as President of the AustMS, and I want to start by thanking Ole Warnaar for all his work as President over the past two years. His term began in the middle of a pandemic, with Australian universities in a crisis due to closed borders. Through the challenges he faced, Ole has been a huge advocate for mathematics in Australia at many levels. He fought for undergraduate maths degrees during budget cuts, and successfully advocated for more input from the mathematics community as the maths school curriculum was changed. He has been working with other societies to address and respond to issues with the Australian Research Council (ARC). By the end of his term, AustMS had renewed its publishing agreement with Cambridge University Press, and renewed its agreement with the Australian Mathematical Sciences Institute (AMSI). In my year of onboarding as president-elect, I have been impressed by Ole's dedication and commitment.

As I step into this role, I also want to thank the AustMS members. You care deeply about mathematics as a profession, and do a huge amount in many different ways to promote mathematical knowledge and its application. We are a community of some of the best mathematics teachers, researchers, and practitioners in the world. Our members are actively contributing to the Society to make it excellent. With all the good that AustMS does for mathematics, I would like to see its reach and impact increase, both externally and internally.

On my mind have been PhD students. During the most recent AustMS meeting — a wonderful event at UNSW — we had a record number of student talks. These talks were so excellent that apparently the committee tasked with assigning student prizes nearly broke down. The AustMS Executive Committee received a harried last minute, late night email from the committee chair asking if they could please, please give out more prizes, because they had an impossible job. Well done, PhD students — well done. However interestingly, we found out later that many student speakers had not formally joined the society! We were able to rush everyone who was interested into membership, but it would be better if more PhD students knew to join in advance. Membership is highly subsidised for students — they pay no membership fees whatsoever. In addition to being eligible for reduced conference registration rates and speaker prizes, AustMS student members can also access student travel awards and early career Lift Off fellowships. They receive our newsletter with info on positions in mathematics and news from the community. And membership in AustMS opens opportunities to engage and participate in mathematics. Students, please double check that you are up to date with your membership. Supervisors, please double check that your students have become AustMS members, to take advantage of all this.

*Email: President@austms.org.au

This year, we plan to work closely with student members and our student representative Matthias Fresacher, to help students become more involved in the society. Keep your eye on this space!

Beyond PhD students, I would like to see the society grow, and remain relevant and useful to those who would like to promote mathematics beyond academia. Throughout their careers, many mathematicians move in and out of rewarding industry positions. Such positions present wonderful opportunities that lead to new growth and new vision. But unfortunately, many who move into industry do not remain members of the AustMS. What can we do as a society so that mathematicians will want to continue and contribute as AustMS members even if their career takes them away from academia?

This is relevant, because a broader view helps us address broader issues. For example, in January and February, I have been representing AustMS in meetings regarding out of field teaching in Australian secondary schools. The latest Australian Teacher Workforce data shows that up to 40 percent of maths school teachers did not receive a qualification in mathematics teaching. This does not have to be a problem — Australian teachers as a whole are very well trained and very good at what they do. However, many teachers feel panic at being thrown into a job for which they have not received the same training as their peers. For teachers, it can lead to burnout and high job turn over. Similarly, students' mathematical learning can be impacted by out of field teachers. They may be less aware of the opportunities and careers available to those who continue in mathematics, and less excited by mathematics itself. We have been seeing fewer and fewer students enrol in advanced high school mathematics units, and the problem is particularly acute in regional areas. In an initiative led by AMSI, partnering with of the Statistical Society of Australia (SSA) and the Mathematics Education Research Group of Australia (MERGA), AustMS is seeking to address this issue. Our first step is to form wider partnerships to find solutions to deal with this problem as soon as possible. We have approached several other societies from science and industry, and all agree that our teachers and students deserve better. I hope I will have more to report soon.

Much more locally and individually, as I write this newsletter I am attending a workshop at the MATRIX Institute in Victoria, in a research program entitled Dynamics, Foliations, and Geometry. Since the MATRIX institute launched in 2016, I have attended a few of its workshops, and it has been a huge pleasure to be able to participate in mathematical research programs here in Australia, with a mix of Australian and international participants. All this week, there have been informative talks and fruitful discussions, and my PhD students have been able to network and present their research. I hope that as a mathematical community we can continue to run small targeted research workshops like this one in Australia. Funding is an issue. (Funding is always a main issue.) The MATRIX is trying to renew funding agreements, and needs to attract more university partners to support its work. Meanwhile, AustMS has more human resources than financial resources. As a society, we are able to support workshops and conferences in mathematics by contributing small monetary grants, for example to host one speaker, funded mainly from membership dues and revenue from journals. But

with costs rising and journals adjusting the way they do business, I don't see a way to grow this funding in the near future if we continue what we have been doing. We need good ideas to support research in mathematics going forward.

Some good news: AMSI has recently received nearly $1M from the Federal Government's Women in STEM and Entrepreneurship (WiSE) grants program to expand their PhD internship program for women in STEM. This will deliver new opportunities for PhD students, and lead to increased diversity in STEM industries. We congratulate AMSI on their success, and encourage AustMS members to consider such internships. And for those of our student members who successfully participate in these internships, and find themselves in mathematical careers in industry in the future, we hope you maintain your AustMS ties!

In closing, mathematics in Australia does face several challenges, from the school level to the research level. But these also lead to opportunities for a society like ours to step up and make a difference. AustMS members are already on the ground addressing these challenges and doing much good for the discipline. I look forward to working with you in these and other areas during my time as President.

Jessica Purcell is a Professor in the School of Mathematics at Monash University. Her research interests are in low-dimensional topology, hyperbolic geometry, and knot theory, and their applications and interactions with other areas of mathematics. She is currently the Deputy Dean of Research in the Faculty of Science at Monash University. She has previously served on the MATRIX advisory board, the National Committee for Mathematical Sciences of the Australian Academy of Sciences, and as the Chair of WIMSIG.

Letters to the Editors

Can we communicate mathematics better?

Inspirations from Lisa Piccirillo's talk at the 2022 Meeting of the Australian Maths Society

Have you been in a maths lecture where you were completely lost?

For me, being lost is an omnipresent experience. The length of time this has been going on (decades!) helps me cope with the feelings of inadequacy, stupidity, and frustration that invariably creep in when one tries/hopes/prays to understand but comes up short. In fact, not being lost in a talk, especially one which is not in one's area, is so singular an experience that it is bound to make a strong impression. It was thus that I experienced an epiphany after sitting through Lisa Piccirillo's incredible plenary lecture at the 2022 AustMS meeting. Her talk was so deep, engaging, well-planned, and well-executed that it felt like, for once, mathematical gods had opened the gates.[1]

The experience was further amplified because during the conference I sat through plenty of talks from which I took away very little! For instance, I sat through a talk where the speaker went on a monologue for a full sixty minutes covering an enormous number of slides full of formulas. Not a single question was asked either during the talk or subsequently. Sadly, what is remarkable is not the event itself, but rather, how often it occurs! Indeed, such experiences are so commonplace as to render any protests by mere mortals redundant.

I found Lisa on the last day of the conference. While talking with her about experience of preparing and delivering talks, she sheepishly said: "I wish preparing talks wouldn't take so long. Is there a way to cut the preparation time?" My knee-jerk response was "No, a good talk takes a huge amount of time to prepare". But what transpired just after was far more interesting. I continued: "But this work must be done. When we talk about Equity, Diversity, and Inclusion, that's not just sitting on some committee deciding who gets hired." And then she looked at me from the corner of her eyes and said: "yeah . . . give them one less thing to be alienated from."

And there it was. In an instant, a profound understanding passed between us whose essence can perhaps[2] be distilled as follows:
Hypothesis: The experience of mathematical alienation is universal.

For professional mathematicians, alienation usually happens later in life, e.g. at the university level. For most, it happens already in grade school. In fact, it is hard

[1] "If the doors of perception were cleansed, everything would appear to man as it is, infinite." William Blake

[2] "Not the ones speaking the same language, but the ones sharing the same feeling understand each other." Rumi

to come up with another intellectual experience which is as universal as alienation from mathematics.[3]

The question then becomes: why is it so and can we do something about it? There are indeed some rather obvious[4] unforced errors, whose avoidance will create at once a far more inclusive mathematical universe. Let me just mention a couple which were showcased in Piccirillo's talk.

First thing she did was to avoid the monologue and repeatedly invite the audience to interrupt with questions. To their credit (and my surprise), the crowd obliged. This elevated the whole experience to a new level making us feel like we are part of a collaborative effort. Why don't we all do this in every opportunity? I guess this is partly because of our insecurities and partly our obsession with "the plan": if the audience interrupts too much, we might not get to "the end". But is the end so important as to justify any means? And is being exposed for our ignorance and follies not the first step towards the Truth?[5]

Despite all the questions and interruptions, Piccirillo managed to transmit the main message. This was achieved because of her tactful avoidance of the number-one pitfall of maths talks: almost all of them suffer from too much information. Indeed, it appears to me that there can hardly be a more appropriate context for applying the maxim "Less is More" than during preparation of a maths talk. The challenge is, of course, that distilling the essence into an accessible and lean format is precisely where the work lies.[6]

One must acknowledge, however, that there are forces beyond our control hindering bests of intentions and efforts. I started to become conscious of one while working with a collaborator who was, mathematically, degrees of magnitude better than me. So we would be climbing the mountain together toe-in-toe, and then all of a sudden he would make a leap to a place totally unforeseen by me. And when pressed about how he saw that move, he would often say, "well, it's obvious, isn't?" Indeed, it was, but *a posteriori* not *a priori*. This points to a quality within mathematics which does not fit neatly in the usual rational objective narrative.[7]

Another challenge for mathematics at large is that, much like religion in the times past, it is *mandated* by the State, and anything mandatory ceases to be fun. It occurs to me that the lay person could see mathematicians as high priests dispensing esoteric formulas which must then be memorised and applied by the

[3] True, everyone also learns to read and write, but that is in their own language, not a universal one (Chomsky excluded).

[4] "Sometimes the most obvious things are the most important ones to say." Volodya Drinfeld

[5] "How nice to be like a fool for then one's Way is grand beyond measure." A Zen poem taken from Sasha Beilinson's reminiscence about Gelfand and his seminar (Notices of AMS, 2016)

[6] "I didn't have the time to write a short letter, so I wrote a long one instead." Mark Twain

[7] It is not necessary to go to higher mathematics to witness this "irrational" aspect. Just try teaching a five year old about counting and addition of natural numbers. What can one do besides repeating the usual exercises and professing the obvious? Yet, somehow, they eventually get it! I reckon we understand just as much about the process of transmission of mathematics as doctors do about childbirth: most of it is a mystery!

captive population. All the utilitarian advocation of mathematics (it forms the basis of our society, computers, AI, etc.) further accentuates the point for the uninitiated: why should one live in a society so dominated by mathematics (and sciences and technology) to the detriment of other human endeavours, such as music, art, or poetry?[8]

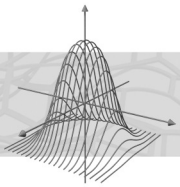
The way out of our predicament may be to go back to the unique reason common to all those who make mathematics their way of life: not the utility nor ubiquity of mathematics but rather its inherent beauty.[9] It is impossible to be unmoved, if not converted, in presence of those who relay this transcendental beauty with a passion and commitment befitting its stature. At the end of the day, all that will be remembered about Piccirillo's talk is: it was beautiful!

Masoud Kamgarpour, The University of Queensland.

Masoud Kamgarpour is a mathematician with interests in algebraic geometry, representation theory, music, poetry, and occult. His website is
https://sites.google.com/site/masoudkomi

[8] Cf. the recent misguided rule changes of Australian government affecting funding for different disciplines at universities, supposedly to encourage students to take up more maths. Needless to say, it will not solve our problems.

[9] "La vraie définition de la science, c'est qu'elle est l'étude de la beauté du monde." Simone Weil



Puzzle Corner

Peter M. Higgins*

Welcome to Puzzle Corner 76 of the Gazette of the Australian Mathematical Society. In this first section I shall introduce "How slow can you bowl a cricket ball?". After that I present a solution to Puzzle Corner 75 "Sudoku Sevens Puzzle".

I would be happy to receive your solution to Puzzle Corner 76 not later than 30 April 2023. The email address for solutions is austmspuzzles@gmail.com. Any particularly interesting solutions received before the deadline will be mentioned in the next Puzzle Corner or, if size warrants, included in the section Addendum to Puzzle Corner, which is edited by Alex Bishop and me.

◇ ◇ ◇ ◇ ◇ ◇

How slow can you bowl a cricket ball?

That is today's question. It is a practical problem that can be solved quite exactly using high school level projectile theory.

If you are still reading, I trust you have some idea how cricket is played. Let us assume that the point of release of the ball is 8 ft above the ground, (which calls for a very tall bowler, but we are after all seeking to find the least possible speed of release). With this in mind, let the ball land 48ft in front of the bowling crease. This is reasonable as the ball is delivered $66 - 4 = 62$ ft from the batter's wicket. This stipulation will land the ball 14 ft in front of the stumps, which is around 10 ft in front of the batter, which is about the shortest a good length delivery can be. Dimensions are set in imperial measurements, partly because that is how the dimensions of a cricket pitch were stipulated in the first place, and partly as this gives nice numbers to work in. We can always translate to km/hr. This lets us take gravitational acceleration to be $g = 32\,\text{ft/sec}^2$.

Problem: With the given set up of the parameters of the problem, find the slowest possible speed of release of the cricket ball, together with the corresponding launch angle.

Air resistance is ignored, although at this slowest of speeds, its effect would be close to negligible.

