Mathematisches
Forschungsinstitut
Oberwolfach
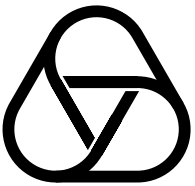
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Gemeinschaft

# Jahresbericht
## Annual Report

2023

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# Annual Report

# 2023

*Gerhard Huisken (Photo: Gerd Fischer)*

## Vorwort des Direktors

Das Jahr 2023 war für das Mathematische Forschungsinstitut Oberwolfach in vielerlei Hinsicht bedeutsam. Drei Jahre nach dem Ausbruch der Covid-19 Pandemie konnten unsere Gäste wieder weitgehend ungehindert anreisen und sich ohne Einschränkungen in der gewohnten „Oberwolfach-Atmosphäre" ihrer Forschung widmen.

Im Fokus des Jahres stand die turnusgemäße Evaluierung des Instituts durch den Senat der Leibniz-Gemeinschaft. Ich freue mich sehr, dass unsere sechs wissenschaftlichen Hauptprogramme von der internationalen Gutachterkommission hervorragend bewertet wurden. Auf dieser Grundlage hat der Senat die Förderung des Instituts durch Bund und Länder für weitere sieben Jahre empfohlen. Wir sind sehr dankbar für die Anerkennung der Qualität unserer Arbeit und für die finanzielle Planungssicherheit, die damit einhergeht.

Weitere Höhepunkte des Jahres waren die Verleihung des Oberwolfach Preises an Vesselin Dimitrov und die Verleihung des John Todd Awards an Michael Lindsey. Die Würdigungen dieser beiden Wissenschaftler durch Jean-Benoît Bost und Eric Cancès können Sie in den Laudationes in diesem Bericht nachlesen. Mein besonderer Dank gilt der Oberwolfach Stiftung, die wieder die Vergabe der Preise ermöglichte.

Die Oberwolfach Stiftung hilft uns außerdem dabei, Forscherinnen und Forscher in einer frühen Phase der Karriere bei den Reisekosten zu

## Director's foreword

The year 2023 was significant for the Oberwolfach Research Institute for Mathematics in many ways. Three years after the outbreak of the Covid-19 pandemic, our guests were once again able to travel largely without restrictions and devote themselves to their research in the familiar "Oberwolfach atmosphere."

The focus of the year was the regular evaluation of the Institute by the Senate of the Leibniz Association. I am very pleased that our six main scientific programs were rated as excellent by the international expert committee. On this basis, the Senate recommended that the Institute be funded by the federal and state governments for a further seven years. We are very grateful for the recognition of the quality of our work and the financial planning security.

Further highlights of the year were the award of the Oberwolfach Prize to Vesselin Dimitrov and the John Todd Award to Michael Lindsey. The tributes to these two scientists by Jean-Benoît Bost and Eric Cancès can be read in the laudations in this report. My special thanks go to the Oberwolfach Foundation, which makes these awards possible.

The Oberwolfach Foundation also helps us to support early career researchers with travel expenses. I extend my gratidude to our other

unterstützen. Ich danke auch unseren weiteren Drittmittelgebern — der Carl Friedrich von Siemens Stiftung, der National Science Foundation der USA und der Simons Foundation — für ihre großzügige Förderung, die vielen jungen Talenten dabei hilft, an unseren Programmen teilzunehmen.

Auch die ehrenamtliche Unterstützung durch die Mitglieder des Fördervereins ist von großer Bedeutung für das Institut. An dieser Stelle möchte ich mich besonders bei Ursula Gather bedanken, die dem Verein über viele Jahre hinweg mit großem Einsatz vorstand. Mit Hannah Markwig, die den Vorsitz 2023 übernommen hat, wird der Förderverein auch in Zukunft eine wesentliche Stütze für das Institut sein. Ein herzliches Dankeschön dafür!

Seit seiner Gründung lebt das Institut durch das persönliche Engagement von Mathematikern und Mathematikerinnen: In der Gesellschaft für Mathematische Forschung als Trägerverein des MFO, in der Wissenschaftlichen Kommission und im Wissenschaftlichen Beirat, im Förderverein und in der Oberwolfach Stiftung. Zwei Mitglieder, die über viele Jahre mit Oberwolfach verbunden waren, sind nun leider von uns gegangen. In den Nachrufen trauern wir um Roland Bulirsch und Peter Roquette.

Eine drängende Herausforderung blieb der Fachkräftemangel, der uns besonders im Bereich der Hauswirtschaft weiter beschäftigte. Zu Beginn des Jahres 2023 sahen wir uns dazu gezwungen, die Beherbergungskapazität des Instituts zu reduzieren. Unsere Bemühungen, qualifiziertes Personal zu gewinnen, setzen wir unvermindert fort.

Ich möchte mich bei allen Mitarbeiterinnen und Mitarbeitern bedanken, die durch ihren täglichen Einsatz den reibungslosen Ablauf am MFO sicherstellen. Sie schaffen die Rahmenbedingungen, die es unseren Gästen ermöglichen, sich voll und ganz auf ihre Forschung zu konzentrieren.

Schließlich danke ich den ehrenamtlichen Mitgliedern unserer Gremien, deren Expertise und Engagement das Fundament unseres Erfolgs bilden. Dank ihrer Unterstützung können wir auch im Jahr 2023 auf hervorragende Ergebnisse zurückblicken.

third-party funders — the Carl Friedrich von Siemens Foundation, the National Science Foundation of the USA and the Simons Foundation — for their generous support, which helps many young talents participate in our programs.

The voluntary support from the members of the Friends of Oberwolfach Association is also of great importance for the Institute. I would especially like to thank Ursula Gather, who chaired the association with great dedication for many years. With Hannah Markwig, who took over the chair in 2023, we see the association well positioned for the future. A heartfelt thank you for this!

Since its founding, the Institute has thrived on the personal commitment of mathematicians: in the Gesellschaft für Mathematische Forschung (Society for Mathematical Research) as the Institute's backing association, in the Scientific Committee and the Scientific Advisory Board, in the Friends of Oberwolfach and in the Oberwolfach Foundation. Two members who felt connected to Oberwolfach for many years have now unfortunately passed away. In the obituaries, we mourn Roland Bulirsch and Peter Roquette.

A pressing challenge this year remained the shortage of skilled workers, which particularly affected us in the area of housekeeping. At the beginning of 2023, we therefore needed to reduce the Institute's accommodation capacity. We are continuing our efforts to recruit qualified staff unabated.

I would like to thank all employees who, through their daily engagement, ensure that the MFO runs smoothly. They create the conditions that enables our guests to concentrate fully on their research.

Finally, I would like to thank the voluntary members of our committees, whose expertise and commitment form the foundation of our success. Thanks to their support, we can look back on excellent results in 2023.

Gerhard Huisken

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# 1. Über das Institut

## Auf einen Blick ...

Das Mathematische Forschungsinstitut Oberwolfach (MFO)

- organisiert und fördert mathematische Forschung,
- stärkt die internationale wissenschaftliche Zusammenarbeit,
- organisiert Fortbildungen in der Mathematik und ihren Grenzgebieten,
- und fördert den wissenschaftlichen Nachwuchs.

Das Institut ist Mitglied der Leibniz-Gemeinschaft und wird gemeinsam von Bund und Ländern finanziert.

## Was wir tun ...

Das MFO bringt Forschende der Mathematik aus allen Teilen der Welt für einen kurzen, aber intensiven Zeitraum zusammen. Pro Jahr kommen mehr als 2500 Wissenschaftlerinnen und Wissenschaftler, die weltweit zu den führenden Köpfen in ihren Spezialgebieten zählen. Das Institut bietet für sie ideale Bedingungen, um gemeinsam zu forschen, aktuelle Entwicklungen zu diskutieren und neue Ideen zu entwickeln.

Das Programm umfasst hauptsächlich einwöchige Forschungsveranstaltungen für größere und mittlere Gruppen. Daneben gibt es längerfristige Forschungsaufenthalte für kleine Gruppen und Einzelpersonen. Einwöchige Fortbildungsveranstaltungen helfen dabei, sich unter Anleitung von Experten in neue, hoch spezialisierte Gebiete einzuarbeiten.

## Wie wir arbeiten ...

Das jeweilige Jahresprogramm wird in einem kompetitiven Verfahren nach streng wissenschaftlichen Kriterien ausgewählt. Forscherinnen und Forscher aus der ganzen Welt können Anträge für Veranstaltungen oder Forschungsaufenthalte einreichen. In der Regel übersteigt die Zahl der Anträge die Kapazität des MFO bei Weitem. Alle Anträge werden von einer wissenschaftlichen Kommission begutachtet. Dieser Kommission gehören circa 20-25 international herausragende Mathematiker und Mathematikerinnen an, welche die gesamte Breite der Mathematik vertreten. Auf der Grundlage ihrer Begutachtung wird das Jahresprogramm festgelegt.

