IMU-Net 103: September 2020
A Bimonthly Email Newsletter from the International Mathematical Union
Editor: Martin Raussen, Aalborg University, Denmark

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1. EDITORIAL: MATHEMATICAL GLOBALIZATION

During a Zoom meeting for presenting M.S. Narasimham the Spirit of Abdus Salam Award in late August, I spoke on the role ICTP played in mathematical research and education in China in our recent history. In the 80s and 90s, after a long period of isolation from the outside world, the level of mathematical research in China was not high. Many young scholars were eager to learn advanced mathematics and tried to be involved in the forefront of mathematical research. For them, ICTP provided pivotal opportunities. They were invited to spend some time there, first by J. Eells and then by M.S. Narasimhan. They learned geometric analysis and algebraic geometry and returned to China. Many then went on to become leaders in the Chinese mathematics community, and they have played a crucial role in the development of mathematics in China over the last two decades.

Starting in the early 80s, many Chinese students, including myself, went to the United States for their PhD studies and benefited from the excellent academic environment there. They had had solid mathematical training as undergraduates in China and provided an indispensable source of top-level students for leading American graduate schools. They interacted with domestic as well as other international students. Together, they expanded the frontiers of mathematical research and made their mark in civilization. Some Chinese students stayed on to become faculty members in leading US institutions, contributing to mathematical research and education in their adopted country. For myself, I first studied at UCSD and then at Harvard where I got my PhD. After that, I worked at leading US universities for many years. In the departments I once worked, more than two thirds of the graduate students came from abroad and many of my colleagues held foreign passports. I think that this is still the case, and I felt lucky to have advised many talented students and post-doctors who came from different continents. Now I am back at Peking University where, though filled with many outstanding Chinese students, I lost the chance to meet and advise top non-Chinese students. I often told my Chinese colleagues at Peking University that this is my biggest loss after leaving Princeton University, and we have to work harder to attract young mathematical talents from other parts of the world; I believe that it is one of the most important criteria for us to reach towards a top world leading university.

Mathematical globalization has existed since ancient times. It is said that the famous Greek mathematician Euclid traveled to today's Egypt and many other places to study mathematics before he

completed his long-lasting book *Elements*. Because of difficulties in long-distance travel, the process of globalization was more restricted and took more time, so did the spreading of mathematical knowledge. It was not until the 17th century that the *Elements* were brought to China. Today, with advancing technology, the world becomes smaller and progress on famous mathematical problems spreads almost instantly. International conferences provide good opportunities for mathematicians to exchange ideas and start collaborations. People from different parts of the world work together towards wonderful achievements in research. For instance, at the Beijing International Center for Mathematical Research, over the last two years, more than thirty percent of publications by our faculty were joint with mathematicians abroad. The Chinese Mathematical Society also made huge efforts to contribute towards mathematical globalization; we had joint conferences with our counterparts in other countries, e.g., the American Mathematical Society. We also co-hosted events with countries along the Silk Road.

Mathematical knowledge has no boundary. I believe that mathematics will flourish from globalization and benefit all of us from all over the world.

Gang Tian (Peking University)

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2. CEIC: NOTES AND COMMENTS

One of the biggest issues with online publication is archiving: how can we ensure that authoritative copies of published papers are permanently available? In traditional publication models, this task is undertaken by librarians, with extra security from the redundancy of having copies in many libraries. In electronic publishing, the responsibility often lies with the publisher, who may quit or lose interest over time. A recent study ("Open is not forever: a study of vanished open access journals" by Mikael Laakso, Lisa Matthias, and Najko Jahn; https://arxiv.org/abs/2008.11933) finds 176 open access journals that have not only quit publishing new papers, but in fact stopped distributing published papers. Some of the journals seem to be somewhat marginal, but they are nevertheless a real loss for the scholarly community. The data set from the study (https://github.com/njahn82/vanished_journals) shows that two of the journals are in mathematics. How many more journals might the mathematics community lose in the future?