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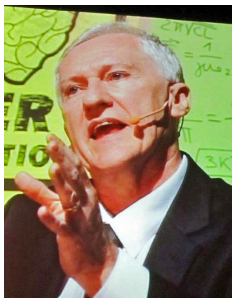
Solution to Puzzle Corner 75: "Sudoku Sevens Puzzle"

3	1	**5**	7	2	4	6
5	3	7	**2**	4	6	1
2	7	4	6	**1**	3	5
7	5	2	**4**	6	1	3
4	2	6	1	**3**	5	7
6	4	1	3	5	7	2
1	6	3	5	7	2	**4**



Peter Higgins is a Professor of Mathematics at the University of Essex. He is the inventor of Circular Sudoku, a puzzle type that has featured in many newspapers, magazines, books, and computer games all over the world. He has written extensively on the subject of mathematics and won the 2013 Premio Peano Prize in Turin for the best book published about mathematics in Italian in 2012. Originally from Australia, Peter has lived in Colchester, England with his wife and four children since 1990.

A base 7 identity

Geoffrey B Campbell*

About ten years ago I posted in a Number Theory online group, equation cases of a base 7 algebraic identity I had found as a student but forgotten. Back then, my post was met with dismay and derision, as these seemed unlikely to be true by that audience. However, they *were and are* true:

$$\begin{aligned}
32^4 - 18^4 &= 7^1 + 7^4 + 7^6 + 7^7,\\
1250^4 - 1152^4 &= 7^2 + 7^7 + 7^{11} + 7^{14},\\
59168^4 - 58482^4 &= 7^3 + 7^{10} + 7^{16} + 7^{21},\\
2884802^4 - 2880000^4 &= 7^4 + 7^{13} + 7^{21} + 7^{28},\\
141254432^4 - 141220818^4 &= 7^5 + 7^{16} + 7^{26} + 7^{35},\\
6920761250^4 - 6920525952^4 &= 7^6 + 7^{19} + 7^{31} + 7^{42},\\
339112359968^4 - 339110712882^4 &= 7^7 + 7^{22} + 7^{36} + 7^{49},\\
16616471049602^4 - 16616459520000^4 &= 7^8 + 7^{25} + 7^{41} + 7^{56},\\
8142068393088832^4 - 8142067586016184 &= 7^9 + 7^{28} + 7^{46} + 7^{63},
\end{aligned}$$

and so on. The right side of the last equation is in base 7 numbers written

$$10000000000000000100000000000000000010000000000000000000010000000000_7.$$

WolframAlpha easily verifies each of the above. And yet these equations, and therefore, the identity they arise from, given now, are not in the literature.

The parent identity is

$$\left(\frac{(7^x+7^y)^2}{2}\right)^4 - \left(\frac{(7^x-7^y)^2}{2}\right)^4 = 7^{y+7x} + 7^{3y+5x+1} + 7^{5y+3x+1} + 7^{7y+x}.$$

Interesting fractional cases of this lead to odd and unfamiliar equations too. For example,

$$\begin{aligned}
\frac{1}{16}\left(\left(\sqrt[16]{7^7} + \frac{1}{\sqrt[16]{7}}\right)^8 - \left(\sqrt[16]{7^7} - \frac{1}{\sqrt[16]{7}}\right)^8\right) &= 7^3 + 7^3 + 7^2 + 7^0,\\
\frac{1}{16}\left(\left(\sqrt[16]{7^9} + \sqrt[16]{7}\right)^8 - \left(\sqrt[16]{7^9} - \sqrt[16]{7}\right)^8\right) &= 7^4 + 7^4 + 7^3 + 7^1,\\
\frac{1}{16}\left(\left(\sqrt[16]{7^{21}} + \sqrt[16]{7^{13}}\right)^8 - \left(\sqrt[16]{7^{21}} - \sqrt[16]{7^{13}}\right)^8\right) &= 7^{10} + 7^{10} + 7^9 + 7^7.
\end{aligned}$$

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The two references [1] and [2] below indicate that, at least 37 years ago, there was no substantial body of mathematical theory for this topic.

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[2] Brenner, J.L. and Foster, L.L. (1982). Exponential Diophantine equations. *Pacific Journal of Mathematics* **101**(2), 1283–301. https://msp.org/pjm/1982/101-2/pjm-v101-n2-p02-s.pdf. Accessed 7 Jan. 2023.

Geoffrey Campbell completed his PhD at Australian National University in 1998 under Rodney Baxter and has enjoyed continued affiliation with the ANU Mathematics Department for 30 years. He also served as a Visitor with LaTrobe University Mathematics and Statistics Department for 8 years. His career has included various Commonwealth and State government contract roles, including at Department of Prime Minister and Cabinet; and at a Royal Commission. Geoffrey is writing a text/ monograph on Vector Partitions for Chapman and Hall Publishers, and is also a published poet in Australia.

Communications

Australia Day 2023 Honours

Michael Charles Mitchelmore OAM

Michael Charles Mitchelmore, Honorary Associate Professor at Macquarie University, has been awarded an Order of Australia Medal in the general division for service to mathematics education, and to the community.

Michael worked full-time at Macquarie University from 1990 to 2004, then part-time as Director of the Centre for Research in Mathematics and Science Education, finally retiring to an honorary position in 2009. His achievements include over 100 academic publications arising from over 20 funded research projects, the latest being published in 2016. He was treasurer of the Mathematics Education Research Association of Australasia from 1991 to 1997 and editor of the Mathematics Education Research Journal 1997–2000.

Australian Mathematical Society Awards

The Society's major awards were announced on 6th December 2022, at the opening session of the 66th Annual Meeting of the Society, held at UNSW Sydney.

The Szekeres Medal

Awarded to Igor Shparlinski

The George Szekeres Medal is the Australian Mathematical Society's most prestigious medal, recognising research achievement and an outstanding record of promoting and supporting the discipline. Igor Shparlinski's long contributions over a long time make him a deserving winner of the Szekeres medal. Igor has made notable contributions in many areas of mathematics with specialisms in number theory and its applications.

Since his move to Australia in 1992, Professor Shparlinski has supervised 15 PhD, 10 Masters and 25 Honours students to completion, as well as mentored 15 postdocs in their progression towards career independence. Many of his former students and postdocs have subsequently received prestigious fellowships and appointments. When Igor arrived at UNSW in 2013 research in Number Theory there was in decline, after having been first established in the department by George Szekeres. He rebuilt a strong Number Theory group at UNSW and number theory is now one of the strongest research discipline areas in Pure Mathematics at the University. This growth in Number Theory at UNSW has achieved broader impact across the Australian mathematical community via a strong visitor program. The influence of Shparlinski on mathematics is reflected in his incredible citation rate. For example, Scopus finds nearly 5000 citations to his over 600 papers and calculates his h-index as 29.

Research achievements

Professor Shparlinski's most significant results are based on a broad range of ideas and approaches — often taken from very different fields and combined in novel ways. His arsenal of methods includes the following deep and complex technical tools:

- Bounds on short exponential and character sums; bounds of incomplete and bilinear Kloosterman sums; and Vinogradov's Mean Value Theorem.
- Sum-product theorems, incidence and energy bounds and other methods and results of additive combinatorics.
- Diophantine geometry such as the theory of heights, effective forms of Hilbert's Nullstellensatz, and Hilbert's Irreducibility Theorem.
- Results on numbers with prescribed arithmetic structures (such as primes and smooth numbers) obtained via sieves and other methods of analytic number theory.

Professor Shparlinski's bound on high degree Gauss sums was the first example of a bound on such sums below the 'square-root' threshold. As an application, he used it to settle Stechkin's conjecture about these sums. These results initiated a new line of research pursued by a number of prominent mathematicians from around the world. The initial motivation for this work came from establishing the Holden-Moree conjecture on the discrete logarithm in finite fields (which has a strong cryptographic aspect). However, the main value of these results is in their further applications to a broad range of other well-known problems on pseudo-powers, Fermat quotients, g-ary digits of rational fractions, etc. There are now several research groups who continue working in this direction.

About a decade ago, Professor Shparlinski initiated a new direction, named "Unlikely intersections in finite fields". This designation reflects the actual content: establishing the mutual avoidance between different types of arithmetic and algebraic structures. This work used a diversity of methods from additive combinatorics, analytic number theory, Diophantine geometry and arithmetic dynamics. The ideas and results of his work provided the origins for applications in addressing a number of problems in cryptography and algorithms.

Shparlinski has obtained new results on cancellations in families of important exponential and character sums, such as Kloosterman sums. In particular, he has improved several previous results in the area on fourth moments of L-functions. Most recently, Professor Shparlinski started working on bounds and applications of Weyl sums. He has used the ideas to derive some results towards introducing a new direction in the theory of these sums, interpolating between the optimal bound on the average values of Weyl sums — known as Vinogradov's Mean Value Theorem — and individual bounds where the results are far from what is believed to be optimal.

Promoting and supporting the discipline

Igor has a notable record in promoting and supporting the discipline. As mentioned above, he has successfully supervised 15 PhD students and ten masters students. Igor has also mentored 15 postdoctoral fellows who have gone on to obtain further postdoctoral positions or continuing positions.

Professor Shparlinski is an editor of the book series *Frontiers in Mathematics* (Birkhauser) and has served (and continues to serve) on several editorial boards. Most significantly, he is on the Editorial Committee of Mathematics of Computation; the body of four mathematicians deciding the long-term policy and strategy of this journal. He is also a regular invitee and participant of workshops in such highly prestigious centres as Oberwolfach, Dagstuhl, CIRM-Luminy, BIRS-Banff, and the Fields institute.

Summary

Professor Igor Shparlinski is one of Australia's leading mathematicians, specialising in number theory and its applications (including to cryptography). Seminal amongst his achievements are: new bounds of exponential and character sums; developing the metric theory of Weyl sums; and developing the theory of "unlikely intersections" in finite fields using the methods of Diophantine geometry and

additive combinatorics. Moreover, he has made influential discipline leadership contributions through the establishing of a world class Number Theory group in Australia, the membership of the Editorial Board of several prestigious international journals and the oversight and organisation of several national/international conferences. He has built capacity via the supervision, mentoring and the attracting of many outstanding Number Theory researchers to visit Australia.

Australian Mathematical Society Medal

Awarded to Guoyin Li

Professor Guoyin Li (UNSW) has made outstanding contributions to optimization, variational analysis and multilinear algebra, while also applying this theory in novel ways to other areas of mathematics or scientific disciplines. His body of work positions him as one of the most dynamic and influential young researchers in the Australian mathematical community.

After receiving his PhD in Mathematics in December 2007 from the Chinese University of Hong Kong, Li joined the UNSW School of Mathematics and Statistics as a Research Associate. He was awarded an ARC Australian Postdoctoral Fellowship in 2009, and an ARC Future Fellowship in 2013, and is now a Professor in the School. Guoyin Li has an outstanding publication record, with over 100 journal articles, the majority in prestigious journals, spanning an impressively broad range of topics. His work has attracted over 1650 citations on MathSciNet, and at least four of his articles are recognized as Web of Science 'highly cited' articles.

One of his most highly regarded contributions is to the theory of KL exponents, an important tool in algebraic geometry and singularity theory, with profound implications in optimization, dynamical systems and optimal control. Prior to Li's work, results on KL exponents were limited to polynomials and were stated under strong assumptions, whereas modern optimization problems often concern nonsmooth functions violating these regularity assumptions. In Guoyin Li's paper in Foundations of Computational Mathematics, joint with T.K. Pong, he provided an innovative and elegant approach, developing comprehensive calculus rules for KL exponents, and drawing a striking connection to the fundamental notion of error bounds. This not only put earlier results into a coherent and powerful framework, but also enabled him to utilize his own earlier error bound result (now referred to as Li's Theorem) to obtain explicit KL exponents for large classes of nonsmooth optimization problems, including many that arise in practical applications. The results rely on delicate techniques from modern variational analysis, and highly non-trivial tools from semi-algebraic geometry.

Another fundamental contribution is his highly original development of nonconvex splitting methods: powerful numerical schemes which exploit hidden separable structure of an optimization problem, leading to easily implementable and highly parallelizable algorithms, often performing well on large scale problems. Li presented some beautiful convergence results in the notoriously difficult nonconvex setting, based on a highly original approach, for two popular splitting methods, and illustrated the effectiveness of his work with striking numerical results. This paper

is regarded as a breakthrough, which has motivated much subsequent work by leading mathematicians. The global impact of the work was evidenced by the best paper award of the 2019 International Consortium of Chinese Mathematicians.

Li has served as Associate Editor for several high-quality journals, and as the Director of the 2019 AMSI Summer School. He has secured numerous grants from both Australian and international sources. During the past six years, he has been invited to deliver five plenary talks in Australia, China, Spain and USA. Li has also been invited to serve as a member of various conference organising committees, and to coordinate mini-symposia within many national and international conferences.

Gavin Brown Prize

Awarded to Mark Holmes and Edwin Perkins for their paper 'On the range of lattice models in high dimensions', *Probability Theory and Related Fields* **176**, no. 3 (2020), 941–1009.

Super-Brownian motion is an evolutionary process involving both branching, and a Brownian motion. It was originally found as the scaling limit of discrete branching Brownian motions, uncovering a rich mathematical structure. Gradually it was recognised that this superprocess arose in many different models from probability and statistical physics, where it is now an important research topic.

A key question here is to find information about the models that is preserved in the scaling limit. The convergence here is quite delicate, as one passes from a discrete system to a continuum limit.

In the paper 'On the range of lattice models in high dimensions', Mark Holmes and Edwin Perkins provide precise conditions that ensure that the range of lattice models converges to the range of the limiting superprocess.

The behaviour of the system is quite different in high and low dimensions: in low dimensions, the scaling limit depends on the model, while in high dimensions it exhibits mean-field behaviour, with the interactions spread out over space.

The results work in a very general setting, and are carefully verified for four of the most well-known models: voter models, the contact process modelling an epidemic on a lattice, oriented percolation, and lattice trees. This unified approach also offers tools for future applications.

