

Nederlands Mathematisch Congres

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Stefanie Jegelka
MIT



Andrew Sutherland
MIT



Leslie Ann Goldberg
University of Oxford



Amie Wilkinson
University of Chicago

De Werelt
Lunteren

Information & Registration
mathematischcongres.nl

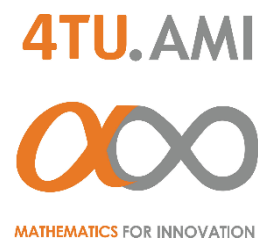
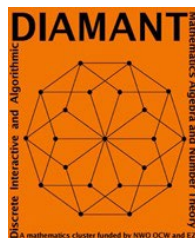


2 & 3 April



Sponsors

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Cover designed by Dick van der Toorn (NWO)

NMC 2024

Programme booklet

Conference Center De Werelt, Lunteren, The Netherlands

Welcome to the 59th Netherlands Mathematical Congress 2024!

We are happy to welcome 225 registered participants to a varied and well-filled program with keynote lectures by Leslie Ann Goldberg, Stefanie Jegelka, and Amie Wilkinson, and the Beeger lecture by Andrew Sutherland. Parallel sessions have been organized by the four mathematics clusters DIAMANT, GQT, NDNS+ and STAR, and by 4TU.AMI, AI & Mathematics, and the NWO Gravitation programs Networks and Quantum Software Consortium. There will also be sessions organized EWM-NL, and by the newly established Young KWG. Especially for PhD students workshops and speed date sessions will be offered, and a Poster session and competition will be held. Furthermore, multiple prizes will be awarded.

The general assembly of the Royal Dutch Mathematical Society will be held at the end the first day, and you will hear the news and plans from the field at the beginning of the second day.

We hope that you will enjoy the opportunities for talking and working with colleagues and friends, and wish you an interesting conference and a pleasant stay in Lunteren.

The Local organizing committee:

Sonja Cox (University of Amsterdam, Chair Scientific Committee)

Mathisca de Gunst (Vrije Universiteit Amsterdam, president Koninklijk Wiskundig Genootschap)

Barry Koren (TU Eindhoven & CWI, vice-president Koninklijk Wiskundig Genootschap)

Marieke Kranenburg (University of Amsterdam, chair)

Nada Mitrovic (CWI)

Olivia Muthsam (NWO)

Ivar Dilweg (NWO)

Wil Schilders (director Platform Wiskunde Nederland)

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Gunther Cornelissen (Utrecht University)
Sonja Cox (University of Amsterdam, chair)
Peter van Heijster (Wageningen University & Research)
Bob Rink (Vrije Universiteit Amsterdam)
Maria Vlasίου (TU Eindhoven & University of Twente)

Beeger committee

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Serge Fehr (CWI & Leiden University)
Ton de Kok (CWI & TU Eindhoven)
Hendrik Lenstra (Leiden University)
Steffen Müller (Rijksuniversiteit Groningen)
Damaris Schindler (University of Göttingen)

Indagationes Mathematicae Best Paper Prize jury:

Gunther Cornelissen (Utrecht University)
Monique Laurent (CWI & University of Twente)
Jan Maas (IST Austria)
Michel Mandjes (Leiden University & University of Amsterdam)
Jan van Neerven (TU Delft)

Stieltjesprijs jury:

Erik van den Ban (Utrecht University)
Odo Diekmann (Utrecht University)
Aernout van Enter (Rijksuniversiteit Groningen)
Frans Oort (Utrecht University)
Marc Uetz (University of Twente)
Aad van der Vaart (TU Delft)
Kees Vuik (TU Delft, chair)

KWG-PhD prize committee:

Francesca Arici (Leiden University, GQT)
Annika Betken (University of Twente, STAR)
Riccardo Cristoferi (Radboud University, NDN+)
Martin van Gijzen (TU Delft, chair)
Aida Abiad Monge (TU Eindhoven, DIAMANT)

Poster prize jury

Sara Arpin (Leiden University)

Pieter Collins (Maastricht University)

Joris Mooij (University of Amsterdam)

Pythagorasprijs jury

Enno Diekema

K.P. Hart (TU Delft)

Geertje Hek (Institut International de Lancy)

Relinde Jurrius (Netherlands Defence Academy)

Niels Kolenbrander (Leiden University)

General information

Venue: Conference Center De Werelt, Lunteren

Westhofflaan 2, 6741 KH Lunteren

By car

From Amsterdam / Apeldoorn direction (A1)

- Take the Barneveld/Ede exit (A30) towards Ede.
- Take the Lunteren exit.
- Follow the ring road (Westzoom) and then the ANWB signs for De Werelt.

From Utrecht / Arnhem direction (A12)

- Take the Ede-Noord/Barneveld exit (A30).
- Take the Lunteren exit.
- Follow the ring road (Westzoom) and then the ANWB signs for De Werelt.

From A15 Rotterdam / Nijmegen direction (A15)

- Take the Kesteren exit (N233); towards Rhenen/Veenendaal.
- Cross the bridge at Rhenen and follow the road.
- Cross straight at the first roundabout.
- Turn right at the next roundabout.
- Follow the road until the A12, take the A12 towards Arnhem.
- Take the A30 towards Ede-Noord/Barneveld.
- Take the Lunteren exit.
- Follow the ring road (Westzoom) and then the ANWB signs for De Werelt.

Public transport

Lunteren is accessible by train from Amersfoort and Ede-Wageningen. From Lunteren Station, it's about a 15-minute walk to Congrescentrum De Werelt.

▪ **Walking route (paved road)**

- Take the gravel path and immediately turn right across the parking lot towards the sauna. Turn left there (= Boslaan).
- Follow Boslaan (about 1 km), then turn right onto Molenweg. First road on the left (Westhofflaan), a sign points to the entrance of Congrescentrum De Werelt.

▪ **Walking route (forest path)**

- Take the gravel path and immediately turn right across the parking lot towards the sauna. Turn left there (= Boslaan).
- After about 300 meters, turn right onto Van den Hamlaan. Follow this road, which turns into a 'paved' forest path. Continue to follow this forest path until you reach the paved road again. Cross this road (= Molenweg). This is Westhofflaan; a sign points to the entrance of Congrescentrum De Werelt.



Food and beverages

Lunches are included in the registration fee. If you registered for the conference dinner on Tuesday, you are welcome at the dinner on Tuesday, 2 April at 19:00 h.

