INSTITUT
MITTAG-LEFFLER

THE ROYAL SWEDISH ACADEMY OF SCIENCES

Annual Report 2020

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Institut Mittag-Leffler

Institut Mittag-Leffler is an international center for research and postdoctoral training in the mathematical sciences. It was founded in 1916 by Professor Gösta Mittag-Leffler and is the oldest mathematics research institute in the world. It operates under the auspices of the Royal Swedish Academy of Sciences and is governed by a board with representatives from all Nordic countries.

The premises of the institute encompass several buildings with a library, offices for staff and researchers, common discussion areas for researchers, a seminar room, a dining hall and housing facilities for researchers staying at IML.

The mission of Institut Mittag-Leffler is to support international top-level research in mathematics, with special attention to the development in the Nordic countries. The institute is a hub for the international mathematical research community and for mathematicians in the Nordic countries.

The main activities include research programs, conferences, workshops, seminars and summer schools, that all aim to conduct and develop current mathematical research. Research programs and conferences have organizing committees approved by the board. Based on the recommendations of the organizing committees, senior and junior mathematicians are invited to stay and work at the institute. Junior program participants (postdocs or advanced PhD students) are offered fellowships to finance their stays. There are yearly calls, and fellowship recipients are chosen by the organizing committee together with the director. Although senior and junior mathematicians from the Nordic countries are given some priority, the institute works actively to ensure diversity among program participants.

The institute also publishes two mathematical journals, *Acta Mathematica*, founded by Gösta Mittag-Leffler in 1882, and *Arkiv för matematik*, founded in 1903. *Acta Mathematica* is one of a small number of exclusive world-leading international mathematics research journals and one of the highest rated journals in the mathematical world. All volumes of these journals are freely available online.

Content

Annual Report 2020

A BRIEF REVIEW OF 2020

During 2020, the institute has continued its efforts to attract world leading mathematicians to programs, as well as the dialogue with Nordic mathematics departments, other international mathematics research institutes, the Swedish Research Council, the Wallenberg Foundations, the Research Council of Norway, and the Verg Foundation. Editorial work with *Acta Mathematica* and *Arkiv för Matematik* during the year has been successfully directed towards faster processes and the creation of a suitably sized backlog. The cooperation with International Press continues.

During 2020, the institute organized two research programs: *Algebraic and Enumerative Combinatorics* and *Knots, Strings, Symplectic Geometry, and Dualities*.

Because of the covid-pandemic, the year 2020 has been very different from other years at IML. Following government restrictions, we had to cancel all on-site activities within the spring program from mid-March and for the summer conferences. However, immediately after the lock-down, programs and conferences were held online. We took several measures to facilitate online work and activities: A project management tool, where program organizers and IML staff work together with the organization of all aspects of conferences and programs, was implemented. An event application for communication and interaction with and between program organizers, participants, and staff was launched in August. The seminar room was equipped with advanced audiovisual technology to stream, record and publish seminars online, keeping the natural seminar atmosphere to an as large extent as possible. Also, during the lock-down, two buildings on the premises were completely refurbished, expanding the accommodation and dining possibilities at IML.

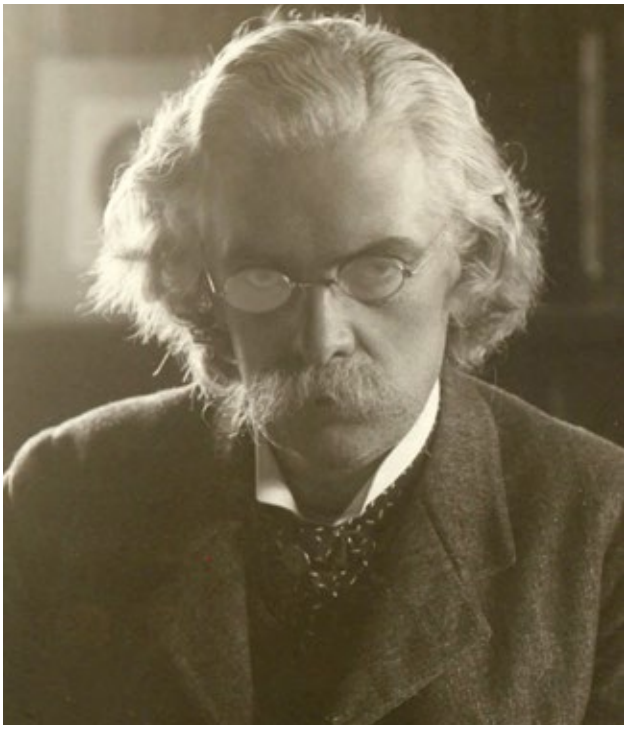

Photo: Institut Mittag-Leffler

The founder of Institut Mittag-Leffler, Prof. Gösta Mittag-Leffler.

Photo: institut Mittag-Leffler

The Director of Institut Mittag-Leffler,
Prof. Tobias Ekholm, Uppsala University.

IML opened for researchers to visit the fall program. During this research program, a small number of participants (between 8 and 15) were present onsite. The new technology proved to be very useful. The fall program became a hybrid program with both on-site and online participants, who followed not only formal seminars but also more informal and pioneering discussions. With program participants from all over the world, IML provided a creative on-site/online environment despite the pandemic limitations. We believe that this is only the beginning of such hybrid research activities and we look forward to continuing this development in coming years.

The institute works closely in cooperation with the Royal Swedish Academy of Sciences and is involved in different Nordic and international collaborations. In June, the institute participated virtually in the yearly meeting of ERCOM, a committee of the *European Mathematical Society* including around 30 European research institutes in mathematics. Also, Institut Mittag-Leffler continues the collaboration with and support for *European Women in Mathematics* (EWM), the *European Mathematical Society* (EMS) and the *American Mathematical Society* (AMS).

Institut Mittag-Leffler is very grateful to all those who have contributed during 2020. First and foremost, to all mathematicians who choose to conduct their research at the institute and to contribute to its scientific environment, especially to our colleagues in Sweden and other Nordic countries. We also thank all organizations who has contributed to us financially: the Academy of Finland, the Acta Mathematica Foundation, the Anna-Greta and Holger Crafoord Foundation, Brummer & Partners, Chalmers/Gothenburg University, the Danish Mathematical Society, the G S Magnuson Foundation, the Knut and Alice Wallenberg Foundation, Linköping University, Luleå University of Technology, Lund University, the Research Council of Norway, KTH Royal Institute of Technology, Jacob and Marcus Wallenberg's memorial foundation, Stockholm University, the Swedish Research Council, the Verg Foundation, Umeå University and Uppsala University.

Tobias Ekholm
Director

Photo: Institut Mittag-Leffler

The library and discussion area for researchers at Institut Mittag-Leffler.

THE BOARD OF INSTITUT MITTAG-LEFFLER

The board of Institut Mittag-Leffler consists of representatives of the Nordic countries and members appointed by the class of mathematics of the Royal Swedish Academy of Sciences. Because of the pandemic, the board meeting was held online in 2020.

