

Scientific Program

The IMU Executive Committee has appointed the ICM 2014 Program Committee (PC) at its meeting in February 2011. The chair of the ICM 2014 PC is Carlos Kenig, (PC-Chair-ICM2014@mathunion.org), the Louis Block Distinguished Service Professor of the University of Chicago, and the PC has set up the structure of the scientific program of ICM 2014. All Plenary and Invited Lectures will be published in the Proceedings after the Congress, and Abstracts of all lectures and of all short presentations will be distributed free of charge to registered participant at Congress check-in.

As in previous years at the ICM, ICM 2014 will offer a wide-ranging, attractive scientific program consisting of plenary and invited lectures, short communications, poster sessions and other scientific activities.

The following subject areas have been chosen for ICM 2014 (section descriptions as well as the number of plenary and invited lectures to be given in each section):

ICM Proceedings Style Files

In order to maintain consistency of the style in the ICM Proceedings, invited plenary and sectional speakers are encouraged to process their electronic files using the style files of the ICM Proceedings. All necessary files, including examples, can be downloaded [here](#).

Click the sections to view invited speakers and panels list.

[1. Logic and Foundations \(6 lectures\)](#)

Model theory. Set theory. Recursion theory. Proof theory. Applications.
Connections with sections 2, 3, 13, 14.

<Invited Speakers>

François Loeser, *Université Pierre et Marie Curie-Paris 6, France* / [Joint section 4](#)
Definability in non-archimedean geometry

Ilijas Farah, *York University, Canada*
Logic and operator algebras

Zoé Chatzidakis, *Université Paris Diderot-Paris 7, France*
Model theory of difference fields and applications to algebraic dynamics

Byunghan Kim, *Yonsei University, Korea*
Amalgamation functors and homology groups in model theory

Antonio Montalbán, *University of California, Berkeley, USA*
Computability theoretic classifications for classes of structures

Slawomir Solecki, *University of Illinois at Urbana-Champaign, USA*
A general approach to finite Ramsey theory

[2. Algebra \(8 lectures\)](#)

Groups (finite, infinite, algebraic) and their representations. Rings, Algebras and Modules (except as specified in other sections, Geometry, or Lie theory). Algebraic K-theory, Category theory, Computational aspect of algebra and applications.
Connections with sections 1, 3, 4, 5, 6, 7, 13, 14.

<Invited Speakers>

Seok-Jin Kang, *Seoul National University, Korea*
Higher representation theory and quantum affine Schur-Weyl duality

Robert Guralnick, *University of Southern California, USA*
Applications of the classification of finite simple groups

Guillermo Cortinas, *Universidad de Buenos Aires, Argentina*
Excision, descent, and singularity in algebraic K-theory.

Nicolás Andruskiewitsch, *Universidad Nacional de Córdoba, Argentina*
On finite-dimensional Hopf algebras

Martin Kassabov, *Cornell University, USA* / [Joint section 7](#)
Finitely Generated Groups with Controlled Pro-algebraic Completions

Olga Kharlampovich, *City University of New York, USA* / [Joint](#)
Model theory and algebraic geometry in groups, non-standard actions and algorithmic problems

Alexei Miasnikov, *Stevens Institute of Technology, USA* / [Joint](#)

Karen Smith, *University of Michigan, USA* / [Joint section 4](#)
Local and global Frobenius splitting

Andrei S. Rapinchuk, *University of Virginia, USA*
Towards the eigenvalue rigidity of Zariski-dense subgroups

[3. Number Theory \(13 lectures\)](#)

Analytic and algebraic number theory. Local and global fields and their Galois groups. Zeta and L-functions. Diophantine equations. Arithmetic on algebraic varieties. Diophantine approximation, transcendental number theory, and geometry of numbers. Modular and automorphic forms, modular curves, and Shimura varieties. Langlands program. p-adic analysis. Number theory and physics. Computational number theory and applications, notably to cryptography.
Connections with sections 1, 2, 4, 7, 11, 12, 13, 14.