Registration desk

Should you have any questions or encounter any problems, please contact the registration desk which will be open during early mornings and the breaks. The hotel registration desk is open full time for non-conference-related questions.

Stands

In the foyer there will be stands of the following organizations:

- Epsilon Uitgaven
- Koninklijk Wiskundig Genootschap
- Optische Fenomenen
- Platform Wiskunde Nederland
- Vierkant voor Wiskunde

Programme NMC 2024

Tuesday 2 April 2024

Plenary sessions

Room Air

09:00 – 10:00	Registration and Reception/Coffee		
10:00 – 10:15	Opening session by KWG and NWO		
10:15 – 11:00	Plenary lecture: Leslie Ann Goldberg (University of Oxford)		
11:00 – 11:30	Break		
11:30 – 12:15	Young KWG- Generative AI in Mathematics Research and Teaching		
12:15 – 13:45	Lunch	13:00- 13:30 Session by EWM-NL	

Parallel sessions

13:45- 15:15	DIAMANT <i>Room Air</i>	NDNS+ <i>Room Water</i>	STAR <i>Room 10+11</i>	GQT <i>Room 21</i>
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Plenary sessions

Room Air

15:15 – 15:45	Coffee break		
15:45 – 16:15	Poster session - pitches		
16:15 – 17:15	Beeger lecture: Andrew Sutherland (Massachusetts Institute of Technology)		

Parallel sessions

17:15 – 18:00	General Assembly of the Royal Dutch Mathematical Society	Speed dating session (<i>Room Water</i>)
18:00 – 19:00	Drinks	

Evening Programme

19:00 – 21:00	Dinner	
21:00 – 23:00	Bar open	

Wednesday 3 April 2024

8:30 – 9:00 Registration and Reception/Coffee

Parallel sessions

9:00 – 9:30 What's cooking? Workshops for PhD students (and others)

Room Air

- Announcements Tafel Wiskunde (Sonja Cox)
- Announcements PWN (Wil Schilders or Richard Boucherie)
- Announcements Young KWG
- Announcements KWG (Mathisca de Gunst)
- Announcements CWI (Ton de Kok)
- **Start your career** - Room Water
- **Funding possibilities** - Room 10+11
- **Wiki edit-a-thon** - Room 21

9:30 – 10:00 The Indagationes Mathematicae Best Paper Prize

Plenary sessions

Room Air

10:00 – 10:45 Plenary lecture: Stefanie Jegelka (Massachusetts Institute of Technology)

10:45 – 11:15 Break

Parallel sessions

11:15 – 12:45 **Mathematics Education for the 21st century** **NETWORKS** **AIM** **QSC**
Room Air *Water* *Room 10 +11* *Room 21*

12:45 – 14:00 Lunch Poster session jury will visit posters

Plenary sessions

Room Air

14:00 – 14:30 Stieltjes Prize 2022-2023

14:30 – 15:30 KWG PhD Prize

15:30 – 16:00 Break

16:00 – 16:45 Plenary lecture: Amie Wilkinson (University of Chicago) Pythagoras Prize (*Room Water*)

16:45 – 17:00 Prize giving ceremony: IM Prize, KWG PhD Prize, Stieltjes Prize, Pythagoras Prize

17:30 – 18:30 Drinks

Plenary lecture

Tuesday 2 April 2024, 10:15-11:00

Leslie Ann Goldberg (University of Oxford)

The Complexity of Approximate Counting

This talk will be a survey on the complexity of approximate counting. This is a research area that lies at the intersection of theoretical computer science, combinatorics, and probability. No special background will be required.



In theoretical computer science, the goal is to determine which computational problems have fast algorithms and which computational problems provably do not have fast algorithms. The “complexity” of a problem is a rigorous quantification of how difficult it is to solve, in terms of the existence of fast algorithms. The particular object of study here is “approximate counting” which is the study of computing certain functions called partition functions. Partition functions are relevant to spin systems such as the Ising model from statistical physics. The basic object is a “configuration”, in which the vertices of a graph are mapped to a finite set of spins, say $\{0,1\}$. The spins interact locally along the edges of the graph, in the sense that any adjacent pair of spins gives rise to an interaction weight. The weight of the configuration is the product of these interaction weights, and the partition function is the sum of the weights of all configurations. It can be used to determine qualitative properties of the model and it is the normalising factor needed to sample configurations from the corresponding probability distribution.

I will tell you what is known about the complexity of exactly computing partition functions (which is a lot!) and about the complexity of approximately computing partition functions (which is much less, though approximation turns out to be the more natural question!). I will focus on the special case where there are only two spins, which, perhaps surprisingly, is still not completely resolved.

I will first describe the pleasing characterisation of the case where interaction weights are non-negative real numbers which was discovered about a decade ago (by several researchers). This characterises the complexity of the approximate counting problem on general graphs in terms of the uniqueness of certain distributions on infinite trees.

I will also tell you about key algorithms by Barvinok and by Patel and Regts, which show how to approximate certain real-valued partition functions by bootstrapping zero-free regions of these functions in the complex plane. Finally, I will tell you about some new work with Yumou Fei and Pinyan Lu on the case with (possibly negative) real interaction weights. In this work, we give some fast approximation algorithms, and we also identify regions where we can prove that fast approximation is impossible, given the usual complexity-theoretic assumptions.

Biography

Leslie Ann Goldberg is a Professor at the University of Oxford, where she is also the Head of the Department of Computer Science. Leslie’s academic interest is in the mathematical foundations of Computer Science, where the goal is to quantify the inherent complexity of computational problems, and the inherent quality of approximation algorithms (giving rigorous proofs about what is possible in terms of computation). Leslie focusses especially on the role of randomness in computation. She has received several awards for her academic work, including 5 best-paper prizes, an ERC Advanced

Grant, election to Academia Europaea, a Suffrage Science award (which “celebrates women in science for their scientific achievement and for their ability to inspire others”) and was elected as a Fellow the European Association for Theoretical Computer Science “for fundamental contributions to many areas of theoretical computer science, primarily focusing on randomized algorithms and their limitations”.

Young KWG Panel discussion

Tuesday 2 April 2024, 11:30-12:15

Generative AI in Mathematics Research and Teaching

This session consists of three short talks by experts from research fields related to generative AI, and will cover the consequences of the developments in AI for mathematics research, industry mathematics, and teaching.