As a bonus, the paper also calculates the one-arm exponent in percolation – the probability that a distant point is hit by the set-valued process – which has been the object of much research.

It is a very beautiful and inspiring presentation despite the difficulty of the subject and the delicate technicalities of the convergence, with several reviewers noting the careful explanations and the way in which new concepts are related to more familiar ones.

In the words of the reviewers, this work "not only solves some long-standing open problems, but also provides new methods that should have fruitful applications

in the future" ... "it is truly outstanding achievement in the area of interacting stochastic systems in high dimensions and is a landmark in our understanding of large space-time scaling".

The Mahony-Neumann-Room Prize

Awarded to Satish K. Pandey and Vern I. Paulsen for their paper 'A spectral characterization of AN operators', *J. Aust. Math. Soc.* **102** (2017), no. 3, 369–391.

This paper establishes an elegant spectral characterization theorem for absolutely norming (AN) operators on complex Hilbert spaces of arbitrary dimensions—those that attain their norm on every closed subspace. Although the class of these operators is not closed under addition, the paper characterizes the intersection of these operators with the positive operators as forming a proper cone in the real Banach space of hermitian operators. Moreover, it provides a counterexample to a previous attempt at characterization in the literature. The methods have been modified and adapted by other authors; for instance, to characterize absolutely minimum attaining operators, and are of interest to the study of the properties of Toeplitz operators. It is considered that the paper is well written and well structured, with its complicated arguments clearly presented and elucidated by excellent use of examples.

Rodney Baxter Prize

Awarded to David Ridout

Associate Professor David Ridout (University of Melbourne) has won the inaugural Rodney Baxter Prize for Mathematical Physics! Congratulations to David who is an extremely deserving winner.

The announcement was made at the ANZAMP meeting in Hobart in February, where we were very grateful to Emeritus Professor Rodney Baxter for attending and participating in the proceedings.

As described on the AustMS website, "The Rodney Baxter Prize, awarded every three years, aims to recognise an outstanding and internationally significant contribution to the area of Mathematical Physics primarily carried out in Australia or New Zealand. The Fellowship is funded by a gift from Emeritus Professor Rodney Baxter". For more details on the prize, see https://austms.org.au/awards-grants/awards/the-rodney-baxter-prize-for-mathematical-physics/

Recipients may be up to 20 years post PhD, allowing for career interruptions, and the prize consists of $5000, funding for travel to the ANZAMP conference where the prize is announced, and a certificate on stout paper.

The citation for David's award is: "For groundbreaking contributions to mathematical physics, in particular (logarithmic) Conformal Field Theories and the corresponding Vertex Operator Algebras, his inspirational role in supervising students and postdocs and his service to the mathematical physics community".

We are glad to have such a worthy winner for the first Rodney Baxter Prize, and it is clear that this prize will become a key fixture for the mathematical physics community in Australia and New Zealand for many years to come.

Heron's Formula and the 3-dimensional Pythagoras Theorem

Peter Donovan*

A formula apparently due to the first-century Greek engineer/scientist/mathematician Heron of Alexandria is that the area H of a triangle with sides of length a, b and c is given by the first line of the display:

$$\begin{aligned} 16H^2 &= (a+b+c)(a+b-c)(a-b+c)(-a+b+c) \\ &= (a^2+2ab+b^2-c^2)(-a^2+2ab-b^2+c^2) \\ &= 4a^2b^2-(a^2+b^2-c^2)^2 \\ &= 2a^2b^2+2b^2c^2+2c^2a^2-a^4-b^4-c^4. \end{aligned}$$

Now consider a tetrahedron in which the three angles at one vertex are right angles and the three edges from that vertex have lengths x, y and z. So the three faces involving that vertex have areas $A = yz/2$, $B = zx/2$ and $C = xy/2$ respectively while the three other edges have lengths $a = \sqrt{y^2+z^2}$, $b = \sqrt{z^2+x^2}$ and $c = \sqrt{x^2+y^2}$ respectively. (The standard Pythagoras theorem *in a right angled triangle the square of the length of the hypotenuse is the sum of the squares of the lengths of the other two sides* is used three times here.) Then the area H of the fourth (or *hypotenuse*) face is given by:

$$\begin{aligned} 16H^2 &= 2(y^2+z^2)(z^2+x^2)+2(z^2+x^2)(x^2+y^2)+2(x^2+y^2)(y^2+x^2) \\ &\quad -(y^2+z^2)^2-(z^2+x^2)^2-(x^2+y^2)^2 \\ &= 4y^2z^2+4z^2x^2+4x^2y^2 \\ &= 16A^2+16B^2+16C^2. \end{aligned}$$

And so the little-known three-dimensional version of Pythagoras theorem *in a right angled tetrahedron the square of the area of the hypotenuse face is the sum of the squares of the areas of the other three faces* emerges as being implied by Heron's formula.

Conversely, given the hypotenuse triangle of a right-angled tetrahedron has edges of lengths a, b and c, the other three edges x, y and z must satisfy $x^2+y^2=c^2$, $y^2+z^2=a^2$ and $z^2+x^2=b^2$ and so $2x^2=c^2-a^2+b^2$. But the cosine rule $c^2-a^2+b^2=2bc\cos\hat{A}$ where $\hat{A}$ is the angle opposite the side of length A applies here. Hence such an x can be found only if the angle $\hat{A}$ is acute. Likewise y and z can be found only if the coresponding angles are acute. So for acute angled triangles only the above argument can be reversed and the three-dimensional Pythagoras theorem implies Heron's formula.

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A proof of Heron's formula (valid even when one angle of the triangle is not acute) using the standard Pythagoras theorem thrice more is given for completeness. The notation may as well be chosen so that $b \geq a$ and $b \geq c$. The perpendicular dropped to the side of length b from the third vertex may be taken to have length q. It divides the side of length b into parts of lengths p and $b - p$. Then by another two applications of the standard Pythagoras theorem:

$$a^2 = q^2 + p^2 \qquad \text{and} \qquad c^2 = q^2 + p^2 - 2bp + b^2,$$

and so $a^2 - c^2 + b^2 = 2bp$. (In essence this last formula is the cosine rule.) Thus:

$$\begin{aligned} 16H^2 &= 4b^2q^2 \\ &= 4b^2a^2 - 4b^2p^2 \qquad \text{(a sixth use of standard Pythagoras!)} \\ &= 4b^2a^2 - (a^2 + b^2 - c^2)^2. \end{aligned}$$

As this last line is just a copy of the third line of the initial display the proof of Heron's formula is complete. So the three-dimensional Pythagoras theorem has been proved using six applications of the standard Pythagoras theorem.

Peter Donovan has been semi-retired for the UNSW School of Mathematics for 19 years. His research interests include modular representations and the associated cohomology of finite groups, reconstruction of Grothendieck's unwritten EGA XI and WW2 cryptology. His last contribution to this Gazette was on Asperger's syndrome.

Demand for teachers in Victorian government schools, 2021–2022

C. T. Lenard* and T. M. Mills**

The mid-term review of Australia's decadal plan for mathematical sciences in Australia emphasised the critical importance of having well-qualified mathematics teachers in our schools (Decadal Plan Steering Committee, 2022, pp. 13–14). However, in recent times, there has been considerable media attention paid to the issue of the supply of teachers in Australia. Our article deals with an aspect of the demand side of the issue, namely the number of opportunities for teachers in Victorian government schools, especially mathematics teachers.

In the State of Victoria, the Department of Education and Training advertises jobs for positions in government schools online (Education and Training, 2022a). Applicants submit their applications online. The jobs include teaching and non-teaching positions, full-time and part-time, but do not include casual relief teaching positions.

Among the many search options, one can search advertisements for jobs posted in the last 7 days. During 2021–2022, on each Wednesday, starting on Wednesday 6 January 2021, we searched for jobs posted in the last 7 days. We recorded the values of the following variables. Although, on any day, the values of these variables may vary with the time of day, we ignored this variation.

vic.total = Number of advertisements for positions in Victoria

vic.prim = Number of advertisements for positions for primary teachers

vic.sec = Number of advertisements for positions for secondary teachers

vic.math = Number of advertisements for positions in which the Subject/Duty is classified as "Mathematics"

Note that many positions for mathematics teachers were positions for teachers who are qualified in two domains such as mathematics and science, or even mathematics and PE.

There were some limitations in our method of data collection. By recording the number of advertisements in which the Subject/Duty is classified as "Mathematics", we would have missed positions classified *only* as, for example, "Math–Further Mathematics", or "Mathematics–VCE". Also, positions labelled *only* as "Learning Specialists" may not have been counted in the categories of primary or secondary teachers. Prospective applicants should be aware that positions for mathematics teachers may be classified in various categories. Furthermore, some of these

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advertisements may be for positions that had been advertised some time before but were not filled.

This paper is essentially an exercise in exploratory data analysis. Our aim is to address the following questions.

- How many advertisements are there for jobs in government schools each week in the categories above?
- Is there evidence of trend or seasonal variation in the data?
- How do the number of advertisements for primary teachers and the number of advertisements for secondary teachers vary?

Five-number summaries for the number of advertisements per week during the two years 2021–2022 are given in Table 1.

There appears to be a positive linear trend in both the total number of advertisements in general, and the number of advertisements for mathematics teachers in particular, although there is considerable variation in each series. See Figure 1 and Figure 2 .

Table 1. Five-number summaries of number of advertisements per week, 2021–2022

Type	Minimum	Lower quartile	Median	Upper quartile	Maximum
vic.total	143	471.5	673.5	912.5	1994
vic.prim	25	120.5	168	335	829
vic.sec	38	124.5	203	292.5	548
vic.math	8	28	43	60	129

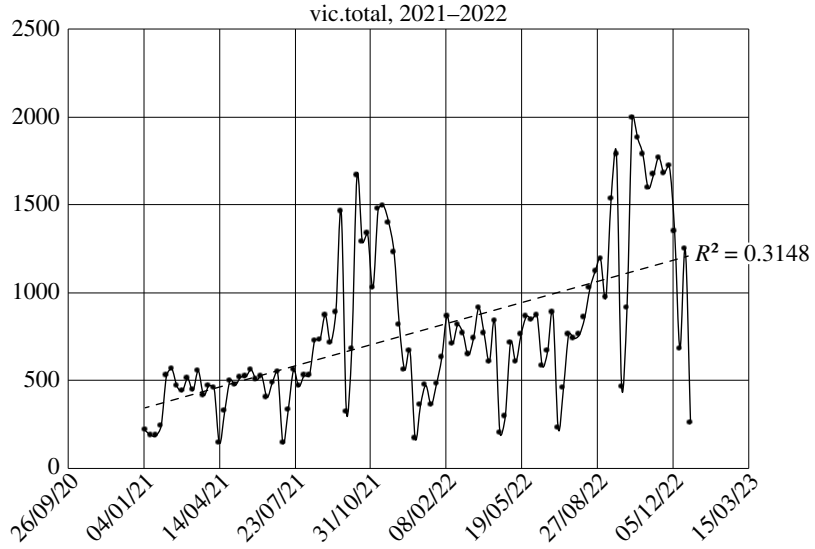

Figure 1. Total number of job advertisements each week, 2021–2022. $n = 104$, $R^2 = 0.31$.

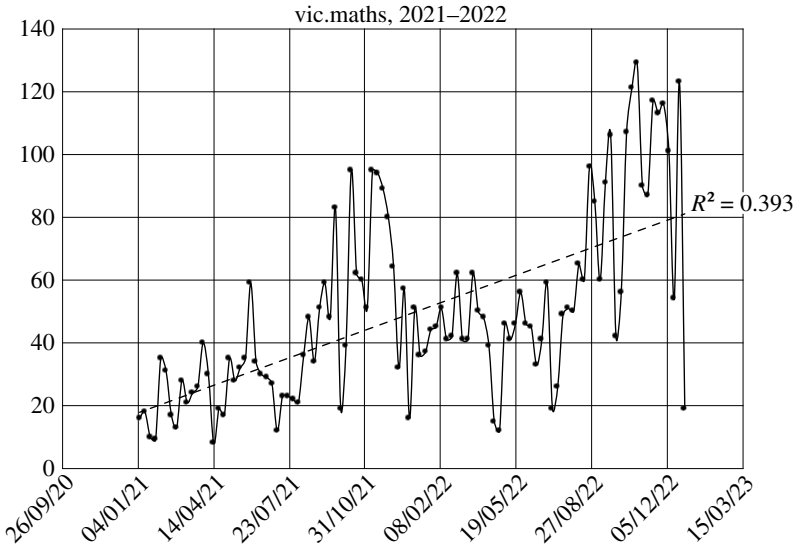

Figure 2. Number of advertisements for mathematics teachers each week, 2021–2022. $n = 104$, $R^2 = 0.39$.

It is apparent that there is some seasonal variation on a weekly basis. For example, the number of advertisements is low in the Christmas week, and also in the second week of a two-week holiday break. However, to estimate seasonal effects more precisely would require several years of data. Weekly time series data are particularly difficult to analyse.

The two series for primary teachers and secondary teachers are noticeably parallel. See Figure 3.

The years 2021–2022 were unusual for several reasons. The Victorian government provided extra funds for positions as tutors in schools under the Tutor Learning Initiative to assist students who need extra support after the interruption to their schooling due to COVID19 restrictions. This boosted the number of advertisements for positions. Possibly this may have reduced the pool of casual relief teachers but that is a side issue as far as this paper is concerned. Victoria experienced further lockdowns during this period but it is hard to tell what effect this may have had on the number of advertisements. Finally, the new Victorian Government Schools Agreement 2022 reduced the maximum face-to-face teaching time for a teacher starting in 2023 (Education and Training, 2022b, p. 8): this may lead to more teachers being required in Victorian schools in 2023. We intend to continue this project in future years.