In principle, we know how to solve this problem. Every electronic journal publisher should partner with a trustworthy, long-lived organization that will commit to preserving and distributing published material forever, potentially long after the publisher disappears (examples include LOCKSS, Portico, CLOCKSS, and PKP PN; see Table 1 in the study cited above). Furthermore, standardization is important: it's best to centralize on a modest number of widely known organizations, so that we don't simply shift the problem to "what if an obscure preservation service disappears?"

Editors of online journals should confirm that a reliable archiving plan is in place, and communicate this information on the journal's website. Otherwise, it's difficult for the community to identify unprepared journals.

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3. IMU-BREAKOUT GRADUATE FELLOWSHIPS (BGF) AWARDED

The BGF Selection Committee of the Commission for Developing Countries CDC has completed the evaluation of the nominations to the BGF program received for the 2020 call during the month of September. Three students were awarded a BGF grant to complete a PhD program in their home countries: Benin, Indonesia and Uganda.

IMU-CDC very much appreciates the generous donations from all the Breakthrough Prize winners that allow funding the BGF grants.

The 2021 call will be announced in due time.

More information: https://www.mathunion.org/cdc/scholarships/graduate-scholarships/imu-breakout-graduate-fellowship-program

See also the interesting article by Della Dumbaugh that appeared in the September 2019 Issue of the AMS Notices: https://www.ams.org/journals/notices/201908/rnoti-p1294.pdf

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4. NEWS FROM THE CWM

STOP PRESS. CWM Vice Chair Carolina Araujo has been named winner of the 2020 Ramanujan Prize for young mathematicians from developing countries:
https://www.ictp.it/about-ictp/prizes-awards/the-ramanujan-prize.aspx
Carolina Araujo, from the Instituto Nacional de Matematica Pura e Aplicada in Brazil (IMPA) works in Algebraic Geometry. She is the second woman to be awarded the Ramanujan Prize, the first being Sujatha Ramdorai in 2006.

a. First meeting of the Standing Committee for Gender Equality in Science (SCGES)

The first (virtual) meeting of SCGES, a permanent organization founded by nine unions and partners including IMU, took place on September 12, 2020. A group of three people were appointed to follow up actions between the meetings of the committee: Catherine Jami (IUHPST) as chair, Guy Smagghe (IUBS) as vice-chair and Marie-Françoise Roy (IMU). The next steps involve the choice of the logo and the launching of the website, before the end of 2020. Catherine Jami and Marie-Françoise Roy will represent SCGES at the scoping meeting of the International Science Council (ISC) on their project in development “Gender equality in Science: from Awareness to Transformation”, planned in October. The hope is that other ISC members will join SCGES.

b. Congratulations to Luna Lomonaco for the UMALCA Prize 2020.

The UMALCA Recognition Prize recognizes young mathematicians who have done work of exceptional quality and who are permanently working in a country in Latin America and the Caribbean. Since 2000, the prize has been awarded every 4 years, to 1 to 4 mathematicians. The 4 recipients of the UMALCA Prize 2020 were announced at a virtual ceremony on September 14, 2020. Luna Lomonaco (IMPA, Brazil) became the first woman to be awarded the prize.

https://www.umalca.org/2020/08/ceremonia-premios-umalca-2020/

c. CWM Meeting in 2020

CWM holds a (virtual) meeting on 5 and 6 October 2020.

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5. IDM 2021 POSTER CHALLENGE "MATHEMATICS FOR A BETTER WORLD"

The theme for the next International Day of Mathematics, on March 14, 2021, is "Mathematics for a Better World." We are inviting school students and math lovers in general to join us in the countdown to the celebration by participating in our worldwide Poster Challenge, where we explore mathematics as a universal language.