The speakers for this session are:

Stefan Buijsman (TU Delft) – Formal proofs versus informal proofs: when proving theorems mathematicians approach problems very differently from current AI systems, distinguishing between trivial and interesting proofs, explanatory and non-explanatory proofs and more. With AI unable to replicate our understanding of a situation where does that leave the interaction with these systems?

Antske Fokkens (VU Amsterdam) – In this talk, I will walk through the basics on how large language models work. I will focus on why they are so good at certain things and bad at others.

Wouter Kool (ORTEC) – Learning to optimize or learning what to optimize? Should AI generate a solution to your problem or can you use AI to define your problem? I will discuss the trade-offs using machine learning for optimization, in academia and in practice.

After the lectures, there will be a panel discussion with the speakers. What is the impact of generative AI on our daily work as mathematicians?

This session is organized by Young KWG, a new section of KWG which aims to attract and support young mathematicians in the early stages of their careers.

EWM-NL

Tuesday 2 April 2024, 13:00-13:30

European Women in Mathematics – The Netherlands (EWM-NL) is the national association of women working in the field of mathematics in the Netherlands. Part of the goals of EWM-NL is to establish a framework of activities to support women in research in the Netherlands, and particularly early career researchers, to enter and establish careers in mathematics.



This EWM-NL session consists of a panel discussion with the invited speakers of the Congress. The starting point of the discussion will be the following questions: How do you think about gender representation in your work, be it in articles, conferences or in the classroom? When doing research or teaching, how do you think about your identity in relation to the subjects you research and the students you teach and supervise? How does an awareness of your positionality affect your work, be that research or teaching? In your opinion, what are the best practices to conduct exit interviews?

Parallel sessions

DIAMANT (Room Air)

Tuesday 2 April 2024, 13:45-15:15

Johan Commelin (Utrecht University)

Mathlib: a look behind the curtain of the digital Bourbaki 2.0

The mathlib library is a community effort to formalize a large body of mathematics in the Lean theorem prover. It can be viewed as a crowd-sourced experiment in mathematical knowledge management. In this talk I will give a brief introduction to Lean, and then I will explain how mathlib is organized.



I will give an overview of the current mathematical content of the library. We will also take a look at some of the social aspects of the project, and give some insights into the design choices that were made, and the trade-offs that were involved.

Mireille Boutin (Eindhoven University of Technology)

Algebraic Problems in Localization and Mapping Applications

Localization is the task of determining one's location in their environment. Mapping is the task of determining the shape and location of the objects in one's environment. Either task can be accomplished using various types of sensors, for example cameras or Lidar. In this talk I will talk about two localization problems (global positioning —GPS— and gun shot localization) and one mapping problem (hearing the shape of a room). I will show how these problems relate to algebra and highlight some new results and their practical implications. This is joint work with Gregor Kemper.



NDNS+ (Room Water)

Tuesday 2 April 2024, 13:45-15:15

Matthew Thorpe (The University of Warwick)

Discrete-To-Continuum Limits in Graph-Based Semi-Supervised Learning

Semi-supervised learning (SSL) is the problem of finding missing labels from a partially labelled data set. The heuristic one uses is that “similar feature vectors should have similar labels”. The notion of similarity between feature vectors explored in this talk comes from a graph-based geometry where an edge is placed between feature vectors that are closer than some connectivity radius. A natural variational solution to the SSL is to minimise a Dirichlet energy built from the graph topology. And a natural question is to ask what happens as the number of feature vectors goes to infinity? In this talk I will give results on the asymptotics of graph-based SSL using an optimal transport topology. The results will include a lower bound on the number of labels needed for consistency.



Riccardo Cristoferi (Radboud University)

Shape optimization for attractive-repulsive energies

Patterns are everywhere! Their regularity is both fascinating and intriguing: if from an aesthetic point of view we are pleased when admiring them, from a mathematical point of view we want to explain this regularity.

In this talk we will shed some light on mechanisms behind pattern formation. In particular, we focus on the formation of a single shape. We work in a variational framework, namely we view patterns as configurations having least energy. The optimal shape will then be the compromise of the effects of competing forces. The prototype is having an attractive and a repulsive force. We will consider several variants of such terms having different features, and investigate how this affect the optimal shape.



This talk is based on a series of works in collaboration with Marco Bonacini (Università di Trento), Maria Giovanna Mora (Università di Pavia), Lucia Scardia (Heriot-Watt University), and Ihsan Topaloglu (Virginia Commonwealth University).

Bertram Düring (The University of Warwick)

A Lagrangian scheme for the solution of nonlinear diffusion equations

Many nonlinear diffusion equations can be interpreted as gradient flows whose dynamics are driven by internal energies and given external potentials, examples include the heat equation and the porous medium equation. When solving these equations numerically, schemes that respect the equations' special structure are of particular interest. In this talk we present a Lagrangian scheme for nonlinear diffusion equations.

For discretisation of the Lagrangian map, we use a finite subspace of linear maps in space and a variational form of the implicit Euler method in time. We present numerical experiments for the porous medium equation in two space dimensions.



STAR (Room 10+11)

Tuesday 2 April 2024, 13:45-15:15

Eni Musta (University of Amsterdam)

Single-index mixture cure model under monotonicity constraints

We consider survival data with a cure fraction, meaning that some subjects never experience the event of interest. For example, in oncology the event of interest is cancer relapse/death and the cured patients after treatment are immune to such event. It is common in this context to use a mixture cure model, consisting of two sub-models: one for the probability of being uncured (incidence) and one for the survival of the uncured subjects (latency). Various approaches, ranging from parametric to nonparametric, have been proposed to model the incidence component, with the logistic model being the standard choice. We consider a monotone single-index model for the incidence, which relaxes the parametric logistic assumption, while maintaining interpretability of the regression coefficients and avoiding the curse-of-dimensionality. A new estimation method is introduced that relies on the profile maximum likelihood principle, techniques from isotonic regression and kernel smoothing. We discuss some unique and challenging issues that arise when incorporating the monotone single-index model within the mixture cure model. The consistency of the proposed estimator is established and its practical performance is investigated through a simulation study and an application to melanoma cancer data.



Joint work with Tsz Pang Yuen.

