

The world of mathematics and mathematicians*

The International Congress of Mathematicians (ICM) is held under the umbrella of the International Mathematical Union (IMU) once every four years. The first ICM was held in Zürich, Switzerland in 1897 with the objectives of fostering personal relations between mathematicians of different countries, presenting an overview of the current state of different areas of mathematical sciences and their applications, and discussing specific problems of particular importance. Since then, the Congress has been held at different locations such as Paris, Oslo, Nice, Kyoto, Beijing and Madrid. It was at ICM in 1900 that Hilbert outlined his 23 problems. In 2010, this largest mathematical event was hosted by India. The Congress was attended by about 3000 participants from across the world. In the inaugural speech, the President of India, Pratibha Patil emphasized the key role played by mathematics in the development of Science and Technology in the modern world.

Following the tradition of ICM, the IMU awards ceremony, where the work of mathematicians is recognized, was held during the inauguration of the Congress. The Fields Medal, considered to be the highest honour in mathematics, is awarded to researchers not more than 40 years of age. The medal recognizes outstanding contributions in mathematics. The ICM 2010 Fields Medal was awarded to Elon Lindenstrauss (Hebrew University of Jerusalem, Israel) 'for his results on measure rigidity in ergodic theory, and their applications to number theory'; Ngô Bảo Châu (Institute for Advanced Study, Princeton) 'for his proof of the Fundamental Lemma in the theory of automorphic forms through the introduction of new algebro-geometric methods'; Stanislav Smirnov (University of Geneva, Switzerland) 'for the proof of conformal invariance of percolation and

the planar Ising model in statistical physics'; and Cédric Villani (Institut Henri Poincaré, Paris) 'for his proofs of nonlinear Landau damping and convergence to equilibrium for the Boltzmann equation'.

The Rolf Nevanlinna Prize for outstanding contributions in mathematical aspects of information sciences was presented to Daniel Spielman (Yale University, USA) 'for smoothed analysis of Linear Programming, algorithms for graph-based codes and applications of graph theory for Numerical Computing'. The Carl Friedrich Gauss Prize for applications of mathematics was instituted in 2006. Given for the second time in the Congress, it was awarded to Yves Meyer (École Normale Supérieure de Cachan, Paris). Meyer's citation read: 'for fundamental contributions to number theory, operator theory and harmonic analysis, and his pivotal role in the development of wavelets and multiresolution analysis'. A new award, the Chern Medal was instituted this year, named after the great mathematician, Shiing-Shen Chern who died in 2004. It recognizes outstanding life-long achievements in the field of mathematics. The prize, given jointly by IMU and the Chern Medal Foundation, was conferred upon Louis Nirenberg

(Courant Institute of Mathematical Sciences, USA) 'for his role in the formulation of the modern theory of nonlinear elliptic partial differential equations and for mentoring numerous students and post-docs in this area'. Nirenberg also had a close association with Chern.

Laudations of the work of the prize-winners were given by well-known experts in the respective fields and were followed by talks by the prize-winners on their own work. The technical programme of ICM included lectures under 20 sections: logic and foundations, algebra, number theory, algebraic and complex geometry, geometry, topology, Lie theory and generalizations, analysis, functional analysis and applications, dynamical systems and ordinary differential equations, partial differential equations, mathematical physics, probability and statistics, combinatorics, mathematical aspects of computer science, numerical analysis and scientific computing, control theory and optimization, mathematics in science and technology, mathematics education and popularization of mathematics, and history of mathematics. While most of the talks delivered were highly technical in nature, others and also the panel discussions were targeted towards a general audience. Kim



Faces of Mathematics at ICM 2010 (clockwise: Daniel Spielman, Ngô Bảo Châu, Elon Lindenstrauss, Cédric Villani, Stanislav Smirnov, Yves Meyer and Louis Nirenberg) (Photos: Rahul V. Pisharody; Collage: Richa Malhotra).

*A report on the International Congress of Mathematicians (ICM) 2010 held at the Hyderabad International Convention Centre, Hyderabad during 19–27 August 2010. The report also includes highlights of the General Assembly Meeting and the International Conference on Women Mathematicians held in association with the ICM.