<Invited Speakers>

Harald Helfgott, *École Normale Supérieure-Paris, France* / [Joint section 13](#)
The ternary Goldbach problem

Matthew Emerton, *University of Chicago, USA*
Completed cohomology and the p-adic Langlands program

Francis Brown, *IHES, France*
Motivic periods and $P_n\{0; 1; 1\}$

Dan Goldston, *San Jose State University, USA* / [Joint](#)
Small gaps between primes

János Pintz, *Alfréd Rényi Institute of Mathematics, Hungary* / [Joint](#)
Small gaps between primes

Cem Yıldırım, *Boğaziçi University, Turkey* / [Joint](#)
Small gaps between primes

Michael Harris, *Institut de Mathématiques de Jussieu, France*
Automorphic Galois representations and the cohomology of Shimura varieties

Wee Teck Gan, *National University of Singapore, Singapore*
Theta correspondence: recent progress and applications

Trevor Wooley, *Bristol University, UK*
Translation invariance, exponential sums, and Waring's problem

Peter Scholze, *Universität-Bonn, Germany*
Perfectoid spaces and their applications

Zeev Rudnick, *Tel-Aviv University, Israel* / [Joint section 8](#)
Some problems in analytic number theory for polynomials over a finite field

Jean-Loup Waldspurger, *Institut de Mathématiques de Jussieu, France*
Stabilization of the geometric side of the twisted trace formula

Umberto Zannier, *Scuola Normale Superiore di Pisa, Italy*
Elementary integration of differentials in families and conjectures of Pink

Tamar Ziegler, *Hebrew University and Technion, Israel* / [Joint section 9](#)
Linear equations in primes and dynamics of nilmanifolds

Yitang Zhang, *University of New Hampshire, USA*
Small gaps between primes and primes in arithmetic progressions to large moduli

[4. Algebraic and Complex Geometry \(10 lectures\)](#)

Algebraic varieties, their cycles, cohomologies, and motives. Schemes. Geometric aspects of commutative algebra. Arithmetic geometry. Rational points. Low-dimensional varieties. Singularities and classification. Birational geometry. Moduli spaces and enumerative geometry. Derived categories. Abelian varieties. Transcendental methods, topology of algebraic varieties. Complex differential geometry, Kähler manifolds and Hodge theory. Relations with mathematical physics and representation theory. Real algebraic and analytic sets. Rigid and p-adic analytic spaces. Tropical geometry. Non-commutative geometry.
Connections with sections 2, 3, 5, 6, 7, 8, 11, 13, 14.

<Invited Speakers>

Kai Behrend, *University of British Columbia, Canada*
On the virtual fundamental class

Mark Gross, *University of California at San Diego, USA* / [Joint](#)
Local mirror symmetry in the tropics

Bernd Siebert, *Universität Hamburg, Germany* / [Joint](#)
Local mirror symmetry in the tropics

Bumsig Kim, *Korea Institute for Advanced Study, Korea*
Quasimap theory

Alexander Kuznetsov, *Steklov Math Institute, Russia*
Semiorthogonal decompositions in algebraic geometry

Davesh Maulik, *Columbia University, USA*
K3 surfaces in positive characteristic

Mircea MustaÅf, *University of Michigan, USA*
The dimension of jet schemes of singular varieties

Keiji Ogiso, *Osaka University, Japan*
Some aspects of explicit birational geometry inspired by complex dynamics

Bertrand Toën, *CNRS, Université de Montpellier 2, France*
Derived Algebraic Geometry and Deformation Quantization

Yukinobu Toda, *Kavli-IPMU, Japan*
Derived category of coherent sheaves and counting invariants

Mikhail Verbitsky, *National Research University HSE, Russia*
Teichmuller spaces, ergodic theory and global Torelli theorem

[5. Geometry \(15 lectures\)](#)

Local and global differential geometry. Non-linear and fully non-linear geometric PDE. Geometric flows. Geometric structures on manifolds. Riemannian and metric geometry. Geometric aspects of group theory. Conformal geometry, Kähler geometry, Symplectic and Contact geometry, Geometric rigidity, General Relativity.