# 1. About the Institute

## At a glance ...

The Mathematisches Forschungsinstitut Oberwolfach (MFO, Oberwolfach Research Institute for Mathematics)

- organizes and promotes mathematical research,
- intensifies international scientific collaboration,
- organizes training activities in mathematics an related areas,
- and promotes early career scientists.

The Institute is a member of the Leibniz Association and is funded jointly by the German federal government and the state governments.

## What we do ...

The MFO brings researchers in mathematics from all parts of the world together for a short but intense period. Each year more than 2500 scientists – leading experts in their field – meet at the Institute which provides them with ideal conditions under which to pursue collaborative research, discuss recent developments and to generate new ideas.

The program mainly includes one-week research meetings for large and medium-sized groups. There are also longer-term research stays for small groups and individuals. One-week training events help to quickly immerse yourself with new, highly specialized areas under the guidance of experts.

## How we work ...

The annual schedule is chosen in a competitive procedure according to strictly scientific criteria. Researchers from all over the world can submit proposals for scientific events or resarch stays. The number of proposals usually far exceeds the capacity of the MFO. All proposals are reviewed by a scientific committee. This committee is made up of around 20-25 internationally outstanding mathematicians who together represent the entire spectrum of mathematics. The annual schedule is decided on the basis of their assessment.

## 2. Neuigkeiten

### 2.1. Evaluation 2023

Das MFO ist im turnusgemäßen Evaluierungs-verfahren durch den Senat der Leibniz-Gemein-schaft erneut exzellent bewertet worden. In seiner Stellungnahme empfiehlt der Senat die Fortführung der gemeinsamen Förderung des Instituts durch Bund und Länder.

Das MFO sei ein international hoch angesehenes Institute for Advanced Studies, so der Senat, und leiste einen herausragenden Beitrag für die Vernetzung der mathematischen Fachgemein-schaft. Das Institut mit seiner ausgezeichneten Bibliothek schaffe hervorragende Arbeitsbedin-gungen für Veranstaltungen mit Wissenschaft-lerinnen und Wissenschaftler aus aller Welt. Zu diesem Erfolg hätten die Beschäftigten des Instituts in erheblichem Maße beigetragen. Be-sonderes Lob erhielt der Umgang mit den He-rausforderungen der Pandemiejahre, in denen das Institut innerhalb kürzester Zeit innovative, hybride Veranstaltungsformate umsetzte. Alle drei Programmlinien – kurzfristige Forschungs-veranstaltungen, längerfristige Forschungsauf-enthalte und kurzfristige Fortbildungsveranstal-tungen – wurden als ausgezeichnet bewertet. Das Prüfungsgremium betrachtete das MFO als „einen fein abgestimmten Mechanismus, der bei seinen aktuellen Bemühungen stets hervorra-gende Ergebnisse liefert".

Leibniz-Einrichtungen werden spätestens alle sieben Jahre vom Senat der Leibniz-Gemein-schaft evaluiert. Auf der Grundlage eines vom Institut vorgelegten schriftlichen Evaluierungs-dokuments und eines zweitägigen Besuchs in Oberwolfach erstellte ein unabhängiges Evalu-ierungsgremium einen Evaluierungsbericht, der einerseits die Qualität und Bedeutung des MFO analysierte und andererseits Empfehlungen für die zukünftige Entwicklung unterbreitete. Dies wiederum bildete die Grundlage für die wissen-schaftliche Grundsatzerklärung des Leibniz-Se-nats und die Empfehlung zur gemeinsamen Finanzierung von Bund und Ländern.

Die vollständige Stellungnahme des Leibniz-Se-nats wurde im März 2024 auf der Website der Leibniz-Gemeinschaft veröffentlicht.

## 2. News

### 2.1. Evaluation 2023

The MFO once again received an excellent rat-ing by the Senate of the Leibniz Association in the regular evaluation process. In its statement, the Senate recommends to continue the joint funding of the Institute by the federal and state governments.

According to the Leibniz Senate, the MFO is an internationally highly appreciated Institute for Advanced Studies and makes an outstand-ing contribution for the interconnection of the mathematical community. The Institute with its excellent library creates perfect working con-ditions for events with scientists from all over the world. The Institute's employees have con-tributed significantly to this success. Particular praise is given to overcoming the challenges of the pandemic years, in which the Institute quickly implemented innovative, hybrid event formats. The MFO's scientific activities are or-ganized into three program lines, all of which are rated as excellent: weeklong Workshops and Miniworkshops, longer-term research stays and weeklong training activities for early ca-reer and established researchers. The review board considered the MFO to operate as a "finely-tuned mechanism, consistently deliver-ing excellent results in its current endeavours."

Leibniz institutions are evaluated by the Senate of the Leibniz Association every seven years at the latest. On the basis of a written evaluation document submitted by the Institute and a two-day visit to Oberwolfach, an independent evalu-ation committee prepared an evaluation report that on the one hand analyzed the quality and significance of the MFO and on the other hand made recommendations for its future devel-opment. This in turn formed the basis for the scientific policy statement of the Leibniz Sen-ate and the recommendation with regard to the joint funding of the Federation and the federal states.

The complete statement of the Leibniz Senate was published in March 2024 at the website of the Leibniz Association.

## 2.2 Übergabe des John Todd Award

Michael Lindsey erhielt den John Todd Award 2022 für seine herausragenden Leistungen an der Schnittstelle zwischen numerischer Analysis, angewandter Analysis, statistischer Physik und Quantenphysik. Die Preisverleihung fand am 15. Juni 2023 im Mathematischen Forschungsinstitut Oberwolfach statt. In feierlichem Rahmen überreichten Thomas Peternell (Oberwolfach Stiftung) und Gerhard Huisken die Urkunde und das Preisgeld in Höhe von 1.000 € an den strahlenden Gewinner. Die Laudatio wurde von Eric Cancès (École des Ponts ParisTech) gehalten.

Die Oberwolfach Stiftung und das Mathematische Forschungsinstitut Oberwolfach verleihen den John Todd Award circa alle drei Jahre an exzellente Nachwuchsforscher und Nachwuchsforscherinnen auf dem Gebiet der numerischen Analysis. Der Preis ist nach dem britischen Mathematiker John Todd benannt, der sich nach dem Ende des Zweiten Weltkriegs für den Erhalt des Mathematischen Forschungsinstituts Oberwolfach einsetzte. Seine Lebensgefährtin, Rosemary Lonergan, spendete der Oberwolfach Stiftung im Jahr 2005 einen Betrag in Höhe von 50.000 €. Dieses Geld wird zu einem großen Teil zur Finanzierung des John Todd Award verwendet.

## 2.2. Presentation of the John Todd Award

Michael Lindsey received the John Todd Award 2022 for his outstanding achievements at the interface between numerical analysis, applied analysis, statistical physics and quantum physics. The award ceremony took place on June 15, 2023 at the Mathematisches Forschungsinstitut Oberwolfach. Thomas Peternell (Oberwolfach Foundation) and Gerhard Huisken presented the certificate and the prize money of € 1,000 to the happily smiling winner. The laudation was given by Eric Cancès (École des Ponts ParisTech)

The Oberwolfach Foundation and the MFO present the John Todd Award approximately every three years to excellent early career researchers in the field of numerical analysis. The award is named after the British mathematician John Todd. After the end of World War II he engaged in the survival of the Mathematisches Forschungsinstitut Oberwolfach. In the year 2005, his spouse, Rosemary Lonergan, donated € 50,000 to the Institute. This money is mainly used for the financing of the John Todd Award.



*Gerhard Huisken, Michael Lindsey, Thomas Peternell*

JOHN TODD AWARD 2022
LAUDATIO FOR MICHAEL LINDSEY

Eric Cancès

During his undergraduate studies at Stanford, Michael Lindsey distinguished himself by winning numerous accolades, most notably the Kennedy Thesis Prize for his exceptional work on optimal transport. The results he obtained, together with Yanir Rubinstein, were subsequently published in the *SIAM Journal on Mathematical Analysis* in 2017. This paper earned Michael the prestigious SIAM Student Paper Prize in 2019.

Michael then pursued his graduate studies at UC Berkeley, where his excellence continued to shine. In 2018, he was awarded the Bernard Friedman Memorial Prize in Applied Mathematics. Under the supervision of Lin Lin, he completed an outstanding PhD thesis in 2019, focusing on the quantum many-body problem – one of the most significant challenges in theoretical physics. The quantum many-body problem is central to understanding matter in all its forms, from atomic nuclei and molecules to condensed matter and Bose-Einstein condensates. Mathematically, for spin-1/2 particles on a finite lattice, the problem boils down to computing the partition function $Z = \mathrm{Tr}\left(e^{-\beta(H-\mu)}\right)$, where $H$ is a Hermitian matrix, $\beta$ is the inverse temperature, and $\mu$ is the chemical potential. The dimension of $H$, however, grows exponentially with the number of lattice sites $L$, making direct computation infeasible for systems where $L$ exceeds 20, corresponding to matrix dimensions larger than $10^{12}$. Fortunately, the algebraic structure of the quantum many-body problem provides a pathway to simplification.

