Daily News 每日新闻

International Congress of Mathematicians Wednesday, August 21, 2002 – No. 2

Congratulations to the Prize Winners!

Warmest Congratulations to the Fields medalists and the winner of the Nevanlinna prize! These prizes were awarded at yesterday's opening ceremony of the ICM-2002.

The 2002 Fields medalists are:

LAURENT LAFFORGUE, Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette, France. He is recognized for making a major advance in the Langlands Program, thereby providing new connections between number theory and analysis.

VLADIMIR VOEVODSKY, Institute for Advanced Study, Princeton, New Jersey, USA. He is recognized for developing new cohomology theories for algebraic varieties, thereby providing new insights into number theory and algebraic geometry.

The 2002 Nevanlinna Prize winner is:

MADHU SUDAN, Massachusetts Institute of Technology, Cambridge, Massachusetts, USA. He is recognized for contributions to probabilistically checkable proofs, to non-approximability of optimization problems, and to error-correcting codes.

L. Lafforgue

V. Voevodsky

M. Sudan

"The achievements of the Fields Medalists and Nevanlinna Prize winner show great depth and originality," said Jacob Palis, President of the International Mathematical Union. "The choice of problems, their methods, and their results are quite different from one another, and this diversity exemplifies the vitality of the whole of the mathematical sciences. The world mathematical community applauds their outstanding work."

The Prize winners will present talks on their work in the Course of the Congress.

Laurent Lafforgue, *Drinfeld Varieties and the Langlands programme.* Aug.21, 8:30-9:30 CH01

Vladmir Voevodsky, *The slice filtration in motivic stable homotopy.* Aug. 22, 16:00-17:00 CH17C

Sudan, Madhu, *List decoding of error-correcting code*, Aug. 23, 19:30-20:30, MR6-8.

About the Prize Winners

LAURENT LAFFORGUE: FIELDS MEDAL

Laurent Lafforgue has made an enormous advance in the so-called Langlands Program by proving the global Langlands correspondence for function fields. His work is characterized by formidable technical power, deep insight, and a tenacious, systematic approach.

The Langlands Program, formulated by Robert P. Langlands for the first time in a famous letter to Andre Weil in 1967, is a set of far-reaching conjectures that make precise predictions about how certain disparate areas of mathematics might be connected. The influence of the Langlands Program has grown over years, with each new advance hailed as an important achievement.

One of the most spectacular confirmations of the Langlands Program came in the 1990s, when Andrew Wiles's proof of Fermat's Last Theorem, together with work by others, led to the solution of the Taniyama-Shimura-Weil Conjecture. This conjecture states that elliptic curves, which are geometric objects with deep arithmetic properties, have a close relationship to modular forms, which are highly periodic functions that originally emerged in a completely different context in mathematical analysis. The Langlands Program proposes a web of such relationships connecting Galois representations, which arise in number theory, and automorphic forms, which arise in analysis.

The roots of the Langlands program are found in one of the deepest results in number theory, the Law of Quadratic Reciprocity, which goes back to the time of Fermat in the 17th century and was first proved by Carl Friedrich Gauss in 1801. An important question that often arises in number theory is whether, upon dividing two prime numbers, the remainder is a perfect square. The Law of Quadratic Reciprocity reveals a remarkable connection between two seemingly unrelated question involving prime numbers p and q: "Is the remainder of p divided by q a perfect square?" and "Is the remainder of q divided by p a perfect square?" Despite many proofs of this Law (Gauss himself produced six different proofs), it remains one of the most mysterious facts in number theory. Other reciprocity laws that apply in more general situations were discovered by Teiji Takagi and by Email Artin in the 1920s. One of the original motivations behind the Langlands Program was to provide a complete understanding of reciprocity laws that apply in ceven more genarla situations.

The global Langlands correspondence proved by Lafforgue provideds this complete understanding in the setting not of the ordinary numbers but of more abstract objects called function fields. One can think of a function field as consisting of quotients of polynomials; these quotients can be added, subtracted, multiplied, and divided just like the rational numbers. Lafforgue established, for any given function field,a precise link between the representations of its Galois groups and the automorphic forms associated with the field. He built on work of 1990 Fields Medalist Vladimir Drinfeld, who proved a special case of the Langlands correspondence in the 1970s. Lafforgue was the first to see how Drinfeld's work could be expanded to provide a complete picture of the Langlands correspondedce in the function field case.

In the course of this work Lafforgue invented a new geometric construction that may prove to be important in the future. The influence of these developments is being felt across all of mathematics.