Connections with sections 2, 4, 6, 7, 8, 9, 10, 11, 12, 16, 17.

<Invited Speakers>

Fuquan Fang, *Capital Normal University, China*
Non-negatively curved manifolds and Tits geometry

Mikhail Belolipetsky, *Instituto Nacional de Matemática Pura e Aplicada, Brazil*
Hyperbolic orbifolds of small volume

Olivier Biquard, *École Normale Supérieure Paris, France*
Einstein 4-manifolds and singularities

Mohammed Abouzaid, *Columbia University, USA* / [Joint section 6](#)
Family Floer cohomology and mirror symmetry

Nancy Hingston, *College of New Jersey, USA*
Loop products, Poincare duality, index growth and dynamics

Aaron Naber, *Northwestern University, USA*
The Geometry of Ricci Curvature

Jeremy Kahn, *Brown University, USA* / [Joint](#) / [Joint section 9](#)
The surface subgroup and the Ehrenpreis Conjectures

Vladimir Markovic, *California Institute of Technology, USA* / [Joint](#) / [Joint section 9](#)
The surface subgroup and the Ehrenpreis Conjectures

Yaron Ostrover, *Tel Aviv University, Israel* / [Joint section 9](#)
When symplectic topology meets Banach space geometry

Hans Ringström, *Royal Institute of Technology-Stockholm, Sweden*
On the future stability of cosmological solutions to Einstein's equations with accelerated expansion

André Neves, *Imperial College London, UK*
New applications of Min-max Theory

Gábor Székelyhidi, *University of Notre Dame, USA*
Extremal Kahler metrics

Natasa Sesum, *Rutgers University, USA*
Solitons in geometric evolution equations

Daniel Wise, *McGill University, Canada* / [Joint section 6](#)
The cubical route to understanding groups

Stefan Wenger, *University of Fribourg, Switzerland*
Isoperimetric inequalities and asymptotic geometry

Peter Topping, *University of Warwick, UK*
Ricci flows with unbounded curvature

[6. Topology \(10 lectures\)](#)

Algebraic Topology, Differential Topology, Geometric Topology, Floer and gauge theories, Low-dimensional manifolds including knot theory and connections with Kleinian groups and Teichmüller theory, Symplectic Geometry and contact manifolds, and Topological quantum field theories.

Connections with sections 2, 4, 5, 7, 8, 11.

<Invited Speakers>

Joseph Ayoub, *University of Zürich, Switzerland*
A guide to (étale) motivic sheaves

Michael Entov, *Technion-Israel Institute of Technology, Israel*
Quasi-morphisms and quasi-states in symplectic topology

Benson Farb, *University of Chicago, USA*
Representation Stability

Soren Galatius, *Stanford University, USA*
Moduli spaces of manifolds

Michael Hill, *University of Virginia, USA*
On the non-existence of elements of Kervaire invariant one

Tao Li, *Boston College, USA*
Heegaard splittings of 3-manifolds

Charles Rezk, *University of Illinois at Urbana-Champaign, USA*
Isogenies, power operations, and homotopy theory

John Rognes, *University of Oslo, Norway*
Algebraic K-theory of strict ring spectra

Thomas Schick, *Universität Göttingen, Germany*
The topology of scalar curvature

Constantin Teleman, *University of California Berkeley, USA*
Gauge theory and mirror symmetry

[7. Lie Theory and Generalizations \(10 lectures\)](#)

Algebraic and arithmetic groups. Structure, geometry, and representations of Lie groups and Lie algebras. Related geometric and algebraic objects, e.g. symmetric spaces, buildings, vertex operator algebras, quantum groups. Non-commutative harmonic analysis. Geometric methods in representation theory. Discrete subgroups of Lie groups. Lie groups and dynamics, including applications to number theory.

Connections with sections 2, 3, 4, 5, 6, 8, 9, 11, 12, 13.

