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A Bimonthly Email Newsletter from the International Mathematical Union
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CONTENTS

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1. EDITORIAL: TOWARDS A GLOBAL DIGITAL MATHEMATICS LIBRARY

I write as chair of the eight-person Global Digital Mathematics Library Working Group (GDML WG) of the IMU's Committee on Electronic Information and Communication (CEIC); we have been working steadily for 18 months. Now I retired from Mathematical Reviews (MR; online MathSciNet) after trying to serve mathematics by helping access its knowledge. Why would I now be involved in trying realize some of the grand promise that is expressed in the 2006 GA Resolution of the IMU? Actually the question for me was why wouldn't I jump at the chance? I've always been committed to mathematics as a global enterprise. After early peripatetic years in London UK, MIT, Groningen, RIMS Kyoto and Heidelberg, I joined MR in 1980; later I could visit Strasbourg and IHES each for a year and Auckland NZ.

MathSciNet and zbMATH provide a much appreciated service in helping navigate the literature of mathematics. Their abstracting (reviewing) and indexing has helped many of us a lot in developing and employing mathematics. There's more that can be done today for the world's mathematical community. There can be novel and effective representations of mathematical knowledge, a store of theorems not just metadata about articles. We can make it open, machine-processable and advance research in this way. There can be links with computation and databases like the current offerings of Wolfram!Alpha, Wikipedia, Maple, OEIS, DLMF and others. The experience gained in other, better funded, fields with data-mining and ontologies can be capitalized upon for our mathematical heritage.

Due to the world communication network of the internet these things will result from a distributed system of contributions looking eventually like a grand modern form of library, but more robust against disasters by reason of its distribution. This protects our mathematical heritage and spreads it to all countries.

The 2006 IMU resolution calling for work toward a World Digital Mathematical Library produced much benevolent discussion. But no actions ensued until a meeting of international experts at the US Academy of Sciences and the resulting 2012 report from the US National Research Council. Work on problems of Mathematical Knowledge Management (MKM), Digital Mathematical Libraries (DML) and Automated

Theorem Proving (ATP) continued all the while, but was made up mostly of small largely independent efforts. In a sense, the whole GDML remained what is commercially termed "vaporware".

At ICM Seoul 2014, IMU President Ingrid Daubechies, supported by CEIC chair Peter Olver, set up the GDML WG to get matters moving and concrete projects underway toward a GDML. The WG has been planning, considering project details, and doing outreach. We've organized a successful special session at JMM Seattle 2016, and will have them in July 2016 at 7ECM and ICMS2016 in Berlin, and be involved in CICM2016 in Bialystok. The GDML WG collaborated with the Wolfram Foundation and the Fields Institute to organize an international workshop on Semantic Representation of Mathematics at Fields in February 2016, generously funded by the Alfred P. Sloan Foundation. This represents the start of exploration of a very promising technical aspect for a digital library now that we have so much computing power available.

What is needed is more engagement and more internationalization. Therefore, the WG setting up an International Mathematical Knowledge Trust (IMKT) based in Canada, this should be followed by regional KTs. The purpose of the IMKT is to establish a mathematical knowledge commons — a public resource consisting of mathematical knowledge represented in non-proprietary, machine-readable formats, together with an international network of knowledge providers, information systems, and semantic services based on it, that is, a global digital mathematical library. Another way of justifying this goal is to assert that using open, interoperable representation standards and open knowledge licenses turns mathematical knowledge into Open Mathematical Knowledge Data, and the body of mathematical knowledge into a public resource that can drive future mathematical research and practice.

There are already efforts in Europe to build upon the successful prototype European Digital Mathematics Library (EuDML) and to push for a new European Knowledge Infrastructure for Mathematics (EuKIM). Mathematics is international, mathematics is universal (ideally and mostly) and is comparatively cheap to practice (usually). Recent mathematical breakthroughs did not involve enormous sums of money to get the resources to build big machines, though there's a great deal of mathematical infrastructure to the search for a Higgs particle at LHC or even the detection of gravitational waves at LIGO. But we each do need to be conscious of the community's need for mathematical infrastructure and support, and be willing to contribute our pieces.