Fabian Mies (TU Delft)

Likelihood asymptotics for stationary Gaussian arrays

Arrays of stationary Gaussian time series can arise naturally in econometric applications, e.g. as the discretization of continuous-time stochastic processes, or be introduced artificially to model persistency via so-called local-to-unity models, i.e. linear time series models with parameters close to a unit root. For the parametric statistical estimation of these stationary models, the spectral density plays a central role. In particular, classical results in time series analysis suggest that the Gaussian likelihood and Fisher information may be approximated in terms of the spectral density, and conditions for efficiency of the MLE have been formulated in the literature. Unfortunately, these general results do not cover arrays of time series. Our contribution is to show in which way the asymptotic likelihood theory needs to be adapted for the array case, and we demonstrate that this yields a straightforward approach to study a broad class of processes.



As a motivating example, we investigate the estimation of the mixed fractional Brownian motion based on high-frequency observations. Our findings reveal that the achievable rates of convergence depend intricately on the size of the various components, as well as their intertemporal and crosstemporal dependence structure.

Frank Röttger (Eindhoven University of Technology)

Structural causal models in multivariate extremes from threshold exceedances

Structural causal models (SCMs) are a fundamental tool in causal inference that allow for flexible dependence modeling. In this talk we discuss a new approach to model the extremal behavior of SCMs. We introduce a limiting extremal SCM that conforms with extremal Markov properties based on the recently introduced notion of extremal conditional independence. This yields a definition of directed graphical models for multivariate extremes from threshold exceedances.



For the parametric subclass of Hüsler–Reiss distributions, which are considered as an analogue of Gaussian distributions in extremes, we find a linear extremal SCM that permits a parametric description of extremal conditional independence.

This gives rise to a simple extremal conditional independence test, which we implement in a PC-type algorithm and demonstrate on real data.

This is joint work with Sebastian Engelke and Nicola Gnecco.

GQT (Room 21)

Tuesday 2 April 2024, 13:45-15:15

Sharmila Gunasekaran (Radboud University)

Rigidity of quasi-Einstein manifolds

Extreme black holes possess event horizons at zero temperature, referred to as degenerate Killing horizons. These horizons are exclusively delineated by a specific limiting procedure, defining a near-horizon geometry or, more broadly, a quasi-Einstein equation which governs their properties. Solutions to this equation manifest as triples (M, g, X) , where M represents a closed manifold (the horizon), g denotes a Riemannian metric, and X is a 1-form.

In the scenario where X is a closed 1-form, it signifies the static case, encompassing near-horizon geometries of static extreme black holes. It was known that when the quasi-Einstein constant is zero, X must vanish. In collaboration with Eric Bahuaud, Hari K Kunduri, and Eric Woolgar, we have extended this characterization to the case of non-vanishing quasi-Einstein constant. When the constant is positive, X must be exact and when the constant is negative, either X vanishes or is not exact, in which case it is a product of negative Einstein manifold and a circle (finalized by Will Wylie).



Recently, Dunajski-Lucietti established that the near horizon geometry arising from a Kerr-(A)dS black hole is unique on a 2-sphere. I will discuss some partial deformability results for this metric.

Yagna Dutta (Leiden University)

Twists of intermediate Jacobian fibration

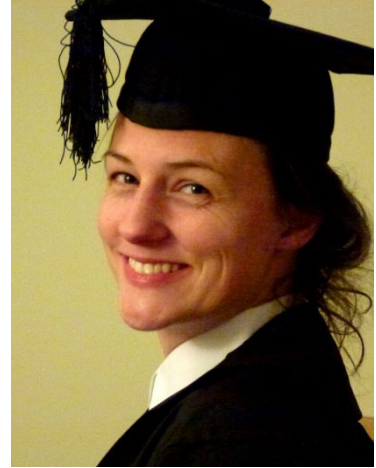
Given an elliptic fibration of a K3 surface, one can reglue the fibres of the elliptic fibration differently to obtain different K3 surfaces. These regluings are governed by a group scheme over the base of the elliptic fibration. My plan for the talk is to tell this story. Moving from curves to 3-folds, we find some very interesting group schemes related to the intermediate Jacobian of a cubic 3-fold. I will report on a joint work in progress with Mattei and Shinder where we consider the family of cubic 3-folds obtained as the hyperplane sections of a fixed smooth cubic 4-fold. The total space this time is a hyperKähler manifold. HyperKähler manifolds are nothing but higher dimensional analogues of K3 surfaces, resulting in impressive parallels with elliptic fibrations of K3 surfaces.



Renee Hoekzema (Free University Amsterdam)

The striped cylinder cobordism category

Cobordism categories describe the algebraic gluing structure of manifolds, and they are central in the functorial description of topological quantum field theories (TQFTs). We consider a new “nested” variation of a cobordism category where manifolds come with embedded submanifolds and cobordisms with subcobordisms. An example is the category of cylinders with lines. In this talk I will describe the algebraic structure associated with this striped cylinder cobordism category. This algebraic structure has links to Temperley-Lieb algebras as well as bearing similarity to the simplicial and the cyclic category, which are involved in the definition of the (cyclic) bar construction. We define a new cylindrical bar construction, a novel algebraic construction for self-dual objects in a strict monoidal category.



Poster session - pitches

Tuesday 2 April 2024, 15:45-16:15

Pitch overview

	Name	Title	University
1	Nicky van den Berg	Geodesic Tracking of Retinal Vascular Trees with Optical and TV-Flow Enhancement in SE(2)	TU/e
2	Ömer Esas	Data-Driven Risk Management for Fire Services	UT
3	Hasti Garjani	Stackelberg evolutionary game theory Treating cancer in the light of evolution	TUD
4	Przemysław Grabowski	Foliations and Galois Theory in Positive Characteristics	UvA
5	Agnieszka Janicka	Scale-free cascading failures: Generalized approach for all simple, connected graphs	TU/e
6	Sanne van Kempen	Analyzing routing policies in matching queues with uncertain payoffs	TU/e
7	Mirmukhsin Makhmudov	Relationship between the half-line and whole-line Gibbs measure	LU
8	Philip Preussler	Tests for L^p -admissibility	UT
9	Lisanne Taams	Computing motives of stacks of sheaves on stacky curves	RU
10	Peter Verleijdsdonk	Scalable Policies for the Dynamic Traveling Multi-Maintainer Problem with Alerts	TU/e
11	Jens de Vries	A unifying approach to von Neumann's inequality and Crouzeix's conjecture	UT
12	Alexander Wierzbna	BIBO-stability of infinite-dimensional systems	UT

Beeger Lecture

Tuesday 2 April 2024, 16:15-17:15

Andrew Sutherland (Massachusetts Institute of Technology)

The fine art of point counting

Some of the most fundamental questions in number theory can be reduced to a problem of “counting points” on some arithmetic object: this includes questions involving Diophantine equations (Hilbert’s 10th problem), zeta functions (the Weil conjectures), algebraic varieties (the BSD and Sato-Tate conjectures), and L-functions (modularity and the Langlands program), as well as many problems in the burgeoning field of arithmetic statistics. I will present some illustrative examples to support this claim, showing how the apparently simple act of counting points can play a pivotal role in proving theorems and formulating conjectures. After giving an overview of some of the computational methods used to count points, I will discuss some of the challenges that arise when applying these methods at scale, challenges that have taken on increasing importance in our modern era of massive data sets, machine learning algorithms, and ever-expanding computational resources.