Plofker, author of *Mathematics in India*, delivered a talk on the mutual encounter of two cultures – Indians and Yavanas and the transmission of mathematics. During the press briefing addressed by the prize-winners, it was admitted that mathematics is too wide a subject to allow one to fully understand the specialized work of others, but the lectures at the Congress help acquaint the attendees with the research areas being pursued.

A panel discussion on school mathematics highlighted the issues of mathematics curriculum in schools. The dire need of good mathematics books for schools was voiced; the need may be fulfilled if researchers write books that are useful for both students and teachers, it was said. It was put forth that by interacting more with the students, they can be made interested in mathematics. ‘Communicating mathematics to society at large’ was the theme of another discussion that brought to light the need to change the perception of public towards mathematics. *Plus* magazine, an initiative of the Millennium Mathematics Project, is an online source of mathematics articles, puzzles and interviews of mathematicians and offers learning in mathematics in an engaging manner. A discussion on ‘Ethnomathematics, language and socio-cultural issues’ was also conducted. In the round table discussion on the use of metrics in evaluating research, some of the speakers criticized the use of impact factor and highlighted the manipulative means adopted by editors and authors in citing their own papers in some of the ‘high impact’ mathematics journals.

Other talks encompassed an Abel Lecture, delivered for the first time at ICM, and the Emmy Noether Lecture. The Abel Lecture was given by the Abel Prize 2007 laureate, S. R. S. Varadhan (Courant Institute of Mathematical Sciences, USA) on ‘large deviations’. The large deviation principle involves

the precise estimation of probabilities of rare events. The Emmy Noether Lecture was instituted to honour women who have made fundamental and sustained contributions to mathematics. This year’s speaker, Idun Reiten (Norwegian University of Science and Technology, Norway) spoke on ‘cluster categories’.

Two awards were presented during the closing ceremony: the Leelavati Prize and the Kenneth O. May Prize 2009. The Leelavati Prize was instituted this year to recognize individual contribution to public outreach in mathematics and was presented to Simon Lehna Singh, author of *Fermat’s Last Theorem*. Singh delivered a popular talk on making of the documentary featuring André Weil. Radha Charan Gupta received the 2009 Kenneth O. May Prize for the history of mathematics. He was recognized for his contributions to the history of development of trigonometry in India.

The Congress also held cultural programmes for the participants along with two lectures on appreciation of classical Indian music delivered by Sunil Mukhi (Tata Institute of Fundamental Research, Mumbai). An English play by Complicite, ‘A Disappearing Number’ revolving around the relationship between Srinivasa Ramanujan and G. H. Hardy and based on Hardy’s *A Mathematician’s Apology* was staged at the Global Peace Auditorium, Hyderabad. Daily activities of the Congress were reported in a newsletter, *Reflexions*.

The General Assembly (GA) meeting of IMU was held in Bangalore during 16–17 August. At the meeting, South Korea was chosen as the venue for the next ICM in 2014; the Weierstrass Institute, Berlin was chosen to be the site for the permanent office of the IMU; and Ingrid Daubechies was elected the next President (2011–2014) of IMU. Speaking on the future of mathematics, László Lovász (present President) said that an important area in applied mathematics

would be the understanding of complex large structures. Daubechies pointed out that the most spectacular developments in mathematics would come from applications because people need them. This would require a better setting and that would lead to new fields and constructions within pure mathematics.

The ICM, for the first time in history, was preceded by the International Conference of Women Mathematicians (ICWM) held during 17–18 August 2010, where about 200 participants discussed problems affecting the success rate of women in mathematics. Panellists presented a global statistical account of women in the field of mathematics. During the discussion, it came to light that there are few role models for women students and there exists a wrong notion that mathematics is not an attractive career for women. Possible ways to enhance the number of women in mathematics – creating women’s associations on the lines of the ‘European Women in Science’ in developing countries such as India and Pakistan, and increasing awards and funding for women in research (positive discrimination) – were proposed. It was hoped that ICWM becomes a regular feature of ICM. It was announced at the end of the panel discussion that a donation of US\$ 90,000 by a Korean company to Korean Women in Mathematical Sciences, to support women from developing countries to attend the next ICM. This money would be used towards the Korean mathematical community’s commitment to bring 1000 mathematicians from developing countries to the ICM 2014.

In addition, a number of satellite conferences were organized throughout India during the period July–September 2010.

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