MEMBERS OF THE BOARD 2020:

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Uppsala University, Uppsala, Sweden

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KTH Royal Institute of Technology, Stockholm, Sweden

CHAIR MEETING AT INSTITUT MITTAG-LEFFLER

Institut Mittag-Leffler hosts a Nordic chair meeting yearly, inviting the heads of mathematical departments and the chairs of mathematical associations from the Nordic countries. Because of the pandemic, the chair meeting was cancelled in 2020.

PUBLICATIONS

Acta Mathematica

2 volumes/year (4 issues, totally around 800 pages).
The issues 220:1, 220:2, 221:1 and 221:2 were published including 12 articles in total.

EDITORIAL COMMITTEE

Editor-in-Chief:
Tobias Ekholm, Director of Institut Mittag-Leffler, Prof. Uppsala University

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Tobias Holck Colding, Massachusetts Institute of Technology, Cambridge
Jesper Grodal, University of Copenhagen
Helge Holden, NTNU – Norwegian University of Science and Technology, Trondheim
Kurt Johansson, KTH Royal Institute of Technology, Stockholm
Eero Saksman, University of Helsinki

Arkiv för matematik

1 volume/year, 2 issues, around 400 pages.
The issues 58:1 and 58:2 were published including 22 articles in total.

EDITORIAL COMMITTEE

Editor-in-Chief:
Hans Ringström, Deputy of Institut Mittag-Leffler and Prof. KTH Royal Institute of Technology

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International Press of Boston Inc.

Editors:
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Carel Faber, Utrecht University
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Volodymyr Mazorchuk, Uppsala University
David Rydh, KTH Royal Institute of Technology, Stockholm
Fredrik Viklund, KTH Royal Institute of Technology, Stockholm
Erik Wahlén, Lund University

FINANCIAL SUPPORT 2020

We are very grateful for the financial support we have received from the following organizations:

THE ACADEMY OF FINLAND

ACTA MATHEMATICA FOUNDATION

ANNA-GRETA AND HOLGER CRAFOORD FOUNDATION

BRUMMER & PARTNERS

THE DANISH MATHEMATICAL SOCIETY (INSTITUT FOR MATEMATIK/AARHUS UNIVERSITET)

GOTHENBURG UNIVERSITY/CHALMERS UNIVERSITY OF TECHNOLOGY

G S MAGNUSON FOUNDATION

JACOB AND MARCUS WALLENBERG MEMORIAL FOUNDATION

KNUT AND ALICE WALLENBERG FOUNDATION

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STOCKHOLM UNIVERSITY

THE SWEDISH RESEARCH COUNCIL

UMEÅ UNIVERSITY

UPPSALA UNIVERSITY

VERG FOUNDATION

Research Programs

Algebraic and Enumerative Combinatorics

JANUARY 13–APRIL 30, 2020

Organizers: Sara Billey, University of Washington; Petter Brändén, KTH Royal Institute of Technology; Sylvie Corteel, Université Paris Diderot, Paris 7; Svante Linusson, KTH Royal Institute of Technology

SCIENTIFIC REPORT

The spring program was devoted to Algebraic Combinatorics with a special focus on enumeration, random processes, and zeros of polynomials. There have recently been a lot of interactions between the three themes. For example, techniques from enumerative combinatorics are frequently used in problems arising in statistical physics, techniques using zeros of polynomials have been used to analyse the behaviour of certain Markov processes, and the zeros of polynomials appearing in enumerative combinatorics have been studied frequently. Tools from algebraic combinatorics are often used to attack problems in the theme areas. The program was motivated by a belief that research in these areas would benefit from further interactions.

The program brought together a mix of people working on problems which share common features. Most participants were mathematician specializing in combinatorics, algebra, probability, or analysis. This was an excellent opportunity for people to share problems and methods, and develop new methods, and to bring the field of algebraic combinatorics forward. Moreover, several of the participants were young researchers including graduate students and postdocs, which contribute to a solid future for the field.

The activities in the program were cancelled or held online from March 2020 due to the Covid-19 pandemic.

There was an introductory workshop with thematically focused talks on *Combinatorics and Random Processes* (January 27–31). The second workshop on *Unimodality, Log-concavity, and Beyond* (March 17–20) reduced to a few talks because of the pandemic. The third workshop on *Algebraic Combinatorics*, was extended to two weeks of afternoon online talks (April 20–30). It became the first online event in the algebraic combinatorics community and a great success with well over 100 listeners and a great influence both mathematically and organizationally.

The weekly seminar schedule, during January and February, was designed to leave time for research and discussions including four one-hour seminars on Tuesday and Thursday mornings, and more informal afternoon seminars on Wednesdays and Fridays. Brändén gave a series of lectures on his work on Lorentzian polynomials, joint with Huh. These were typed up by Billey and a summary of the workshop is available on IML's website.

There was a creative atmosphere during the semester and several new projects, on diverse topics such as Grothendieck polynomials, Lorentzian polynomials, Ehrhart polynomials, bounds for contingency tables, and the random cluster model, were initiated. See the list of preprints for examples.

Photo: Institut Mittag-Leffler

Participants of the research program *Algebraic and Enumerative Combinatorics*.

SEMINARS

2020-01-16
Ezgi Kantarci Oguz, KTH Royal Institute of Technology
Connecting peak and descent polynomials

2020-01-16
Florian Kohl, Aalto University
Ehrhart theory and its applications

2020-01-21
Matjaz Konvalinka, University of Ljubljana
The first bijective proof of the ASM theorem

2020-01-21
Robin Sulzgruber, KTH Royal Institute of Technology
Patterns in Shi tableaux and Dyck paths

2020-01-23
Per Alexandersson, KTH Royal Institute of Technology
Cyclic Sieving phenomenon

2020-01-23
Anna Ying Pun, University of Virginia
Catalan functions and k-Schur functions

2020-01-27
Svante Janson, Uppsala University
Random permutations avoiding some patterns

2020-01-27
Anne Schilling, University of California, Davis
Stationary distributions and mixing times for finite Markov chains

2020-01-27
Kurt Johansson, KTH Royal Institute of Technology
Scaling limits in random tiling models

2020-01-27
Benjamin Young, University of Oregon
The combinatorial PT-DT conjecture via the double

2020-01-28
Jang Soo Kim, Sungkyunkwan University, Suwon
Counting standard barely set-valued tableaux of shifted shapes

2020-01-28
Svante Linusson, KTH Royal Institute of Technology
Limit shape of shifted staircase SYT

2020-01-28
Arvind Ayyer, Indian Institute of Science
Hook-lengths of random cells in random partitions

2020-01-28
Sylvie Corteel, Université Paris Diderot
Arctic curves for bounded Lecture Hall Tableaux

2020-01-29
Sunil Chhita, Durham University
Local geometry of the rough-smooth interface in the two-periodic Aztec diamond

2020-01-29
Ilse Fischer, University of Vienna
Alternating sign trapezoids and cyclically symmetric lozenge tilings with a central hole

2020-01-30
Alejandro Morales, University of Massachusetts, Amherst
Asymptotics of principal evaluations of Schubert

2020-01-30
James Martin, University of Oxford
Recursive constructions for the multi-type ASEP

2020-01-30
Olya Mandelshtam, Brown University
Compact formulas for modified Macdonald polynomials

2020-01-30
Omer Angel, University of British Columbia
Asymptotic speed of 2nd class particles in ASEP