We hope that this paper will be useful to readers with an interest in the demand for teachers in Victoria, especially mathematics teachers. Mathematics departments in universities that are keen to increase their subject offerings to attract potential teachers may find this evidence useful to their cause.

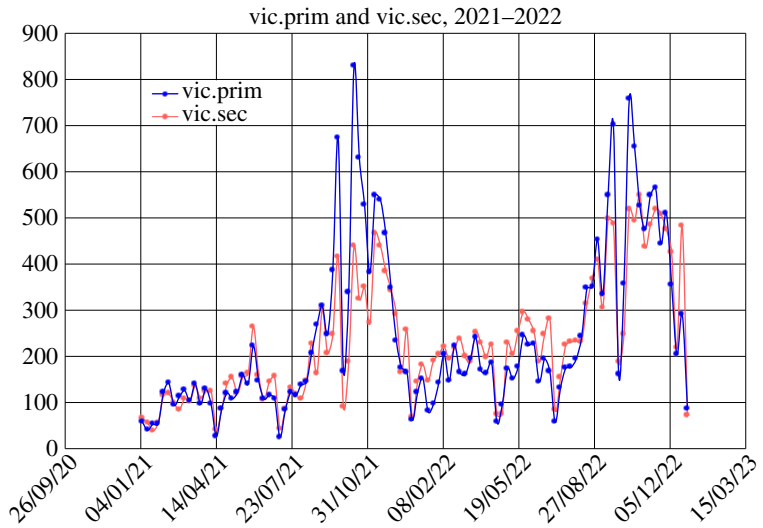

Figure 3. Number of advertisements for primary (blue) and secondary (red) teachers each week, 2021–2022.

Acknowledgements and disclaimer

We thank Bev Miller, formerly Human Resources Coordinator at Bendigo Senior Secondary College, and Tasamin Dwyer, Crusoe 7-10 Secondary College for helpful advice. We also thank the Department of Education and Training, Victoria for permission to use the data for this paper, but note that the data were collected by Terence Mills and not provided by the Department.

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Education and Training. (2022b). Victorian Government Schools Agreement 2022: Implementation Guide. https://www.education.vic.gov.au/hrweb/Documents/VGSA-2022-Implementation-Guide.pdf

The 2022 Simon Marais Mathematics Competition

Anthony Henderson* and S. Ole Warnaar**

The sixth annual Simon Marais Mathematics Competition (SMMC) was held on Saturday 15 October 2022. Participation in the East division returned to pre-COVID levels in India and Singapore, though not yet elsewhere, with a total of 825 students from 48 universities competing. India overtook Australia to be the country with the greatest number of universities in the competition, as well as the largest number of students, see Tables 1 and 2.

Table 1. Participation in the Simon Marais Mathematics Competition for 2017–2022 (East division only, registered entrants who submitted at least one solution for marking)

	2017	2018	2019	2020	2021	2022
Total entrants	459	891	971	587	597	825
Individual entrants	217	355	393	301	333	413
Pairs entrants	242	536	578	286	264	412
Participating universities	33	50	50	37	41	48
Australia	14	15	13	13	14	12
Bangladesh	–	–	–	–	1	1
China (Hong Kong)	4	5	6	5	4	5
India	1	9	12	5	6	14
Indonesia	–	1	–	–	–	–
Malaysia	7	7	7	4	5	5
New Zealand	4	6	6	3	4	4
Philippines	–	2	2	1	1	1
Singapore	2	2	2	2	2	2
South Korea	–	2	2	3	3	3
Sri Lanka	–	–	–	1	1	1
Thailand	1	1	–	–	–	–

In its second year, the West division roughly doubled in size with 145 students from 17 universities competing, including in four countries new to the competition: Ireland, Portugal, Slovenia and Turkey. Accordingly, the prize-money on offer in the West was increased to 80% of that in the East, and the Problem Committee set three papers rather than two, so that the East contestants could sit Paper A in the morning and Paper B in the afternoon while the West contestants sat Paper B in the morning and Paper C in the afternoon. Although the October date is less

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Table 2. Gender breakdown of entrants in the 2022 Simon Marais Mathematics Competition (East division) by country

	Female	Male	Non-binary	Total
All countries	146 (17.7%)	669 (81.1%)	10 (1.2%)	825
Australia	25 (15.5%)	130 (80.7%)	6 (3.7%)	161
Bangladesh	1 (33.3%)	2 (66.7%)	–	3
China (HK)	17 (21.8%)	60 (76.9%)	1 (1.3%)	78
India	39 (12.1%)	283 (87.9%)	–	322
Malaysia	46 (54.8%)	38 (45.2%)	–	84
New Zealand	3 (14.3%)	17 (81.0%)	1 (4.8%)	21
Philippines	4 (23.5%)	13 (76.5%)	–	17
Singapore	8 (10.1%)	69 (87.3%)	2 (2.5%)	79
South Korea	1 (2.3%)	43 (97.7%)	–	44
Sri Lanka	2 (12.5%)	14 (87.5%)	–	16

convenient for many European universities, we hope that the West division will continue to grow in 2023.

The twelve problems in the 2022 competition covered a wide variety of topics in mathematics, including analysis, combinatorics, game theory, geometry, number theory and probability. Interestingly, the final problem on paper A, which asked contestants to show that if q is an odd integer greater than one such that all of its prime factors exceed n, then $[n]_q!/n!$ is an integer coprime to $(q-1)/2$, arose in the context of a more general research question by the incoming Chair of the Problem Committee, Peter McNamara, on the isomorphism of certain cohomology groups. (The q-analogue of the factorial function is defined as $[n]_q! := \prod_{i=1}^{n}(1-q^i)/(1-q)$.) As is becoming tradition, this year's competition once again included an open problem, which was part of both the East and West Divisions. In this problem a pair of sequences of positive integers $a = (a_0, a_1, \dots)$ and $b = (b_0, b_1, \dots)$ is given with initial condition $a_0 b_0 \geq 600$ and coupled system of recursions

$$a_{n+1} = a_n + 2\lfloor b_n/20 \rfloor,$$
$$b_{n+1} = b_n + 3\lfloor a_n/30 \rfloor,$$

for all $n \geq 0$. For example, if $a_0 = 30$ and $b_0 = 20$ then

$$a = (30, 32, 34, 36, 38, 40, 42, 44, 48, 52, \dots),$$
$$b = (20, 23, 26, 29, 32, 35, 38, 41, 44, 47, \dots).$$

Part (a), which has a known solution, albeit not an easy one, asks for a proof of the fact that for sufficiently large n, $d_n := a_n - b_n \in \{-13, \dots, 23\} =: I$. For the two sequences in the above example, sufficiently large means $n = 0$, but since the initial difference $|d_0|$ can be arbitrarily large, it may take arbitrarily long before d_n lies in I. Part (b), which is the open problem, asks if it must always be true that there exists an n such that $d_n = 0$? Intuitively one would expect this to be true, and although d_n is of course deterministic, numerical experiments by PC Chair Chris Tuffley — who gave a talk on the problem at the 2022 NZMS Colloquium

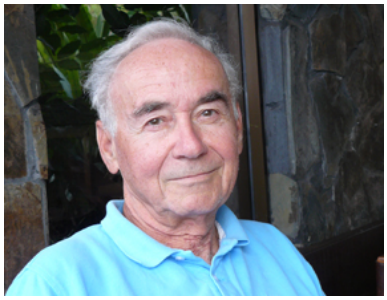
in Christchurch — seems to suggest its behaviour has a close resemblance to that of a random walk. The problem was posed by PC member Johan Meyer. In his own words "I 'discovered' this problem in 2012 during the IMO in Argentina. The origin is rather simple: I was, for some reason, thinking of compound interest, but a bit more interesting. Suppose you have two investments (a_0 and b_0). Then, at the end of each year, add the interest (say 10%) earned by one investment to the other investment, and vice versa. So $a_1 = a_0 + b_0/10$ and $b_1 = b_0 + a_0/10$, etc. Then it is easy to see that $a_n - b_n$ tends to 0 (irrespective the starting values). Hence, to make it even more interesting, let us stay in the integers. But this time adding 10% is done in a 'skew' manner: $2\lfloor b_n/20 \rfloor$ and $3\lfloor a_n/30 \rfloor$. A natural question then is if the difference will still be 'close' enough to 0 for large n. Since we are dealing with integers, close enough means $a_n = b_n$ for some n large enough." For the above example, the first few occurrences of zero are for $n = 125, 137, 264, 267, 268, 346$, but it indeed appears the gap between consecutive zeros is not bounded. Among the first million values of d_n, for example, the largest gap between consecutive zeros is 816, while the average gap-size is close to 31. No marks were awarded for the open problem, but a total of 6 entrants achieved a full score for part (a). This includes the 2022 Hofflin Prize winner, Yu Peng Ng, from the National University of Singapore. Writing $a_n = 30q_n + r_n$ and $b_n = 20s_n + t_n$ for $0 \leq r_n < 30$ and $0 \leq t_n < 20$, it readily follows that $10d_{n+1} = 9d_n + r_n - t_n$, which implies that if $d_n \in I$ for $n = N$ then $d_n \in I$ for all $n \geq N$. The main task is thus to show that such an N exists. Ng's highly original solution to this problem shows that if no such N exists, then there exists an M such that s_m and q_m are divisible by arbitrarily large powers of 5 for all $m \geq M$. This forces $s_m = q_m = 0$ and hence $a_m b_m = r_m t_m < 600$ for $m \geq M$. Since a and b are monotonic increasing sequences with $a_0 b_0 \geq 600$, this yields a contradiction.

Although the cut-offs for performance in the top quartile were not unusually high, the very top scores this year broke all records for the competition. Remarkably, two pairs from Seoul National University, one comprising Taehun Kim and Ingyu Yang and the other comprising Jimin Kim and Yuwan Seo, tied for first place on a score of 56, the highest possible without making progress on the unsolved problem B4(b). Also oustanding was the top individual score of 54 by Luka Horjak of the University of Ljubljana. New Australian records were set by Preet Patel (Monash University) with an individual score of 43 and Albert Smith and Chenxiao (Kevin) Zhou (Australian National University) with a pairs score of 48. Seoul National University maintained its top position in the East Division, with the new entrant IIT Bombay edging out National University of Singapore for second place. Australian universities occupied four positions in the top ten, with Monash University being the best-placed among them for the first time, and thus having the honour of hosting the ceremony for Australian prizewinners. Other results, as well as all the problems and solutions, can be found on the web-site https://www.simonmarais.org.

Once again we wish to thank all entrants and local coordinators, the members of the Organising Committee, Problem Committee, and marking team, our Administration Coordinator Luna Liu, and MATRIX and SAMF for their assistance. We are grateful to the Marais family, Philipp Hofflin, and the

Stonehage-Fleming Charitable Foundation for their ongoing financial support of the competition. In 2022, we were happy to welcome Optiver Pty Ltd as a new sponsor of the prizes for entrants who came top in their own university in Australia, New Zealand, and Singapore. We look forward to developing more such relationships in all competing countries, with organisations that value the mathematical problem-solving skills which the competition fosters.

Ludvik Bass



Emeritus Professor Ludvik Bass of the School of Mathematics and Physics at the University of Queensland, died while walking his dog on October 23, 2022. Born in Prague, he was 91 years old.

Ludvik considered himself a lucky person. The day before the Nazis invaded Czechoslovakia in 1939, his Jewish father was returning by plane from London to his family in Prague when a snowstorm forced a landing and overnight stay in Brussels. Learning of the invasion, he returned at once to London from Brussels. From there he contacted his Catholic wife and urged her to divorce him and get 8-year-old Ludvik and his two siblings baptised at once, thus distancing them from their Jewish father and helping to protect them from persecution. Even so, Ludvik's older brother was imprisoned in a work camp for 3 years. An uncle, aunt and cousin were put to death by the Nazis in a concentration camp.

Ludvik's parents remarried in Prague when the war ended. After the Communists came to power in Czechoslovakia a rebellious 20-year-old Ludvik was warned that he faced imprisonment or worse for his refusal to bow down to the regime. Unable to tell even his family of his plans for fear of incriminating them, he fled from Prague to Vienna one night in 1951, evading Czech guards at the border and then an Austrian guard who spotted him but fortunately gave up the chase. Luckily he made it to the American sector of Vienna, avoiding the sector under Russian control.

Carrying a letter of commendation for his undergraduate studies at Charles University in Prague, Ludvik was admitted in late 1951 to the graduate class of the distinguished physicist Hans Thirring, Head of Physics at the University of Vienna. There he impressed enough to be taken on as Thirring's doctoral student, and completed a thesis on the unlikely-sounding topic, "The Mathematical Theory of Grinding Processes". He was admitted to his doctorate in mid-1954 but by then he had already joined Erwin Schrödinger at the Dublin Institute for Advanced Study (DIAS) on Thirring's recommendation.

In 1955, Ludvik and Schrödinger published their well-known paper "Must the photon mass be zero?" in the *Proceedings of the Royal Society of London*. Ludvik's

first publication, it was submitted on his 24th birthday! Shortly afterwards Ludvik and the distinguished general-relativist Felix Pirani who was visiting DIAS, published a paper relating to well-known early work by Thirring, which Ludvik had no doubt learned of while in Vienna. Ludvik published one more paper while at DIAS and then took up a lecturing position at Trinity College Dublin, where he was awarded an honorary MA in 1959.

In Dublin he met Nina Schmahl, visiting from Denmark, and offered to teach her English. They married in Dublin in 1961. Ludvik liked to joke that teaching English to Nina was clearly going to be a life-long task! Later that year he moved with Nina to a short visiting lectureship at the School of Chemistry, University of Newcastle-upon-Tyne, working with M. Fleischmann. After a short stint in industry with the BSA Group Research Centre in Birmingham, he took up a lectureship in the Department of Mathematics at Lanchester College of Technology in Coventry in 1963. All of these appointments led to significant publications, including another paper in *Proc. Roy. Soc.* and remarkably, four letters in *Nature*. During this period, Ludvik developed an active research interest in the mathematics of liquid junctions and ionic interactions in electrolytes, and introduced the first application of the *Painlevé II* ODE to a physical process.