<Invited Speakers>

Yves Benoist, *Université Paris-Sud, France* / [Joint section 9](#)
Recurrence on the space of lattices

Konstantin Ardakov, *Queen Mary University of London, UK*
 $\widehat{\mathcal{D}}$ -modules on rigid analytic spaces

Emmanuel Breuillard, *Université Paris-Sud 11, France*

Diophantine geometry and uniform growth of finite and infinite groups

Michela Varagnolo, *Université de Cergy-Pontoise, France / Joint*

Double affine Hecke algebras and Hecke algebras associated with quivers

Eric Vasserot, *Institut de Mathématiques de Jussieu, France / Joint*

Double affine Hecke algebras and Hecke algebras associated with quivers

Alexander Furman, *University of Illinois at Chicago, USA / Joint section 9*

Boundaries, rigidity of representations, and Lyapunov exponents

Jonathan Brundan, *University of Oregon, USA*

Schur-Weyl duality and categorification

Alexander Kleshchev, *University of Oregon, USA*

Modular representation theory of symmetric groups

Victor Ostrik, *University of Oregon, USA*

Multi-fusion categories of Harish-Chandra bimodules

Nicolas Ressayre, *Institut Camille Jordan, France*

Some qualitative properties of branching multiplicities

Bertrand Rémy, *Institut Camille Jordan, France*

On some recent developments in the theory of buildings

[8. Analysis and its Applications \(15 lectures\)](#)

Classical analysis. Real and Complex analysis in one and several variables, potential theory, quasiconformal mappings. Harmonic analysis. Linear and non-linear functional analysis, operator algebras, Banach algebras, Banach spaces. Non-commutative geometry, spectra of random matrices. Asymptotic geometric analysis. Metric geometry and applications. Geometric measure theory.

Connections with sections 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16.

<Invited Speakers>

Laszlo Erdős, *Institute of Science and Technology, Austria, Austria / Joint section 11 & 12*

Random matrices, log gases and H^1 -older regularity

Alessio Figalli, *University of Texas at Austin, USA*

Quantitative stability results for the Brunn-Minkowski inequality

Kengo Hirachi, *University of Tokyo, Japan*

Q and Q-prime curvature in CR geometry

Tuomas Hytönen, *University of Helsinki, Finland*

Advances in weighted norm inequalities

Nets Katz, *California Institute of Technology, USA*

The flecnode polynomial: a central object in incidence geometry

Izabella Laba, *University of British Columbia, Canada*

Harmonic analysis and the geometry of fractals

László Székelyhidi, *Universität Leipzig, Germany / Joint section 10*

The h-principle and turbulence

Wilhelm Schlag, *University of Chicago, USA / Joint section 10*

Semilinear wave equations

Tom Sanders, *Oxford University, UK / Joint section 13*

Roth's theorem: an application of approximate groups

Andrea Malchiodi, *Scuola Internazionale Superiore di Studi Avanzati, Italy*

Liouville equations from a variational point of view

Sasha Sodin, *Princeton University, USA and Tel Aviv University, Israel*

A modification of the moment method, and its applications to random matrices

Jill Pipher, *Brown University, USA*

Carleson measures and elliptic boundary value problems

Roland Speicher, *Universität des Saarlandes, Germany*

Free probability and random matrices

Chang-Shou Lin, *National Taiwan University, Taiwan*

Mean field equation, Hyperelliptic curve and Modular forms

Adam W. Marcus, *Yale University and Crispily, Inc., USA / Joint / Joint section 13*

Ramanujan graphs and the solution of the Kadison–Singer problem

Daniel A. Spielman, *Yale University, USA / Joint / Joint section 13*

Ramanujan graphs and the solution of the Kadison–Singer problem

Nikhil Srivastava, *Microsoft Research India, India / Joint / Joint section 13*

Ramanujan graphs and the solution of the Kadison–Singer problem

[9. Dynamical Systems and Ordinary Differential Equations \(9 lectures\)](#)

Topological and symbolic dynamics. Geometric and qualitative theory of ODE and smooth dynamical systems, bifurcations and singularities. Hamiltonian systems and dynamical systems of geometric origin. One-dimensional and holomorphic dynamics. Strange attractors and chaotic dynamics. Multidimensional actions and rigidity in dynamics. Ergodic theory including applications to combinatorics and combinatorial number theory. Infinite dimensional dynamical systems and PDE.