2020-01-31
Stephan Wagner, Uppsala University
Coefficients of graph polynomials associated with random trees and graphs

2020-01-31
Cecilia Holmgren, Uppsala University
Split trees – A unifying model for many important random trees of logarithmic height

2020-01-31
Igor Pak, University of California, Los Angeles
Burnside processes on graphs and contingency tables

2020-02-03
Petter Brändén, KTH Royal Institute of Technology
Lorentzian polynomials Pt. 1

2020-02-04
Vasu Tewari, University of Pennsylvania
Divided symmetrization, Schubert polynomials and quasisymmetric functions

2020-02-04
Darij Grinberg, Drexel University
The Petrie symmetry functions and Murnaghan-Nakayama rules

2020-02-05
Petter Brändén, KTH Royal Institute of Technology
Lorentzian polynomials Pt. 2

2020-02-06
Angela Hicks, Lehigh University
Eigenoperators of Macdonald polynomials

2020-02-06
Angela Carnevale, National University of Ireland Galway
Odd length in Weyl groups

2020-02-11
Pamela Harris, Williams College
Recent results on Kostant's partition function

2020-02-11
Gaku Liu, KTH Royal Institute of Technology
Semistable reduction in characteristic 0

2020-02-13
Bridget Tenner, DePaul University
Pinnacle sets: introduction and recent developments

2020-02-18
Surjadipta De Sarkar, Indian Institute of Science
On conjectures about the continuous TASEP by Aas and Linusson

2020-02-18
Ivan Martino, KTH Royal Institute of Technology
Cooperative game on simplicial complexes

2020-02-20
Mohan Ravichandran, Mimar Sinan University
Root bounds for Real Stable polynomials and applications

2020-02-20
Anders Claesson, University of Iceland
Counting interval orders

2020-02-25
Thomas Roby, University of Connecticut
Dynamical algebraic combinatorics: actions, orbits, and averages

2020-02-25
Anne Schilling, University of California, Davis
Crystal for stable Grothendieck polynomials

2020-02-27
Christian Krattenthaler, University of Vienna
Chen Wang's proof of the Borwein Conjecture

2020-02-27
Francesco Brenti, Universita di Roma Tor Vergata
Permutations, tensor products, and Cuntz algebra automorphisms

2020-03-03
Jang Soo Kim, Sungkyunkwan University, Suwon
Jacobi–Trudi formula for dual stable Grothendieck polynomials

2020-03-03
Jonathan Leake, University of California, Berkeley
Log-concavity of independence sets of claw-free graphs via stable polynomials

2020-03-10
Darij Grinberg, Drexel University
Gaussian elimination greedoids from ultrametric spaces: the combinatorics of Bhargava's generalized factorials

2020-03-12
Mats Boij, KTH Royal Institute of Technology
Waring rank and SLP for annihilators of symmetric forms

2020-03-12
Alexander Engström, Aalto University
Refined Ehrhart polynomials and an h-triangle*

2020-03-16–2020-03-20

Workshop

Igor Pak, University of California, Los Angeles
Bounds on Kronecker coefficients

Karim Adiprasito, KTH Royal Institute of Technology
Biased pairing theory, varieties at infinity and vanishing conjectures for l^2 cohomology

Greta Panova, University of Pennsylvania
The Kronecker coefficients on many fronts

Jonathan Leake, University of California, Berkeley
Approximate counting via polynomial capacity

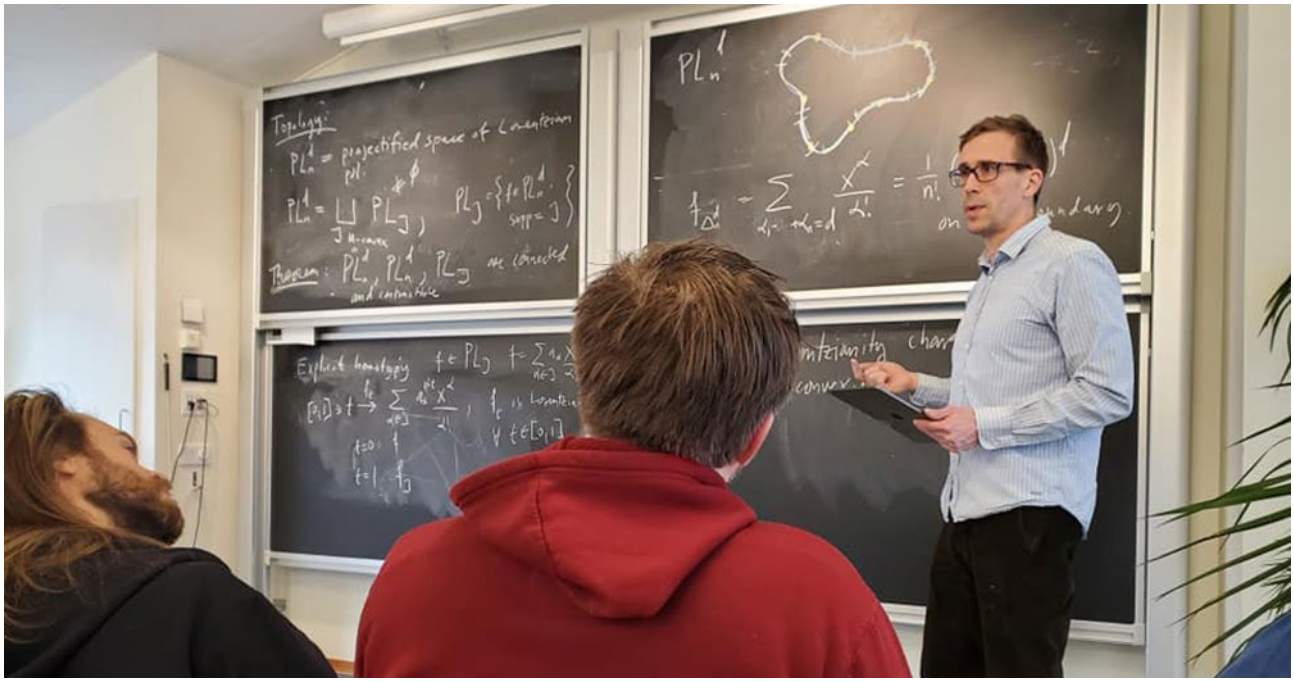
Francesco Brenti, Universita di Roma Tor Vergata
Some open problems on unimodality

Mohan Ravichandran, Mimar Sinan University
Generalized permutahedra: Minkowski linear functionals and Ehrhart positivity

Christos Athanasiadis, University of Athens
Combinatorics of chromatic subdivisions

Christopher Eur, University of California, Berkeley
Simplicial generation of Chow rings of matroids

Photo: Anna Pun Ying



Prof. Petter Bränden, KTH Royal Institute of Technology, during a seminar on *Lorentzian polynomials*.