In 1965 he left England with Nina and daughter Karen, born in Birmingham in 1963, to take up a Readership in Mathematics at the University of Queensland, where he was promoted to Professor in 1967 and stayed until retirement in 1994. A second daughter, Marianne, was born in Brisbane in 1968.

At UQ he took up the development and teaching of advanced courses in mathematical physics, and before the end of 1965 had successfully submitted a paper with a postgraduate student. Papers with many other students were to follow over the years. In 1966 he began a fruitful collaboration on aspects of nerve conduction with the distinguished physical chemist and biographer W.J. Moore leading to several papers, including one in *Nature* and one in *Proc. Nat. Acad. Sci. USA*. During his early years at UQ he was one of the few mathematical scientists in Australia receiving regular ARGC support.

In 1975 he began an extremely productive collaboration on aspects of drug elimination by the liver with Danish physiologists N. Tygstrup, K. Winkler, S. Keiding and subsequently with Keiding's research team. That collaboration would continue for 45 years, with multiple exchange visits, and lead to a large number of influential publications. It also led to Ludvik being elected a Member of the Royal Danish Academy of Science and Letters (MRDASL) in 1980. Many colleagues from Australia and overseas published with Ludvik, developing mathematical models in biology. He was the principal architect in 1978 of the well-known "distributed model" of hepatic elimination, and in 1987 of a new nonlinear mechanism for pattern formation in the liver. Most recently, in a series of papers with colleagues he expanded on his early modelling of ionic interactions using *Painlevé II*, the last of these papers appearing in 2018.

Ludvik maintained an active interest in quantum mechanics, apart from his work in mathematical biology. In 1975 he published a much-cited attempt to explain the interaction between the brain and an atomic system during the quantum

measurement process, and in 2014 suggested a relationship between quantum mechanics and iconic memory. Several essays on the philosophy of science appeared over the years in the Trinity College Dublin journal Hermathena, notably his influential paper "The mind of Wigner's friend" in 1971.

Apart from his scientific interests, he was a keen student of classical literature, and published a short article on Joseph Conrad in 2015. He also published two short stories, and in 2001 his novel *The Masaryk File: A Memoir of the Cold War* appeared, built around the death by defenestration of the Foreign Minister of Czechoslovakia in 1948. It contains a description of an escape from Prague to Vienna, no doubt built upon his own experience. Ludvik obtained Irish citizenship while in Dublin and Australian citizenship after moving to Brisbane. He spoke perfect English but with an eastern European accent, which often prompted people to ask what was his nationality before becoming Australian. He was always amused to reply "Irish".

A great admirer of Schrödinger and his philosophy, and still active in his 92nd year, Ludvik had just completed with his chess companion M. Pendrith a note on Schrödinger's "cat paradox" and the quantum Zeno effect when he died. Ludvik's wife Nina died in 2020. They are survived by daughters Karen and Marianne and eight grandchildren.

Tony Bracken and Vincent Hart
Brisbane, February 2023.

(Tony taught and co-authored papers with Ludvik at UQ for 20 years. They continued their research collaboration for a further 25 years after Ludvik's retirement, with their last joint paper appearing in 2018. Vincent first met Ludvik in Dublin in 1954, and later taught and worked with him at UQ for almost 30 years. Both remained close friends of Ludvik after their respective retirements. They thank his daughter Karen for providing key information about his early life.)

MATRIX

Tom Keegan*

MATRIX Collaborations

MATRIX has been delighted to host program organisers and participants in-person at Creswick in January-March (incl.) of this year across five research programs (https://www.matrix-inst.org.au/events-01/programs/page/2/).

Domestically MATRIX is continuing a PhD student research symposium series together with AMSI.

Check out the various funding opportunities below through our research programs and MATRIX-Simons funding schemes.

Upcoming Research Programs

MATRIX looks forward to the following eight research programs planned for the remainder of 2023:

https://www.matrix-inst.org.au/events-01/programs/

- MATRIX-RIMS Tandem Workshop: Geometric Analysis in Harmonic Analysis and PDE, 27–31 March 2023
    - Program Organisers: Michael Cowling (University of New South Wales, Sydney), Ji Li (Macquarie University), Neal Bez (Saitama University), Mitsuru Sugimoto (Nagoya University)
- MATRIX-IBS Workshop: Structural Graph Theory Downunder III, 17–23 April 2023
    - Program Organisers: David Wood (Monash University), Sang-il Oum (Institute for Basic Science and KAIST), Alex Scott (University of Oxford), Liana Yepremyan (Emory University)
- Monte Carlo Algorithms in Statistical Mechanics, 26 June – 7 July 2023
    - Program Organisers: Nathan Clisby (Swinburne University of Technology), Tim Garoni (Monash University), Catherine Greenhill (University of New South Wales, Sydney), Andrew Rechnitzer (University of British Columbia), Ying Wai Li (Oak Ridge National Laboratory)
- Algebraic Geometry and the Interface between Mathematics and Physics, 17–21 July 2023
    - Program Organisers: Peter Bouwknegt (Australian National University), Anand Deopurkar (Australian National University), Paul Norbury (The University of Melbourne)
- Spectrum and Symmetry for Group Actions in Differential Geometry II, 24 July – 4 August 2023

*MATRIX, Creswick, http://www.matrix-inst.org.au/

    - Program Organisers: Emma Carberry (The University of Sydney), Michael Eastwood (The University of Adelaide), Carolyn Gordon (Dartmouth College), Joseph Wolf (University of California, Berkeley)
- Hyperbolic PDEs and Nonlinear Evolution Problems, 18–30 September 2023
    - Program Organisers: Jesse Gell-Redman (The University of Melbourne), Andrew Hassell (Australian National University), Todd Oliynyk (Monash University), Volker Schlue (The University of Melbourne), Zoe Wyatt (King's College London)
- Extremal Problems in Graphs, Designs, and Geometries, 4–9 December 2023
    - Program Organisers: Daniel Horsley (Monash University), Anita Liebenau (University of New South Wales, Sydney), Tibor Szabo (Freie Universitat Berlin)

MATRIX-AMSI PhD Student Research Symposia

MATRIX and AMSI support PhD students in the mathematical sciences around Australia to design and run their own research symposia. The focus of each symposium is on exchanging ideas, collaborating and building relationships with your peers.

https://www.matrix-inst.org.au/events-01/phd-student-research-symposia/

In 2023, MATRIX and AMSI is hosting the Australian Student Symposium on Relativity, Cosmology, and Astrophysics.

Symposium Organisers: Jack Aimer (University of Canterbury), Louie Bernhardt (The University of Melbourne), Alex Goodenbour (University of Canterbury), Earl Lester (University of Tasmania), Spencer Magnall (Monash University), Elliot Marshall (Monash University), Petra Tang (The University of Adelaide), Salvatore Vultaggio (University of Otago), Frank Wang (University of Auckland)

MATRIX-AMSI PhD Student Research Collaboration Scheme

The MATRIX-AMSI PhD Student Research Collaboration scheme supports ongoing post-symposium / MATRIX research program collaboration between PhD students.

Australian based PhD students who participated in a MATRIX-AMSI sponsored PhD Student Online Research Symposium or a MATRIX Research Program/Workshop, can apply for funding through this scheme.

The scheme aims to support teams to continue their research collaboration for the purposes of exchanging ideas, building relationships with peers and working towards research outcomes.

MATRIX will provide:

- assessment on academic merit of the proposed collaboration by the MATRIX Scientific Committee guidance on your research collaboration plan
- up to $1,000 in funding per team, multiple teams possible per symposium

Applications for funding are to be submitted within 4 weeks post-symposium/ MATRIX Research Program/Workshop.

Further details at: https://www.matrix-inst.org.au/phd-student-research-collaboration-scheme-guidelines/

Call for MATRIX Research Programs

Anyone can apply to organise a MATRIX research program. Every research program should have ample unstructured time to encourage collaborative research. Longer programs can have an embedded conference or lecture series. Short workshops focusing on a special theme are also welcome. The MATRIX Family Fund (https://www.matrix-inst.org.au/support-for-families-matrix-family-fund/) provides additional support to participants with families.

The MATRIX Scientific Committee selects programs on scientific excellence as well as on the participation rate of high-profile international participants and/or business and industry partners, among other criteria.

The next deadline for research program proposals in 2023–2025 is **Friday, 22 September 2023**. Expressions of interest may be submitted at any time. Guidelines can be found at https://www.matrix-inst.org.au/guidelines/

Research Program Organisers are encouraged to supplement base funding from MATRIX through other schemes including the: MATRIX-Simons Research Funding opportunities, International Visitor Program of the University of Sydney Mathematical Research Institute; AMSI and AustMS/ANZIAM workshop funding scheme; and AustMS travel grants.
https://www.matrix-inst.org.au/funding-opportunities/

MATRIX-Simons Fellowship Program

The MATRIX-Simons Fellow program supports eminent international scholars in the mathematical sciences to make an extended visit to MATRIX, and to lead a research program in an emerging area or as part of a special theme year.

The Fellowship will provide a return airfare and cost for domestic travel to Australian universities (up to AUD3,850), and a stipend of AUD35,000 for housing and living expenses. For further information: https://www.matrix-inst.org.au/fellowship-program-guidelines/

Applications close: **Friday, 22 September 2023**

MATRIX-Simons Young Scholar Program

MATRIX-Simons Young Scholars will co-organise and participate in a MATRIX research program, and interact with MATRIX-Simons Fellows or other leading researchers from around the world. Scholars are encouraged to also make an extended visit to an Australian university on a collaborative project. The scholarship will provide a return airfare (up to AUD3,100), housing (up to AUD2,100) and a stipend of AUD1,050 for living expenses for a two-week visit to MATRIX and to support travel costs associated with a visit to an Australian university. For further information: https://www.matrix-inst.org.au/young-scholar-program-guidelines/

Applications close: **Friday, 22 September 2023**

MATRIX-Simons Collaborative Fund

MATRIX has launched a new fund to enhance collaborations and co-funding opportunities with external partners. The fund is made available by a generous grant from the US-based Simons Foundation. Access to this resource will become available to research program organisers with significant contributions to their MATRIX Research Program from funding bodies, institutions or external partners in business, industry and government, or private donors. Funding will be available to support research programs scheduled in 2022, 2023 and 2024. For further information: https://www.matrix-inst.org.au/collaborative-fund-guidelines/

Applications close: **Friday, 22 September 2023**

MATRIX-Simons International Family Fund

The MATRIX-Simons International Family Fund is designed to lower the barrier for participation in mathematics research by mathematicians with carer responsibilities. The Fund supports the costs of international airfares for children and partners or carers, on top of additional housing, living support and access to local childcare services (where required).

Funding will be allocated on a case-by-case basis according to need. The Fund provides a per diem for a family, which may include a partner or carer, to cover the costs of housing and meals. The Fund will support each family with up to 14 nights housing (up to $2,140) and living expenses (up to $780).

The Fund will also support a return economy airfare subsidy of up to $4,580 per family, and cover childcare costs up to $130 per child/day for up to 14 days.

MATRIX-Simons Travel Grant Scheme

MATRIX provides partial travel support in the form of grants of up to 75% of the cost of travel, capped at $2,500, to those invited to participate in research programs at Creswick in 2022, 2023 and 2024. Preference may be given to participants from

developing countries especially in the Asia-Pacific region and to applicants from diverse backgrounds.

This scheme is made available by a generous grant from the US-based Simons Foundation. For further information:
https://www.matrix-inst.org.au/travel-grant-scheme-guidelines/

Applications close six months prior to commencement of each research program/workshop.

MATRIX Family Fund

Australian-based researchers may access the MATRIX Family Fund (https://www.matrix-inst.org.au/guidelines/) that allows researchers with caring responsibilities to attend MATRIX research programs by providing additional housing and support for children as well as a partner or carer. For further information: https://www.matrix-inst.org.au/international-family-fund-guidelines/

MATRIX Minor Programs

MATRIX offers the opportunity to hold MATRIX minor programs by bringing small groups of researchers together for a week in Creswick for collaboration.

Support is given to groups that have an ongoing project, typically in the final stages of completion (e.g. writing up a paper), that come together in an environment where they can intensely work on the project, away from the usual distractions at their home institutes.

Groups will have access to:

- collaboration space in MATRIX House with individual desks, printing facilities, stationery, tea and coffee supplies
- other meeting spaces (if required)
- on-campus accommodation and meals

Expressions of Interest (EOIs) may be sent to the MATRIX Office (office@matrix-inst.org.au) at any time.

Further details:
https://www.matrix-inst.org.au/call-for-programs/matrix-minor-programs/

Online Seminar Series

MATRIX hosts an online seminar series. For information on upcoming seminars and access to recordings of past seminars, visit:
https://www.matrix-inst.org.au/events-01/online-seminars/

Become a Friend of MATRIX

Contributions to MATRIX help grow mathematical research in Australia and the Asia-Pacific region. Support from researchers in the mathematical sciences is key

to success in leveraging further support from funding agencies and donors, and will contribute to enhanced opportunities for students, early career researchers and under-represented groups.

https://www.matrix-inst.org.au/donations/

We would be delighted for you and those in your network/s to become a Friend of MATRIX and show your support with a tax-deductible gift. You will receive a Friend of MATRIX 2023 edition mug for a contribution of $150 or more, and recognition as a private donor and an invitation to a special event for $1,000 or more.

Further Information

MATRIX is a national partnership between the University of Melbourne, Monash University and the Australian National University, with the University of Queensland and the ARC Centre of Excellence for Mathematical and Statistical Frontiers (ACEMS) as Associate Members.