To participate, create a poster that is sharing one idea to make the world a little bit better using mathematics. Instead of words, use images combined with numbers, formulas, geometric shapes, or other mathematical elements to express your idea, so people worldwide can understand it. You can send us your poster until February 15, 2021. We will share the best submissions on the IDM website.

Learn more at https://www.idm314.org/2021-poster-challenge.html

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6. SIR VAUGHAN F.R. JONES (1952 – 2020)

Sir Vaughan Jones died aged 67 on September 6, 2020, following complications after a severe ear infection. An inspired and inspiring mathematician of exceptional originality and breadth, his enduring work brought together several disparate areas of mathematics, from analysis of operator algebras, to low dimensional topology, statistical mechanics and quantum field theory, with major impact and unexpected, stunning applications, even outside of mathematics, as in the study of DNA strands and protein folding in biology. A crucial idea leading to these striking connections was his groundbreaking discovery in the early 1980s that the symmetries of a *factor* (an irreducible weak* closed algebra of operators on Hilbert space), as encoded by its *subfactors*, are *quantized* and generate quantized groups, a completely new type of structures, endowed with a dimension function given by a *trace* and an *index* that can be non-integral.

Vaughan Jones was born on December 31, 1952, in Gisborne, New Zealand. He was educated at Auckland Grammar School and the University of Auckland, where he earned a bachelor of science and a master of science with first class honors. He then received a Swiss government scholarship and completed his PhD at the University of Geneva in 1979, under the supervision of André Haefliger and Alain Connes, with his thesis awarded the Vacheron Constantin Prize. He was a Hedrick assistant professor at UCLA in 1980-1981, at the University of Pennsylvania 1981- 1985 and was then appointed full professor at UC Berkeley in 1985. From 2011 on, he held the Stevenson Distinguished Chair at Vanderbilt University, while also being professor emeritus at UC Berkeley. Already in his thesis work, Vaughan Jones was interested in the classification of finite groups of automorphisms ("classical symmetries") of a class of von Neumann algebras called II_1 factors, following up on Connes' classification of single automorphisms. He developed a novel, algebraic approach, where the action of the group was encoded in the isomorphism class of a subfactor. Soon

after, this led him to consider abstract subfactors together with a natural notion of relative dimension, that he called *index*, and to study the values it can take. By late 1982, he made a series of amazing discoveries. On the one hand, the index of a subfactor can only take values in the discrete set $\{4\cos^2(\pi/n) \mid n \geq 3\}$ or in the continuous half-line $[4, \infty)$. On the other hand, all these values can actually occur as indices of subfactors, and, indeed, as indices of subfactors of the most important II_1 factor, the so-called *hyperfinite* II_1 factor (the non-commutative, quantized version of the unit interval). The proof involved the construction of an increasing sequence of factors (a *tower*), obtained by "adding" iteratively projections (i.e., idempotents) satisfying a set of axioms which together with the trace provide the restrictions. Shortly after, Jones realized that his sequences of projections give rise to a one-parameter family of representations of the braid groups and that appropriate re-normalizations of the trace give rise to a polynomial invariant for knots and links - the *Jones polynomial*.

This immediately led to a series of spectacular applications in knot theory, solving several of Tait conjectures from the 19th century. More importantly, it completely reinvigorated low dimensional topology, igniting totally unexpected developments, with an exciting interplay of areas, including physics, and a multitude of new invariants for links and 3-dimensional manifolds, altogether leading to a new brand of topology, *Quantum Topology*.

This revolutionary work had also a huge far-reaching impact in the theory of II_1 factors and operator algebras, posing exciting new questions about the classification of subfactors and of the quantized groups they generate. Many outstanding results by a large number of people have followed. Jones was much involved in this development, notably finding the best way to characterize the group-like object arising from the tower of factors (*the standard invariant*), as a two dimensional diagrammatic structure of tangles called *planar algebra* (1999), and then classifying them up to index 5, in a remarkable programme developed with some of his former students (2005-14). This, together with a quest to produce conformal field theory from subfactors, led Jones to a study of the Thompson groups and again to unexpected spin-offs for the theory of knots and links (2015-2020). In a parallel development, which started in 1983, the connection was made with calculations by Temperley and Lieb in solvable statistical mechanics, triggering yet another series of connections with physics, statistical mechanics, conformal quantum field theory, where a similar dichotomy of discrete and continuous parts of the central charge occurs.