PREPRINTS

Participants were encouraged to submit preprints with results that were obtained during the program. Files of the preprints listed below can be found on our website www.mittag-leffler.se

Erik Aas, Arvind Ayyer, Svante Linusson, Samu Potka
Limiting directions for random walks in classical affine Weyl groups

Per Alexandersson, Robin Sulzgruber
A combinatorial expansion of vertical-strip LLT polynomials in the basis of elementary symmetric functions

Per Alexandersson, Ezgi Kantarci Oğuz, Svante Linusson,*Promotion and cyclic sieving on families of SSYT*

Christos Athanasiadis, Jan-Marten Brunink, Martina Juhnke-Kubitzke
Combinatorics of antiprism triangulations

Christos Athanasiadis
Face numbers of uniform triangulations of simplicial complexes

Arvind Ayyer, Ilse Fischer
Bijective proofs of skew Schur polynomial factorizations

Arvind Ayyer, Sunil Chhit
Correlations in totally symmetric self-complementary plane partitions

Arvind Ayyer, Daniel Hathcock, Prasad Tetali
Toppleable Permutations, Exceedances and Acyclic Orientations

Francesco Brenti, Angela Carnevale, Bridget Tenner
Odd diagrams, Bruhat order, and pattern avoidance

Petter Brändén, Jonathan Leake, Igor Pak
Lower bounds for contingency tables via Lorentzian polynomials

Johann Cigler, Christian Krattenthaler
Hankel determinants of linear combinations of moments of orthogonal polynomials

Darij Grinberg, Victor Reiner
Hopf Algebras in Combinatorics (v6 update)

Darij Grinberg
Petrie symmetric functions

Darij Grinberg
The Bhargava greedoid as a Gaussian elimination greedoid

Matjaž Konvalinka, Robin Sulzgruber, Vasu Tewari
Trimming the permutahedron to extend the parking space

Matjaž Konvalinka, Vasu Tewari
Some natural extensions of the parking space

Jang Soo Kim, Michael Schlosser, Meesue Yoo
Enumeration of standard barely set-valued tableaux of shifted shapes

Jang Soo Kim
Jacobi—Trudi formulas for flagged refined dual stable Grothendieck polynomials

Jang Soo Kim
Jacobi—Trudi formula for refined dual stable Grothendieck polynomials

Bridget Tenner
The range of repetition in reduced decompositions

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Arvind Ayyer, Indian Institute of Science, Bangalore, India

Spencer Backman, University of Vermont, Burlington, United States

Sara Billey, University of Washington, Seattle, United States

Anders Björner, KTH Royal Institute of Technology, Stockholm, Sweden

Francesco Brenti, Universita di Roma Tor Vergata, Rome, Italy

Petter Brändén, KTH Royal Institute of Technology, Stockholm, Sweden

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Anders Claesson, University of Iceland, Reykjavik, Iceland

Sylvie Corteel, Université Paris Diderot, Paris, France

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Alexander Engström, Aalto University, Espoo, Finland

Christopher Eur, University of California, Berkeley, United States

Ilse Fischer, University of Vienna, Vienna, Austria

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Pamela Harris, Williams College, Williamstown, United States

Angela Hicks, Lehigh University, Bethlehem, United States

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Alexander Holroyd, Microsoft Research, Redmond, United States

Axel Hultman, Linköping University, Linköping, Sweden

Svante Janson, Uppsala University, Uppsala, Sweden

Katharina Jochemko, KTH Royal Institute of Technology, Stockholm, Sweden

Kurt Johansson, KTH Royal Institute of Technology, Stockholm, Sweden

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Ezgi Kantarci Oguz, KTH Royal Institute of Technology, Stockholm, Sweden

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Svante Linusson, KTH Royal Institute of Technology, Stockholm, Sweden

Gaku Liu, KTH Royal Institute of Technology, Stockholm, Sweden

Olya Mandelshtam, Brown University, Providence, United States

James Martin, University of Oxford, Oxford, United Kingdom

Ivan Martino, KTH Royal Institute of Technology, Stockholm, Sweden

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Jennifer Morse, University of Virginia, Charlottesville, United States

Philippe Nadeau, Université de Lyon, Lyon, France

Igor Pak, University of California, Los Angeles, United States

Greta Panova, University of Pennsylvania, Philadelphia, United States

Samu Potka, KTH Royal Institute of Technology, Stockholm, Stockholm, Sweden

Anna Ying Pun, University of Virginia, Charlottesville, United States

Mohan Ravichandran, Bogazici University, Bebek-Istanbul, Turkey

Petter Restadh, KTH Royal Institute of Technology, Stockholm, Sweden

Thomas Roby, University of Connecticut, Storrs, United States

Raman Sanyal, Goethe University Frankfurt am Main, Frankfurt am Main, Germany

Anne Schilling, University of California, Davis, United State

Liam Solus, KTH Royal Institute of Technology, Stockholm, Sweden

Andrea Sportiello, Université Sorbonne Paris Nord, Paris, France

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Jessica Striker, North Dakota State University, Fargo, United States

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Vasu Tewari, University of Pennsylvania, Philadelphia, United States

Stephan Wagner, Uppsala University, Uppsala, Sweden

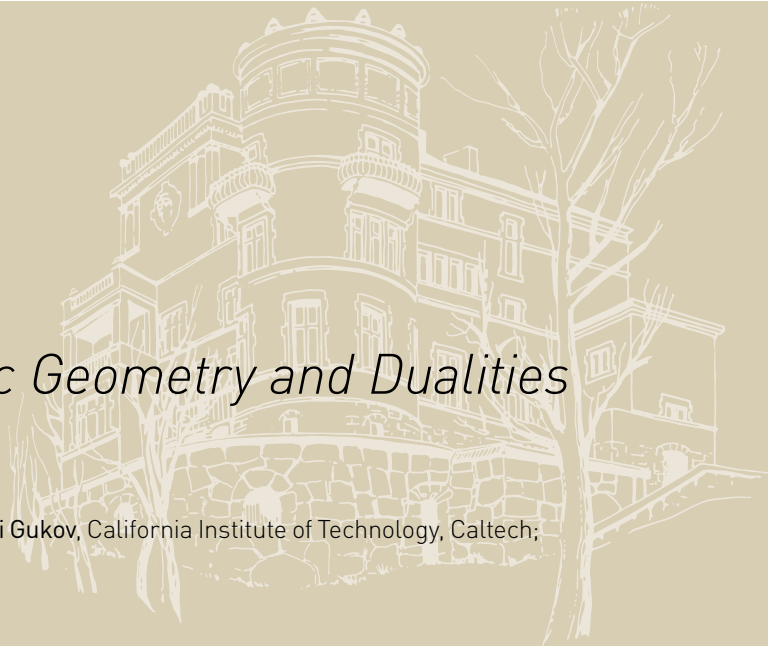
Lauren Williams, University of California, Berkeley, United States

Cynthia Vinzant, North Carolina State University, Raleigh, United States

Benjamin Young, University of Oregon, Eugene, United States

Research Programs

Knots, Strings, Symplectic Geometry and Dualities



SEPTEMBER 1–DECEMBER 11, 2020

Organizers: Tobias Ekholm, Uppsala University; Sergei Gukov, California Institute of Technology, Caltech; Vivek Shende, University of California, Berkeley

SCIENTIFIC REPORT

The fall program was devoted to the very fruitful interactions between geometry and physics that have had large impact on mathematics over the last 35 years. Exceptionally symmetric theories in physics become topologically invariant and have found their mathematical counterparts. These physical theories are typically part of a larger framework that is often hard to capture mathematically but nevertheless very useful and effective for example for finding dualities between different theories. Some highlights of the research conducted in this area during the program are the following:

A key area on the interface between geometry, topology, and physics that was further developed during the program is the connection between knots and holomorphic curve counting (Gromov-Witten theory) related through the following chain of dualities. The HOMFLY (Jones) polynomial in knot theory can be interpreted as the expectation value of Wilson loop observables in Chern-Simons gauge theory on a 3-manifold, which in turn is related to open topological string theory in its cotangent bundle. From the symplectic geometric viewpoint (A-model) topological string theory is Gromov-Witten theory. Next, Ooguri-Vafa large N duality predicts that the open Gromov-Witten theory in the cotangent bundle of the 3-sphere is equivalent to closed Gromov-Witten theory in the resolved conifold. The relation between HOMFLY polynomials and holomorphic curve counting was recently established mathematically in the simplest case. During the program, relevant tools were developed to establish this relation in full. Also, the counterpart of the relation for holomorphic curves invariant under an involution with relation to the Kauffman skein module was established.

