

STATUS REPORT FOR THE IMU

1. INTRODUCTION

As Secretary General of the IMU, I would like to take this opportunity to report on some of the activities of the International Mathematical Union (IMU) since we met in Rio de Janeiro, Brazil, in 2018.

The ultimate governing body of the IMU is the General Assembly (GA), consisting of Delegates appointed by the Adhering Organizations of the IMU, together with the members of the Executive Committee, and of the Representatives of Associate and Affiliate IMU Members. The GA normally meets once every four years, usually at a place and date close to an International Congress of Mathematicians (ICM). In the intervening period between GA meetings, the daily activities of the IMU are carried out by its Executive Committee (EC), which – in accordance with the IMU Statutes and subject to the direction and review of the members – conducts the business of the Union. The EC meets once a year (before the COVID-19 pandemic always in person), and in 2020, just before the onset of the pandemic, the EC met for the first time in Africa, in Cape Town. In addition, the focused activities of the IMU are organized into three Commissions and two Committees – the International Commission on Mathematical Instruction (ICMI), the Commission for Developing Countries (CDC), the International Commission on the History of Mathematics (ICHM), the Committee on Electronic Information and Communication (CEIC), and the Committee for Women in Mathematics (CWM). The members of these Commissions and Committees (C&Cs) all do excellent work for the global mathematical community in their respective areas – and they do so on a voluntary basis, for which we are extremely grateful. I refer to the respective websites of the C&Cs for a more detailed description of their ongoing activities.

Over the past term, there has been a considerable increase of attention devoted worldwide to the issues of diversity and inclusion. The IMU EC thus decided to create the

Committee on Diversity (CoD) as an ad hoc committee that can offer us advice on these issues. The purpose of CoD is threefold:

- (1) Assess how the IMU has performed to date;
- (2) Offer advice on how we can improve our performance;
- (3) Offer advice on how the Adhering Organizations can improve their performance nationally.

The IMU is a founding and funding partner in the International Year of Basic Sciences for Sustainable Development (IYBSSD2022). In addition, the IMU recently signed the Declaration on Research Assessment (DORA) and the International Science Council's (ISC) declaration on Science in Exile.

In addition to the gratitude owed to those who serve on the IMU's C&Cs, I would also like to thank multiple organizations and individuals – too numerous to name individually – for their generous financial support of our activities. The IMU does not charge any overheads, and all IMU officers are true volunteers without any remuneration for their work. It is only because of this fact that we are able to utilize generous donations to the full effect and employ them wholly for their intended purpose.

2. MEMBERSHIP

Members of the IMU are countries, and only countries. In practice, for each country there is an Adhering Organization and a (National) Committee of mathematics that the IMU communicates with. It is not easy to describe in detail what the IMU really “is”, except that the ICMs are organized under our auspices and that we award some of the most coveted prizes in mathematics. If one had to summarize it, one might say that the IMU is the “United Nations of Mathematics.”

The IMU's regular membership has experienced positive developments in the past period, which were threefold in nature – we acquired new members, several of the present members upped their group of adherence, and, finally, but no less important, there are currently fewer countries experiencing serious problems in covering their membership dues.

At the 18th GA in 2018, Kyrgyzstan was admitted as a group I member, while both Chile and Portugal progressed from group II to group III. In the period 2019–2022, Mongolia was accepted as a new Associate Member, while Cyprus and Belarus were admitted as regular members in group I. We also had the following changes in group of adherence: Uzbekistan from Associate Member to a (regular) member in group I, Indonesia from group I to II, Denmark from group II to group III, and finally, Republic of Korea from group IV to group V.

Unfortunately, the associate membership of Cambodia, Madagascar, Moldova, and Nepal came to an end during the period 2019–2022 following the maximum period of two terms. The next stage would be an application for regular membership, which we hope will be forthcoming in due course. However, it appears to be difficult for many countries to secure

the stable funding required to cover membership dues and thus take the step from associate to regular member.

Currently, the IMU has 87 regular and Associate Members and five Affiliate Members.

3. CONSEQUENCES FOR THE IMU OF THE COVID-19 PANDEMIC AND THE RUSSIAN INVASION OF UKRAINE

This term was characterized by two big events with global consequences, including for the IMU, namely the COVID-19 pandemic and the Russian invasion of Ukraine on 24 February 2022.