Laurent Lafforgue was born on 6 November 1966 in Antony, France. He graduated from the Ecole Normale Superieure in Paris (1986). He became an attaché de recherché of the Centre National de la Recherche Scientifique (1990) and worked in the Arithmetic and Algebraic Geometry team at the Universite de Paris-Sud, where he received his doctorate (1994). In 2002 he was made a permanent professor of mathematics at the Institut des Hautes Etudes Scientifiques in Bures-sur-Yvette, France.

About the work of Lafforgue:

"Fermat's Last Theorem's First Cousin," by Dana Mackenzie. Science, Volume 287, Number 5454, 4 February 2000, pages 792-793.

VLADIMIR VOEVODSKY: FIELDS MEDAL

Vladimir Voevdsky made one of the most outstanding advances in algebraic geometry in the past few decades by developing new cohomology theories for algebraic varieties. His work is characterized by an ability to handle highly abstract ideas with ease and flexibility and to deploy those ideas in solving quite concrete mathematical problems.

Voevodsky's achievement has its roots in the work of 1966 Fields Medalist Alexandre Grothendieck, a profound and original mathematician who could perceive the deep abstract structures that unite mathematics. Grothendieck realized that there should be objects, which he called "motives", that are at the root of the unity between two branches of mathematics, number theory and geometry. Grothendieck's ideas have had widespread influence in mathematics and provided inspiration for Voevodsky's work..

The notion of cohomology first arose in topology, which can be loosely described as "the science of shapes". Examples of shapes studied are the sphere, the surface of doughnut, and their higher-dimensional analogues. Topology investigates fundamental properties that do not change when such objects are deformed (but not torn). On a very basic level, cohomology theory provides a way to cut a topological object into easier-to-understand pieces. Cohomology groups encode how the pieces fit together to form the object. There are various ways of making this precise, one of which is called singular cohomology. Generalized cohomology theories extract data about properties of topological objects and encode that information in the language of groups. One of the most important of the generalized cohomology theories, topological K-theory, was developed chiefly by another 1966 Fields Medalist, Michael Atiyah. One remarkable result revealed a strong connection between singular cohomology and topological K-theory.

In algebraic geometry, the main objects of study are algebraic varieties, which are the common solution sets of study are algebraic varieties can be represented by geometric objects like curves or surfaces, but they are far more "rigid" than the malleable objects of topology, so the cohomology theories developed in the topological setting do mot apply here. For about forty years, mathematicians worked hard to develop good cohomology theories for algebraic varieties; the best understood of these was the algebraic version of K-theory. A major advance came when Voevodsky, building on a little-understood ides proposed by Andrei Suslin, created a theory of "motivic cohomology". In analogy with the topological setting, there is a strong connection between motivic cohomology and algebraic K-theory. In addition, Voevodsky provided a framework for describing many new cohomology theories for algebraic varieties.

His work constitutes a major step toward fulfilling Grothendieck's vision of the unity of mathematics.

One consequence of Voevodsky's work, and one of his most celebrated achievements, is the solution of the Milnor Conjecture, which for three decades was the main outstanding problem in algebraic K-theory, This result has striking consequences in several areas, including Galois cohomology, quadratic forms, and the cohomology of complex algebraic varieties. Voevodsky's work may have a large impact on mathematics in the future by allowing powerful machinery developed in topology to be used for investigating algebraic varieties.

Vladmir Voevodsky was born on 4 June 1966 in Russia. He received his B.S. in mathematics from Moscow State University (1989) and his Ph.D. in mathematics from Harvard University (1992). He held visiting positions at the Institute for Advanced S TUDY, Harvard University, and the Max-Planck-Institut fuer Mathematik before joining the faculty of Northwestern University in 1996. In 2002 he was named a permanent professor in the School of Mathematics at the Institute for Advanced Study in Princeton, New Jersey.

About the work of Voevodsky: "The Motivation Behind Motivic Cohomology," by Allyn Jackson.

MADHU SUDAN: NEVANLINNA PRIZE

Madhu Sudan has made important contributions to several areas of theoretical computer science, including probabilistically checkable proofs, non-approximability of optimization problems, and error-correcting codes. His work is characterized by brilliant insights and wide-ranging interests.

Sudan has been a main contributor to the development of the theory of probabilistically checkable proofs. Given a proof of a mathematical statement, the theory provides a way to recast the proof in a form where its fundamental logic is encoded as a sequence of bits that can be stored in a computer. A "verifier" can, by checking only some of the bits, determine with high probability whether the proof is correct. What is extremely surprising, and quite counterintuitive, is that the number of bits the verifier needs to examine can be made extremely small. The theory was developed in papers by Sudan, S. Arora, U. Feige, S. Goldwasser, C. Lund, L. Lovasz, R. Motwani, S. Safra, and M. Szegedy. For this work, these authors jointly received the 2001 Goedel Prize of the Association for Computing Machinery.