Another broad topic studied was perturbative Gromov-Witten theory and its application. This included applications of Floer theory in dynamics.

Also, a new Legendrian surgery approach to calculations in partially wrapped Fukaya categories was developed. In recent years, an elaborate system for a 'cut and paste' approach to the Fukaya category of a Weinstein manifold was developed. During the program, a dual approach via Legendrian surgery was formulated. It leads, in particular, to generalizations of Chekanov-Eliashberg dg-algebras to singular Legendrians.

Progress was also made on the, so called, knots quivers correspondence, where HOMFLY generating series and associated holomorphic curve counts are expressed as quiver partition functions. The underlying geometry here is that of basic holomorphic disks attached to a Lagrangian solid torus. The quiver picture was uniformized and a main conjecture specifying a unique quiver for each knot (that explains HOMFLY and associated Khovanov-Rozansky homologies) was formulated.

Photo: Institut Mittag-Leffler

The Director and organizer, Prof. Tobias Ekholm, welcoming everyone to the research program *Knots, Strings, Symplectic Geometry and Dualities*.

SEMINARS

2020-09-03
Luis Diogo, Universidade Federal Fluminense
Augmentations, Annuli, and Alexander polynomials

2020-09-08
Kai Cieliebak, University of Augsburg
Secondary coproducts in Morse and Floer homology

2020-09-15
Mohammed Abouzaid, Columbia University
Floer homotopy without spectra

2020-09-21
Pietro Longhi, ETH Zürich
Review of the relation between Chern-Simons and WZW theories

2020-09-24
Vivek Shende, University of California, Berkeley
Skeins on branes

2020-10-01
Johan Asplund, Uppsala University
Fiber Floer cohomology and conormal stops

2020-10-08
Agustin Moreno, Uppsala University
On the spatial restricted three-body problem

2020-10-15
Yanki Lekili, King's College London
A symplectic look at the Fargues-Fontaine curve

2020-10-22
Lenhard Ng, Duke University
Infinitely many fillings through augmentations

2020-10-29
Paolo Ghiggini, Université de Nantes
Knot Floer homology and monodromy

2020-11-05
Yuhan Sun, Stony Brook University
Displacement energy of Lagrangian 3-spheres

2020-11-12
Tobias Ekholm, Uppsala University
Perturbations for bare curve counts

2020-11-17
Georgios Dimitroglou Rizell, Uppsala University
Legendrian lifts of montone tori

2020-12-03
Lukas Nakumara, Uppsala University
Small energy isotopies of loose Legendrians

PREPRINTS

Participants were encouraged to submit preprints with results that were obtained during the program. Files of the preprints listed below can be found on our website www.mittag-leffler.se

Johan Asplund, Tobias Ekholm
Chekanov-Eliashberg dg-algebras for singular Legendrians

Tobias Ekholm, Vivek Shende
Skein recursion for holomorphic curves and invariants of the unknot

Tobias Ekholm, Vivek Shende
Colored HOMFLYPT counts holomorphic curves

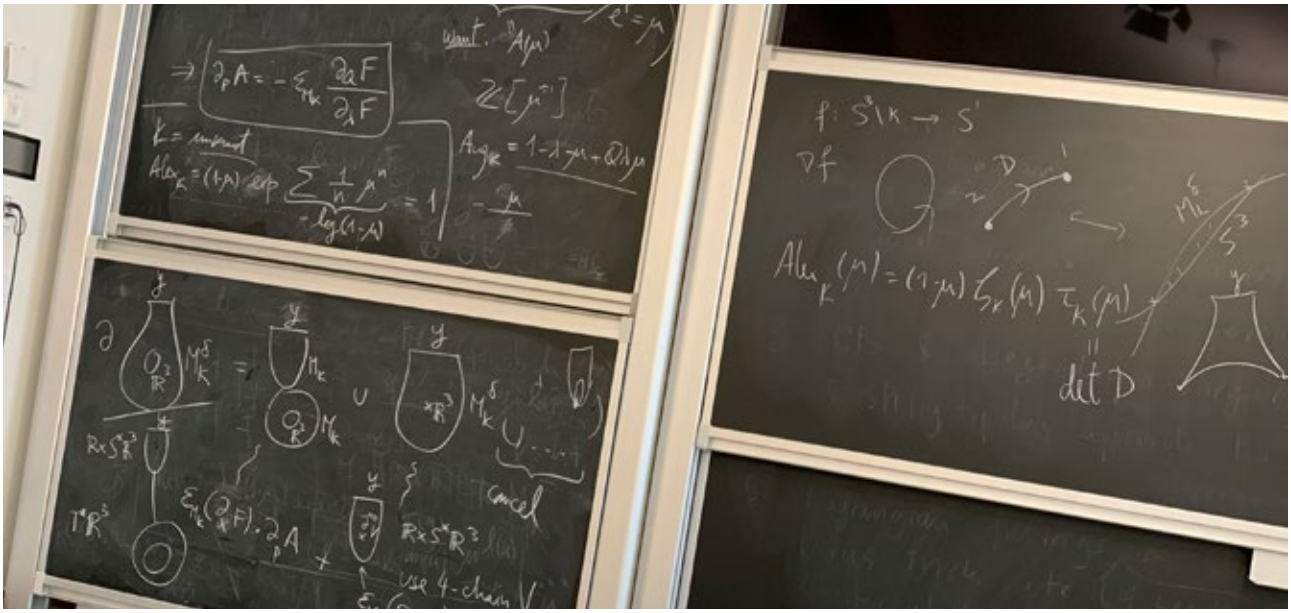
Agustin Moreno
Holomorphic dynamics in the spatial restricted three-body problem

Agustin Moreno , Otto van Koert
A generalized Poincaré-Birkhoff theorem

Agustin Moreno , Otto van Koert
Global hypersurfaces of section in the spatial restricted three-body problem

Agustin Moreno, Zhengyi Zhou
A landscape of contact manifolds via rational SFT

Photo: Institut Mittag-Leffler



Calculations from a seminar during the research program *Knots, Strings, Symplectic Geometry and Dualities*.