The quantum many-body problem can indeed be formulated in terms of operator algebras, using the second-quantized formulation of the many-body Hamiltonian

$$\widehat{H} := \sum_{i,j=1}^{L} h_{ij}\widehat{a}_i^\dagger \widehat{a}_j + \frac{1}{2}\sum_{i,j,k,l=1}^{L} V_{ijkl}\widehat{a}_i^\dagger \widehat{a}_j^\dagger \widehat{a}_l \widehat{a}_k \qquad \text{(for two-body interactions)},$$

where $\widehat{a}_i$ and $\widehat{a}_i^\dagger$ represent the annihilation and creation operators of particles, subject to either the canonical commutation (CCR) or anticommutation (CAR) relations depending on whether the particles are bosons or fermions. The matrix $h$ is Hermitian, and the 4th-order tensor $V$ has certain symmetries that make the operator $H$ self-adjoint. The first term in the Hamiltonian models the kinetic and external potential energy of the particles, while the second term describes the interactions between the particles. The goal is to compute the partition function, along with other key quantities, such as one-body Green's functions or self-energies.

A powerful approach physicists use to tackle this is many-body perturbation theory, visualized through Feynman diagrams. The simplest version involves putting a coupling parameter $\alpha$ in front of the interaction term and expanding the partition function in powers of $\alpha$. Feynman diagrams provide an efficient way to keep track of the many terms in the expansion and can be given a physical interpretation. In addition, each diagram can be translated into a mathematical expression involving two simple objects: straight or curved lines correspond to free particle propagations described by the non-interacting Green's function $G_0$ (i.e. the resolvent of the matrix $h$), while wiggly lines represent interactions between the particles described by the interaction tensor $V$. At first order, there are only two diagrams: the dumbbell and the oyster, but the number of diagrams grows exponentially with the order of the expansion (Fig. 1).

However, this "bare" diagrammatic expansion is limited in practical value, as interactions are rarely small enough for perturbation theory to be effective. More useful is the bold diagrammatic expansion, describing the dynamics of "dressed" particles subjected renormalized interactions. The bold diagrammatic expansion can be formally derived from the Luttinger-Ward formalism, but this construction is not mathematically sound, and the very existence of the Luttinger-Ward functional for fermions has recently been questioned. In collaboration with Lin Lin, Michael produced a series of groundbreaking papers that provided a rigorous mathematical foundation for the Luttinger–Ward theory for Euclidean lattice fields.
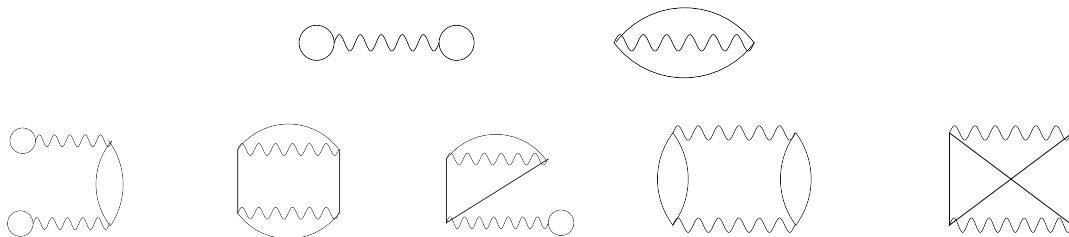
Figure 1: Bare first-order (top) and second-order connected (bottom) Feynmann diagrams.

Michael Lindsey also made major strides in quantum embedding methods. These methods provide approximations of large many-body problems by breaking them into smaller, locally solvable problems that interact through a global mean field. One notable example is the dynamical mean-field theory (DMFT), which revolutionized our understanding of the Hubbard model. Michael Lindsey proved the first rigorous mathematical results on DMFT, made improvements to numerical methods, and even introduced a novel quantum embedding method. His method, the first of its kind with a variational structure, provides a lower bound to the ground-state energy and can be solved using standard semi-definite programming (SDP) algorithms.

During his postdoctoral research at the Courant Institute, Michael Lindsey broadened his field of action to include Monte Carlo methods and tensor networks. His collaboration with top physicists notably resulted in a highly regarded paper published in *Nature Communications*. Michael Lindsey has since returned to UC Berkeley as an Assistant Professor, continuing to expand the frontiers of mathematical and numerical physics. His current research ventures into new areas such as randomized, entropically regularized semi-definite programming.

To conclude, let me quote one of Michael Lindsey's reference letters, which perfectly encapsulates his unique talents: *In my entire career, I have not met someone who so perfectly embodies the complete package – someone for whom mathematics truly has no boundaries. Lindsey is one of the few people I know who has made contributions to both pure and applied mathematics at the very highest level.*

*Klaus Hulek, Vesselin Dimitrov, Gerhard Huisken (Photo: Matthias Dorn)*

## 2.3. Übergabe des Oberwolfach Preises

Das MFO und die Oberwolfach Stiftung verliehen den Oberwolfach Preis 2022 an Vesselin Dimitrov für seine herausragenden Leistungen auf dem Gebiet der Algebra und Zahlentheorie. Die Preisverleihung fand am 14. Oktober 2023 in Oberwolfach statt.

Zu Dimitrovs Erfolgen zählen überraschende Durchbrüche wie der Beweis der Schinzel–Zassenhaus-Vermutung und – in Zusammenarbeit mit Frank Calegari und Yunqing Tang – der Beweis der „Unbounded Denominators Conjecture" von Atkin und Swinnerton-Dyer. Detailliertere Einblicke bietet die Laudatio von Jean-Benoît Bost auf den folgenden Seiten.

Der Oberwolfach Preis wird etwa alle drei Jahre von der Oberwolfach Stiftung und dem Mathematischen Forschungsinstitut Oberwolfach an exzellente Nachwuchswissenschaftlerinnen und Nachwuchswissenschaftler in wechselnden Fachgebieten der Mathematik verliehen. Über die Vergabe entscheidet die wissenschaftliche Kommission der Gesellschaft für Mathematische Forschung e.V. Der Oberwolfach Preis ist mit 10.000 Euro dotiert.

## 2.3. Awarding of the Oberwolfach Prize

In cooperation with the MFO the Oberwolfach Foundation awarded the Oberwolfach Prize 2022 to Vesselin Dimitrov for his outstanding contributions in the field of algebra and number theory. The award ceremony took place on October 14, 2023.

Vesselin Dimitrov's achievements include surprising breakthroughs such as the proof of the Schinzel–Zassenhaus conjecture and – in joint work with Frank Calegari and Yunqing Tang – the proof of the unbounded denominators conjecture by Atkin and Swinnerton-Dyer. More detailed insights are provided in the laudation by Jean-Benoît Bost on the following pages.

The Oberwolfach Prize is awarded about every three years by the Oberwolfach Foundation and the Mathematisches Forschungsinstitut Oberwolfach to excellent early career researchers in changing fields of mathematics. The Scientific Committee of the Gesellschaft für mathematische Forschung e.V. is involved in selecting the fellows from the nominations. The Oberwolfach Prize comes with an award of Euro 10,000.

## Oberwolfach Prize 2022 – Welcoming Speech by Klaus Hulek

*Lieber Herr Huisken,*
*Dear colleagues and friends,*

*it is a great pleasure for me to represent the Oberwolfach Foundation (Oberwolfachstiftung) on this very special occasion, and I am happy that this gives me the opportunity to say a few words about the Foundation and its aims.*

*First of all, a very special welcome to the winner of the Oberwolfach Prize 2022: Vesselin Dimitrov (Georgia Tech). Congratulations to you on winning the Oberwolfach Prize 2022!*

*I am also very happy to welcome Jean-Benoît Bost (Paris-Saclay), who will be giving the laudatory speech today. Fascinating as the mathematical achievements of Vesselin Dimitrov are, I will abstain from discussing any of these and leave it entirely to Jean-Benoît to speak about the work of the prizewinner.*

*I would also like to extend a special welcome to the representatives of the institutional members of the Förderverein: Gudrun Thäter for the German Mathematical Society DMV (Deutsche Mathematiker Vereinigung) and Karsten Urban for GAMM (Gesellschaft für Angewandte Mathematik und Mechanik).*

*The Förderverein/Friends of Oberwolfach (its full name is "Verein zur Förderung des Mathematischen Forschungsinstituts Oberwolfach") was founded in 1992. By now it has well over 500 individual members. I suppose that most of you present in the room are in fact members. And if not, you might want to join the society. The annual fees of the members provide most of the income of the Förderverein and this is used directly to support the Institute.*

*Reinhold Remmert became the first chairman of the Friends of Oberwolfach, a position he held for 15 years. For many years Ursula Gather has now been at the head of the Förderverein. Unfortunately, she is unable to be here in person today. At this point I would also like to inform you that Hannah Markwig from the University of Tübingen was elected as Ursula Gather's successor at yesterday's annual general meeting.*

