INFOMAT

MARS 2025

The Norwegian Academy of Science and Letters awards the Abel Prize 2025 to

Masaki Kashiwara

Research Institute for Mathematical Sciences, Kyoto University, Japan

"for his fundamental contributions to algebraic analysis and representation theory, in particular the development of the theory of $\mathcal{D}$-modules and the discovery of crystal bases."

INFOMAT kommer ut med 11 nummer i året og gis ut av Norsk Matematisk Forening. Deadline for neste utgave er alltid den 15. i neste måned. Stoff til INFOMAT sendes til

arnebs at math.uio.no

Foreningen har hjemmeside http://www.matematikkforeningen.no/
Ansvarlig redaktør er Arne B. Sletsjøe, Universitetet i Oslo

Matematisk kalender

2025

Mai:

20. Abelprisutdeling, Oslo
<https://abelprisen.no>

26.-30. TiME 2025, INVARIANT THEORY, Tromsø
<https://sites.google.com/view/time-2025-invariant-theory/home?authuser=0>

Juni:

9.-13. CLUSTER GEOMETRY, summer school, Nordfjordeid
<https://www.mn.uio.no/math/english/research/groups/algebra/events/conferences/nordfjordeid2025/index.html>

Arrangementer

TiME 2025, INVARIANT THEORY from classics to modern developments, Lie-Størmer Center, Tromsø, 26.-30. mai 2025

A graduate school on the shoulders of Cayley and Sylvester. The school will provide a multifaceted viewpoint on the theory of invariants, tracing its origin to the pioneering works of Cayley and Sylvester, connecting the theory of XIX century and its development through computational algebra, modern algebraic geometry, and applications to other applied sciences.

The acronym TiME stands for Treasures in Mathematical Encounters. The first TiME event took place in 2019 in Levico (Trento, Italy) and it focused on Curves and Surfaces.

We will have 4 mini-courses exploring the connections between the questions that interested mathematicians in the past and how these theories evolved in contemporary mathematics and their applications.

Giorgio Ottaviani (U. Firenze, Italy): *Classical Invariant Theory*
Harm Derksen (Notheastern U., USA): *Computational Invariant Theory*
Kristin DeVleming (UC San Diego, USA): *Geometric Invariant Theory*
Michael Walter (Ruhr U. Bochum, Germany): *Invariant Theory in Applications*

For any questions, please contact us at
<time2025invariant@gmail.com>

Organizers:
Kathlén Kohn (KTH, Sweden)
Alessandro Oneto (U. Trento, Italy)
Pierpaola Santarsiero (U. Bologna, Italy)
Ettore Teixeira Turatti (UiT, Norway)

CLUSTER GEOMETRY, Nordfjordeid Summer School, Sophus Lie Conference Centre, Nordfjordeid, 9.-13. juni 2025

The aim of the summer school is to provide an introduction to cluster algebras and their connection to various aspects of algebraic geometry. The school is aimed at PhD students (as well as advanced master students and early postdocs) with a general background in algebra, and with interests in algebra, geometry or topology. There will be three lecture series and extensive problem sessions.

Lecturers:
Tom Bridgeland (Sheffield)
Sergey Fomin (Michigan)
Bernhard Keller (Université Paris Cité)
Lauren K. Williams (Harvard)

Practical Information:
Arrival date: Sunday 8 June
Departure date: Friday 13 June or Saturday 14 June (the school will end on Friday around noon)
Price of stay at Sophus Lie Center (per person per day, meals included): double room 1025 NOK, single room 1250 NOK For questions about the school, contact any member of the organising committee listed below.

Organizing Committee:
Martin Gulbrandsen (Stavanger),
Jørgen Vold Rennemo (Oslo),
Helge Ruddat (Stavanger)

Nyheter

Source: Kyoto University

Masaki Kashiwara,

Research Institute for Mathematical Sciences, Kyoto University, Japan

is awarded the Abel Prize for 2025,

"for his fundamental contributions to algebraic analysis and representation theory, in particular the development of the theory of $\mathcal{D}$-modules and the discovery of crystal bases."

Symmetries are ubiquitous in mathematics and the physical world. Representation theory uses algebraic tools to investigate the ways in which a given symmetry can be expressed by linear transformations on vector spaces. Linear partial differential equations on the other hand are traditionally investigated using tools of analysis. Algebraic analysis, as initiated by the work of Mikio Sato (1928-2023), is a systematic study of these equations by algebraic means. Kashiwara has made groundbreaking contributions to this programme, leading to surprising connections and spectacular results in representation theory.

$\mathcal{D}$-modules provide an algebraic language for studying systems of linear partial differential equations. The 1970 master's thesis of Kashiwara develops the theory of analytic $\mathcal{D}$-modules, introducing the fundamental notion of characteristic variety, and proving a vast generalization of the Cauchy-Kovalevskaya theorem. This demonstrated early on the power of algebraic methods in tackling problems of an analytic nature.

This philosophy was taken further by Kashiwara when developing the microlocal analysis of sheaves in a prolific collaboration with Pierre Schapira. In a nutshell, microlocal analysis relates differential equations on manifolds to geometric objects on the cotangent bundle. Kashiwara, together with Takahiro Kawai and Sato, introduced various fundamental new concepts in this theory and clarified the generic microlocal structure of systems of linear differential equations.