PARTICIPANTS

Mohammed Abouzaid, Columbia University, New York, United States

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Jennifer Brown, University of California, Davis, United States

Roger Casals, University of California, Davis, United States

Marco Castronovo, Rutgers, The State University of New Jersey, New Brunswick, United States

Baptiste Chantraine, Université de Nantes, Nantes, France

Zhechi Cheng, Columbia University, New York, United States

Kai Cieliebak, University of Augsburg, Augsburg, Germany

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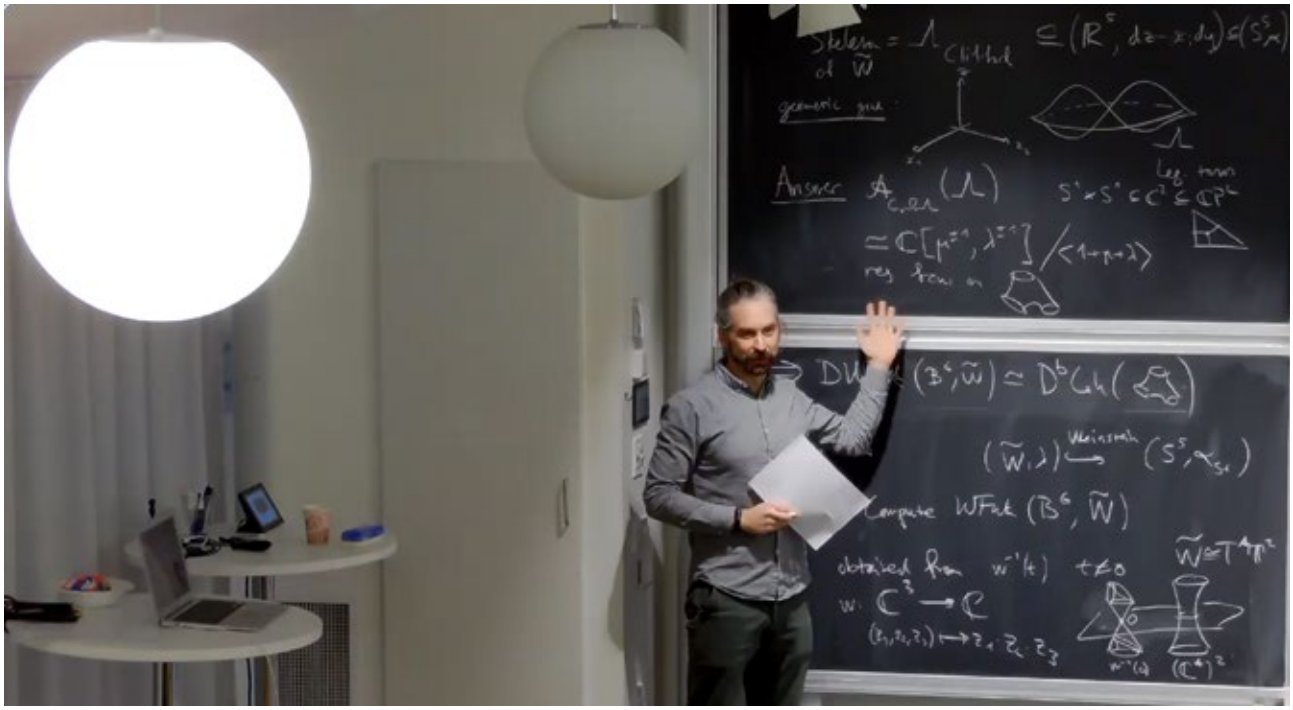

Photo: Institut Mittag-Leffler

Georgios Dimitroglou Rizell, Ass. Prof. and Head of Department at Uppsala University, during a seminar on *Legendrian lifts of montone tori*.

Heather Lee, University of Washington, Seattle, United States

Nomie Legout, Uppsala University, Uppsala, Sweden

Yanki Lekili, King's College London, London, United Kingdom

Wanmin Liu, Uppsala University, Uppsala, Sweden

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Ivan Smith, University of Cambridge, Cambridge, United Kingdom

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Jörg Teschner, Universität Hamburg, Hamburg, Germany

Johannes Walcher, Heidelberg University, Heidelberg, Germany

Thomas Walpuski, Michigan State University, East Lansing, United States

Luya Wang, University of California, Berkeley, United States

Paul Wedrich, Australian National University, Canberra, Australia

Harold Williams, University of California, Davis, United States

Maxim Zabzine, Uppsala University, Uppsala, Sweden

Conferences

Scattering, microlocal analysis and renormalisation
Online conference

MAY 2 –JUNE 18, 2020

Organizers: Claudio Dappiaggi, University of Pavia; Jacob Schach Møller, Aarhus University; Michał Wrochna, Université de Cergy-Pontoise

SCIENTIFIC REPORT

The mathematical description of phenomena in relativistic and non-relativistic physics requires a deep understanding of how local and global aspects are tied together. The conference was a unique opportunity to discuss the most recent progress using methods that intertwine partial differential equations and microlocal analysis with spectral and scattering theory. This combination of techniques served as a starting point to address an array of interconnected problems in mathematical physics.

Singularities of propagators and their relationships with global or asymptotic features of the system were at the heart of a number of new results presented by the speakers. C. Fewster demonstrated that nonlocal operators have propagators with good enough properties to serve as a basis for field quantization. J. Dereziński showed how the Feynman propagator on stationary spacetimes arises as a boundary limit of the resolvent of the d'Alembertian interpreted as a self-adjoint operator. In turn, D. Vassiliev presented a geometric construction of the wave propagator on Riemannian manifolds with a complex phase function, allowing thus a global invariant definition of the full symbol, and M. Capoferri showed a generalization to massless Dirac operators, with applications to spectral asymptotics. A. Marta described a new propagation of singularities theorem on anti-de Sitter spacetimes for general boundary conditions, and second quantization for Maxwell fields on spacetimes with boundaries was analyzed by N. Drago.

Propagators and bounds on their infrared and ultraviolet properties are the essential ingredient in perturbative approaches in Quantum Field Theory and also arise in quantum statistical mechanics. K. Rejzner gave an overview of the perturbative Algebraic Quantum Field Theory program, emphasizing the interplay between symmetries and locality. N.V. Dang proposed a rigorous

answer to Quillen's conjecture on renormalization of determinant lines in QFT. Renormalization was also the central theme in a talk by F. Hiroshima, who discussed localizations of the ground state of the renormalized and non-renormalized Nelson model. A different setting was considered by A. Panati who presented results unravelling the connection between heat fluctuation in the two-time measurement framework and ultraviolet regularity.

The relationship between spectral theory and geometry was analyzed by P. Kurasov, who characterized the occurrence of arithmetic sequences in the spectrum of the Laplacian on a metric graph, using diophantine analysis and a trace formula connecting the spectra to sets of periodic orbits. In the case of spatially compact stationary spacetimes, A. Strohmaier showed a generalization of the Gutzwiller-Duistermaat-Guillemin trace formula to the relativistic setting.

The interplay between regularity and asymptotic aspects was the subject of P. Hintz' talk on asymptotic expansions of linear waves propagating on stationary and asymptotically flat spacetimes, proving sharp decay for scattering by short range potentials and a strengthening of Price's Law on Kerr spacetimes. Scattering theory and the property of asymptotic completeness played an important role in new results by W. Dybalski on the Bisognano-Wichmann property for massless fields. Finally, the emergence of techniques of stochastic PDEs in QFT was illustrated by O. Matte who showed differentiability properties of stochastic flows and semigroup kernels in nonrelativistic QED.