Connections with sections 5, 7, 8, 10, 11, 12, 13, 15, 16.

<Invited Speakers>

Viviane Baladi, *CNRS, DMA-Ecole Normale Supérieure, Paris, France*

Linear response, or else

Luigi Chierchia, *Università degli Studi Roma Tre, Italy / Joint*

Metric stability of the planetary N-body problem

Gabriella Pinzari, *Università Federico II, Napoli, Italy / Joint*

Metric stability of the planetary N-body problem

Masato Tsujii, *Kyushu University, Japan*

Resonances for geodesic flows on negatively curved manifolds

Jens Marklof, *University of Bristol, UK*

The low-density limit of the Lorentz gas: periodic, aperiodic and random

Albert Fathi, *ENS de Lyon, France*

Weak KAM Theory: the connection between Aubry-Mather theory and viscosity solutions of the Hamilton-Jacobi equation

Sylvain Crovisier, *University Paris-Sud 11, France*

Dynamics of C^1 -diffeomorphisms: global description and prospects for classification

Carlos Gustavo Moreira, *IMPA, Brazil*

Fractal geometry and dynamical bifurcations

Mark Pollicott, *University of Warwick, UK*

Zeta functions for Anosov flows

Sebastian van Strien, *Imperial College London, UK / Joint*

Recent developments in interval dynamics

Weixiao Shen, *National University Singapore, Singapore / Joint*

Recent developments in interval dynamics

[10. Partial Differential Equations \(13 lectures\)](#)

Solvability, regularity, stability and other qualitative properties of linear and non-linear equations and systems. Asymptotics. Spectral theory, scattering, inverse problems. Variational methods and calculus of variations. Geometric Evolution equations. Optimal transportation. Homogenization and multiscale problems. Relations to continuous media and control. Modeling through PDEs.

Connections with sections 5, 8, 9, 11, 12, 15, 16, 17.

<Invited Speakers>

Panagiota Daskalopoulos, *Columbia University, USA*

Ancient Solutions to Geometric Flows

Mihalis Dafermos, *University of Cambridge, UK / Joint section 11*

The mathematical analysis of black holes in general relativity

Luis Silvestre, *University of Chicago, USA*
Regularity estimates for parabolic integro-differential equations and Applications

Robert Jerrard, *University of Toronto, Canada*
Quantized vortex filaments in complex scalar fields

Ki-Ahm Lee, *Seoul National University, Korea*
Homogenization Theory in Nonlinear Partial Differential Equations

Robert J. McCann, *University of Toronto, Canada*
Academic wages, singularities, phase transitions and pyramid schemes

Laure Saint-Raymond, *École Normale Supérieure, France*
From molecular dynamics to kinetic theory and hydrodynamics

Isabelle Gallagher, *Université Paris-Diderot, France*
From molecular dynamics to kinetic theory and hydrodynamics

Shih-Hsien Yu, *National University of Singapore, Singapore*
Duality in Boltzmann Equation and its Applications

Pierre Raphael, *Université de Nice Sophia Antipolis, France / [Joint section 11](#)*
On singularity formation in Hamiltonian evolution equations

Jeremie Szeftel, *Université Pierre et Marie Curie, France*
The resolution of the bounded R^2 curvature conjecture in general relativity

Andras Vasy, *Stanford University, USA*
Some recent advances in microlocal analysis

Juncheng Wei, *Chinese University of Hong Kong, Hong Kong and University of British Columbia, Canada*
Geometric approaches to semilinear elliptic equations

[11. Mathematical Physics \(12 lectures\)](#)

Quantum mechanics. Quantum field theory including gauge theories. General relativity. Statistical mechanics and random media. Integrable systems. Supersymmetric theories. String theory. Fluid dynamics.
Connections with sections 4, 5, 6, 7, 8, 9, 10, 12.