Comments, suggestions and requests are always welcome. Please send these, as appropriate, to:

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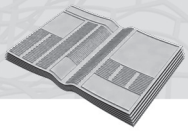
Tom Keegan is the Executive Officer of MATRIX. He has worked in research and graduate research management in the university sector in Victoria for the past 17 years. He provides expertise in managing high-level strategic initiatives, resources and operational planning for MATRIX. Tom is a member of the Australasian Research Management Society (ARMS) and the National Science Quiz Steering Committee and is a former member of the ARMS Victoria-Tasmania Chapter Executive. https://www.linkedin.com/in/tomkeegan2/



News

Completed PhDs

University of Melbourne

- Dr Behrooz Niknami, *Stochastic matching models*, supervisor: Peter Taylor
- Dr Anubhav Kaphle, *A novel SNP heritability model for heritability analyses and genomic prediction*, supervisors: David Balding, Doug Speed, Damjan Vukcevic
- Dr Michael Swaddle, *Deformation quantisation and Airy structures*, supervisor: Paul Norbury

University of Sydney

- Dr Gaston Burrull, *On the combinatorics of parabolic Schubert varieties*, supervisors: Geordie Williamson and Oded Yacobi
- Dr Giulian Wiggins, *Stratified categories and a geometric approach to representations of the Schur algebra*, Supervisors: Oded Yacobi and Kevin Coulembier

UNSW Canberra

- Dr Aleksander Simonič, *New effective results in the theory of the Friedman zeta-function*, supervisor: Tim Trudgian
- Dr Ethan Lee, *Explicit Mertens' theorems for number fields*, supervisor: Tim Trudgian

UNSW Sydney

- Dr Meiram Akhymbek, *Trotter-Kato product formula and an approximation formula for a propagator in symmetric operator ideals*, supervisors: Fedor Sukochev, Galina Levitina and Dmitriy Zanin
- Dr Michael Denes, *Transport and mixing by persistent and materially coherent ocean structures*, supervisors: Shane Keating and Gary Froyland
- Dr Max Kulinich, *A Markov chain method for weighting climate model ensembles and uncertainty estimation on spatially explicit data*, supervisors: Yanan Fan, Spiro Penev and Jason Evans (CCRC)
- Dr Sean Lynch, *The Slivered Into Parts Method for Semilocal Zeta Functions*, supervisors: Daniel Chan and Lee Zhao
- Dr Gavin Robertson, *Roundness, negative type and bi-lipschitz embeddings into Hilbert space*, supervisors: Ian Doust and Denis Potapov
- Dr Chris Rock, *Extracting features from eigenfunctions: higher Cheeger constants and sparse eigenbasis approximation*, supervisors: Gary Froyland and Mark Holzer
- Dr Kris Wu, *Optimal stopping problems with a random time horizon*, supervisors: Libo Li, Ben Goldys and Jake Olivier
- Dr Jiefei Yu, *Pricing and hedging of VIX derivatives in modified stochastic models*, supervisors: Leung Chan and Feng Chen

Awards and other achievements

La Trobe University

- Dr Rebecca Chisholm and her collaborators were awarded an NHMRC Ideas Grant at the end of last year, led by the Menzies School of Health Research, for an application entitled "Multi-species malaria transmission modelling to inform policy decisions". Chief Investigators: CIA Dr Angela Devine (Menzies School of Health Research), CIB Dr Rebecca Chisholm (LTU), CIC Dr David Price (University of Melbourne).
- Prof Marcel Jackson (Associate Dean Research and Industry Engagement) has been selected to join the 2023 ARC College of Experts.

Macquarie University

- Xuan Duong was recognised in The Australian newspaper's Research 2023 magazine as a leading researcher in his field.

Monash University

- David Wood was recognised in The Australian newspaper's Research 2023 magazine as a leading researcher in his field.

Queensland University of Technology

- Fawang Liu was recognised in The Australian newspaper's Research 2023 magazine as a leading researcher in his field.

RMIT University

- Professor Vipul Bansal and Associate Professor Rajesh Ramanathan (Centre for Advanced Materials and Industrial Chemistry), and Professor Irene Hudson (Statistics and Data Analytics) have been awarded ARC Discovery grant DP230101650 for the project Rational design of array-based nanozyme sensors. The project aims to obtain a deep understanding of molecular interactions at the nano-bio interface, and use this knowledge to develop a robust sensor technology for the rapid detection of food-borne pathogens in complex samples. The project proposes to employ an innovative approach that mimics the senses of smell and taste, where an array of aptamers are expected to work in synergy to precisely identify a target, providing an edge over current sensing technologies. Expected outcomes include a ready-to-go analytical tool for the detection of food contaminants. This should provide significant economic, health, and social benefits through supporting Australian food and health sectors, and the potential commercialisation of sensor technologies. Primary Field of research is 3106 Industrial Biotechnology; the project also involves Chemometrics, Artificial Intelligence, Statistics and Data Mining.

Swinburne University of Technology

- Associate Professor Tonghua Zhang was recognised in The Australian newspaper's Research 2023 magazine as a leading researcher in his field (Nonlinear Science).

University of Melbourne

- James Kerlidis was awarded the Applied Probability Special Interest Group prize for the best talk in applied probability at the AustMS conference in Sydney in December 2022. In his talk, James presented the work he did in his Masters thesis in Data Science, under the supervision of A/Prof Sophie Hautphenne and Dr Peter Braunsteins. James just started a PhD under the supervision of A/Prof Sophie Hautphenne, A/Prof Nathan Ross and Dr Peter Braunsteins.

University of Queensland

- Poh Wah Hillock was chosen as the recipient of the prestigious University Teacher of the Year Award from Universities Australia.
- Fred Roosta was recognised in The Australian newspaper's Research 2023 magazine as a leading researcher in his field.

University of Sydney

- Geordie Williamson was awarded the 2022 NSW Premier's Prize for Excellence in Mathematics, Earth Sciences, Chemistry or Physics.
- Zsuzsanna Dansco received the 2022 Vice-Chancellor's Award for Outstanding Contribution to Diversity and Inclusion.
- Pengyi Yang was awarded the 2023 Sydney Research Accelerator Prize.

University of Wollongong

- Aidan Sims was recognised in The Australian newspaper's Research 2023 magazine as a leading researcher in his field.

UNSW Sydney

- Trevor McDougall has received the 2022 Prime Minister's Prize for Science. Professor McDougall has had a transformative impact on the study of oceanography and ocean thermodynamics, and in furthering our understanding of the role of the ocean in regulating the Earth's climate. He is recognised for his discoveries of new ocean mixing processes and his work to redefine the thermodynamic definition of seawater. This has been adopted by the Intergovernmental Oceanographic Commission as the new international standard.
- Shane Keating is the Lead Chief Investigator on the 2022 ARC Linkage Grant LP220100515 Next-generation ocean current forecasting to improve maritime safety. This project aims to measure upper ocean currents at scales of 10–100 km in Australia's marine estate using pioneering satellite radar technology. The Surface Water and Ocean Topography

(SWOT) mission will map currents at 10 times the resolution of present-day satellites and revolutionise our understanding of ocean dynamics. Expected outcomes include validation of SWOT data in Australian waters and merging this data into Bureau of Meteorology ocean models. Downstream benefits include improved ocean forecasts for maritime safety, search-and-rescue, spill modelling, and marine conservation. At the same time, the project will build sovereign capability in emerging remote sensing technology with a legacy beyond the life of the SWOT mission.

- Gary Froyland has taken up an Einstein Visiting Fellowship at Freie Universität Berlin. He is aiming to use mathematical modeling to explore the predictability of complex dynamic phenomena in the oceans and atmosphere as well as in society. In the three-year role, he will work with experts from Freie Universitäat Berlin to develop an overarching mathematical abstraction in order to form connections between these very different areas of research. The researchers plan to investigate how atmospheric eddies and ocean currents form and disappear to help address unresolved questions in the field of fluid dynamics. Professor Froyland will also examine the extent to which these types of methods can be applied to modeling the emergence or breakup of social coherence.
- Fedor Sukochev was recognised in The Australian newspaper's Research 2023 magazine as a leading researcher in his field.
- Three School of Mathematics and Statistics students were awarded 2022 University Medals. They are Jason Lambe (Statistics), Noah Vinod (Applied Mathematics) and Chris Zeng (Pure Mathematics). The most distinguished academic award to be bestowed on an undergraduate, the University Medal recognises exceptional achievement.

Appointments, departures and promotions

Australian National University

- Joshua Robinson has completed his term at ANU.

Curtin University

- Dr Honglei Xu has been promoted to Associate Professor.

Deakin University

- Simon James has been promoted to Associate Professor.
- Renier Diaz-Millan has been promoted to Lecturer level B.

Federation University

- Minh Dao has left to join RMIT.

La Trobe University

- Daniel Fryer has been appointed as Associate Lecturer in Statistics.

- Gerardo Gonzales Robert and Ben Ward have joined the department of mathematical and physical sciences (Bendigo) to work as Research Associates with Mumtaz Hussain.
- Deborah Jackson (Maths Hub Manager) has been promoted to Senior Lecturer.

RMIT University

- Minh N. Dao has recently (November 2022) been appointed as a senior lecture in Mathematics. He received the BSc (Hons) and MSc degrees in mathematics from Hanoi National University of Education, Vietnam, and the PhD degree in applied mathematics from the University of Toulouse, France. Prior to this, he was a Lecturer with Hanoi National University of Education, Vietnam, a Postdoctoral Fellow with The University of British Columbia, Canada, a Research Associate with The University of Newcastle and The University of New South Wales, Australia, and a Lecturer with Federation University Australia. His research interests include mathematical optimization, convex and variational analysis, control theory, signal processing, and machine learning. Dr Dao received the Annual Best Paper Award from the Journal of Global Optimization in 2017. He is serving as an Associate Editor for Springer's journal of Set-Valued and Variational Analysis.
- Mahshid Sadeghpour has recently been appointed as an Early Career development fellow (ECDF) at RMIT University. She submitted her PhD thesis on Privacy-Preserving Biometrics in July 2022 under the supervision of Stephen Davis, Arathi Arakala, and Kathy Horadam. Her research interests include biometric template protection, privacy-preserving machine learning, pattern recognition, and computer vision. Since the submission of her PhD research, she has been offered multiple research positions including a research fellow position at Deakin University, a senior research associate position at UNSW, and a data scientist position at the ANU's Social Research Centre where she had the opportunity to gain industrial experience. For the research she conducted during her PhD program, she has received awards from internationally recognised research associations such as the U.S. National Science Foundation and International Association for Pattern Recognition and won multiple competitions including People's Choice award: 3MT Competition at WIMSIG 2021 Conference, and the Research Elevator Pitch 2021 competition at World Cities World Class University network. In 2022, she was selected to receive the Young Scientist Research Prize by the Royal Society of Victoria for her PhD research. Mahshid has developed "the first privacy-preserving retinal recognition system" and generated "the first large-scale high-quality synthetic retinal image dataset". Two of her most recent publications (co-authored with her PhD supervisors) are "Protection of Sparse Retinal Templates using Cohort-based Dissimilarity Vectors", and "GRETINA: A large-scale high-quality generated retinal image dataset for security and privacy assessment". Mahshid is a member of IEEE (since Jan 2016),

Biometrics Institute (since Aug 2018), AustMS (since Feb 2019), and the Royal Society of Victoria (since May 2022).

- Kerri Morgan has joined as a senior lecturer. She was previously at Deakin University and Monash University.
- Devindri Perera has joined as a lecturer in Statistics. She received her undergraduate degree in mathematics with Honours; after which she completed a master's degree in statistics at the Tokyo Institute of Technology. In 2007 Devindri obtained her doctoral degree in statistics from the University of Sydney, Sydney Australia. Before joining the RMIT, she worked as a lecturer in statistics at Murdoch University, Perth WA, and as a postdoctoral researcher at the Genome Institute, Singapore, and at the Menzies Research Institute, Hobart, Tasmania.

Swinburne University

- Federico Frascoli has been promoted to Professor.
- Paul Hernandez Martinez has been promoted to Associate Professor.

University of Melbourne

- Dr Emma Horton has been appointed as Research Fellow on the ARC Discovery Project "Computational methods for population-size-dependent branching processes" with Chief Investigators Sophie Hautphenne, Melanie Massaro and Giang Nguyen.

University of South Australia

- Amie Albrecht has been promoted to Professor, and has taken up a role as Professor of Mathematics Education in UniSA Educations Futures.

University of Southern Queensland

- Dr Hamid Shobeiri Nejad has joined University of Southern Queensland as a Lecturer in Statistics.
- Dr Zahirul Hoque has joined University of Southern Queensland as a Senior Lecturer in Statistics.
- Professor Shahjahan Khan has resigned from University of Southern Queensland.

University of Sydney

- Haotian Wu has been promoted to Senior Lecturer.
- Zsuzsanna Dansco has been promoted to Associate Professor.

UNSW Canberra

- Dr Aleksander Simonič joined the faculty as Associate Lecturer in January 2023.

UNSW Sydney

- Kristen Hunter has joined the School of Mathematics and Statistics as Senior Lecturer in Statistics.
- Daniel Chan was promoted to Professor for his outstanding contributions to research, education, and leadership.
- After almost eight years, Professor Daniel Chan has retired from the role of Head of Pure Mathematics in the School. Professor Catherine Greenhill has taken over the role of Head of Pure Mathematics.

New Books

Victoria University

Pintu Bhunia, Silvestru Sever Dragomir, Mohammad Sal Moslehian, Kallol Paul (2022). *Lectures on Numerical Radius Inequalities*, Springer, Cham, Series Infosys Science Foundation Series https://doi.org/10.1007/978-3-031-13670-2

Conferences and Courses

Conferences and courses are listed in order of the first day.