Biography

Andrew Sutherland is a Principal Research Scientist in the mathematics department at the Massachusetts Institute of Technology (MIT), where he received his Ph.D. in mathematics in 2007, earning the Sprowls Award for his thesis. Sutherland’s research focuses on computational aspects of number theory and arithmetic geometry; he was awarded the 2012 Selfridge Prize for his work in these areas. He has played a leading role in several large scale collaborations in number theory, including the Polymath project on Bounded Gaps Between Primes, the L-functions and Modular Forms Database, and the sums of three cubes project, and is currently one of the Principal Investigators leading the Simons Collaboration on Number Theory, Arithmetic Geometry, and Computation. Sutherland currently serves as Editor of Mathematics of Computation, Editor in Chief of Research in Number Theory, Managing Editor of the L-Functions and Modular Forms Database, and President of the Number Theory Foundation. He was named Fellow of the American Mathematical Society in 2021 for his “contributions to number theory, both on the theoretical and computational aspects of the subject”.

Speed dating session

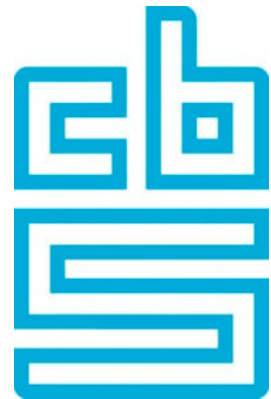
Tuesday 2 April 2024, 17:15-19:00

Statistics Netherlands (CBS)

In a society where the amount of information is growing explosively, free access to reliable and integral data is crucial. As the national statistical office, CBS produces reliable statistical information and data that provide insight into social issues, thus supporting the public debate, policy development and decision-making while contributing to prosperity, well-being and democracy.

Working at CBS

The office environment at CBS – with offices located in The Hague, Heerlen and on Bonaire – is a pleasant mix of government and business. You will find a very diverse group of employees who range widely in age, nationality, discipline and career. One thing all our employees have in common is their focus on the quality of our research results. Would you like to learn more and/or apply? Check out our current vacancies and/or current internships (in Dutch) on www.werkenbijhetcbs.nl



CQM

CQM (Consultants in Quantitative Methods), a leading consultancy based in Eindhoven, specializes in using data science and mathematical modeling to



improve supply networks, innovate products, and enhance manufacturing processes. With over 40 years of proven experience, CQM has consistently applied quantitative methods to solve complex challenges in various industries.

Our dynamic team of around 40 highly skilled consultants, all with an academic background in mathematics or a related field, is dedicated to clarifying complex processes, enabling our clients to make informed, fact-based decisions that significantly enhance their organizational effectiveness and operational outcomes. We immerse ourselves in their business situation, we empathize and collaborate with them; determined to tackle problems together as one team.

CQM's portfolio showcases we are at the forefront of data science to offer the best, practically applicable solution for clients such as Agrico, Ahold, ASML, CARU, FrieslandCampina, NS, Philips, ProRail and Transvision.

Nederlandse Spoorwegen

Nederlandse Spoorwegen (NS) are the main train operator in the Netherlands, transporting over 1 million passengers per day, with over 700 train sets, over more than 3000 km track along almost 400 train



stations. That's a lot. Moreover the network is very intertwined, making the logistic planning a complex, mathematical challenge.

I work with my team on a mathematical model that solves the planning of trains at night on the yards (called shunting): trains that arrive in a specific order and combination, have to be serviced and cleaned on specific tracks and have to be able to leave the next morning, in time, in the right order and in the right combination. With a lot of trains, and very limited space on the yards, this quickly becomes a major shuffle puzzle.

The shunting problem is closely related to the timetable planning during the day. Both have a lot of challenging questions, that require mathematical models.

If you would like to know more about mathematics at NS, you are most welcome to pass by.

Probabilty & Partners

Probability & Partners is a fast-growing consultancy firm specialized in Risk

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Parallel sessions

Wednesday 3 April 2024, 9:00-9:30

What's cooking? (Room Air)

- Announcements Tafel Wiskunde (Sonja Cox)
- Announcements PWN (Wil Schilders or Richard Boucherie)
- Announcements Young KWG
- Announcements KWG (Mathisca de Gunst)
- Announcements CWI (Ton de Kok)

Start your career (Room Water)

Are you thinking about what you want to do after your PhD, but have you lost track of what options you have? What will be the next step in your career? Do you stay in academia or are you going to give it a try in industry or maybe something completely different? Career coach Margret Smitters lets you know what career options are available to you after your PhD and helps you figure out what you really want to do.

Funding possibilities (Room 10+11)

Your academic career is about to start and you want to know what funding options you have? Then this workshop is for you. NWO policy officers will give you an overview about the most important funding instruments for young researchers and let you know which points are important when submitting your proposal.

Wiki edit-a-thon (Room 21)

During the one-hour Wiki-Edit-a-thon, we will translate Wikipedia pages of female mathematicians to increase their visibility in society. No experience necessary; all welcome, but please bring your own laptop with you.

Parallel sessions

Wednesday 3 April 2024, 9:30-10:00

The Indagationes Mathematicae Best Paper Prize

In 2023, the Royal Dutch Mathematical Society (KWG) and Elsevier have introduced an award for the best paper of the year in the journal *Indagationes Mathematicae* (IM). IM is published by Elsevier under the auspices of KWG.

The *IM Best Paper Award 2024* has been awarded to Gautam Chinta, Nathan Kaplan, and Shaked Koplewitz for their article [*The cotype zeta function of \$\mathbb{Z}^d\$*](#) , *Indagationes Mathematicae* 34 (3) 2023, 643-659.