Also together with other researchers, Sudan has made fundamental contributions to understanding the non-approximability of solutions to certain problems. This work connects to the fundamental outstanding question in theoretical computer science: Does P equal NP? Roughly, P consists of problems that are "easy" to solve with current computing methods, while NP is thought to contain problems that are fundamentally harder. The term "easy" has a technical meaning related to the efficiency of computer algorithms for solving problems. A fundamentally hard problem in NP has the property that a proposed solution is easily checked but that no algorithm is known that will easily produce a solution from scratch. Some NP hard problems require finding an optimal solution to a combinatorial problem such as the following: Given a finite collection of finite sets, what is the largest size of a subcollection such that every two sets in the subcollection are disjoint? What Sudan and others showed is that, for many such problems, approximating an optimal solution is just as hard as finding an optimal solution. This result is closely related to the work on probabilistically checkable proofs. Because the problems in question are closely related to many everyday problems in science and technology, this result is of immense practical as well as theoretical significance.

The third area in which Sudan made important contributions is error-correcting codes. These codes play an enormous role in securing the reliability and quality of all kinds of information transmission, from music recorded on CDs to communication over the Internet to satellite transmissions. In any communication channel, there is a certain amount of noise that can introduce errors into the messages being sent. Redundancy is used to eliminate errors due to noise by encoding the message into a larger message. Provided the coded message does not suffer too many errors in transmission, the recipient can recover the original message. Redundancy adds to the cost of transmitting messages, and the art and science of error-correcting codes is to balance redundancy with efficiency A class of widely used code the Reed-Solomon codes (and their variants), which were invented in the 1960s. For40 years it was assumed that the codes could correct only a certain number of errors. By creating a new decoding algorithm, Sudan demonstrated that the Reed-Solomon codes could correct many more errors than previously thought possible.

Madhu Sudan was born on 12 September 1966, in Madras (now Chennai), India. He received his B. Tech. degree in computer science from the Indian Institute of Technology in New Delhi (1987) and his Ph.D. in computer science at the University of California at Berkeley (1992). He was a research staff member at the IBM Thomas J. Watson Research Center in Yorktown Heights, New York (1992-1997). He is currently an associate professor in the Department of Electrical Engineering and Computer Science at the Massachusetts Institute of Technology.

About the work of Sudan:

"The easy way to check hard maths," by Arturo Sangalli. New Scientist, 8 May 1993, pages 24-28. "Coding theory meets theoretical computer science," by Sara Robinson. SIAM News, 34(10):216-217, December 2001

(Allyn Jackson).

Public Talk by John F. Nash, Jr. Today!

Date: Wednesday, August 21, 2002, 19:30.
Venue: Convention Hall No. 1, BICC.
Title: *Studying Cooperation in Games via Agencies.*
Tickets available at Room 3055 (third floor) from 8:00 to 18:00 on a first-come-first-serve base. (Limited Number of tickets!)

Announcement

August 22, 16:00-17:00, CH17C, Lecture of the Fields Medalist: Voevodsky, Vladimir (Institute of Advanced Study, USA) *The slice filtration in motivic stable homotopy.*

followed by Informal Seminar on K-Theory, 17:15-18:00, CH17C, Geisser, Thomas (University of Southern California, USA) *Weil etale motivic cohomology.*

18:00-18:45, CH17C Kahn, Bruno, University of Paris 7, France *Algebraic K-theory, algebraic cycles, and arithmetical geometry*

R3018 should be corrected to R5018! (This is related to the sections: 2, 4, 8, 9, 10, 11, 12, 15, 17, 19)

Cancellation

1. Logic	
Li, Na, Aug. 22, 14:25, R3058.	
10. Probability and Statistics	
Zhou, Yong, Aug. 21, 17:50-18:05, R5020.	
Wang, Qihua, Aug. 21, 18:05-18:20, R5020.	
11. Partial Differential Equations	
Lin, Jeng-Eng, Aug. 22, 17:35, R5015.	

Scientific Program – Changes

7. Lie Groups and Representation Theory

The chair of Eckhard Meinrenken's lecture is changed: Zhao, Kaiming (AMSS, CAS, China), August 23, 17:15-18:00, CH17B.

8. Real and Complex Analysis

The chair of Steven Zelditch's lecture is changed: Wang, Yuefei (AMSS, CAS, China), August 22, 16:15-17:00, CH02.

11. Partial Differential Equations

Wen Guo Chun will replace Chen, Dechang to give the talk. Aug. 26, 15:15, R3018.