<Invited Speakers>

Anton Alekseev, *Université de Genève, Switzerland*
Three lives of the Gelfand-Zeitlin integrable system

Ivan Corwin, *Clay Mathematics Institute, Columbia University and Institut Henri Poincaré, USA*
Macdonald processes, quantum integrable systems and the Kardar-Parisi-Zhang universality class

Bertrand Duplantier, *Institut de Physique Théorique, France*
Liouville quantum gravity, KPZ & Schramm-Loewner Evolution

Samson Shatashvili, *Trinity College, Ireland*
Gauge theory angle at quantum integrability

Vladimir Fock, *Université de Strasbourg et CNRS, France*
Cluster varieties and integrable systems

Anton Gerasimov, *Institute of Theoretical and Experimental Physics, Russia*
Archimedean Langlands duality in number theory and exactly solvable quantum systems

Robert Seiringer, *Institute of Science and Technology Austria, Austria*
Structure of the excitation spectrum for many-body quantum systems

Rinat Kedem, *University of Illinois at Urbana-Champaign, USA*
Fermionic spectra in integrable models

Sandrine Péché, *Université Paris-Diderot, France / [Joint section 12](#)*
Deformed ensembles of random matrices

Seung-Yeal Ha, *Seoul National University, Korea / [Joint section 17](#)*
Lyapunov functional approach and collective dynamics of some interacting many-body systems

Bertrand Eynard, *Institut de Physique Théorique, France*
An overview of the topological recursion

Jörg Teschner, *Universität Hamburg, Germany*
Quantization of moduli spaces of flat connections and Liouville theory

[12. Probability and Statistics \(13 lectures\)](#)

Stochastic processes, Interacting particle systems, Random media, Random matrices, conformally invariant models, Stochastic networks, Stochastic geometry, Statistical inference, High-dimensional data analysis, Spatial methods.
Connections with sections 3, 5, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17

<Invited Speakers>

Sourav Chatterjee, *Stanford University, USA*
A short survey of Stein's method

Geoffrey Grimmett, *University of Cambridge, UK*
Criticality, universality, and isoradiality

Takashi Kumagai, *Kyoto University, Japan*
Anomalous random walks and diffusions: From fractals to random media

Russell Lyons, *Indiana University, USA*
Determinantal probability: surprising relations

Michel Ledoux, *Université de Toulouse, France*
Heat flows, geometric and functional inequalities

Martin Hairer, *University of Warwick, UK*
Regularity structures

Terry Lyons, *University of Oxford, UK*
Rough paths, signatures and the modelling of functions on streams

Timo Seppäläinen, *University of Wisconsin, USA*
Variational formulas for directed polymer and percolation models

Kenneth Lange, *University of California at Los Angeles, USA / [Joint section 17](#)*
The MM proximal distance algorithm

Alexandre Tsybakov, *CREST-ENSAE, France*
Aggregation and minimax optimality in high-dimensional estimation

Vladas Sidoravicius, *Instituto Nacional de Matemática Pura e Aplicada, Brazil*
Criticality and Phase Transitions: five favorite pieces

Bálint Virág, *University of Toronto, Canada*
Operator limits of random matrices

Martin Wainwright, *University of California Berkeley, USA*
Constrained forms of statistical minimax: Computation, communication, and privacy

[13. Combinatorics \(10 lectures\)](#)

Combinatorial structures. Enumeration: exact and asymptotic. Graph theory. Probabilistic and extremal combinatorics. Designs and finite geometries. Relations with linear algebra, representation theory and commutative algebra. Topological and analytical techniques in combinatorics. Combinatorial geometry. Combinatorial number theory. Additive combinatorics. Polyhedral combinatorics and combinatorial optimization.
Connections with sections 1, 2, 3, 4, 7, 9, 12, 14.