PARTICIPANTS

Benjamin Alvarez, Aarhus University, Aarhus, Denmark

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Matteo Capoferri, University College, London, United Kingdom

Claudio Dappiaggi, University of Pavia, Pavia, Italy

Jan Derezinski, University of Warsaw, Warsaw, Poland

Nicolò Drago, University of Würzburg, Würzburg, Germany

Wojciech Dybalski, The Technical University of Munich, Munich, Germany

Jérémy Faupin, Université de Lorraine, Nancy, France

Chris Fewster, University of York, York, United Kingdom

Christian Gérard, Université Paris-Saclay, Paris, France

Rohan Ghanta, Aalborg University, Aalborg Denmark

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Fumio Hiroshima, Kyushu University, Fukuoka, Japan

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Daniel Siemssen, University of York, York, United Kingdom

Alexander Strohmaier, University of Leeds, Leeds, United Kingdom

Dmitri Vassiliev, University College London, United Kingdom

Michał Wrochna, Université de Cergy-Pontoise, Cergy, France

Photo: Institut Mittag-Leffler

The first volumes of *ACTA Mathematica*, one of the world-leading international mathematics research journals, founded by Gösta Mittag-Leffler in 1882.

Kleindagarna

JANUARY 8 – 10, 2020

Three times a year, high school teachers of mathematics are invited to Institut Mittag-Leffler together with mathematics professors and university teachers. For three days, they inspire each other and develop tomorrow's mathematics lessons for high school students, by combining the pedagogical expertise of high school teachers with the advanced subject knowledge of higher mathematics.

The purpose of *Kleindagarna* is to fill the gap between the knowledge and learning within mathematics in High shools in Sweden and the university level of mathematics by giving insight into the respective mathematical approaches and teaching situations.

Kleindagarna is an appreciated learning and development opportunity aiming to create lessons in mathematics with an instant impact on high school students all around Sweden.

Organizer: Mats Boij, Chair of The Swedish National Committee for Mathematics and Professor in mathematics at KTH Royal Institute of Technology, Stockholm

Supporting organization: Brummer & Partners

REPORT

The teacher development program *Kleindagarna* for high school teachers in mathematics has several years been arranged three times per year by The Swedish National Committee for Mathematics together with Institut Mittag-Leffler and financed by Brummer & Partners.

In 2020, only one event, in January, could take place because of the pandemic. The program was based on inspirational lectures by university professors, followed by work in groups, in order to develop lesson plans that can be implemented in high school teachers' classrooms. One of the lessons that was developed has led to a publication in *Nämnaren*, a journal for teaching in mathematics.

LECTURERS

Wojciech Chacholski, KTH Royal Institute of Technology, Stockholm
Vad avstånd kan betyda

Laura Fainsilber, Chalmers/University of Gothenburg, Gothenburg
Logaritmer förr och nu

Svante Linusson, KTH Royal Institute of Technology, Stockholm
Att dela planet med linjer

Anders Logg, Chalmers/University of Gothenburg, Gothenburg
Ekvationslösning och datorsimulering

LESSON PILOTS

Mats Boij
KTH Royal Institute of Technology, Stockholm

Mikael Cronhjort
KTH Royal Institute of Technology, Stockholm

Petter Restadh
KTH Royal Institute of Technology, Stockholm

Photo: Håkan Måtbäck

Participants of Kleindagarna January 2020.

PARTICIPANTS

David Andersson, Finnvedens gymnasium, Värnamo

Jenny Arthur, Östra Reals gymnasium, Stockholm

Piotr Badziag, Klara Östra gymnasium, Stockholm

Johan Bergdahl, Erik Dahlbergs gymnasiet, Jönköping

Jonas Björling, Sjödalsgymnasiet, Huddinge

Lars Blomgren, Brogårdsgymnasiet, Kristinehamn

Mats Boij, KTH Royal Institute of Technology, Stockholm

Wojciech Chacholski, KTH Royal Institute of Technology, Stockholm

Mikael Cronhjort, KTH Royal Institute of Technology, Stockholm

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Laura Fainsilber, Chalmers/University of Gothenburg, Göteborg

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Hanna Lundqvist, LM Engströms Gymnasium, Göteborg

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Petter Restadh, KTH Royal Institute of Technology, Stockholm

Cordula Richter, Uppvidinge Gymnasieskola, Uppvidinge gymnasieskola

Cliff Robinson, Rosendalsgymnasiet, Uppsala

Mattias Steinwall, Baldergymnasiet, Skellefteå

Katarina Ståhl Kaltea, KTH Royal Institute of Technology, Stockholm

Magnus Thelander, Rudbecksskolan, Sollentuna

Nina Waldenström, Täby Enskilda Gymnasium, Täby

Financial Report

Förvaltningsberättelse

MAKARNA MITTAG-LEFFLERS MATEMATISKA STIFTELSE
Org.nr 802408-0890

VERKSAMHETEN

Allmänt om verksamheten
Makarna Mittag-Lefflers matematiska stiftelse har sitt säte i Stockholm. Stiftelsens ändamål är att inom de fyra nordiska länderna, Sverige, Danmark, Finland och Norge, och alldeles särskilt Sverige, för framtiden uppehålla och ytterligare utveckla den ställning, vilken matematiken i dessa länder numera intager, samt att härvid även bereda aktning och rättvist uppskattande utom Nordens gränser för dessa länders insats inom tankelivets högsta område. Makarna Mittag-Lefflers matematiska stiftelse bedriver verksamhet bl.a. i form av tidskriftsutgivning varför alla uttag redovisas över resultaträkningen som kostnader för drift av stiftelsen.

KVA förvaltar ett kapital med ett marknadsvärde som per 2020-12-31 uppgår till 2 033 mkr via sina anknutna stiftelser. KVA och dess anknutna stiftelsers kapital (exklusive Stiftelsen Anna-Greta och Holger Crafoords fond) förvaltas av Carnegie enligt av akademistyrelsen fastställda riktlinjer.

Makarna Mittag-Lefflers matematiska stiftelses andel uppgår till 11,63%.

Stiftelsen har inte haft några anställda och inga löner och ersättningar har utbetalats under året. Personalkostnader finns bokförda på 290.

Främjande av ändamålet
Resultatet från stiftelsens verksamhet exklusive de finansiella posterna uppgår till 4 555 700 kr som därmed återförs till fonden. Det positiva resultatet är en följd av att gamla projektmedel kunnat utnyttjas för årets kostnader. Stiftelsen driver Institut Mittag-Leffler och utger tidskrifterna Acta Mathematica och Arkiv för Matematik. Eftersom Makarna Mittag-Lefflers matematiska stiftelse bedriver verksamhet, och därmed är klassad som näringsdrivande, redovisas alla uttag som kostnader för drift av stiftelsen.

Väsentliga händelser under räkenskapsåret
Inga väsentliga händelser finns att rapportera.