Patrick D. F. Ion
Chair GDML WG of IMU CEIC

Biographical Info: I have been involved in Mathematical Knowledge Management (MKM) for many years. At MR I was instrumental in passing to the use of TeX in 1985, on TUG's Steering Committee for a decade, and heavily implicated in the revisions of the Mathematical Subject Classification (MSC). I became co-chair of the World Wide Web Consortium Math Working Group, which developed the MathML specification, of which I am an editor and one author; this is now an ISO standard. My main mathematical interests are now in quantum stochastics, q-analogues and the discrete Fourier transform in elementary geometry; my MKM concerns are MSC in the Semantic Web, the relation of graph structures found in the mathematical literature to mathematical knowledge and sociology, and digital libraries.

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2. ICM 2018

From **August 1st to 9th, 2018,** Rio de Janeiro will host the International Congress of Mathematicians (ICM) in its largest and most traditional convention center: **Riocentro,** in the **Barra da Tijuca** neighborhood. Subscription to the Congress Newsletter is now open.

The Program Committee (PC) for the International Congress of Mathematicians 2018 in Rio de Janeiro, Brazil, August 1-9, 2018 has been set up. The PC has decided on a list of 19 sections at congress. The Adhering Organizations of IMU and the mathematical societies worldwide are invited to nominate plenary and sectional speakers.

All communication concerning the scientific program of ICM 2018 is handled by the Chair of the Program Committee, Prof. János Kollár at the email address <chair@pc18.mathunion.org>.
Nominations should be received by the PC Chair no later than November 1, 2016.

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3.   **IMU GENERAL ASSEMBLY, SÃO PAULO, BRAZIL, 2018**

A perhaps less visible, but just as important task of the ICM Organizing Committee is to set the stage for the **IMU General Assembly (GA),** which takes place every 4 years, just a few days prior to the Congress itself. It has been decided that the 18th IMU General Assembly will take place in the city of **São Paulo, Brazil**, on **July 29-30, 2018** (Sunday and Monday preceding the ICM in Rio de Janeiro). The choice for the venue of the General Assembly is currently under negotiation, and will be announced shortly at the ICM website. Some social activities will take place at the University of São Paulo, which is one of the sponsors of the event. Around 300 participants are expected, including more than 200 delegates from the mathematical societies of over 80 countries in the world.

São Paulo is the largest metropolitan area in Brazil, and the country´s financial capital, boasting the largest gross domestic product Of any city in Latin America. Its cosmopolitan character is witnessed by the many international communities, including the Arab, the Italian, and the Japanese, that have made São Paulo their home. Gastronomy, arts and entertainment are typical of everyday life in the city.

The transfer of delegates from São Paulo to the ICM venue in Rio de Janeiro will take place on July 31st, 2018. This will be a bus trip with a total driving time of around 5 hours. The trip will include a stop for lunch and a short sightseeing tour of Paraty, a charming colonial city on the coast. Arrival at the Riocentro Convention Center will be early in the evening, on time for the opening cocktail of ICM 2018.

Nominating Committee: The IMU Executive Committee has started forming the Nominating Committee (NC), whose task it is to present slates of nominations to the Adhering Organizations (AOs) prior to the GA meeting in São Paulo. Every AO is requested to nominate one person for this Nominating Committee. The NC is one of the most important IMU committees since it has a strong influence on the composition of the IMU leadership for the term 2019–2022.

The IMU Executive Committee asks for the nomination of persons
– who are not current members of the IMU Executive Committee,
– who are willing to serve, and
– who do not work in the same country as the NC Chair or the IMU President.

IMU President Shigefumi Mori has chosen Martin Grötschel (IMU Secretary 2007–2014) as the Chair of the NC. In particular, this implies that no person working in Japan or in Germany can be nominated.

All submissions are to be sent via email, post, or fax to IMU at the address: International Mathematical Union, Markgrafenstr. 32, 10117 Berlin, Germany (Fax: +49 30 20372-439). All email submissions must be sent from the official email address of the Adhering Organization to the IMU Secretary at

secretary@mathunion.org.
The deadline for receipt of nominations, from which a random selection will be made, is August 1, 2016.