Shaked Koplewitz

The Cotype Zeta Function of $\mathbb{Z}^d$

I go through my work with Nathan Kaplan and Guatum Chinta, where we give an asymptotic formula for the number of sublattices $\Lambda \subseteq \mathbb{Z}^d$ of index at most X for which $\mathbb{Z}^d / \Lambda$ has rank at most m , answering a question of Nguyen and Shparlinski. We compare this result to work of Stanley and Wang on Smith normal forms of random integral matrices and discuss connections to the Cohen-Lenstra heuristics. Our arguments are based on Petrogradsky's formulas for the cotype zeta function of $\mathbb{Z}^d$, a multivariable generalization of the subgroup growth zeta function of $\mathbb{Z}^d$.



Plenary lecture

Wednesday 3 April 2024, 10:00-10:45

Stefanie Jegelka (Massachusetts Institute of Technology)

Machine learning with symmetries: graphs, eigenvectors and generalization

In many applications, especially in the sciences, data and tasks have known structure, e.g., known symmetries.

Encoding such invariances directly into a machine learning model can improve learning outcomes, while it also poses challenges on efficient model design. In this talk, we will look at the example of deep learning models on graphs and, in this context and beyond, on eigenvectors. For instance, eigenvectors are used as additional input, i.e., “positional encodings”, to graph neural networks, but also in applications related to point clouds and graphics. Graphs and eigenvectors possess symmetries such as invariance or equivariance to

permutations and changes of basis. A first question is how to effectively and efficiently model such symmetries in neural network models. A second question is the approximation power of the resulting models, i.e., which functions they can approximate. A third question concerns empirical implications for various applications. Finally, we will address a more general question: empirically, encoding symmetries in a model often helps to learn with less data — is it possible to understand this theoretically? From a viewpoint of differential geometry, we show how encoding symmetries can help sample complexity of learning



Biography

Stefanie Jegelka is a Humboldt Professor at TU München and an Associate Professor in the Department of EECS at MIT. Before joining MIT, she was a postdoctoral researcher at UC Berkeley, and obtained her PhD from ETH Zürich and the Max Planck Institute for Intelligent Systems. Stefanie has received a Sloan Research Fellowship, an NSF Career Award, a DARPA Young Faculty Award, the German Pattern Recognition Award, a Best Paper Award at ICML and an invitation as sectional lecturer at the International Congress of Mathematicians. She has co-organized multiple workshops on (discrete) optimization in machine learning and graph representation learning, and has served as an Action Editor at JMLR and as program chair of ICML 2022. Her research interests span the theory and practice of algorithmic machine learning, in particular, learning problems that involve combinatorial, algebraic or geometric structure.

Parallel sessions

4TU.AMI: Mathematics Education for the 21st century (Room Air)

Wednesday 3 April 2024, 11:15-12:45

Educating students in and for the volatile, uncertain, complex and ambiguous society we live in, requires continuous consideration of university education. We need to consider what has to be kept while simultaneously thinking about what should and could be adapted. Firstly there are changes in the background, skills and attitudes of students. Secondly, developments in computational power change the way mathematics is being used. Quite recently, progress in AI is starting to have a large impact on the educational landscape. This session serves as a starting point for a (national) discussion on Mathematics Education for the 21st century in the Netherlands.

Samuel Bengmark (Chalmers University of Technology)

Study your own teaching practice! – Pragmatic Research on Education Practice (PREP)

Many mathematicians are ambitious and strive to continuously improve their teaching by experimenting with different teaching approaches while trying to find out if it is effective or not. Unfortunately, many of us think we lack the time, knowledge, motivation, or data to turn these experiments into studies that can be published in (educational) journals. In rare cases they are shared in pedagogical conferences, most insights are at most told to the closest colleagues.



We therefore propose a collegial process that we call PREP, Pragmatic Research on Educational Practice, with the aim of getting us teachers to succeed in completing simpler educational studies and share the results with each other. In this presentation, I will tell you about this process, our experiences so far and what we hope for the future, with the goal to inspire you to study your own teaching practice. PREP is a collegial process aimed at engaging educators in studying, documenting, and sharing their initiatives to improve teaching practices. We will tell you about the experiences and results so far and invite you to take part.

Alessandro Di Bucchianico (Eindhoven University of Technology)

The 4TU.AMI SRI Research on Mathematics Education Project

4TU.AMI very recently approved a research project proposal from the four technical universities and Groningen University on



Research on Mathematics Education. We will give an outline of the goals of the project, highlight how all university mathematics teaching will benefit from it and invite members of the audience to participate in the project.

Annoesjka Cabo (TU Delft)

Mathematical competencies: What, why and how?

Societal challenges of both today and tomorrow require that we educate students with an adequate mathematical skills set. There is an increasing need for students who specialize in mathematics, as well as an increasing need for mathematical proficiency of students from other disciplines. Several developments urge us to go beyond traditional ways of teaching mathematics. The questions ‘what’, ‘how’ and ‘with what purpose’ mathematics is taught at university level deserve thorough investigation. Moreover, there is added value of the teaching being delivered by mathematicians and there is a need for scientific proof of this added value. Since the current state-of-the-art in research on mathematical education does not satisfactorily cover the needs in higher education, there is an urgency to perform targeted research on mathematical competencies. In this talk you will learn about the mathematical competencies framework, think along about which developments are to be dealt with and how the community of mathematicians can contribute to these topics.



NETWORKS (Room Water)

Wednesday 3 April 2024, 11:15-12:45

Dan Kral (Masaryk University)

Graph limits

The theory of graph limits provides analytic tools to represent and study large networks/graphs. The theory has led to new views on a wide range of topics in mathematics and computer science, and opened new links between analysis, combinatorics, ergodic theory, group theory and probability theory.