The COVID-19 pandemic has changed the life of billions of people across the globe. In addition to the tragic loss of millions of lives, the global economic consequences have been severe. We express our deepest sympathies with all affected. The pandemic has also had dramatic consequences for the way we work – and the IMU itself has not been immune to these effects. We have all had to practice remote teaching, participate in video and hybrid meetings, and attend fully virtual conferences. Furthermore, we have yet again seen the absolute necessity of fast and reliable internet to facilitate our daily work. While modern technology is truly amazing and makes rapid progress every day, we have also been keenly reminded that humans are social beings who need to interact in person. I am happy to be able to report below on a number of occasions on which the global mathematics community was able to come together and connect.

In passing, I can mention that mathematicians have been able to profit from pandemics in the past. In 1665, the University of Cambridge had to close due to the great plague, and the young Isaac Newton had to go home to Woolsthorpe where he remained for two years. During this period, he developed the theories of calculus, optics, and gravitation! While we have yet to see similar developments again this time round, we have been reminded of the importance of fundamental, curiosity driven research.

In response to the situation, the IMU established a COVID-19 resource page on the IMU website in May 2020, allowing for the submission of mathematically related papers on the emerging pandemic and also providing links to international online seminars, such as the One World series.

In terms of the specific ramifications of the pandemic for the work of the IMU, these were profound and touched every aspect of our activities.

ICME-14, the quadrennial congress organized under the auspices of ICMI, scheduled for July 2020 in Shanghai, had to be postponed due to the pandemic. It was however successfully carried out as a hybrid congress one year later, in July 2021 in Shanghai. The General Assembly of ICMI had already been carried out in 2020 as a fully virtual event, including the use of electronic voting for its elections.

Many of the programs of CDC involve exchange of scholars, and with travel and other restrictions in place for much of the last period, many of these programs came to a halt. However, alternative ways of carrying out scholarly exchange using modern technology

have been investigated and developed. This may be one of the positive outcomes to result from the pandemic period, from which we will hopefully continue to benefit in the future.

The 2018 GA awarded the ICM 2022 and 19th GA to Saint Petersburg, Russia, scheduled for July 2022. The preparations for the ICM 2022 started at the first meeting of the IMU EC in 2019 and have been discussed at every meeting of the IMU EC since. The collaboration with the Russian organizers went well and ICM 2022 was shaping up to be an exciting and impressive congress. However, the brutal invasion by Russia of Ukraine on 24 February 2022 made holding the ICM and GA in Saint Petersburg impossible. The IMU EC had its annual meeting for 2022 scheduled for 24–27 February, and so it coincidentally had the opportunity to discuss how to proceed while the tragic events unfolded in real time.

Following the deliberations during its meeting, the IMU EC issued several statements in this connection (the full statements can be found on the IMU website), communicating its decision that:

- The General Assembly would be organized outside Russia on 3–4 July;
- The ICM would be organized as a fully virtual congress over 6–14 July;
- There would be an IMU Award Ceremony held outside Russia on 5 July;
- The ICM would be open to all participants;
- The GA and the ICM would be conducted without any financial contribution from the Russian Government;
- No official or representative of the Russian Government would be part of the organization or activities of the ICM.

This left the IMU EC with little time and no additional financial or human resources to organize a virtual ICM – which had never been done before – and an in-person GA at an unconfirmed location.

The IMU EC was approached by several member countries, offering to host the GA. In addition, we solicited bids from a few countries. We are extremely grateful to all those countries. Ultimately, we accepted an exceptionally generous offer from the Council of Finnish Academies to host the GA in Helsinki, Finland.

For the organization of the virtual ICM, our initial priority was to source a suitable platform for the event. We solicited bids from several companies, and we eventually accepted the bid from K.I.T. Group, a subsidiary of Messe Berlin GmbH.

These changes to the format of the ICM and GA prompted a further novelty, with the IMU EC deciding to hold a separate award ceremony as a live event on the day between the GA and the opening of the ICM. We were again supported by colleagues in Finland in hosting and organizing this unique event.