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4. IMU BREAKOUT GRADUATE FELLOWSHIPS

The IMU has recently launched the novel IMU Breakout Graduate Fellowship Program.
Thanks to a generous donation by the winners of the Breakthrough Prizes in Mathematics – Ian Agol, Simon Donaldson, Maxim Kontsevich, Jacob Lurie, Terence Tao and Richard Taylor – IMU with the assistance of FIMU (Friends of the IMU) and TWAS (The World Academy of Sciences) has launched a fellowship program to support postgraduate studies in a developing country, leading to a PhD degree in the mathematical sciences. The IMU Breakout Graduate Fellowships will offer a limited number of grants for excellent students from developing countries. The program will be administered by CDC (Commission for Developing Countries), a commission of IMU.
Professional mathematicians are invited to nominate highly motivated and mathematically talented students from developing countries who plan to complete a doctoral degree in a developing country, including their own home country. Nominees must have a consistently good academic record from the high school level and must be seriously interested in pursuing a career of research and teaching in mathematics. The **deadline** for online nominations is 09:00 am CET on **22 June 2016**. Please help in making this initiative widely known.

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5. CALL FOR SUGGESTIONS FOR APPLICATIONS TO THE NEW ICSU GRANTS PROGRAMME

IMU is calling for suggestions for applications to the new **ICSU Grants Programme**. Grants are up to 100,000 € per year for the three years 2017-2019. The ICSU Grants Programme aims to create new international initiatives spearheaded by ICSU Unions, which collaborate with other members of the ICSU family, along with other relevant societal actors and organisations in order to address issues of **science education, outreach and public engagement.**

At least two scientific unions must be lead applicants. See the list of scientific unions. The Grants Programme will foster these larger initiatives that actively involve developing regions, **promote the involvement of young scientists and women.** The aim is also to mobilise a broader community of actors through these larger international initiatives.

ICSU encourages the submission of proposals that
(i) actively involve the ICSU Regional Offices,
(ii) promote the involvement of young scientists, women scientists, and scientists from developing countries, and
(iii) forge new partnerships between organisations that do not routinely collaborate.

The ICSU grant can be spent for all necessary costs that are attributable to the programme, including (but not limited to):
- Core research project funding
- Early career fellowship costs
- Capacity building activities
- Travel, accommodation and other expenses directly related to meetings with partners and field visits to research sites and institutions involved in the programme

- Meetings, seminars, workshops, conferences
- Facilitators and skills trainers for working with stakeholders, media, and public outreach
- Communication tools and expertise, dissemination activities and publication support
- Project monitoring and coordination costs
- Publication and communication support

A one page letter of intention should be sent by **June 15 2016** to Christiane Rousseau: rousseac(at)dms.umontreal.ca .

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6. NEWS FROM ICSU

Important developments are presently taking place at the International Council of Science (ICSU). The planet and its human civilization will face some of its most significant challenges in the near future: global change, increase of the population pushing the planetary resources to their limit.

- **Science International:** More than ever, it is essential that the voice of science be present with the decision makers. Four organizations have decided to to present a unified voice of science: these are ICSU together the International Social Science Council – ISSC), the InterAcademy Partnership – IAP, and the The World Academy of Sciences – TWAS. As a first step they have created Science International: *Science International* is a series of regular meetings of top-level representatives of these four organizations (ICSU, ISSC, IAP and TWAS), that are designed to represent the global scientific community in the international policy for science arena. The theme of *Science International* 2015, which took place from 7-9 December 2015 in Pretoria, South Africa, was 'Big Data/Open Data'. The 2015 edition of Science International has developed an international accord on the values of open data in the emerging scientific culture of big data. The Accord recognizes the need for an international framework of principles on "Open Data in a Big Data World" and proposes a comprehensive set of principles. The report produced at this meeting was circulated to the scientific unions and IMU has endorsed it.

- **Merger**: The second step has been taken last month at the respective board meetings of ISSC and ICSU: they have unanimously agreed to propose to their members **to merge** to form a single international organization for the social and natural sciences. Such a merger will bring together the unique membership base of both ISSC and ICSU – i.e. national scientific organizations and international scientific unions and associations – and create an organization best suited to develop a unified vision and drive a holistic approach to some of the great contemporary challenges for science. The unions will be consulted in the fall on that project of merging.