*The Förderverein in turn founded the Oberwolfach Foundation in 1998, with the aim of establishing an endowment for Oberwolfach. This may sound complicated, but there are good legal reasons for this construction of a foundation within the Förderverein. Besides Reinhold Remmert (Münster), the main driving forces were Jürgen Lehn (Darmstadt), Hanspeter Kraft (Basel) and Gerhard Rupprecht from Allianz.*

*It is worth looking back to the situation in the 1990's to understand the motives behind these activities. At that time the Institute in Oberwolfach was in a much more vulnerable position than it is now. It depended solely on a grant from the Ministry of Science of the Land of Baden Württemberg. The Land was not unwilling to support Oberwolfach, and it certainly recognised the excellence of the scientific work done here, but the question remained why the government of a Land should support an institution where the participants from Baden Württemberg were clearly in a minority. And this was a serious issue at the time. Given this situation, Reinhold Remmert, and many other colleagues, felt that the mathematical community should make a determined effort to support the Institute. This would also send a signal to the political stakeholders as to how highly the community valued the Oberwolfach Institute.*

*As you know, MFO is, fortunately, in a much more stable situation now, after becoming a member of the Leibniz Association in 2005. The funding of the Institute thus rests on a broader basis involving in particular the Federal Government, the Länder, primarily Baden-Württemberg, and grants from various other organisations and foundations.*

*But this does not make the role of the Förderverein or the Oberwolfach Foundation obsolete. On the contrary, the continued support of MFO through the donors from within*

*and beyond the mathematical community is not only financially helpful, but, as I have already mentioned, it also sends an important message to the world of politics and the grant-providing institutions.*

*Immediately after its establishment, the Oberwolfach Foundation started collecting funds for an endowment. This has been growing constantly. The funds typically come from larger donations of individuals, but also from inheritance. There have been a number of cases where donors have included a bequest in favour of the Oberwolfach foundation in their will.*

*The task of the board of the Oberwolfach Foundation is to invest the funds acquired. Clearly, the recent years with zero or negative interest rates were a challenge to us – but then this applied to all foundations. Still, I think that we have weathered these years reasonably well, and I hope that our investments have been wise and will contribute to the growth of the endowment. The Foundation uses (some of) the proceeds of its investments to support the Institute.*

*One of the aims of Reinhold Remmert and the Oberwolfach Foundation was to form a network extending beyond academia. Right from the beginning, various top-level representatives from the business world became involved in the work of the foundation, and this has been continuing ever since. As of now, the Board includes Andreas Barner, a member of the shareholders' committee of Boehringer Ingelheim and Bernd Pischetsrieder, Chairman of the supervisory board of Daimler (Mercedes), just to name two prominent examples.*

*Another activity of the Oberwolfach Foundation was to initiate the book project "Mathematik Motor der Wirtschaft" (Mathematics the driving force of the economy). This was an initiative in connection with the German "Year of Mathematics 2008". You may know the book or have seen it in the library. In this collection more than a dozen CEO's of DAX-listed companies explain why mathematics is indispensable for their companies. The book is complemented by other contributions from organizations such as the Bundesagentur für Arbeit (the Federal Employment Agency). The foreword was by written by Frau Schavan, the then federal Minister of Science. This clearly demonstrates a very wide interest in mathematics and not least the activities of the Institute in Oberwolfach, and it helped to sensitise a broader audience to the importance of mathematics.*

*But let me return to the support the Oberwolfach Foundation provides to the Institute:*

- *First of all the Foundation sponsors the Oberwolfach Prize (and this is what we are celebrating today)*

- *The Foundation also administers the John Todd award*

- *Further, it supports the Institute in keeping and upgrading its infrastructure. The advantage is that this money is not subject to the, often very restrictive, rules governing public funding.*

- *And a more recent activity has been that the Foundation provides some funds for travel grants for mathematicians who have received invitations to Oberwolfach, but who find it difficult to finance their travel.*

*We hope and trust that we will be able to support the work of the Oberwolfach Institute for many years to come.*

*I also hope that I have been able to give you some insight into the work of the Oberwolfach foundation and its aims.*

*Thank you very much for your attention!*

Oberwolfach Prize 2022
Laudatio for Vesselin Dimitrov

Jean-Benoît Bost

It is a great pleasure to present the work of Vesselin Dimitrov for which he has been awarded the Oberwolfach Prize, whose topic in 2022 is *Algebra and Number Theory.*

Vesselin Dimitrov has contributed to several fundamental advances in number theory, more specifically to the so-called Diophantine geometry, and this *laudatio* is to a large extent an apologia for Diophantine geometry.

Actually the work of Vesselin Dimitrov constitutes a wonderful illustration of some ironic observations by various great masters of number theory concerning this field.

In relation to his own arithmetic contributions, Charles Hermite did write: *Il n'y a pas de méthode en théorie des nombres,*[1] to emphasize the unexpected role, when investigating Diophantine problems, of very diverse areas of mathematics — for instance in his work, of analytic techniques, and of the geometry of group actions and of Euclidean lattices.

In a similar vein, Jean-Pierre Serre and Jean-Marc Fontaine liked to say jokingly that *number theory is a part of applied mathematics.* The rationale behind this provocative sentence is that, while the expression "applied mathematics" usually alludes to applications of mathematics to other scientific areas (astronomy, physics, chemistry, data analysis, computing machinery, etc.), there also exist "inner applications" of mathematics, namely applications of mathematics to (a priori unrelated) basic problems of mathematics. It is notably the case of number theory, which nowadays relies on a considerable corpus of algebraic geometry, homological and homotopical algebra, representation theory, analysis on manifolds, etc.

I would like to briefly describe three major results of Vesselin Dimitrov. Each of them may be stated in rather elementary terms, while its proof relies on some remarkably clever and original use of an impressive diversity of techniques, and therefore provides a striking illustration of the above views of Hermite, Serre, and Fontaine.

The first of these results appears in his joint work with Z. Gao and P. Habegger, *Uniformity in Mordell-Lang for curves.*

Let us consider a smooth projective curve $C$, of genus $g$, defined over some number field $K$, namely an extension of the field $\mathbb{Q}$ of rational numbers of finite degree $d := [K : \mathbb{Q}]$. To this curve is canonically associated its Jacobian, $\mathrm{Jac}(C)$, an Abelian variety of dimension $g$ over $K$.

A basic finiteness results concerning the Diophantine geometry of curves over number fields is due to Weil, who proved in 1929 that the abelian group $\mathrm{Jac}(C)(K)$ of $K$-rational points of the algebraic group $\mathrm{Jac}(C)$ is finitely generated.[2]

In 1984, Faltings achieved a fantastic breakthrough by proving that, when $g \geq 2$, the set of $K$-rational points $C(K)$ of the curve is finite, proving a long standing conjecture of Mordell. Faltings' theorem was given an alternative proof in 1991 by Vojta, by means of new techniques of Diophantine approximation. By elaborating considerably on Vojta's approach to Faltings' theorem, Dimitrov, Gao, and Habegger have established a bound for the cardinality of $C(K)$ when $g \geq 2$, of the form:

$$|C(K)| \leq c(g,d)^{1+\mathrm{rk}\,\mathrm{Jac}(C)(K)}, \tag{1}$$

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[1] There is no method for number theory.

[2] This extended some earlier work of Mordell, dealing with the case $g = 1$.

where $c(g,d)$ denotes an explicit positive constant depending only of the genus $g$ of the curve and the degree $d$ of the base field, and $\operatorname{rk}\operatorname{Jac}(C)(K)$ the rank of the finitely generated abelian group $\operatorname{Jac}(C)(K)$.

This is a major contribution to the central problem of number theory consisting in understanding the finiteness properties of solutions in rational numbers of systems of polynomial equations. In a few lines it is difficult to say anything precise concerning the proof of such a uniform bound, beyond that it involves a large amount of techniques from algebraic and Diophantine geometry and some very clever new ideas.

However, to put in perspective this result which provides an explicit bound on the cardinality of the finite set $C(K)$, I may emphasize that the existence of some effective control on the points of $C(K)$ themselves (for instance on their heights, or on the vacuity of $C(K)$) appears today completely out of reach. Actually, one cannot exclude that such an effective control does not exist in general, and from this perspective, the uniform bound (1) appears as a definitive result.

A second striking result of Vesselin Dimitrov is his positive solution of the *Schinzel-Zassenhaus conjecture*.