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Flerårsöversikt

	2020	2019	2018	2017	2016
Huvudintäkter	25 525 568	25 529 537	14 205 623	14 939 124	20 930 057
Årets resultat	11 374 962	16 933 114	-6 556 296	20 279 793	-2 585 868
Ingående kapital	190 342 926	173 409 812	179 966 108	159 686 315	162 272 183
Utgående kapital	201 717 888	190 342 926	173 409 812	179 966 108	159 686 315
Årlig förändring i %	5,98%	9,76%	-3,64%	12,70%	-1,59%

Vad beträffar stiftelsens resultat och ställning i övrigt, hänvisas till efterföljande resultat- och balans räkningar med tillhörande noter.

RESULTATRÄKNING

	Not	2020	2019
Stiftlesens intäkter			
Bidrag		21 764 904	21 418 559
Nettoomsättning		350 000	350 000
Övriga stiftelseintäkter		3 410 664	3 760 977
		25 525 568	25 529 537
Stiftelsens kostnader			
Övriga externa kostnader	2	-23 420 004	-19 836 499
Av- och nedskrivningar av materiella anläggninstillgångar		-323 035	-301 138
Övriga stiftelserkostnader		-819 537	-836 199
		-24 562 576	-20 973 837
Rörelseresultat		962 992	4 555 700
Finansiella poster			
Resultat från övriga finansiella anläggningstillgångar	3	9 985 971	12 028 741
Övriga ränteintäkter och liknande resultatposter	4	425 999	348 673
		10 411 970	12 377 414
Årets resultat		**11 374 962**	**16 933 114**

>>

BALANSRÄKNING

Tillgångar		2020	2019
Anläggningstillgångar			
Materiella anläggningstillgångar			
Inventarier, verktyg och installationer	5	215 804	33 522
Förbättringsutgifter på annans fastighet	6	2 774 346	1 843 762
Pågående nyanläggning		11 462 671	-
		14 452 821	1 877 284
Finansiella anläggningstillgångar			
Andra långfristiga värdepappersinnehav	7	199 486 067	188 994 071
		199 486 067	188 994 071
Summa anläggningstillgångar		**213 938 888**	**190 871 355**
Omsättningstillgångar			
Kortfristiga fordringar			
Övriga fordringar		7 990 187	16 272 763
Förutbet. kostnader och uppl. intäkter		205 131	751 946
		8 195 318	17 024 709
Kassa och bank		2 159 161	608 811
Summa omsättningstillgångar		10 354 479	17 633 520
Summa tillgångar		**224 293 367**	**208 504 875**

Eget kapital och skulder			
Bundet eget kapital			
Bundet eget kapital vid räkenskapsårets början		187 297 309	178 791 846
Förändringar av bundet kapital		4 504 643	8 505 464
Bundet eget kapital vid räkenskapsårets slut		191 801 952	187 297 309
Fritt eget kapital			
Fritt eget kapital vid räkenskapsårets början		3 045 617	-5 382 034
Överfört till och från bundet eget kapital		-4 504 643	-8 505 464
Lämnade och återförda anslag		-	-
Årets resultat		11 374 962	16 933 114
Fritt eget kapital vid räkenskapsårets slut		9 915 936	3 045 617
Summa eget kapital		**201 717 888**	**190 342 926**
Kortfristiga skulder			
Leverantörsskulder		462 695	128 638
Övriga skulder		-	-
Uppl. kostnader och förutbet. intäkter		22 112 784	18 033 311
		22 575 479	18 161 949
Summa skulder		**22 575 479**	**18 161 949**
Summa tillgångar		**224 293 367**	**208 504 875**

>>

NOTER

Not 1 – Redovisnings- och värderingsprinciper

Allmänna redovisningsprinciper
Årsredovisningen har upprättats i enlighet med Årsredovisningslagen och Bokföringsnämndens allmänna råd (BFNAR 2016:10) Årsredovisning i mindre företag.

Avskrivningsprinciper för anläggningstillgångar
Följande avskrivningstider tillämpas

Materiella anläggningstillgångar

Inventarier, verktyg och installationer	3–5 år
Förbättringsutgifter på annans fastighet	10–40 år

Eget kapital
Bundet eget kapital består dels av det ursprungliga donationskapitalet, dels av rearesultat som förs direkt mot bundet eget kapital. Utöver detta ingår även kapitaliseringar, årlig avsättning om 10 % på räntor och utdelningar. Fritt kapital avser den del av kapitalet som kan disponeras för utdelningar.

Not 2 – Övriga externa kostnader

	2020	2019
Lokalkostnader	-3 293 436	-3 552 259
Projektkostnader	-15 114 808	-7 828 483
IT-kostnader	-834 585	-1 148 761
Personalkostnader	-2 397 192	-4 833 743
Övrigt	-1 779 983	-2 473 253
	-23 420 004	**-19 836 499**

Not 3 – Resultat från övriga finansiella anläggningstillgångar

Utdelningar	5 154 201	3 664 144
Ränteintäkter	983 497	289 350
Realisationsresultat	3 848 273	534 782
Återföring nedskrivning / Nedskrivning värdepapper	0	7 540 465
	9 985 971	**12 028 741**

Not 4 – Övriga ränteintäkter och liknade resultatposter

Fondrabatter	425 999	348 673
	425 999	**348 673**

Not 5 – Inventarier, verktyg och installationer

Ackumulerade anskaffningsvärden		
Vid årets början	1 429 985	1 429 985
Nyanskaffningar	207 378	-
Vid årets slut	**1 637 363**	**1 429 985**
Netto anskaffningsvärde	**1 637 363**	**1 429 985**
Ackumulerade avskrivningar enligt plan		
Vid årets början	-1 396 463	-1 371 458
Årets avskrivning på anskaffningsvärden	-25 096	-25 005
Vid årets slut	**-1 421 559**	**-1 396 463**
Redovisat värde vid årets slut	**215 804**	**33 522**

>>

Not 6 - Förbättringsutgifter på annans fastighet	2020	2019
Ackumulerade anskaffningsvärden		
Vid årets början	4 531 896	4 161 956
Nyanskaffningar	1 228 523	369 940
Vid årets slut	5 760 419	4 531 896
Netto anskaffningsvärde	5 760 419	4 531 896
Ackumulerade avskrivningar enligt plan		
Vid årets början	-2 688 134	-2 412 001
Årets avskrivning på anskaffningsvärden	-297 939	-276 133
Vid årets slut	-2 986 073	-2 688 134
Redovisat värde vid årets slut	**2 774 346**	**1 843 762**

Not 7 – Andra långfristiga värdepappersinnehav		
Ackumulerade anskaffningsvärden		
Vid årets början	188 994 071	176 939 724
Köp	23 041 385	39 205 904
Försäljning	-12 549 389	-27 151 557
Utgående anskaffningsvärden	199 486 067	188 994 071
Ackumulerade avskrivningar enligt plan		
Vid årets början	0	-7 540 464
Årets nedskrivning	-	-
Återförda nedskrivningar	0	7 540 464
	0	0
Bokfört värde	199 486 067	188 994 071
Marknadsvärde	236 406 913	217 213 021

Stockholm den 10 maj 2021

Göran K Hansson

Ständig sekreterare

Min revisionsberättelse har avgivits den ´

Magnus Prööm

Auktoriserad revisor

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