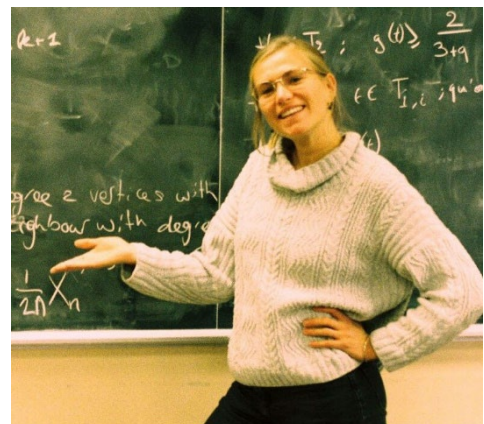
We introduce this rapidly developing area of combinatorics and discuss several problems from extremal combinatorics when viewed through lenses of graph limits. In particular, we will present a counterexample to a conjecture of Lovász concerning finitely forcible optima, which was one of the two most cited conjectures in the theory of combinatorial limits. At the end of the talk, we will briefly discuss the relation of graph limits and the stochastic block model, a random graph model widely used in network science, and we then conclude with several open problems related to the presented notions



Serte Donderwinkel (Rijksuniversiteit Groningen)

Enumerating score sequences via integrated random walks

A score sequence of length n is a non-decreasing sequence that can occur as the sequence of in-degrees of an orientation of the edges of the complete graph on n vertices. We let S_n be the number of score sequences of length n . The first bounds on S_n were found by Erdős and Moser in the sixties. The order of S_n was obtained by Kim and Pittel (2000), who built on the work of Winston and Kleitman (1984). We improve their result and show that $S_n = (1 + o(1))C4^n/n^{5/2}$. We rephrase the question in terms of a question on integrated random walks, that we then answer. This talk is based on joint work with Brett Kolesnik.



Fernando de Oliveira Filho (TU Delft)

Bounds for Grothendieck's constant and the integrality gap of MAXCUT

I will describe infinite-dimensional convex optimization problems whose optimal values are the Grothendieck constant in fixed dimension or the integrality gap of MAXCUT in fixed dimension. These problems characterize the corresponding constants, and can be used to compute bounds for them.



AIM (Room 10+11)

Wednesday 3 April 2024, 11:15-12:45

Stephanie van der Pas (Amsterdam UMC)

Causal conclusions from a cut-off: Bayesian regression discontinuity designs

An opportunity for causal inference presents itself when an intervention is assigned based on a cut-off, as is very common in medical decision-making. Suppose for example that patients aged 65 or younger receive treatment A and patients older than 65 receive treatment B. On average, patients aged 64 will be similar to patients aged 66 in all potentially confounding aspects like BMI or smoking status. So if the outcomes for patients aged 64 are much better than those of patients aged 66, we may reasonably ascribe this difference to the intervention, and claim a causal effect. This is the core concept behind the regression discontinuity design (RDD). In RDD, the causal is estimated only locally at the cut-off point. Here we focus on the situation where the cut-off is unknown. We introduce a Bayesian approach in which we incorporate prior knowledge about the cut-off location, suitable for the hitherto somewhat neglected fuzzy version of the RDD, where compliance may be imperfect. We compare the new method to the most popular frequentists methods in simulations and on medical data sets.



Joint work with Julia Kowalska and Mark van de Wiel

Alexander Taveira Blomenhofer (CWI)

Tensor decomposition models in Machine Learning

Many problems in Machine Learning ask for structured representations of high-dimensional tensors. Examples include the parameter estimation for Gaussian mixture models, as well as polynomial neural networks. We will discuss some tensor decomposition models and present a theorem to quantify their expressiveness in the presence of a group action. We also discuss when overdetermined models have a unique solution.



Dirk van der Hoeven (Leiden University)

Advances in bandit convex optimization

In this talk I will present some recent advances in bandit convex optimization, in which the goal is to optimize a sequence of convex functions. The main challenges in bandit convex optimization are a) estimating a convex function based solely on one evaluation and b) developing a suitable optimization algorithm to be run on the estimated function. I will discuss a recently proposed approach to tackle a) that builds an estimator of the convex function which is globally a very poor estimator. Crucially, it can be shown that close to the minimizer of the convex function this estimator is actually a reasonable estimator, which combines with a suitable algorithm for b) that never strays too far from that minimizer and leads to good guarantees for the bandit convex optimization setting.



Silke Glas (University of Twente)

Model reduction on manifolds: a differential geometric framework

Using nonlinear projections and preserving structure in model order reduction (MOR) are currently active research fields. In this paper, we provide a novel differential geometric framework for model reduction on smooth manifolds, which emphasizes the geometric nature of the objects involved. The crucial ingredient is the construction of an embedding for the low-dimensional submanifold and a compatible reduction map, for which we discuss several options. Our general framework allows capturing and generalizing several existing MOR techniques, such as structure preservation for Lagrangian- or Hamiltonian dynamics, and using nonlinear projections that are, for instance, relevant in transport-dominated problems. The joint abstraction can be used to derive shared theoretical properties for different methods, such as an exact reproduction result. To connect our framework to existing work in the field, we demonstrate that various techniques for data-driven construction of nonlinear projections can be included in our framework.



QSC (Room 21)

Wednesday 3 April 2024, 11:15-12:45

Jonas Helsen (CWI)

Shadow tomography in practice: repeating circuits and estimating means

In this talk, based on joint work with Michael Walter, I want to take a deeper dive into the Huang-Kueng-Preskill shadow tomography protocol. I will address two problems: (1) whether it is statistically disadvantageous to repeat randomly sampled circuits, and (2) whether the median-of-means estimator can be replaced with a regular mean estimator without losing exponential concentration (which is required for the seemingly magical logarithmic sample complexity of shadow tomography). We will see that in both cases the answer depends strongly on the underlying gateset, even when that gateset is already a 3-design. In particular, in both cases the Clifford group performs poorly while fully Haar random gates perform well. We also consider efficiently constructible circuit families that interpolate between these two behaviours. On the technical side, we lean strongly on Weingarten calculus and its recently developed Clifford counterpart. We give upper and lower bounds for moments of stabilizer state estimators which might be of independent interest.



Sarah Arpin (Leiden University)

Isogeny paths to quantum-resistant cryptography

With the advent of quantum computers, the cryptographic landscape faces unprecedented challenges as traditional standards fall vulnerable to quantum attacks. Mathematicians and cryptographers are called to construct a cryptographic toolkit capable of withstanding both classical and quantum attacks. Isogeny-based cryptography emerged as a compelling newcomer to cryptography, entering the scene in 2006 with a hash function proposed by Charles-Goren-Lauter and cryptographic group actions proposed by Couveignes and Rostovtsev-Stolbunov. In this presentation, we will delve into supersingular elliptic curve isogeny graphs, shedding light on the unique properties that make them powerful objects for constructing versatile cryptographic protocols.