Hilbert's 21st problem (often referred to as the Riemann-Hilbert problem) asks for the existence of a linear differential equation on the Riemann sphere with regular singularities and with prescribed local monodromies. Pierre Deligne extended and solved this problem in higher dimensions. Kashiwara formulated and proved a vastly generalized Riemann-Hilbert correspondence, i.e., the equivalence between regular holonomic $\mathcal{D}$-modules and perverse sheaves. This result was obtained independently by Zoghman Mebkhout. Quite recently, Kashiwara and Andrea D'Agnolo extended the Riemann-Hilbert correspondence to holonomic $\mathcal{D}$-modules that are not necessarily regular.

The Kazhdan-Lusztig conjecture in representation theory can be viewed as connecting characters of representations to intersection cohomology groups. It was proved by Kashiwara together with Jean-Luc Brylinski, in a striking application of the Riemann-Hilbert correspondence. An independent proof was obtained by Alexander Beilinson and Joseph Bernstein using different methods. Kashiwara and Toshiyuki Tanisaki later generalized the Kazhdan-Lusztig conjecture to infinite dimensional affine Lie algebras by developing $\mathcal{D}$-module theory on an infinite dimensional flag variety. Since then, $\mathcal{D}$-module theory has become an indispensable tool and brought numerous new developments in representation theory, including in positive characteristic.

Inspired by the study of solvable lattice models in mathematical physics, Vladimir Drinfeld and Michio Jimbo independently formalized quantum groups in the late '80s. They are deformations of the enveloping algebras of complex semi-simple or Kac-Moody Lie algebras. Kashiwara introduced the notion of crystal bases and proved the existence of crystal bases for integrable highest weight representations of quantum groups. The proof, which proceeds by an intricate induction process now known as the grand loop argument, is a tour de force that has not been much simplified over time. Kashiwara also generalized crystal bases to global bases, which were independently discovered by

George Lusztig under the name canonical bases. This work can be thought of as a vast and fruitful generalization of the theory of Young diagrams and Young tableaux.

Kashiwara is an exceptionally prolific mathematician with more than seventy collaborators. For over fifty years he has reshaped and deeply enriched the fields of representation theory, in its numerous incarnations, and algebraic analysis. His work continues to be at the forefront of contemporary mathematics and to inspire generations of researchers.

Kunngjøringer

ABELSTIPEND

Norsk matematisk forening deler årlig ut Abelstipend til studenter som er opptatt ved et masterprogram i matematiske fag ved et norsk lærested. Abelstipendene har som formål å stimulere lovende studenter til videre studier og forskning i matematiske fag.

Neste søknadsfrist er 15. april 2025. Det kan da søkes om midler for studieåret 2025/2026. For denne søknadsrunden er maksimalbeløpet kr. 25.000,- for den første måneden og kr. 15.000,- for hver av de påfølgende månedene. Totalt kan det deles ut kr. 50.000,-. Neste søknadsfrist vil normalt være 15. april 2026.

Informasjon og retningslinjer for søknader:

*Abelstipend kan tildeles studenter som er opptatt i masterprogram i matematiske fag ved norske læresteder. Abelstipendene har som formål å stimulere lovende studenter til videre studier og forskning i matematiske fag.

*Et Abelstipend er et personlig stipend som skal dekke utgifter i forbindelse med opphold ved et utenlandsk lærested. Det gis til mastergradsstudenter ved norske læresteder som har fullført utdanning på bachelornivå eller tilsvarende. Som faglig minstekrav for tildeling av Abelstipend kreves normalt 80 studiepoeng i matematiske fag.

*Norsk matematisk forening krever ikke reiseregning eller annen rapportering fra mottaker av Abelstipend. Norsk matematisk forening er ansvarlig for rapportering om stipendtildelingene til Skatteetaten. Mottaker av Abelstipend er selv ansvarlig for at tildelt beløp anvendes som forutsatt og for nødvendig rapportering til Skatteetaten.

*Norsk matematisk forening fastsetter hvert år et månedlig maksimalbeløp det kan søkes om og totalbeløp for utdelingen.

*Norsk matematisk forening kan vedta å innvilge hele eller en del av det beløpet det er søkt om i en søknad.

*Utlysning av Abelstipend skjer normalt en gang per år. Norsk matematisk forening er ansvarlig for utlysning og fatter beslutning om tildeling av stipend.

En søknad om Abelstipend skal inneholde:

- Faglig mål for studieoppholdet
- Navn på utenlandsk lærested der studieoppholdet planlegges gjennomført, fortrinnsvis
med bekreftelse fra faglig kontaktperson og/eller dokumentasjon på at studieopphold er innvilget
- Kandidatens karakterutskrift
- Anbefaling fra veileder.

Hovedkriteriet for tildeling er faglig kvalitet.

ICM 2026

Registration is now open for the International Congress of Mathematicians 2026, to be held in Philadelphia (Pennsylvania, USA), from 23 to 30 July 2026.

Visit the ICM 2026 website

<www.icm2026.org>

for more information.

Below is the welcome message from Jalal Shatah, Chair of the ICM 2026 Organizing Committee:

The International Congress of Mathematicians will be held July 23-30, 2026 in Philadelphia, Pennsylvania. The congress coincides with the 250th anniversary of the signing of the Declaration of Independence and the 40th anniversary of the last ICM was held in the U.S. The ICM offers a rare opportunity to meet some of the world's leading mathematicians and be inspired by the vast diversity of today's mathematics.