Consider a monic irreducible polynomial $P$ in $\mathbb{Z}[X]$, of degree $n \geq 2$. A classical result of Kronecker asserts that, either $P$ is a cyclotomic polynomial (or equivalently all its roots are roots of unity), or there exists a complex root $\alpha$ of $P$ such $|\alpha| > 1$. The Schinzel-Zassenhaus conjecture asserts that the following quantitative form of this dichotomy holds: *for some positive universal constant $c > 0$, if $P$ is not cyclotomic, then*

$$\max_{\alpha \in \mathbb{C}, P(\alpha)=0} \log|\alpha| \geq c/n. \tag{2}$$

Vesselin Dimitrov establishes this inequality with the optimal constant $c = (\log 2)/4$, answering positively a question open for more than half a century, and considered by the experts as completely out of reach in spite of (or because ?) of its elementary character.

The estimate (2) constitutes a breakthrough in the theory of *heights* — the real numbers attached to rational points of algebraic varieties over number fields that provide a measure of their arithmetic complexity. Since the work of Fekete, Szegö and Polya, properties of heights of rational points of the affine line are known to be closely related with potential theory in the plane.

Vesselin Dimitrov establishes the estimate (2) by an original application of a classical arithmetic rationality criterion on formal series with integral coefficients, involving the capacity of its domain of analyticity. A key point of the proof are precise capacity estimates concerning very special figures in the plane. His derivation of (2) is strikingly clever and elegant, and reveals that suitable "capacitary arguments" provide some new lines of attack to Diophantine problems considered till now as out of reach.

The recent joint work of Vesselin Dimitrov with Frank Calegari and Yunqing Tang, devoted to the proof of the *unbounded denominators conjecture*, provides another wonderful illustration of the relevance of such capacitary arguments to deep problems in arithmetic geometry.

The unbounded denominators conjecture asserts that, if a modular form $f$ associated to some finite index subgroup $\Gamma$ of $SL_2(\mathbb{Z})$ admits a $q$-expansion at the cusp $i\infty$ with integral coefficients, then $f$ is actually a modular form associated to a congruence subgroup of $SL_2(\mathbb{Z})$:

$$\Gamma(N) := \big\{ \gamma \in SL_2(\mathbb{Z}) \mid \gamma \equiv \mathrm{I}_2 \mod N \big\},$$

for some positive integer $N$.

The elementary formulation of this conjecture does not shed much light on its significance in arithmetic geometry. Let me simply recall that it has been formulated by Birch in the 70's, at

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the beginning of the revival of the theory of modular forms which eventually led to Wiles' proof of Fermat's conjecture, and stayed open till the breakthrough by Calegari, Dimitrov and Tang.

Let me also emphasize that the statement of this conjecture is in a sense extremely surprising: it relates two properties of "arithmeticity" concerning modular forms — admitting an integral $q$-expansion, and being associated to some congruence subgroup of $SL_2(\mathbb{Z})$ — which are related by some highly transcendental construction.

The proof by Calegari, Dimitrov and Tang intertwines very diverse threads. Subtle arithmetic and group theoretic results related to the congruence subgroup problem play a key role, and also delicate estimates involving potential theory in the plane and uniformization. All in all, their proof combines arguments originating from very different areas of arithmetic geometry in some highly unexpected and clever manner, and is awe inspiring by the fortitude required by their implementation into details.

For his impressive body of work, Vesselin Dimitrov has been awarded with the 2022 Oberwolfach Prize by the Oberwolfach Foundation.

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*Links: Jean-Benoît Bost hält die Laudatio. Rechts: Vesselin Dimitrov trägt seine Forschungsergebnisse vor.*
*Left: Jean-Benoît Bost gives the laudatory speech. Right: Vesselin Dimitrov presents his research results.*

## 2.4. Anpassung der Kapazität

Aufgrund des Personalmangels, insbesondere in der Hauswirtschaft, musste das Institut seine Besucherkapazitäten mit Beginn des Jahres 2023 anpassen. Vakanzen nach Abgängen, Pensionierungen oder Elternzeit konnten im Umfeld des allgemeinen Arbeitskräftemangels infolge der Corona-Pandemie nicht adäquat durch neues Personal ersetzt werden. Dies hat zur Folge, dass in den großen Workshops auf absehbare Zeit nur noch 48 Personen teilnehmen können, statt wie vorher 53 Personen. Eine ähnliche Reduzierung von etwa 10% gilt auch für unsere anderen wissenschaftlichen Programme.

Im Zusammenhang mit der generellen Einschränkung unserer Kapazitäten enden nun alle einwöchigen Veranstaltungen am Freitagnachmittag und die Abreise findet spätestens am Freitagabend statt. Eine Unterbringung bis Samstag ist seit Sommer 2023 grundsätzlich nicht mehr möglich.

Das Institut bemüht sich weiterhin darum, geeignetes Fachpersonal anzuwerben, um zukünftig die Veranstaltungen wieder voll besetzen zu können.

## 2.5. Neue Vorsitzende des Fördervereins

Hannah Markwig (Universität Tübingen) wurde in der Jahrestagung des Vereins zur Förderung des Mathematischen Forschungsinstituts Oberwolfach (Friends of Oberwolfach) zur neuen Vorsitzenden gewählt. Sie übernimmt das Amt der Vorsitzenden von Ursula Gather, die zuvor viele Jahre ehrenamtlich in dieser Position tätig war.

Der Förderverein wurde 1992 als gemeinnütziger Verein unter dem Gründungsvorsitzenden Reinhold Remmert gegründet. Zweck des Vereins ist die Förderung von Wissenschaft und Forschung auf dem Gebiet der Mathematik durch die Einwerbung und Bereitstellung von finanziellen Mitteln für das MFO. Traditionell fördert der Verein drei Hauptbereiche:

- Unterstützung bei der Instandhaltung der Gebäude,

- Unterstützung der Bibliothek, um sie auf ihrem aktuellen Niveau als eine der besten Mathematikbibliotheken der Welt zu halten,

- sowie in begründeten Ausnahmefällen Reisekostenunterstützung für Tagungsteilnehmer.

## 2.4. Adjustment of capacity

Due to a shortage of staff, in particular in the housekeeping area, the Institute needed to adjust its visitor capacity with the beginning of 2023. Vacancies after departures, retirements or parental leave could not be adequately replaced by new staff in an environment of general labor shortage following the corona pandemic. As a consequence, instead of typically 53 visitors in a full workshop we will for the foreseeable future now only be able to accommodate 48 visitors. A similar reduction of about 10% also applies to our other scientific programs.

In connection with the general restriction of the capacity, all week-long events now end on Friday afternoon and departure takes place on Friday evening at the latest. Since summer 2023, accommodation at the MFO until Saturday is generally not possible.

We will continue to strive to recruit qualified staff in order to be able to use the Institute to full capacity again in the future.

## 2.5. New chair of Friends of Oberwolfach

Hannah Markwig (Tübingen University) has been elected as the new head of the "Verein zur Förderung des Mathematischen Forschungsinstituts Oberwolfach" (Förderverein, Friends of Oberwolfach) in the association's annual meeting. She takes over the chair from Ursula Gather, who engaged in this position on a honorary basis for many years.

The Friends of Oberwolfach have been founded in 1992 as a non-profit association with founding chairman Reinhold Remmert. The purpose of the association is the promotion of science and research in the field of mathematics through the acquisition and provision of funds for MFO. Traditionally the Förderverein supports three main areas:

- support for the maintenance of the buildings,

- support for the library to keep it at its current level as one of the best mathematics libraries in the world,

- and travel support for participants of meetings in exceptional cases.

*Ursula Gather*



*Hannah Markwig*

Auf diese Weise profitieren Mathematikerinnen und Mathematiker direkt von den gesammelten Geldern.

Im Jahr 2023 unterstützte der Förderverein u.a. die Installation eines Notstromaggregats, mit dem das Institut bei anhaltenden Stromausfällen, beispielsweise aufgrund von Extremwetterlagen und anderen Naturereignissen, die anwesenden Gäste weiterhin versorgen kann.

This way mathematicians directly profit from the money collected by the association.

In 2023, the association supported, among other things, the installation of an emergency generator, with which the Institute can continue to supply its guests in case of persistent power outages, for example due to extreme weather or natural disasters.

## 2.6. Nachrufe

## 2.6. Obituaries

### Roland Bulirsch (1932 – 2022)

Roland Bulirsch starb am 22. September 2022 im Alter von 91 Jahren. Nach einer Ausbildung bei Siemens-Schuckert in Nürnberg studierte er Mathematik und Physik an der Technischen Universität München und schloss sein Studium 1959 mit dem Diplom ab. 1961 promovierte er in Numerischer Mathematik bei Robert Sauer und habilitierte sich 1965 für die Mathematik. 1967 war er Associate Professor in San Diego, 1969 wurde er zum ordentlichen Professor in Köln berufen. Von 1972 an bis zu seiner Emeritierung im Jahr 2001 hatte er einen Lehrstuhl an der Technischen Universität München inne.

Er veröffentlichte wichtige Ergebnisse über numerische Methoden für komplexe Differentialgleichungssysteme und deren Anwendung auf Flugbahnen von Raumfahrzeugen und die dynamischen Probleme von Autos und schrieb zusammmen mit Stoer einflussreiche Bücher zur numerischen Analyse.