On 5 July we held the first ever IMU Award Ceremony, hosted in the Aula of Aalto University. We were honored that Mr Sauli Niinistö, the President of Finland, opened the ceremony. Fortunately, all four Fields Medalists – Hugo Duminil-Copin, June Huh, James

Maynard, and Maryna Viazovska – the inaugural IMU Abacus Medalist Mark Braverman, as well as the recipient of the Leelavati Prize, Nikolai Andreev, were able to be present in Helsinki. The recipients of the Chern Medal and the Gauss Prize, Barry Mazur and Elliott H. Lieb, participated in the ceremony remotely. For each winner, the audience heard the brief citation of the prize committee and a laudatio by an expert in the field, and also watched the superb videos produced by the Simons Foundation. The fully packed Aula delighted in the celebrations, with an electric atmosphere pervading the entire occasion.

Regarding the financial support, the IMU had promised to offer travel support for one delegate from each member country and offer full accommodation support for all delegates at the GA prior to the changes occasioned by the war in Ukraine. Despite the significant financial ramifications of having to plan the events anew after the cancellation of the ICM in Saint Petersburg, the IMU stood by this offer. While the costs were not insubstantial, it proved vital in facilitating member representation at the GA, especially in view of the particularly challenging times experienced in the last years.

Fortunately, the IMU received generous support towards the organization of the General Assembly, the Award Ceremony, and the virtual ICM from the following institutions and organizations:

- Heidelberg Laureate Forum Foundation
- Council of Finnish Academies
- London Mathematical Society
- Mathematical Society of Japan
- Norwegian University of Science and Technology
- CDC/ICMI/FIMU (Friends of the IMU)

The work in preparing both the GA and the virtual ICM put a severe strain on the leadership of the IMU and the IMU Secretariat. However, by the concerted effort of all involved, we were able to host a virtual ICM as well as a mostly in-person GA.

The 19th GA was the first hybrid GA in IMU history. The overwhelming majority of delegates wanted to participate in person – and indeed the quality of the meeting improves considerably with the informal discussions that only an in-person meeting allows for – but the travel restrictions due to the pandemic, air traffic problems in Europe, and many last-minute positive tests, resulted in about 30 remote participants, while 165 were present in Helsinki. For the first time all balloting was carried out electronically, in part due to the element of remote participation but also as a means of modernizing the voting procedure. The live voting system worked extremely smoothly and efficiently.

4. ICM 2022

As per the decision of the 2018 GA, the scientific program of the ICM is to be analyzed by the ICM Structure Committee. This includes novel ways to organize the congress, as well as the structure and relative size of the sections of the ICM. Based on recommendations from the Structure Committee, the IMU EC determined the scientific structure for the ICM. The selection of speakers for the ICM is the responsibility of the Program Committee, whose chair is appointed by the IMU President. The Program Committee is assisted by sectional committees for each section. All in all, there is approximately an equal number of people involved in the selection of speakers as there are speakers. The final selection of speakers is taken by the Program Committee, whose members, apart from the chair, are confidential until the opening of the ICM. On the other hand, membership in the Structure Committee is public, and the committee actively invites proposals and suggestions from the community.

The IMU Structure Committee for ICM 2022 was composed as follows: Terence Tao (US, chair), Carlos E. Kenig (IMU President, ex officio, US), Nalini Anantharaman (France), Alexei Borodin (US), Annalisa Buffa (Switzerland/Italy), H el ene Esnault (France/Germany), Irene Fonseca (US), Terry Lyons (UK), Stephane Mallat (France), Hiraku Nakajima (Japan),  eva Tardos (US), Peter Teichner (Germany), Akshay Venkatesh (Australia/US), Anna Wienhard (Germany).

The ICM 2022 Program Committee was composed as follows: Martin Hairer (UK, chair), Sanjeev Arora (US), Anna-Karin Tornberg (Sweden), Shafi Goldwasser (US), Ursula Hamenstaedt (Germany), Sergei Ivanov (Russia), Mikhail Kapranov (Japan), Yiming Long (China), Felix Otto (Germany), Jonathan Pila (UK), T. N. Venkataramana (India), Geordie Williamson (Australia).

On 6 July, we took advantage of the fact that the Fields Medalists and the IMU Abacus Medalist were all present in Helsinki, and arranged for them to give their plenary ICM prize lectures in front of a live audience in the Auditorium of Aalto University. This was a great success, with outstanding lectures delivered by the laureates.