<Invited Speakers>

David Conlon, *University of Oxford, UK*
Combinatorial theorems relative to a random set

Maria Chudnovsky, *Columbia University, USA*
Coloring graphs with forbidden induced subgraphs

Michael Krivelevich, *Tel Aviv University, Israel*
Positional games

Daniela Kühn, *University of Birmingham, UK / [Joint](#)*
Hamilton cycles in graphs and hypergraphs: an extremal perspective

Deryk Osthus, *University of Birmingham, UK / Joint*
Hamilton cycles in graphs and hypergraphs: an extremal perspective

Marc Noy, *Universitat Politècnica de Catalunya, Spain*
Random planar graphs and beyond

Grigori Olshanski, *Institute for Information Transmission Problems, Russia*
The Gelfand-Tsetlin graph and Markov processes

János Pach, *EPFL, Switzerland and Rényi Institute, Hungary*
Geometric intersection patterns and the theory of topological graphs

Van Vu, *Yale University, USA*
Combinatorial Problems in Random Matrix Theory

Angelika Steger, *ETH Zürich, Switzerland*
The determinism of randomness and its use in combinatorics

Jacob Fox, *MIT, USA*
The graph regularity method: variants, applications, and alternative methods

[14. Mathematical Aspects of Computer Science \(8 lectures\)](#)

Complexity theory and design and analysis of algorithms. Formal languages. Computational learning. Algorithmic game theory. Cryptography. Coding theory. Semantics and verification of programs. Symbolic computation. Quantum computing. Computational geometry, computer vision.

Connections with sections 1, 2, 3, 4, 12, 13, 15.

<Invited Speakers>

Boaz Barak, *Microsoft Research, USA*
Sum-of-squares proofs and the quest toward optimal algorithms

Mark Braverman, *Princeton University, USA*
Interactive information and coding theory

Andrei Bulatov, *Simon Fraser University, Canada*
Counting Constraint Satisfaction Problems

Julia Chuzhoy, *Toyota Technological Institute at Chicago, USA*
Flows, cuts and integral routing in graphs - an approximation algorithmist's perspective

Craig Gentry, *IBM Research Thomas J. Watson Research, USA*
Computing on the Edge of Chaos: Structure and Randomness in Encrypted Computation

Ryan O'Donnell, *Carnegie Mellon University, USA*
Social choice, computational complexity, Gaussian geometry, and Boolean functions

Ryan Williams, *Stanford University, USA*
Algorithms for circuits and circuits for algorithms: connecting the tractable and intractable

Sergey Yekhanin, *Microsoft Research, USA*
Codes with local decoding procedures

[15. Numerical Analysis and Scientific Computing \(6 lectures\)](#)

Design of numerical algorithms and analysis of their accuracy, stability, and complexity. Approximation theory. Applied and computational aspects of harmonic analysis. Numerical solution of algebraic, functional, stochastic, differential, and integral equations. Grid generation and adaptivity.

Connections with sections 8, 9, 10, 12, 14, 16, 17.

<Invited Speakers>

Rémi Abgrall, *University of Zürich, Switzerland*
On a class of high order schemes for hyperbolic problems

Chi-Wang Shu, *Brown University, USA*
Discontinuous Galerkin method for time-dependent convection dominated partial differential equations

Yalchin Efendiev, *Texas A&M University, USA*
Multiscale Model Reduction with Generalized Multiscale Finite Element Methods

Annalisa Buffa, *Istituto di Matematica Applicata e Tecnologie Informatiche "E. Magenes", C.N.R., Italy*
Spline differential forms

Denis Talay, *INRIA, France*
Singular stochastic computational models, stochastic analysis, PDE analysis, and numerics

Ya-xiang Yuan, *Chinese Academy of Sciences, China / Joint section 16*
A review on subspace methods for nonlinear optimization

[16. Control Theory and Optimization \(6 lectures\)](#)

Minimization problems. Controllability, observability, stability. Robotics. Stochastic systems and control. Optimal control. Optimal design, shape design. Linear, non-linear, integer, and stochastic programming. Applications.

Connections with sections 9, 10, 12, 15, 17.