### Roland Bulirsch (1932 – 2022)

Roland Bulirsch passed away on the 22th of September 2022 aged 91. After working as an apprentice at Siemens-Schuckert in Nürnberg he studied mathematics and physics at the technical university in Munich with diploma in 1959. Here he got his PhD 1961 in numerical mathematics with Robert Sauer and his habilitation in Mathematics 1965. He held positions in San Diego 1967 and 1969 he received a full professorship in Cologne. From 1972 on held a chair at the technical university of Munich till his retirement in 2001.

He published important results about numerical methods for complex systems of differential equations and their applications to trajectories of space crafts and the dynamical problems of cars and wrote together with Stoer influential books in numerical analysis.

Er war Mitglied der Bayerischen Akademie, der Acatech und mehrerer ausländischer Akademien, erhielt vier Ehrendoktortitel und 1969 die Bayerische Maximiliansmedaille. Seit 1984 war er Mitglied der GMF, wo er bis 2000 in der wissenschaftlichen Kommission tätig war. Später war er Mitglied der Oberwolfach Stiftung. Er war Dekan seiner Fakultät und viele Jahre in Gremien der DFG und der Humboldt-Stiftung tätig.

Er war ein ausgezeichneter Lehrer und begeisterter Forscher und hatte durch seine vielen Doktoranden und Postdoktoranden, darunter insbesondere Georg Bock, Peter Deuflhard und Wolfgang Hackbusch, einen nachhaltigen Einfluss auf die Angewandte Mathematik.

*Friedrich Götze*
*Vorsitzender der GMF / Chair of the GMF*

He was member of the Bavarian, the Acatech and several foreign academies, was awarded four honorary doctorates and received the Bavarian Maximilian medal in 1969. He was member of the GMF since 1984 where he served in the scientific commission till 2000. Later he was member of the Oberwolfach Foundation. He served as Dean of his faculty and for many years in committees of the DFG und the Humboldt foundation.

He was an excellent teacher and enthusiastic researcher and through his many PhD students and PostDocs, among them notably Georg Bock, Peter Deuflhard and Wolfgang Hackbusch, he had a lasting influence on Applied Mathematics.



*Roland Bulirsch 2006 in Oberwolfach*

*Peter Roquette 2006 in Oberwolfach*

## Peter Roquette (1927 – 2023)

Peter Jaques Roquette starb am 24. Februar 2023 im Alter von 96 Jahren. Er promovierte 1951 bei Helmut Hasse und beschäftigte sich mit arithmetischer algebraischer Geometrie und der Riemannschen Vermutung für Funktionskörper, wobei er einen neuen Beweis der Riemannschen Vermutung für algebraische Funktionskörper lieferte. 1951/1952 war er Assistent des Direktors Süß und arbeitete an seiner Dissertation in Oberwolfach, bevor er 1954 in München habilitierte.

Von 1954 bis 1956 war er wissenschaftlicher Mitarbeiter am IAS in Princeton und hatte danach bis 1959 Anstellungen in Hamburg, dann in Saarbrücken, bevor er 1959 einen Lehrstuhl in Tübingen erhielt. 1967 folgte er einem Ruf nach Heidelberg, wo er 1996 emeritierte. Zu seinen Doktoranden zählen namhafte Kollegen wie Frey, Geyer, Pop, Stichtenoth und Weissauer.

Er organisierte zusammen mit Martin Kneser die erste Oberwolfacher Arbeitsgemeinschaft Kneser–Roquette und nahm seit 1951 an zahlreichen Workshops teil, davon 28 als Mitorganisator. Er war Gründungsmitglied der GMF und von 1963 bis Mitte der siebziger Jahre Mitglied der wissenschaftlichen Kommission.

Er wurde in die Heidelberger Akademie und in die Leopoldina gewählt, erhielt einen Ehrendoktortitel von Duisburg-Essen und war eingeladener Dozent beim ICM 1958 in Edinburgh.

## Peter Roquette (1927 – 2023)

Peter Jaques Roquette passed away on the 24th of February 2023 aged 96. He got his PhD 1951, supervised by Helmut Hasse and worked in arithmetic algebraic geometry and the Riemann hypothesis for function fields where he gave a new proof of Riemann conjecture for algebraic function fields. In 1951/1952 he was assistant of the director Süss and worked on his thesis at Oberwolfach, before he got his habilitation 1954 in Munich.

From 1954 till 1956 he was a research fellow at the IAS in Princeton and after that held appointments in Hamburg till 1959, than in Saarbrücken before he got 1959 a chair in Tübingen. 1967 he followed a call to Heidelberg where he retired 1996. Among his PhD students are well-known colleagues like Frey, Geyer, Pop, Stichtenoth and Weissauer.

He organized together with Martin Kneser the first Oberwolfach Study Group Kneser–Roquette and attended since 1951 numerous workshops with 28 of them as coorganizer. He was a founding member of the GMF and served in the scientific commission since 1963 till the mid of seventies.

He was elected to the Heidelberg and Leopoldina academy, got an honorary degree from Duisburg-Esssen and was invited lecturer at the ICM 1958 in Edinburgh.

In seiner Arbeit wandte er Non-Standard-Arithmetik in der Zahlentheorie an (zusammen mit Abraham Robinson), um das Siegel–Mahler-Theorem über die Endlichkeit ganzzahliger Punkte auf Kurven vom Geschlecht größer als eins zu beweisen. Im letzten Jahrzehnt veröffentlichte er Beiträge zur Geschichte der Mathematik, insbesondere über die Schule von Hasse und Emmy Noether.

*Friedrich Götze*
*Vorsitzender der GMF / Chair of the GMF*

In his work he used Nonstandard Arithmetic (together with Abraham Robinson) in number theory to prove the the Siegel–Mahler theorem on finiteness of integral points on curves of genus larger than one. In the last decade he published contributions to the history of Mathematics in particular about the school of Hasse and Emmy Noether.
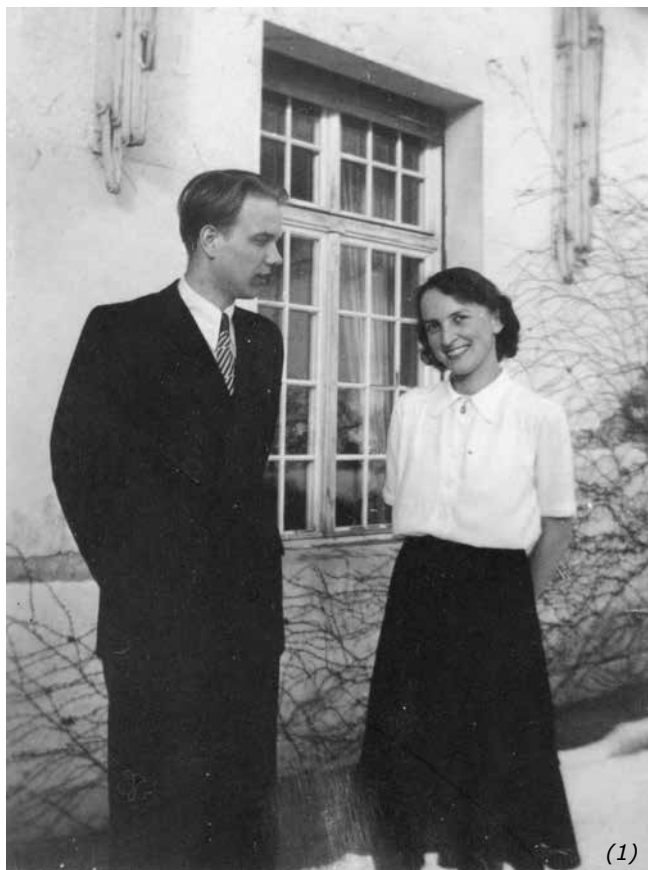










*Über Jahrzehnte dem MFO verbunden: (1) Peter und Erika Roquette, 1951 in Oberwolfach (2) Peter Roquette, ca. in den 1960er Jahren in Oberwolfach (Bild: Wolfgang Gaschütz) (3) 1984 beim 40-jährigen Jubiläum des Instituts (Bild: Gerd Fischer) (4) Peter und Erika Roquette mit Gerhard Huisken, 2013 bei der der feierlichen Übergabe des Direktorats an Gerhard Huisken (5) Peter Roquette und Florian Pop, 2009 beim Workshop „The Arithmetic of Fields" in Oberwolfach.*

*Decades of commitment to the MFO: (1) Peter and Erika Roquette, 1951 in Oberwolfach (2) Peter Roquette, around the 1960s in Oberwolfach (Photo: Wolfgang Gaschütz) (3) 1984 at the 40th anniversary of the Institute (Photo: Gerd Fischer) (4) Peter and Erika Roquette with Gerhard Huisken, 2013 at the ceremonial handover of the directorship to Gerhard Huisken (5) Peter Roquette and Florian Pop, 2009 at the workshop "The Arithmetic of Fields" in Oberwolfach*

# 3. Wissenschaftliches Programm

Das wissenschaftliche Programm wird vom Direktor in Zusammenarbeit mit der Wissenschaftlichen Kommission der Gesellschaft für Mathematische Forschung entschieden. Dieses Gremium basiert auf der ehrenamtlichen Arbeit von circa 20-25 hochkarätigen Mathematikern und Mathematikerinnen, welche die gesamte Breite der Mathematik vertreten. Die Wissenschaftliche Kommission begutachtet alle wissenschaftlichen Veranstaltungen des Instituts vor ihrer Genehmigung. Das Programm wird in einem wettbewerblichen Verfahren nach streng wissenschaftlichen Kriterien gestaltet. Wie in den Vorjahren erhielt das MFO wesentlich mehr Anträge als genehmigt werden konnten.