Vaughan Jones was awarded the Fields Medal in Kyoto in 1990, and was elected Fellow of the Royal Society in the same year, Honorary Fellow of the Royal Society of New Zealand 1991, member of the American Academy of Arts and Sciences in 1993 and of the US National Academy of Sciences in 1999, foreign member of national learned academies in Australia, Denmark, Norway and Wales. He received the Onsager Medal in 2000 from the Norwegian University of Science and Technology (NTNU). In 2002 he was made a Distinguished Companion of the NZ Order of Merit (DCNZM), later re-designated Knight Companion KNZM. The Jones Medal of the Royal Society of New Zealand is named in his honor.

He had a strong commitment of service to the community. In 1994 he was the principal founder and Director of the New Zealand Mathematical Research Institute, leading summer schools and workshops each January. He was Vice President of the American Mathematical Society 2004-2006, and Vice President of the International Mathematical Union 2014-2018.

Vaughan had a very distinctive and personal style of research in mathematics. His warmth, generosity, sincerity, humor and humility led him to thrive on social interaction, and for the mathematical community to significantly benefit from his openness in sharing ideas through every

stage of development from initial speculations and conjectures about the way forward, to the discussion and explanation of the final results. His presence both at formal and informal events and his regular interaction with mathematicians, especially graduate students, including his own, of which he had more than 30, enriched all who came into contact with him. Vaughan regularly mixed his passion for skiing and kite-surfing with hosting informal scientific meetings at Lake Tahoe, Maui and his family retreat in Bodega Bay. His love for rugby was legendary, as was the fact that he wore an All Blacks jersey for his plenary at the ICM in Kyoto following the award of his Fields medal. His other major passion was music, choral singing and orchestral playing, shared intimately with his family and friends. Vaughan is survived by his wife Martha (Wendy), children Bethany, Ian and Alice and grandchildren. He will be dearly missed by his family and the many friends all over the world.

David Evans (Cardiff, UK), Sorin Popa (UCLA, USA)

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7. 2020 FIELDS MEDAL SYMPOSIUM

The Fields Institute is delighted to announce the 2020 Fields Medal Symposium, to take place October 19–23, 2020 hosted online by the Fields Institute in Toronto, Canada. For the first time, both the Scientific Program and the Public Opening event will be hosted virtually, presenting a unique opportunity for participants to join in from around the globe. The Symposium will honour **Alessio Figalli** (Fields Medal 2018, ETH Zürich), and will aim to bring the general topic of optimal transport to a broader audience and present recent development in related areas of research. The Scientific Program will be centred on Figalli's work, and its current and potential impact.

There will be a Public Opening on October 19, 2020 at 12:30pm EDT. It will feature an introduction to Figalli's work by **Franceso Maggi** (University of Texas at Austin); an interview with Figalli, a panel discussion and Q&A (hosted by **Hannah Fry**, University College London) with Figalli, **Maria Columbo** (École Polytechnique Fédérale de Lausanne), and **Ingrid Daubechies** (Duke University), **Robert McCann** (University of Toronto), and **Cédric Villani** (Fields Medal 2010 & Member of Parliament, French National Assembly); and messages from esteemed dignitaries including **Carlos E. Kenig** (President, International Mathematical Union) and Her Excellency the Right Honourable **Julie Payette**, Governor General and Commander-in-Chief of Canada.

For more information, please visit http://www.fields.utoronto.ca/activities/20-21/fieldsmedalsym

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