Information given here is the most up to date available to us at the time of going to press. Please check the relevant webpages, or contact the organisers directly, for any updates.

For a summary of upcoming MATRIX programs at Creswick in the coming months, please see the report by Tom Keegan in this issue. For details of all upcoming events, consult
https://www.matrix-inst.org.au/events-01/matrix-events/#post-286

Asian-Oceanian Women in Mathematics

Dates: 24–28 April 2023
Venue: ICTS, Bangalore, India and Online
Web: https://www.icts.res.in/discussion-meeting/AOWM

Asian-Oceanian Women in Mathematics was formed on 1 August 2022, in online mode, with the support of the Committee for Women in Mathematics of the IMU, in order to facilitate interactions among women mathematicians in these regions. AOWM hopes to provide an empathetic platform to women mathematicians to share their concerns, and to highlight and bring to the forefront their achievements.

The first (hybrid) meeting of the AOWM will be held under the auspices of the International Centre for Theoretical Sciences, Bangalore. One of the primary goals of this meeting is to decide the future course of academic activities in these regions.

We also plan to have a number of lectures by distinguished as well as young promising women mathematicians.

Further, we will have interactive sessions in hybrid mode with women students and postdocs from all over the world to enlighten them on various career opportunities in research, and the means and support systems available to overcome any challenges they might meet in their pursuits.

Australia-NZ Student Conference on General Relativity

Dates: 8–10 May 2023
Venue: MATRIX, Creswick
Web: https://www.gravity.ac.nz/rca23/

This is an online event for postgraduate students in General Relativity, Cosmology, and Astrophysics. Research in general relativity draws on many sources from differential geometry and classical field theory to astrophysical observations and techniques in numerical analysis. We hope to provide a platform for postgraduate students with expertise in these diverse fields to share their research and to foster interdisciplinary collaboration across the Tasman.

Along with student talks, we will hear from a number of researchers in Australia and New Zealand who work with general relativity and there will be spaces for networking and discussion. Local student hubs are also being organised, so you can attend together with other students in your region.

Contact: For queries about the symposium, please contact Elliot Marshall at elliot.marshall@monash.edu

AMSI Winter School on Modelling our Changing Biosphere

Dates: 3–14 July 2023
Venue: Queensland University of Technology
Web: https://amsi.org.au/events/event/amsi-winter-school-2023-on-modelling-our-changing-biosphere/

The Winter School will centre around the planet's biosphere (the coupled system of physical and biological systems that support human life), and how mathematical modelling can help conserve and sustain it in the face of anthropogenic change.

Themes and speakers to be announced.

SMC Down Under: Workshop on Sequential Monte Carlo

Dates: 10–13 July 2023
Venue: Queensland University of Technology
Web: https://research.qut.edu.au/qutcds/events/smc-down-under-23/

Sequential Monte Carlo is a robust computational method for simulation-based inference including Bayesian statistics. It can facilitate sampling from complex probability distributions and optimising challenging functions where other methods fail. Exciting new research has extended SMC to distributed settings and developed novel SMC algorithms for new applications. This workshop will

foster discussion and collaboration around new and important SMC and particle methods, including new applications of SMC to real world problems. To spur discussion and interest, the workshop content will be multifaceted. It will include an introduction to SMC, opportunities for attendees to highlight and disseminate cutting-edge research, talks on best-practice use of SMC and new SMC algorithms, as well as theoretical developments in SMC. During the workshop, ample time will be devoted to facilitated small-group discussions on new opportunities in SMC applications and novel algorithmic and theoretical advancements. The organisation of this workshop has considered a wide range of people, making reasonable adjustments to its location and format to ensure that barriers are removed that would otherwise prevent participation.

International conference on nonlinear partial differential equations

Dates: 10–14 July 2023
Venue: The University of Sydney
Web: https://www.maths.usyd.edu.au/u/neil80/

This conference is being held in honour of Professor Neil Trudinger's 80th birthday to celebrate his important contributions in nonlinear partial differential equations and geometric analysis. The event aims to host several leading mathematicians as well as to provide an opportunity for young researchers and PhD students to get together to present their new works and discuss recent advances in the field, share ideas and generate/strengthen collaborations. The conference will showcase the latest developments on several themes in partial differential equations and their applications, especially those to which Professor Trudinger has made lasting contributions. These include nonlinear elliptic and parabolic equations, calculus of variations, optimal transportation and geometric analysis.

String Math 2023

Dates: 10–14 July 2023
Venue: The University of Melbourne, Parkville Campus
Web: https://stringmath2023.sciencesconf.org

The prestigious annual String Math conference will be held in Australia for the first time in 2023, hosted by The University of Melbourne. String Math is an annual conference held in different locations around the world. Its aim is to cover the most important recent developments at the interface between string theory, quantum field theory and mathematics, while keeping a rough balance between physics and mathematics, stimulating interactions between the two communities. The conference will assemble the top people in the field. The schedule may include 'paired talks' by mathematicians and physicists on the same topic, as well as open or focussed discussion sessions. The conference will include outreach events such as a public lecture to be publicised via established networks through schools in Victoria.

International Congress on Industrial and Applied Mathematics ICIAM 2023, Tokyo, Japan

Dates: 20–25 August 2023
Venue: Waseda University, Tokyo, Japan
Web: https://iciam2023.org

Every session at ICIAM 2023 will be held at Waseda University in person. For participants who have to attend the conference online for appropriate reasons, all conference rooms are capable of hybrid-style meetings.

Call for Posters

Contributed presentations in poster format are invited in all areas consistent with the congress themes. The author that intends to present a poster at ICIAM 2023 must submit a title and a brief abstract not to exceed 75 words. Contributed presentations in poster format can be submitted via https://iciam2023.org/1030#Call_for_Posters

Onsite poster presentation submission has two categories, Applied Mathematics and Industrial Mathematics. Even if you give an oral talk in the congress, you can submit one poster for Applied Mathematics and one poster for Industrial Mathematics, respectively.

Closing date for submissions of posters: 20 April 2023.

Acceptance notification for posters: within two weeks after submission of each poster.

Table Mountain Delta 2023

Dates: Sunday 26 November to Friday 1 December 2023
Venue: Cape Town, South Africa
Web: https://uctcmc.eventsair.com/delta-maths-conference-2023/

The Southern Hemisphere Delta conferences attract educators and researchers interested in tertiary mathematics and statistics education. The 14th in the series will be held from at The Graduate School of Business, University of Cape Town, set in the heart of the Victoria and Alfred Waterfront. The conference promises to dish up a feast of lively academic interactions, breath-taking scenery, diverse cultural experiences, and sumptuous cuisine.

Important Dates

9 April 2023: Final date for full refereed papers in a special issue of the International Journal of Mathematical Education in Science and Technology, IJMEST (suggested limit: 6000–8000 words, excluding figures)

15 August 2023: Final date for submission of full papers for the Conference Proceedings (limit: 5000 words, excluding references)

30 September 2023: Final date for submission of abstracts for posters, workshop proposals, and abstract-only presentations

67th Annual Meeting of the Australian Mathematical Society

Dates: 4–8 December 2023
Venue: University of Queensland
Conference Director: Artem Pulemotov

Australian Statistical Conference (ASC) and Australian Conference on Teaching Statistics (OZCOTS)

Dates: 10–15 December 2023
Venue: University of Wollongong
Web: https://www.asc2023.org/

The 15th International Congress on Mathematical Education (ICME-15)

Dates: 7–14 July 2024
Venue: International convention Centre Sydney
Web: under construction

Vale

Noel Smyth

Professor Noel Smyth died in Edinburgh, UK on the 5th February, aged 64.

Noel was a professor of applied mathematics at the University of Edinburgh — his fields of research included nonlinear waves and optics.

Noel grew up in Queensland; he was a graduate of Queensland University and the California Institute of Technology. He held academic positions at the University of Melbourne, UNSW and the University of Wollongong, before migrating to Scotland in the early 1990s, to take up an academic position at the University of Edinburgh.

Noel was an enthusiastic world traveller (and a platinum frequent flyer) and visited both Australia and Mexico on a yearly basis. Noel was very generous with his time, and undertook collaborative research with many academics and students in both those countries. I was Noel's post-doctoral fellow in the late 1980s and remain very grateful for his friendship and mentoring, both at that time and in later years.

He organized a series of conferences, on nonlinear waves and optics, in interesting locations — India, Turkey, Spain, Morocco, Mexico, Scotland and Wollongong. I was fortunate to go to most of these meetings and fondly remember the tourist excursions, such as our trip to the Gallipoli peninsula.

Noel was a gifted linguist, being fluent in both Scottish Gaelic and Spanish.

Deepest condolences to his wife Julie and son Calum.

Tim Marchant
University of Melbourne and University of Wollongong

Visiting mathematicians

International visitors are listed here. Details (as supplied) are presented in the format: name of visitor; home institution; dates of visit; field of interest; host institution; contact for enquiries.

Dr Wencheng Hu; Zhongyuan University of Technology, Zhengzhou, China; August 2022 to August 2023; soliton dynamics in two-dimensional media; USQ; Yury Stepanyants

Professor Mark MacLean; UBC; March 1 to May 31; University of Melbourne; Deborah King

Dr Sheelan Abdulkader Osman; Soran University; A high order approximation for the Caputo fractional derivative; University of Southern Queensland; Trevor Langlands

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Journal of the Australian Mathematical Society

Volume 114, Issue 1, February 2023

https://www.cambridge.org/core/journals/journal-of-the-australian-mathematical-society/issue/187D0B287B431C06F5FF5339C84E85A3?utm_source=SFMC&utm_medium=email&utm_content=Issue+URL&utm_campaign=New+Cambridge+Alert+-+Issues&WT.mc_id=New+Cambridge+Alert+-+Issues

Published online January 2023

Research articles

Representing structured semigroups on étale groupoid bundles
Tristan Bice, pp. 1–49,
doi: 10.1017/S1446788722000064, published online on 13 April 2022

Some homological properties of category $\mathcal{O}$ for Lie superalgebras
Chih-Whi Chen, Volodymyr Mazorchuk, pp. 50–77,
doi: 10.1017/S1446788721000239, published online on 21 January 2022

Solenoidal maps, automatic sequences, van der Put series, and Mealy automata
Rostislav Grigorchuk, Dmytro Savchuk, pp. 78–109,
doi: 10.1017/S1446788722000027, published online on 6 April 2022

Gaps in the Thue–Morse word
Lukas Spiegelhofer, pp. 110–144,
doi: 10.1017/S1446788721000380, published online on 25 January 2022

Other

Front Cover (OFC, IFC) and matter
JAZ volume 114 issue 1 Cover and Front matter
Journal of the Australian Mathematical Society,
Volume 114, Issue 1, February 2023, pp. f1–f2,
doi: 10.1017/S1446788722000234, published online on 13 January 2023

Back Cover (OBC, IBC) and matter
JAZ volume 114 issue 1 Cover and Back matter
Journal of the Australian Mathematical Society,
Volume 114, Issue 1, February 2023, pp. b1–b2
doi: 10.1017/S1446788722000246, published online on 13 January 2023

Journal of the Australian Mathematical Society

Volume 114, Issue 2, April 2023

https://www.cambridge.org/core/journals/journal-of-the-australian-mathematical-society/issue/31443F80ECEACD0F4D9A2778F825E454?utm_source=SFMC&utm_medium=email&utm_content=Issue+URL&utm_campaign=New+Cambridge+Alert+-+Issues&WT.mc_id=New+Cambridge+Alert+-+Issues

Published online March 2023

Research articles

Cayley–Abels graphs and invariants of totally disconnected, locally compact groups
Arnbjörg Soffía Árnadóttir, Waltraud Lederle, Rögnvaldur G. Möller,
pp. 145–177,
doi: 10.1017/S1446788722000040, published online on 13 April 2022

Lower-order terms of the one-level density of a family of quadratic Hecke L-functions
Peng Gao, Liangyi Zhao, pp. 178–221,
doi: 10.1017/S1446788721000410, published online on 22 February 2022

Small-scale equidistribution of random waves generated by an unfair coin flip
Miriam J. Leonhardt, Melissa Tacy, pp. 222–252,
doi: 10.1017/S1446788721000185, published online on 29 November 2021

Twists, crossed products and inverse semigroup cohomology
Benjamin Steinberg, pp. 253–288,
doi: 10.1017/S144678872100015X, published online on 8 October 2021

Other

Front Cover (OFC, IFC) and matter
JAZ volume 114 issue 2 Cover and Front matter
Journal of the Australian Mathematical Society,
Volume 114, Issue 2, April 2023, pp. f1–f2,
doi: 10.1017/S1446788722000258, published online on 6 March 2023

Back Cover (OBC, IBC) and matter
JAZ volume 114 issue 2 Cover and Back matter
Journal of the Australian Mathematical Society,
Volume 114, Issue 2, April 2023, pp. b1–b2
doi: 10.1017/S144678872200026X, published online on 6 March 2023

Nominations sought for the 2023 Australian Mathematical Society Medal

The Medal Committee for the 2023 Australian Mathematical Society Medal is now seeking nominations and recommendations for possible candidates for this Medal, which will be awarded to a member of the Society for distinguished research in the Mathematical Sciences.

Nominations, which close on **26th May 2023**, should comply with rule 9 below, and should be uploaded at http://journal.austms.org.au/ojs/index.php/AMPA/. Nominators should receive an acknowledgement of the nomination: if this is not received, please contact the Committee Chair. Nominations will not be automatically rolled over from previous years. For further information, please contact the Chair of the 2023 AustMS Medal Committee, Prof M. Simpson (matthew.simpson@qut.edu.au). The other members of the 2023 Medal Committee are Prof M. Luczak (Outgoing Chair), Prof G. Williamson (Incoming Chair), Em Prof R. Quispel (one year), and Prof S. Dipierro (one year).