## 3.1. Überblick der Aktivitäten

Die Aktivitäten des MFO gliedern sich in drei Teilbereiche: Kurzzeitige Forschungsveranstaltungen, längerfristige Forschungsaufenthalte und Fortbildungsveranstaltungen. Diese drei Bereiche sind in sechs zentralen wissenschaftlichen Programmen konkretisiert: Workshops und Miniworkshops, Oberwolfach Research Fellows und Oberwolfach Leibniz Fellows sowie Oberwolfach Arbeitsgemeinschaft und Oberwolfach Seminare.

Im Rahmen der sechs wissenschaftlichen Programme gibt es finanzielle Fördermöglichkeiten für den wissenschaftlichen Nachwuchs und etablierte Forscherinnen und Forscher. Einige dieser Fördernmöglichkeiten werden durch Drittmittel finanziert.

In Zusammenarbeit mit der Oberwolfach Stiftung fördert das MFO darüber hinaus herausragende Forschungsleistungen von Mathematikern und Mathematikerinnen am Beginn ihrer Karriere durch die Verleihung des Oberwolfach Preises und des John Todd Awards.

Zur Sicherung und weiteren Verbreitung der Ergebnisse aus den Forschungs- und Fortbildungsaktivitäten pflegt das Institut vier Publikationsreihen mit unterschiedlichen Zielgruppen.

### Kurzzeitige Forschungsveranstaltungen

**Workshops.** Der Hauptteil des Jahresprogramms besteht aus etwa 40 einwöchigen Workshops pro Jahr, an denen jeweils bis zu 48 Personen teilnehmen. Alternativ können zwei Workshops halber Größe parallel stattfinden. Die Workshops werden von international führenden Expertinnen und Experten der jeweiligen

# 3. Scientific program

The Director of the Institute decides on the scientific program in cooperation with the Scientific Committee of the Gesellschaft für Mathematische Forschung. The committee is based on the honorary work of about 20 to 25 top-class mathematicians, covering all areas of mathematics. The Scientific Committee examines all scientific events at the Institute prior to their approval. The program is fixed in a competitive procedure according to strictly scientific criteria. As in the preceding years, the MFO received many more proposals than could be approved.

## 3.1. Overview of activities

The activities of the MFO are organized in three subdivisions: short-term research meetings, longer-term research stays and training. These subdivisions are specified in six central scientific programs: Workshops and Mini-Workshops, Oberwolfach Research Fellows and Oberwolfach Leibniz Fellows, as well as Oberwolfach Arbeitsgemeinschaft and Oberwolfach Seminars.

Within these programs, there are special funding opportunities for early career researchers and established researchers. Several of these grants are financed by third party funds.

In cooperation with the Oberwolfach Foundation, the MFO also promotes outstanding research achievements by early career mathematicians by awarding the Oberwolfach Prize and the John Todd Award.

To document and further disseminate the results of its research and training activities, the Institute maintains four publication series with different target groups.

### Short-term research meetings

**Workshops.** The main scientific program consists of about 40 week-long Workshops per year, each with up to 48 participants. Alternatively, there can be two parallel Workshops of half size (24 participants). The Workshops are organized by internationally leading experts in the relevant fields. Participation is subject to a

Fachgebiete organisiert. Teilnehmen kann nur, wer auf ihre Empfehlung hin vom Direktor persönlich eingeladen wurde. Das Ziel der Workshops ist es gleichermaßen die jüngsten Entwicklungen in einem bestimmten Fachgebiet zu diskutieren und daran anknüpfend neue Forschungsaktivitäten anzustoßen.

**Miniworkshops.** Ergänzend zu den großen Workshops können an festgelegten Wochen im Jahr jeweils bis zu drei einwöchige Miniworkshops mit jeweils bis zu 16 Teilnehmenden parallel veranstaltet werden. Das Programm richtet sich besonders an den wissenschaftlichen Nachwuchs. Da über die Themen erst ein halbes Jahr im Voraus entschieden wird, ist es möglich, auf aktuelle Entwicklungen schnell zu reagieren.

**Tandem-Workshops.** Die Idee der Tandem-Workshops ist es, dass zwei Gruppen zu je 16-24 Personen an zwei, üblicherweise weit entfernten Orten über Videokonferenz miteinander interagieren. Vor Ort können sich die Teilnehmenden auf die übliche intensive, direkte Weise austauschen. Zusätzlich können Vorträge mit der Tandem-Gruppe geteilt und gemeinsame Diskussionsrunden veranstaltet werden.

**Networking activities.** Das Ziel dieser speziellen Kategorie von Workshops und Miniworkshops ist es, Chancengleichheit und Vielfalt noch stärker zu fördern und den Einfluss von Minderheiten in der Mathematik zu stärken. Zu diesem Zweck müssen Anträge für networking activities ein Konzept für ausgeprägte Vernetzungs- und Mentoringaktivitäten enthalten.

## Längerfristige Forschungsaufenthalte

**Oberwolfach Research Fellows (OWRF).** Dieses Programm ermöglicht es Gruppen von 2-4 Forschenden für einen Zeitraum von 1-4 Wochen an einem vorher festzulegenden Projekt gemeinsam zu arbeiten. Projekte aus allen Gebieten der Mathematik können gefördert werden.

**Oberwolfach Leibniz Fellows (OWLF).** Nachwuchsforschende können sich zusätzlich für eine Oberwolfach Leibniz Fellowship bewerben. Dies ermöglicht ihnen eine Aufenthaltsdauer von bis zu 3 Monaten, als Einzelperson oder als Teil einer OWRF-Gruppe, sowie eine finanzielle Förderung bis zur Höhe eines Postdoc-Gehalts.

## Fortbildungsveranstaltungen

**Oberwolfach Arbeitsgemeinschaft.** Die Idee der Arbeitsgemeinschaft ist es, sich unter Anleitung international anerkannter Spezialisten

personal invitation by the Director after recommendation of the organizers. The aim of the Workshops is at the same time to discuss the latest developments in a specific subject area and, based on this, to initiate new research activities.

**Mini-Workshops.** In addition to the large Workshops, up to three one-week Mini-Workshops can be held in parallel on specific weeks of the year, each with up to 16 participants. The Mini-Workshops are aimed especially at early career researchers. Since the subjects are fixed only half a year before the Mini-Workshops take place, they allow to react to very recent developments.

**Tandem-Workshops.** The idea of Tandem-Workshops is that two groups of 16-24 people in two, usually distant locations interact with each other via video conference. On site, participants can exchange ideas in the usual intensive, direct way. In addition, a number of lectures or discussion sessions can be shared with the tandem group.

**Networking activities.** The aim of this special category of Workshops and Mini-Workshops is to further enhance equal opportunities and diversity and to strengthen the influence of minorities in mathematics. To this end, applications for networking activities must contain a detailed concept for networking and mentoring activities.

## Longer-term research stays

**Oberwolfach Research Fellows (OWRF).** The program enables groups of 2-4 researchers to work together on a previously defined project for a period of 1-4 weeks. Projects from all areas of mathematics can be supported.

**Oberwolfach Leibniz Fellows (OLWF).** Early career researchers may additionally apply for an Oberwolfach Leibniz Fellowship. This enables them to stay for up to 3 months, as an individual or as part of an OWRF group, as well as financial support up to the amount of a postdoctoral salary.

## Training activities

**Oberwolfach Arbeitsgemeinschaft.** The idea of the Oberwolfach Arbeitsgemeinschaft (study group) is to learn about a new active topic by

durch eigene Vorträge in ein neues, aktuelles Gebiet einzuarbeiten. Die Arbeitsgemeinschaft findet dreimal jährlich für jeweils eine Woche statt. Sie richtet sich sowohl an den wissenschaftlichen Nachwuchs als auch an etablierte Forscherinnen und Forscher. Das Thema einer Arbeitsgemeinschaft wird im Gespräch mit den Teilnehmenden der Arbeitsgemeinschaft des Vorjahres festgelegt. Die Arbeitsgemeinschaft wird von Prof. Dr. Martin Hairer, Prof. Dr. Peter Scholze und Prof. Dr. Andreas Thom koordiniert.

