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LETTER FROM OUR FAR-FLUNG CORRESPONDENT ICM 2002 BEIJING

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Mark,

ICM 2002, the first meeting in a developing country (the noise proposes India for 2010 or 14), was attended by 4,270 mathematicians from over 100 countries and regions. At the opening ceremony were the President of China, Jiang Zemin, who presented the Fields medal to the French mathematician Laurent Lafforgue (Institut des Hautes Scientifiques in Bures-sur-Yvette) whose work in advancing the Langlands Program has established new connections between analysis and number theory, and to the Russian-born Vladimir Voevodsky (Institute for Advanced Study in Princeton, N.J.) for developing new cohomology theories for algebraic varieties that have provided new connections between algebraic geometry and number theory. The Nevanlinna prize went to the Indian-born mathematician Madhu Sudan (MIT, Cambridge, Mass.) for his work in error-correcting codes; in the theory of probabilistically checkable proofs, which requires that proofs be written (usually mechanically) in a formal axiomatic system such as Zermelo-Fraenkel set theory, and includes showing that for many NP-hard problems that require finding an optimal solution to a combinatorial problem, e.g., given a finite collection of finite sets, what is the largest size of a subcollection such that every pair of sets in the subcollection is disjoint?—that for these problems approximating an optimal solution is just as hard as finding the optimal solution.

There were 20 plenary lectures (none in logic), and 174 invited lectures, of which five were in the logic section. Three were: "Groups Interpretable in Theories of Fields," delivered by E. Bouscaren (Université de Paris 7-CNRS); "Motivic Integration and the Grothendieck Group of Pseudo-Finite Fields," delivered by J. Denef (University of Leuven, Belgium), joint work with F. Loeser (École Normale Supérieure, France); "The Power Set Function," delivered by M. Gitik (Tel Aviv University, Israel). The speaker discussed the history of the topic since

Cantor's set theory, i.e., the function taking a cardinal κ to the cardinality of its power set, 2^κ, the basic problem being to determine all the possible values of 2^κ for a cardinal κ. Soon after Paul Cohen invented the method of forcing and proved the independence of the Continuum Hypothesis, Easton showed the function $\kappa \mapsto 2^\kappa$ for regular κ can behave in any prescribed way consistent with Koenig's Theorem, which reduces the problem to the study of singular cardinals. The fourth talk, by D. Lascar (Université de Paris 7, CNRS), was entitled "Automorphisms Groups of Saturated Structures: A Review." The fifth talk, by H. Woodin (University of California, Berkeley), was entitled, "The Continuum Hypothesis, Iterable Structures and the Omega Conjecture."

Two invited lectures in the section on Mathematical Aspects of Computer Science appealed to those interested in applications of logic. These were: the talk by S. Arora (Princeton University, Princeton, N.J.) "How NP Got a New Definition: A Survey of Probababilistically Checkable Proofs"; and the talk by R. Raz (Weizmann Institute for Science, Rehovat, Israel), who spoke on "P = NP, Propositional Proof Complexity, and Resolution Lower Bounds for the Weak Pigeonhole Principle." This talk is based on propositional proof theory, a notion first introduced by S. Cook and R. Reckhow in 1973, which is the study of the length of proofs for different tautologies in different propositional proof systems. Propositional versions of the statement P = NP were first introduced by A. Razborov in 1995. One of the simplest propositional proof systems is Resolution, the basis of most automatic theorem provers. The Pigeonhole Principle is probably the most widely studied tautology in propositional proof theory.

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