Correction to the 1st Daily News

Section 11: Se, Wan (Kim Hangyang University, Korea) ⇒ Kim, Se Wan, (Hangyang University, Korea)

ad-hoc Talks and Posters

2. Algebra

Short Talk: Aug. 21, 17:00-17:15, Moazzami, Dara (University of Tehran, Iran), *A Survey on Tenacity and its Properties in Stability Calculation*, CH14.

Short Talk: Aug. 21, 17:00-17:15, Juriaans, Stanley Orlando (Universidade de So Paulo, Brazil),*Structure theorems in Algebras.*

16. Numerical Analysis and Scientific Computing

Poster: Aug. 21, 17:20-18:20, EH02, Kerayechian, Asghar (Ferdowsi University, Iran), *The Schwarz method for the unsteady Stokes problem.*

Footloose tours – Item I

All tours will start in front of the Congress Venue (Beijing International Convention Center). Buses (free of charges) will be provided by the Organizing Committee, and one ticket just for one person. All the passengers please hand in the entrance fee to the volunteer in the bus. The duration time for each tour will be no longer than 3 hours, unless we have heavy traffic.

In case a tour you are interested in is booked out please continue registering in the conference office to show your interest in a repetition since we try to repeat this tour another day. A brief of descriptions of the footloose tours are as follows.

Tour 1-A: Great Bell Temple (Da zhong si); booked out
Date : August 21,
Tour 1-B: Great Bell Temple (Da zhong si); booked out
Date : August 27,
Tour 2: Madam Song's Mansion; booked out
Date : August 21,
Tour 3-A: Chinese Ethnic Culture Park; booked out
Date: August 22,
Tour 3-B: Chinese Ethnic Culture Park; booked out
Date: August 27,
Tour 4-A: Beijing Botanic Garden; booked out
Date: August 23,
Tour 4-B: Beijing Botanic Garden; booked out
Date: August 26,
Tour 5: Peking University; booked out
Date: August 24,
Tour 6-A: Yuan Ming Yuan (the old Summer Palace); booked out
Date: August 22,
Tour 6-B: Yuan Ming Yuan (the old Summer Palace); booked out
Date:August 26,
Tour 7-A: Ancient Observatory(Gu Guan Xiang Tai); booked out
Date: August 23,

Tour 7-B: Ancient Observatory(Gu Guan Xiang Tai); booked out
Date : August 27,
Tour 8-A: Exhibition Hall of Chinese Science and Technology;
Date : August 28,
Tour 8-B: Exhibition Hall of Chinese Science and Technology;
Date : August 24,
Tour 9: Confucius Temple; booked out
Date : August 26,
Tour 10: Legend Computer Company; booked out
Date : August 22,

Footloose tours – Item II

A brief of descriptions of the footloose tours on August 21 are as follows.
Tour 1-A: Great Bell Temple (Da Zhong Si); booked out
Description: Great Bell Temple Situated in Haidian in the northwestern suburbs, the temple was built in 1732 in the reign of Emperor YongZheng of the Qing Dynasty. It is the largest bell in China and the second largest in the world. Originally it was one to the six to be hung at the six corners of the city walls to strike the hours, but now it is the only remaining one.The Bell is also know as the Avatamsaka Bell because it bears the full text of all 81 volumes of the Lotus Scripture(the Avatamsaka Sutra). It is sometimes referred to as the Yongle Bell since it was cast by the order of Emperor Yongle of the Ming Dynasty in 1406.
Meeting: **9:00 a.m.** in front of BICC
Duration: aprrox. 3 hours
Entrance Fee: 10 yuans

Tour 2: Madam Song's Mansion; booked out
Description: Madam Song Qingling was the wife of Dr. Sun Yat-sen, the founder of the republic, and she herself was the Vice-president of the People's Republic of China. As the second daughter of the famous Song family(Her younger sister Song Mei-ling married Chiang Kai-shek), she studied in the United States and was deeply involved in China's political life. Just as Dr. Sun Yat-sen was regarded as the "Father of the Republic", she was sometimes called the "Mother of the Republic". Her personal life was to some extent a mini-history of modern China.The layout of the houses and the arrangement of the furniture and her personal belongings are kept as they were when she was alive. Pictures of historical interest are also displayed.
Meeting: **3:00 p.m.** in front of BICC
Duration: aprrox. 3 hours
Entrance Fee: 10 yuans

Daily News of the International Congress of Mathematicians, August 20-28, 2002, Beijing, China	*Editor in Chief*: Wenlin Li *Editors*: Qi Feng, Shirong Guo, Yafen Jin, Huimin Weng, Huijuan Wang, Qixiao Ye	*English Consultant*: Joseph C.Y. Chen *Latex Support*: Jinrong Wu