<Invited Speakers>

Friedrich Eisenbrand, *École Polytechnique Fédérale de Lausanne, Switzerland*
Recent results around the diameter of polyhedra

Pierre Rouchon, *Mines ParisTech, France*
Models and feedback stabilization of open quantum systems

Adrian Lewis, *Cornell University, USA*
Nonsmooth optimization: conditioning, convergence, and semi-algebraic models

Luc Robbiano, *Université de Versailles Saint-Quentin-en-Yvelines, France*
Carleman estimates, results on control and stabilization for partial differential equations

Monique Laurent, *Centrum Wiskunde & Informatica and Tilburg University, Netherlands*
Optimization over polynomials: selected topics

Jiongmin Yong, *University of Central Florida, USA*
Time-inconsistent optimal control problems

[17. Mathematics in Science and Technology \(10 lectures\)](#)

Mathematics applied to the physical sciences, engineering sciences, life sciences, social and economic sciences, and technology. Bioinformatics. Mathematics in interdisciplinary research. The interplay of mathematical modeling, mathematical analysis, and scientific computation, and its impact on the understanding of scientific phenomena and on the solution of real life problems.

Connections with sections 9, 10, 11, 12, 14, 15, 16.

<Invited Speakers>

Weizhu Bao, *National University of Singapore, Singapore*
Mathematical Models and Numerical Methods for Bose-Einstein Condensation

Anna Gilbert, *University of Michigan, USA*
Sparse Analysis

Eric Cancès, *École des Ponts ParisTech, France*
Mathematical models and numerical methods for electronic structure calculation

Andrea Braides, *Università di Roma Tor Vergata, Italy*
Discrete-to-continuum variational methods for lattice systems

Jean-Michel Morel, *École Normale Supérieure de Cachan, France*
A mathematical perspective of image denoising

Barbara Niethammer, *University of Bonn, Germany*
Scaling in kinetic mean-field models for coarsening phenomena

Hinke Osinga, *The University of Auckland, New Zealand*
Computing global invariant manifolds: techniques and applications

Batmanathan Dayanand (Daya) Reddy, *University of Cape Town, South Africa*
Numerical approximation of variational inequalities arising in elastoplasticity

Andrew Stuart, *University of Warwick, UK*
Uncertainty Quantification in Bayesian inversion

Thaleia Zariphopoulou, *University of Texas at Austin, USA*
Stochastic modeling and methods in optimal portfolio construction

[18. Mathematics Education and Popularization of Mathematics \(2 lectures plus 3 panel discussions\)](#)

All aspects of mathematics education, from elementary school to higher education. Mathematical literacy and popularization of mathematics.

<Invited Speakers>

Étienne Ghys, CNRS, École Normale Supérieure de Lyon, France
The internet and the popularization of mathematics

Günter M. Ziegler, Freie Universität Berlin, Germany
Teaching and learning "What is Mathematics"

<Panels>

Deborah Ball, *University of Michigan, USA*
William Barton, *University of Auckland, New Zealand*
Jean-Marie Laborde, *Université Joseph Fourier, France*
Man Keung Siu, *University of Hong Kong, Hong Kong*
Christiane Rousseau, *Université de Montréal, Canada*
Eduardo Colli, *Universidade de São Paulo, Brazil*
Fidel Nemenzo, *University of the Philippines, Philippines*
Konrad Polthier, *Universität Freie Berlin, Germany*

[19. History of Mathematics \(3 lectures\)](#)

Historical studies of all of the mathematical sciences in all periods and cultural settings.

<Invited Speakers>

Han Qi, *Chinese Academy of Sciences, China*
Knowledge and Power: A Social History of the Transmission of Mathematics Between China and Europe during the Kangxi Reign (1662-1722)

Reinhard Siegmund-Schultze, *University of Agder, Norway*
One hundred years after the Great War - A century of breakdowns, resumptions and fundamental changes in international mathematical communication

Dominique Tournes, *University of La Reunion, France*
Mathematics of engineers: elements for a new history of numerical analysis