Over 7–14 July we had a fully virtual ICM for the first time in IMU history. In the lead up to the ICM, we worked closely with K.I.T. Group to develop a platform that would not only deliver the lectures, but also allowed for a Q&A with the speakers. However, in the last few days before the virtual ICM launched, we were facing serious technical problems, which necessitated the restructuring of the format for the virtual ICM at very short notice. This was an exceptionally stressful period for all involved. In short, we ended up with a simplified platform that posted all talks to the IMU YouTube channel but eliminated the possibility of a Q&A with the lecturers. This was of course disappointing, but the upside was that, in this format, no registration was necessary, and thus the ICM was truly open to all.

Since a fully virtual ICM had not been tried before, all speakers were given the opportunity to submit a prerecorded lecture, or to give their talk live via zoom (with the possibility to submit a prerecorded lecture as a back-up). The program of lectures was scheduled according to the CEST time zone. Many lectures were given in person in front of a live audience, and we felt that the speakers had gone the extra mile to make their lectures as engaging

and accessible as possible. The experience we have all gained in giving video lectures over the two years of the pandemic was certainly evident. Many of these efforts were coordinated by the independently-organized ICM Satellite Coordination Group led by Martin Hairer, Alexei Borodin, and Terence Tao. As satellite events, the IMU does not provide financial or organizational support to these activities, but we wholly commend the organizers for their efforts and are grateful for their engagement.

All lectures of the virtual ICM 2022 are now published on the IMU YouTube channel and it is positive to see that many are taking the opportunity to watch the lectures after they were given at the ICM. We hope that this will continue to serve as a repository of the most exciting and cutting-edge work currently being undertaken in mathematics, and one which is freely and openly accessible to the world. We are also certain that this feature of recording all ICM lectures and posting them on the IMU YouTube channel will become a standard for future ICMs.

5. INTERNATIONAL DAY OF MATHEMATICS – MARCH 14

As anticipated at the GA in 2018, UNESCO secured enough support for the proposal, and on 26 November 2019, declared March 14 (“ π day”) as the official International Day of Mathematics (IDM). The IMU EC set up a Governing Board for the IDM (IDMGB) and put out a call for both a logo and a host for the IDM website. Ultimately, the proposal from IMAGINARY, based in Germany, was chosen, with the dedicated IDM website idm314.org. The grand, official launch in 2020 of the new IDM at the UNESCO Paris Headquarters unfortunately had to be cancelled due to the pandemic, but the online events organized for the first IDM in 2020 were a great success. Each year a specific theme for the IDM is decided. The themes in the first three years of the IDM were:

Mathematics is Everywhere (2020)

Mathematics for a Better World (2021)

Mathematics Unites (2022)

As part of the events, the IDMGB coordinates activities worldwide, and material is developed in several languages. The IDM allows the IMU to reach out to new groups outside research mathematicians and, in a very short time, has managed to establish itself with a truly global presence.



6. THE IMU CENTENNIAL

The IMU was founded in Strasbourg, France, on 20 September 1920. Together with our colleagues in France, the IMU organized the conference “Mathematics without Borders” at Université de Strasbourg, the same venue at which the IMU was founded. The conference – originally planned for 2020 – had to be postponed to September 2021 due to the pandemic. Although some of the talks still had to be given by video link due to the pandemic, many were delivered in person in front of a live audience. For many it was the first in-person event since the beginning of the pandemic and allowed many from the international community to reconnect. This, together with the celebratory occasion, helped make the conference a huge success.

To mark the occasion of the IMU’s centennial, the IMU solicited the mathematician and historian Norbert Schappacher to write a book on the history of the IMU in May 2019. The book has just been published under the title “Framing Global Mathematics: The International Mathematical Union between Theorems and Politics” by Springer. Schappacher’s book provides the most comprehensive and exciting take on the history of the IMU since Olli Lehto’s “Mathematics without borders, a history of the International Mathematical Union”, and more broadly analyzes the historical context of today’s mathematics and its place in world culture. It is available in open access and can be freely downloaded. The project is generously funded by the Klaus Tschira Foundation.

7. A CHANGE IN THE STATUTES OF THE IMU

As a member of the ISC, the IMU already subscribes to the ISC’s mission to “Defend the free and responsible practice of science,” as described in Article 7 of the ISC Statutes. The GA wanted to make the IMU’s commitment to this principle more explicit and thus adopted an amendment to the IMU Statutes to underscore its importance to the mathematical community. Specifically, the Article

“The Union adheres to the International Science Council’s principle of embodying the free and responsible practice of science, freedom of movement, association, expression and communication for scientists, as well as equitable opportunities for access to science, its production and benefits, access to data, information and research material; and actively upholds this principle, by opposing any discrimination on the basis of such factors as ethnic origin, religion, citizenship, language, political or other opinion, gender, gender identity and sexual orientation, disability or age.”

was added to the IMU Statutes as a new Article 3.