A list of past AustMS Medal winners appears at https://austms.org.au/awards-grants/awards/the-australian-mathematical-society-medal/

Rules for the Australian Mathematical Society Medal

(i) There shall be a Medal known as "The Australian Mathematical Society Medal".

(ii) (i) This will be awarded annually to a Member of the Society for distinguished research in the Mathematical Sciences, who has been conferred a PhD (or equivalent) (a) no more than 15 years before 31st December of the year in which the Medal is awarded, or (b) with allowable periods of career interruption that would be commensurate with part 2(i)(a). Through to 2023 nominees that are no more than 40 years of age as at 31st December of the year in which the Medal is awarded will also be accepted and the Medal Committee may waive this age limit by up to five years in cases where there have been significant interruptions to a mathematical career.

The term "commensurate" allows for part-time employment of equivalent duration to be considered; "career interruption" should include those accepted by the Australian Research Council in their Fellowship application guidelines.

The final decision on allowable periods due to career interruption will be made by the AustMS Medal Committee. Likewise, this Committee may accept for 'conferral of PhD' that all requirements for a PhD have been met, or rule that an alternative pathway of recognised distinguished research is equivalent to the PhD requirement. In the

case that a candidate for the Medal has not received a doctoral degree, the Committee will make their best determination of a date analogous to that of a PhD conferral.

Nomination of a candidate for the AustMS medal who has had a career interruption should include a statement to this effect, including a quantification of the total number of years of interruption, plus present details of recognised distinguished research if they have not received a doctoral degree.

(ii) A significant proportion of the research work should have been carried out in Australia.

(iii) In order to be eligible, a nominee for the Medal has to have been a member of the Society for the calendar year preceding the year of the award; back dating of membership to the previous year is not acceptable.

(iii) The award will be approved by the President on behalf of the Council of the Society on the recommendation of a Selection Committee appointed by the Council.

(iv) The Selection Committee shall consist of 5 persons each appointed for a period of 3 years and known as "Incoming Chair", "Chair" and "Outgoing Chair" respectively, together with a fourth and fifth person appointed each year for one year only.

(v) The Selection Committee will consult with appropriate assessors.

(vi) The award of the Medal shall be recorded in one of the Society's Journals along with the citation and photograph.

(vii) The Selection Committee shall also prepare an additional citation in a form suitable for newspaper publication. This is to be embargoed until the Medal winner has been announced to the Society.

(viii) One Medal shall be awarded each year, unless either no one of sufficient merit is found, in which case no Medal shall be awarded; or there is more than one candidate of equal (and sufficient) merit, in which case the committee can recommend the award of at most two Medals.

(ix) Nominations for the Australian Mathematical Society Medal should include: (a) A nomination form (available from the AustMS website) to be completed by the nominee (b) an extended citation, not more than two pages in length, arguing the case for awarding the Medal to the nominee; (c) a full list of publications of the candidate, with the most significant marked by an asterisk; (d) a curriculum vitae of the candidate's professional career, highlighting any achievements which add support to the nomination; and (e) the names of three suitable referees, along with a brief statement as to their appropriateness.

The Rules are listed at:
https://austms.org.au/awards-grants/awards/the-australian-mathematical-society-medal/the-australian-mathematical-society-medal-rules/

Nominations sought for the 2023 Gavin Brown Prize

The 2023 Gavin Brown Prize Selection Committee is now seeking nominations and recommendations for possible candidates for this prize, to be awarded for an outstanding and innovative piece of research in the mathematical sciences published by a Member or Members of the Society. The award will be for a single article, monograph or book consisting of original research, and published in the 9 calendar years 2013–2021.

Nominators should complete the Nomination Form and also provide a brief (1–2 pages) summary of what makes the nominated publication important and original, with appropriate references to prior or subsequent work in the field. These should be lodged through the AMPA web form (link below). Nominators are requested to suggest names of three assessors.

Nominations close on **26th May 2023** and should be uploaded at
http://journal.austms.org.au/ojs/index.php/AMPA/
Nominators should receive an acknowledgement of the nomination: if this is not received, please contact the Committee Chair. For further information, please contact the Chair of the 2022 Gavin Brown Prize Selection Committee, Professor M. Giudici (michael.giudici@uwa.edu.au). The other members of the 2023 Gavin Brown Prize Selection Committee are Dr J. Clutterbuck (Outgoing Chair), Professor A. Xia (Incoming Chair), Prof M. Myerscough (one year), and Prof B. Parker (one year).

A list of past Gavin Brown Prize winners appears at https://austms.org.au/awards-grants/awards/gavin-brown-best-paper-prize/ gavin-brown-prize-winners/

Rules for the Gavin Brown Prize

1. The Gavin Brown Prize will be awarded annually for an outstanding and innovative piece of research in the mathematical sciences published by a Member or Members of the Society.
2. Each award will be for a single article, monograph, or book, consisting of original research, and published in the 9 calendar years $Y-10$ to $Y-2$, where Y is the year of the award.
3. To be eligible for the award of the Gavin Brown Prize, a publication must have at least one author who must
   i) be a member of the Society, and have been a member of the Society for the calendar year at the time of publication of the paper (back-dating of membership is not allowed);
   ii) normally be resident in Australia, and have been normally resident in Australia at the time when the research was carried out.

4. In the case of publications with multiple authors, the prize will be shared by all authors. The existence of authors who do not meet the conditions in Rule 3 will not preclude this award, although the Selection Committee may take it into account in assessing the achievement of the author(s) who do meet those conditions.
5. The Selection Committee may deem a publication ineligible if an author has previously received an award from the Australian Mathematical Society for a body of research which included the publication in question.
6. Nominations for the Gavin Brown Prize will be called for in the first half of each year. A publication may be nominated for the award by anyone who is not an author of that publication.
7. The award will be decided by a Selection Committee appointed by the Council.
8. The Selection Committee will consist of 5 persons:
   (i) 3 persons each appointed for a period of 3 years, namely a Chair, an Incoming Chair who will become the Chair in the following year, and an Outgoing Chair who has been the Chair in the preceding year;
   (ii) 2 persons each appointed for one year only.
9. The Selection Committee may consult with appropriate external assessors. Nominators are requested to suggest names of three assessors.

The Rules above are listed at
https://austms.org.au/awards-grants/awards/gavin-brown-best-paper-prize/

Nominations sought for the 2023 George Szekeres Medal

The Medal Committee for the 2023 George Szekeres Medal is now seeking nominations and recommendations for possible candidates for this Medal. The George Szekeres Medal is awarded annually for outstanding research achievement for work done substantially in Australia. Nominations close on **26th May 2023**, should comply with rule 6 below and should be uploaded at http://journal.austms.org.au/ojs/index.php/AMPA/

Nominators should receive an acknowledgement of the nomination: if this is not received, please contact the Chair of the 2023 George Szekeres Medal Committee, Professor N. Thamwattana (Natalie.Thamwattana@newcastle.edu.au).
The other members of the 2023 George Szekeres Medal Committee are Professor A. Bassom (Outgoing Chair), Prof M. Varghese (Incoming Chair), Prof J. de Gier (one year), and Prof J. Ramagge (one year). A list of past winners of the medal can be found at
https://austms.org.au/awards-grants/awards/the-george-szekeres-medal/

Rules for the George Szekeres Medal of the AustMS

Rule 1. The award is for a mathematical scientist who is a member of the Australian Mathematical Society and normally resident in Australia.

Rule 2. The Medal is awarded annually, but only to a candidate of sufficient merit.

Rule 3. At most one Medal is to be awarded each year.

Rule 4.
- **(i)** The award is for a sustained outstanding contribution to research in the mathematical sciences. The candidate should have been resident in Australia when the bulk of the work was completed.
- **(ii)** The successful candidate will have an excellent record of promoting and supporting the discipline, through activities such as extensive graduate student supervision, outstanding contributions to leadership in the Australian Mathematical Society, or other activities which have materially promoted the mathematical sciences discipline within Australia.

Rule 5.
- **(i)** The George Szekeres Medal can be awarded to a recipient of the Australian Mathematical Society Medal, provided that the sustained outstanding contribution to research in Rule 4(i) is subsequent to the work for which the Australian Mathematical Society Medal was awarded.
- **(ii)** The George Szekeres Medal cannot be awarded to the same person on more than one occasion.

Rule 6. Nominations should include: (a) an extended citation, not more than two pages in length, arguing the case for awarding the Medal to the nominee; (b) a shorter citation, of not more than 100 words, which may be used to report the candidate's achievements in the event that the nomination is successful; (c) a full list of publications of the candidate, with the most significant (up to a maximum of 20) marked by an asterisk; (d) a curriculum vitae of the candidate's professional career, highlighting any achievements which add support to the nomination; and (e) the names of between three and six suitable referees, along with a brief statement as to their appropriateness.

The Rules above are listed at https://austms.org.au/awards-grants/awards/the-george-szekeres-medal/the-george-szekeres-medal-background/

News from the annual conference

The Society's 66th Annual Meeting was held in December, run by the University of New South Wales. The Director, Assoc Professor Pinhas Grossman, his team of local organisers and the Program Committee, led by the Vice-President (Annual Conferences), Professor Regina Burachik, were responsible for a very successful conference.

The following matters from the meeting are provided here for the information of those who could not attend. Congratulations to all award recipients.

(1) The Australian Mathematical Society Medal for 2022 was awarded to Professor Guoyin Li of the University of New South Wales.

(2) The 2022 Gavin Brown Prize for Best Paper was awarded to Professor Mark Holmes of the University of Melbourne and Professor Emeritus Edwin Perkins of the University of British Columbia for their paper 'On the range of lattice models in high dimensions', *Probability Theory & Related Fields* **176**, no. 3 (2020), 941–1009.

(3) The George Szekeres Medal was awarded to Professor Igor Shparlinski of the University of New South Wales.

(4) The 2022 Mahony-Neumann-Room Prize was awarded to Dr Satish K. Pandey and Professor Vern I. Paulsen from the University of Waterloo for their paper 'A spectral characterization of AN operators', *J. Aust. Math. Soc.* **102**, no. 3, (2017), 369–391.

(5) The 2022 B.H. Neumann Prize was awarded to two recipients:
- Mitchell Curran (University of Sydney), who spoke in the Dynamical Systems and Ergodic Theory session with a talk entitled 'Counting eigenvalues in Hamiltonian systems via the Maslov index'; and
- Emanuela Gussetti (Bielefeld University), who spoke in the Stochastic differential equations: From Theory to Numerical Analysis session, with a talk entitled: 'Existence of an ergodic invariant measure to the stochastic Landau-Lifschitz-Gilbert equation in 1D'.

Four honourable mentions were awarded to
- Madeline Nurcombe (University of Queensland) who spoke in the Mathematical Physics session with a talk entitled 'The Ghost Algebra';
- Alexander He (University of Queensland) who spoke in the Topology session with a talk entitled 'Greedy retriangulation II: tunnels and handlebodies';
- Christian Bagshaw (UNSW) who spoke in the Number theory and Algebraic Geometry session with a talk entitled 'Lattices and their applications in function fields'; and
- James Stanfield (University of Queensland) who spoke in the Geometry with Symmetries session with a talk entitled 'Recent progress on the curvatures of Gauduchon connections'.

(6) At the AGM, it was confirmed that the sixty-seventh annual meeting of the Society will be held in Brisbane at the University of Queensland, December 4th to December 8th, 2023. Assoc Prof Artem Pulometov is nominated conference director for this meeting.
It was also confirmed that the sixty-eighth annual meeting of the Society be held at the University of Auckland, as a joint meeting with the American Mathematical Society (AMS) and the New Zealand Mathematical Society (NZMS) from Monday 9th December to Friday 13th December 2024 (dates to be confirmed). The conference Director has not yet been nominated for this meeting.

Applications for AMSI-AustMS Scientific Workshop Funding

Are you interested in organising a mathematical sciences research event between March and December 2023? AMSI and AustMS invite you to apply for funding, promotional support and more.

Proposals for face-to-face and online events are welcomed. PhD students, early-career researchers and first-time organisers are strongly encouraged to apply. Don't need financial support? See link for other benefits or contact AMSI directly at funding@amsi.org.au.

Learn more at /rhed.amsi.org.au/workshop-funding/

Applications are considered twice a year. If funding is being sought from both AustMS and AMSI, a single application should be made at the link above.

If funding is not being sought from AMSI, please contact Dr Deborah Jackson, Secretary AustMS, Secretary@austms.org.au

AustMS Accreditation

The following members have been accredited as Fellows (FAustMS):

- Professor Catherine Greenhill of the University of New South Wales;
- Professor Guoyin Li of the University of New South Wales;
- Assoc Professor Timothy Trudgian of UNSW Canberra, Australian Defence Force Academy;
- Emeritus Professor Jie Sun of Curtin University.

Deborah Jackson
Honorary Secretary AustMS
Email: Secretary@AustMS.org.au

Deborah Jackson (née Trueman) is Senior Lecturer at La Trobe University. She began her academic career at Monash University and then moved to Swinburne University. After several years back at Monash, she joined La Trobe in 2010. Deborah was honorary Chair of the Victorian Algebra Group from 1996 to 2003 and its Secretary from 1994 to 1995. Deborah took over as Secretary of the Society in September 2019.

The Australian Mathematical Society

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Membership and Correspondence

Applications for membership, notices of change of address or title or position, members' subscriptions, correspondence related to accounts, correspondence about the distribution of the Society's publications, and orders for back numbers, should be sent to the Treasurer. All other correspondence should be sent to the Secretary. Membership rates and other details can be found at the Society web site: www.austms.org.au.

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The *Bulletin of the Australian Mathematical Society* aims at quick publication of original research in all branches of mathematics. Two volumes of three numbers are published annually.

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