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7. AIMS WORKSHOP ON DISEASES AND ALIEN SPECIES EXPANSION

The workshop took place at the African Institute for Mathematical Sciences (AIMS), in Cape Town, South Africa on May 2-6 2016. Supported by the International Council of Science (ICSU), the workshop was a joint venture between the international partners: International Mathematical Union (IMU), International Union of Biological Sciences (IUBS), International Union of Immunological Societies (IUIS), International Union of Microbiological Societies (IUMS), International Social Science Council (ISSC), International Council of Industrial and Applied Mathematics (ICIAM), International Council of Science Regional Office for Africa

(ICSU ROA), International Society of Biometeorology (ISB), UNESCO, EcoHealth Alliance of Future Earth and Mathematics of Planet Earth: MPE.

The workshop was truly interdisciplinary with mini courses given by biologists, mathematicians and specialists of climate data. The workshop welcomed 40 participants coming from 15 different African countries, China, Cuba, and the Philippines, 13 lecturers, organizers and representatives of the partner organizations and 18 students of AIMS. They had very diverse backgrounds from mathematical sciences (modelling or statistics) to biology, medicine, climate, forestry, environmental economy. The workshops comprised mini courses on the spreading and control of infectious diseases and invasive species, with a mixture of courses on mathematical modelling and on biological research on these phenomena, thus emphasizing the interdisciplinary nature of the field. Several mini courses included labs and playing with real data. Some projects labs dealt with open problems and the teams who worked on thesis problems are continuing their joint work after the workshop.

Important networking took place during the workshop. The mini courses have been video-taped and will soon be on line.

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8. AFRICA MATHEMATICS PROJECT

The Africa Mathematics Project (AMP) of the Simons Foundation invites applications for grants to support mathematical activities in Africa, including research of faculty at African universities, the training of graduate students, and the organization of international exchanges and conferences.

Deadline for submission of proposals:August 31, 2016 at 11:59:59 PM EST. Notification of awards is planned for about July 1, 2017.

Level and Duration of Funding: Each AMP award will receive 90,000 USD per year for up to five years, which includes 20 percent for indirect costs (overhead) to the awardee's institution. Continued support after the first three years will be contingent on the ongoing evaluation of the project.

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9. MATHEMATICAL COUNCIL OF THE AMERICAS: CALL FOR BIDS

The MCofA – Mathematical Council of the Americas - invites the mathematical organizations based in the continent to bid to organize the 3rd Mathematical Congress of the Americas, which will take place in July - August 2021 in some mathematical center in North America, Central America, South America, or the Caribbean. The first MCA was held in Guanajuato, Mexico in August 05-09, 2013, and the second congress will take place in Montreal, Canada in July 20-24, 2017.

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10. V CONGRESO LATINOAMERICANO

The V Congreso latinoamericano de matemáticos under the auspices of Unión Matemática de América Latina y el Caribe (UMALCA) takes place in the period July 11-15, 2016, at the Universidad del Norte, Barrranquilla, Columbia.

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11. 7ECM

The quadrennial Congress of the European Mathematical Society, 7ECM, will be held in Berlin, Germany, July 18 - 22, 2016. The program contains ten plenary lectures, 31 invited lectures, several prize lectures, the Hirzebruch Lecture, the Abel Lecture, several history and public lectures, 43 mini-symposia, and much more. Almost 100 grants have been offered to mathematicians from less developed countries. 1300 participants have already registered.

The event is preceded by the Council of the European Mathematical Society at Humboldt University, Berlin, on July 16-17. Council will have to choose between two bids for the 8ECM in 2020; one from Portoroz (Slovenia) and one from Seville (Spain). It elects two new vice-presidents and five members of the executive committee.

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12. ABEL PRIZE AWARDED TO SIR ANDREW WILES

On May 24, Sir Andrew Wiles received the Abel Prize 2016 from Crown Prince Haakon of Norway during a ceremony at the University aula in Oslo. The Abel lectures on the following day were presented by the laureate himself, by Henry Darmon and Manjul Bhargava and by Simon Singh (science lecture). The editor of this newsletter had the opportunity to participate in an interview with the laureate that is going to appear in the Newsletter of the European Mathematical Society later this year.

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13. SUBSCRIBING TO IMU-NET

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