The GA also passed a resolution expressing support for all mathematicians affected by the war in Ukraine, and in particular the IMU calls upon its members and other scientific

organizations to do everything they can to assist our Ukrainian colleagues in these difficult times.

Some of the IMU's Adhering Organizations face temporary adverse circumstances that result in problems paying their IMU membership dues. Thus, the GA decided to establish a "reserve fund," based on earmarked donations to assist members in financial difficulties. The IMU EC will administer this fund and consider requests for assistance from members on a case-by-case basis.

8. ELECTIONS

The Executive Committee for the term 2023–2026 comprises President Hiraku Nakajima (Japan), Secretary General Christoph Sorger (France), Vice Presidents Ulrike Tillmann (UK) and Tatiana Toro (US/Colombia). Members-at-Large are Mouhamed Moustapha Fall (Senegal), Nalini Joshi (Australia), JongHae Keum (Republic of Korea), Paolo Piccione (Brazil), Günter Ziegler (Germany), Tamar Ziegler (Israel). Carlos E. Kenig (US) will serve as past President.

The majority of the members of the CDC are also elected by the GA. For the term 2023–2026 the President will be Andrea Solotar (Argentina), Secretary for Policy Ludovic Rifford (France), and Secretary of Grants Jose Maria P. Balmaceda (Philippines). Members-at-Large: Norbert Hounkonnou (Benin, representing Africa). Le Tuan Hoa (Vietnam, representing Asia). Mariel Saez (Chile, representing Latin America). Further members will be appointed by the IMU EC.

The IMU representatives on the ICHM Executive Committee for the term 2023–2026 are Guillermo Curbera (Spain), and Isobel Falconer (UK).

9. MEMBERS OF AWARD COMMITTEES

The IMU depends on a high number of volunteers that decide on the recipients of the many prizes that the IMU awards. The reputation of the prizes relies on the quality of the work carried out by the committees, and the IMU is grateful to committee members for their commitment and engagement. As is the tradition, all committee members except the chair are confidential until the prize recipients have been announced. For the 2022 IMU awards – including the first awarding of the IMU Abacus Medal, a continuation of the Rolf Nevanlinna Prize – the selection committees were composed as follows:

Fields Medal: Carlos E. Kenig (IMU President, chair, US), Artur Avila (Switzerland/Brazil), Camillo de Lellis (US/Switzerland), Michael Hopkins (US), Antti Kupiainen (Finland), Rahul Pandharipande (Switzerland), Alfio Quarteroni (Italy/Switzerland), Vera Serganova (US), Laure Saint-Raymond (France), Richard Taylor (US), Weiping Zhang (China), Tamar Ziegler (Israel).

IMU Abacus Medal: James Demmel (US, chair), Annalisa Buffa (Switzerland/Italy), Meena Mahajan (India), Amit Singer (US), Daniel Spielman (US).

Carl Friedrich Gauss Prize: Éva Tardos (US, chair), Liliana Borcea (US), Albert Cohen (France), Bernd Sturmfels (US/Germany), Tao Tang (Hong Kong, SAR).

Chern Medal Award: Yakov Eliashberg (US, chair) Sun-Yung Alice Chang (US), Henri Darmon (Canada), Alice Guionnet (France), Hiraku Nakajima (Japan).

Leelavati Prize: Pavel Etingof (US, chair), Kannan Soundararajan (US), Tadashi Tokieda (US), Chandrashekhar Khare (US), Michèle Artigue (France).

ICM Emmy Noether Lecture: Sylvia Serfaty (US, chair), Manindra Agrawal (India), Jesper Grodal (Denmark), Hinke Osinga (New Zealand), Anna Wienhard (Germany).

10. THE ICM IN 2026

It is the prerogative of the GA to decide on the venue for the next ICM. The IMU had received one bid for ICM 2026, namely from the Adhering Organization of the US. The GA gratefully accepted the bid. Thus, the 20th GA will take place in New York City on 19–20 July 2026, while ICM 2026 will be hosted in Philadelphia over 22–29 July 2026.

Helge Holden
Secretary General of the IMU

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