Sebastian de Bone (TU Delft)

Fault-tolerant channels for distributed quantum computation

In the search for scalable, fault-tolerant quantum computing, distributed quantum computers are promising candidates. In distributed quantum computers, small quantum devices are connected with entanglement. Next to realizing these distributed structures with multiple nodes on a single chip, these systems can also be extended to large-scale quantum networks. Fault tolerance is naturally achieved by connecting the nodes according to the architecture of, e.g., a two-dimensional topological quantum error-correction code. An example of such an error-correction code is the (toric) surface code.



Carrying out the corresponding error-detection measurements over time can equivalently be interpreted as measuring out the qubits of a three-dimensional cluster state. This equivalence allows one to consider more general fault-tolerant channels. We use this idea to construct fault-tolerant channels for distributed architectures. For several channels, we investigate the resilience against a general type of circuit-level and network noise. For a more specific surface code channel, we perform detailed numerical simulations, employing models developed from experimental characterization of nitrogen-vacancy centers in diamond.

The results highlight the significance of lattice geometry in the design of distributed channels and emphasize the potential for constructing robust and scalable distributed quantum computers.

Joint work with Yves van Montfort, Paul Möller, and David Elkouss

Stieltjes Prize Award 2022-2023

Wednesday 3 April 2024, 14:00-14:30

Lucas Slot (CWI & Tilburg University)

The jury for the Stieltjes Prize met on 13 December 2023 to award the prize for the best mathematical dissertation published in The Netherlands in the academic year 2022-2023. A total of 76 dissertations were assessed. The jury decided to award the Stieltjes Prize 2022-2023 to Lucas Slot (CWI and Tilburg University), for his thesis entitled “Asymptotic Analysis of Semidefinite Bounds for Polynomial Optimization and Independent Sets in Geometric Hypergraphs”.



The dissertation of Lucas Slot consists of three parts. The first two parts deal with the performance analysis of hierarchies of semidefinite approximations for polynomial optimization problems. These nonlinear nonconvex optimization problems are hard to analyze and are used in many applications. Lasserre hierarchies provide upper bounds (Part 1) and lower bounds (Part 2) for the global optimum. For the upper bounds the thesis offers an essentially optimal analysis for polynomial optimization problems over convex bodies and general compact semi-algebraic sets and a tight analysis for special sets including the box, the simplex, the ball and general convex bodies with a nice boundary. These results represent the state-of-the-art. They show an explicit performance analysis with quadratic dependence in the degree, which gives a strong improvement on the best known results in literature. The third part of the thesis is devoted to bounding the size of simplex-avoiding sets in geometric hypergraphs via a recursive theta-number, extending in a very nice way ideas that are classical in the case of graphs.

The thesis is based on 7 papers most of them already published in high ranked journals. Finally the jury noted that the thesis was written in only 3,5 years

Lucas Slot will give a presentation about the research performed during his PhD during the NMC 2024.

KWG PhD Prize

Wednesday 3 April 2024, 14:30-15:30

for the best presentation of PhD research in mathematics

Each year the Royal Dutch Mathematical Society (KWG) organizes the KWG PhD prize for the best presentation of PhD research in mathematics. The PhD prize competition is open to PhD candidates in mathematics from all universities in the Netherlands and CWI, provided they have not yet defended their thesis on 29 February 2024.

A jury of mathematicians from various fields chooses a winner, who receives besides the prestige of winning, an exchange trophy and a monetary reward of 1000 euro made available by the Foundation Compositio Mathematica.

The jury received nine submissions for the KWG PhD prize and selected the following four candidates to present their work during NMC 2024:

- Matthijs Borst (TU Delft)
- Przemysław Grabowski (UvA)
- Pim Spelier (TU Delft)
- Jana Sotáková (UvA)

From the four invited candidates the jury will select the prize winner. The main criterion for being invited is the quality of the PhD research, the main criterion for winning the prize is the capability to present the research to a broad mathematical audience.

Composition of the jury

- Francesca Arici (Leiden University, GQT)
- Annika Betken (University of Twente, STAR)
- Riccardo Cristoferi (Radboud University, NDNS+)
- Martin van Gijzen (TU Delft, chair)
- Aida Abiad Monge (TU Eindhoven, DIAMANT)

Plenary lecture

Wednesday 3 April 2024, 16:00-16:45

Amie Wilkinson (University of Chicago)

Asymmetry in dynamics

The origins of the subject of dynamical systems lie in classical mechanics, in the study of such fundamental problems as the stability of the solar system. A theme that traces back to Noether's theorem is that symmetries in such physical systems must occur for a reason: for example, if the motion of a system does not depend on position in space, then there must be a conserved quantity, such as angular momentum. I will discuss, in the broader contexts of modern dynamics, how this theme expands and reoccurs in beautiful ways: on the one hand, a typical object has the minimum amount of symmetry possible, and on the other hand, a little extra symmetry implies a lot of symmetry, a phenomenon known as rigidity.



Biography

Amie Wilkinson (born 1968) is a professor of Mathematics at the University of Chicago. Her research topics include dynamical systems, ergodic theory, chaos theory, and semisimple Lie groups. Wilkinson received a PhD in Mathematics from the University of California, Berkeley in 1995 under Charles Pugh. She gave an invited talk at the ICM in 2010, was named fellow of the AMS in 2014 and elected for the American Academy of Arts and Sciences in 2021. In 2020 she received the AMS Levi L. Conan Prize for her overview article on the modern theory of Lyapunov exponents and their applications to diverse areas of dynamical systems and mathematical physics.

Pythagoras Prize

Wednesday 3 April 2024, 16:00-16:45

The Pythagoras prize for the best high school final project in mathematics is annually awarded by Pythagoras. On April 3rd the nominated candidates will present their final project. Note that this session will be in Dutch!

Tijdens het NMC presenteren de genomineerde leerlingen het onderzoek uit zijn/haar profielwerkstuk, waarna er kort een mogelijkheid is voor het stellen van vragen. Om 16.45 uur vindt de ontknoping plaats tijdens de Prize-giving ceremony.

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P R I J S

De beste inzendingen van een wiskundig profielwerkstuk zijn:

1. *'Optimisation of distribution centres'* door Tjeerd Duursma en Stijn Meershoek, Alfrink College Zoetermeer
2. *'De continuïteitshypothese'* door Eva Jiang en Alex Hereijgers, Stedelijk Gymnasium Nijmegen