**Oberwolfach Seminare.** Die Oberwolfach Seminare sind einwöchige Veranstaltungen, die sechsmal im Jahr stattfinden. Sie werden von führenden Experten der jeweiligen Fachgebiete organisiert und wenden sich an Promovierende und Postdoktoranden aus aller Welt. Das Ziel ist es, 24 Teilnehmerinnen und Teilnehmer in ein besonders aktuelles Arbeitsgebiet einzuführen.

**Banach Center – Oberwolfach Graduate Seminare.** In Ergänzung zu den sechs jährlichen Oberwolfach Seminaren starteten im Jahr 2019 die „Banach Center – Oberwolfach Graduate Seminars". Sie werden in Zusammenarbeit mit dem Forschungsinstitut für Mathematik (Banach Center) der Polnischen Akademie der Wissenschaften (IMPAN) organisiert und finden im Konferenzzentrum Będlewo statt. Die Seminare richten sich an Promovierende und Postdoktoranden aus der ganzen Welt.

**IMO Vorbereitungswoche.** Das Institut beherbergt traditionell die abschließende Trainingswoche für besonders begabte Schülerinnen und Schüler zur Vorbereitung auf die Internationale Mathematik-Olympiade (IMO).

## Finanzielle Fördermöglichkeiten

**Simons Visiting Professors.** Das Simons Visiting Professors (SVP) Programm wird durch die Simons Foundation finanziert. Das Programm unterstützt jährlich bis zu 40 führende Forscherinnen und Forscher von außerhalb Europas, die eine Teilnahme an einem Oberwolfacher Workshop mit einem Aufenthalt an einer europäischen Universität kombinieren möchten. Die Höhe der Förderung beträgt 135 € pro Tag des Gastaufenthalts an der Universität und wird für bis zu zwei Wochen gezahlt. Die beteiligten Universitäten stellen Unterkünfte für die Dauer des Besuchs an der Universität zur Verfügung und tragen die Reisekosten innerhalb Europas zwischen Oberwolfach und der Universität. Über die Förderung entscheidet der Direktor auf Vorschlag der Organisatorinnen und Organisatoren eines Workshops.

giving a lecture on it, guided by leading international specialists. The Arbeitsgemeinschaft meets three times per year for one week each time. It is aimed both at established and early career researchers. The topic of an Arbeitsgemeinschaft is chosen in discussion with participants of the previous meeting one year in advance. The Arbeitsgemeinschaft is coordinated by Prof. Dr. Martin Hairer, Prof. Dr. Peter Scholze and Prof. Dr. Andreas Thom.

**Oberwolfach Seminars.** The Oberwolfach Seminars are week-long events taking place six times per year. They are organized by leading experts in the field and address postdocs and Ph.D. students from all over the world. They aim at introducing 24 participants to a particularly hot development.

**Banach Center – Oberwolfach Graduate Seminars.** In addition to the six annual Oberwolfach seminars, the "Banach Center – Oberwolfach Graduate Seminars" started in 2019. The seminars are organized in cooperation with the Institute of Mathematics (Banach Center) of the Polish Academy of Sciences (IMPAN) and take place at the conference center in Będlewo. They are aimed at doctoral candidates and postdocs from all around the world.

**IMO training week.** The Institute traditionally hosts the final training week for especially gifted pupils to prepare for the International Mathematical Olympiad (IMO).

## Grants

**Simons Visiting Professors.** The Simons Visiting Professors (SVP) program is funded by the Simons Foundation. The program annually supports up to 40 Simons Visiting Professors, distinguished scientists from outside Europe, who wish to combine an invitation to an Oberwolfach Workshop with a research visit to a European university of up to two weeks. The program provides support to each Simons Visiting Professor by Oberwolfach amounting to 135 € per day of the university visit. Additionally, the participating universities are required to provide accommodation for the duration of the visit at the university as well as travel expenses within Europe between Oberwolfach and the university as a matching of this support. The SVP awards are decided by the Director on suggestion of the organizers of a Workshop.

**Oberwolfach Leibniz Graduate Students.** Das MFO unterstützt die Teilnahme von im Durchschnitt fünf Oberwolfach Leibniz Graduate Students (OWLG) an den Oberwolfach Workshops. Gefördert werden exzellente Promovierende oder frisch Promovierte bis zu zwei Jahre nach der Promotion, insbesondere durch Reisekostenunterstützung. Es handelt sich um fünf zusätzliche Plätze pro Workshop, die für die OWLG reserviert sind und nicht durch etablierte Forscher besetzt werden dürfen.

**US Junior Oberwolfach Fellows.** Das MFO fördert die Teilnahme von herausragenden Nachwuchsforscherinnen und -forschern US-amerikanischer Universitäten in allen einwöchigen Programmen des Instituts. Diese Förderung ist möglich dank der Unterstützung der amerikanischen National Science Foundation (NSF).

**Oberwolfach Foundation Fellows.** Dieses Förderprogramm der Oberwolfach Stiftung erlaubt es dem MFO, eingeladene exzellente Nachwuchsforscherinnen- und forscher bei ihren Reisekosten zu unterstützen. Das MFO kann durchschnittlich einer Person pro Woche bis zu 1000 € der Reisekosten erstatten. Bewerben können sich alle eingeladenen Teilnehmerinnen und Teilnehmer, deren Promotion nicht länger als 10 Jahre zurückliegt, und die nachweislich von Orten mit unzureichender Unterstützung für den wissenschaftlichen Nachwuchs kommen.

**Förderung der Oberwolfach Seminare.** Die Carl Friedrich von Siemens Stiftung unterstützt die Oberwolfach Seminare seit 2008 mit einem substanziellen Beitrag. Dank dieser Unterstützung können Teilnehmende auf Antrag einen Zuschuss zu ihren Reisekosten erhalten.

## Publikationen

Das MFO veröffentlicht vier Publikationsreihen und unterstützt dabei die Idee von Open Access. Mit Ausnahme der Buchreihe „Oberwolfach Seminars" sind alle Veröffentlichungen elektronisch frei verfügbar.

**Oberwolfach Reports.** Um die Ergebnisse der Workshops einem international weiteren Kreis zugänglich zu machen wurde 2004 die Buchserie „Oberwolfach Reports" (OWR) gegründet. In Zusammenarbeit mit EMS Press erscheint sie jährlich mit vier Ausgaben von insgesamt mehr als 3.000 Seiten als Print- und Onlineversion. Die OWR beinhalten erweiterte Kurzfassungen aller Vorträge der Workshops, Miniworkshops und Arbeitsgemeinschaften im Umfang von jeweils ein bis drei Seiten.

**Oberwolfach Leibniz Graduate Students**. The MFO supports the participation of an average of five doctoral students per Oberwolfach Workshop. This program fosters excellent graduate students and recent postdocs (the Ph.D./Dr. degree must be received not more than two years ago), in particular by the reimbursement of travel costs. For this program, each Oberwolfach Workshop is given an extra capacity of five places which may not be taken by established researchers.

**US Junior Oberwolfach Fellows.** The MFO supports the participation of outstanding early career researchers from US universities in all weekly programs of the Institute. This is possible thanks to the support of the National Science Foundation (NSF).

**Oberwolfach Foundation Fellows**. This grant financed by the Oberwolfach Foundation enables the MFO to support invited excellent early career researchers with regard to their travel. It allows to reimburse travel expenses up to an amount of 1000 € for one early career researcher on average in every week. Invited participants coming from places with insufficient support for early career researchers to the MFO, with Dr./Ph.D. not longer than 10 years ago, can apply.

**Support of the Oberwolfach Seminars.** The Carl Friedrich von Siemens Foundation has been supporting the Oberwolfach Seminars with a substantial contribution since 2008. Thanks to this support, participants can apply for a subsidy for their travel expenses.

## Publications

The MFO has four distinct publication series and supports the idea of open access. Hence, all publications are freely available, with the exception of the book series "Oberwolfach Seminars".

**Oberwolfach Reports.** The Oberwolfach Reports (OWR) were initiated in 2004 to make the results of the workshops accessible to an even broader international audience. In collaboration with EMS Press they appear quarterly as print and online edition. The four issues comprise more than 3,000 pages per year. The OWR contain extended abstracts of all given talks of every Workshop, Mini-Workshop and Arbeitsgemeinschaft, with one to three pages per talk.

**Oberwolfach Seminars.** Diese Buchreihe entsteht in Zusammenarbeit mit dem Birkhäuser Programm des Springer Verlags (Basel) und macht den Inhalt der Oberwolfach Seminare für ein größeres Publikum zugänglich.

**Oberwolfach Preprints.** In den Oberwolfach Preprints (OWP) werden hauptsächlich Resultate von längerfristigen Forschungsaufenthalten (OWRF und OWLF) publiziert.

**Schnappschüsse moderner Mathematik aus Oberwolfach.** In den „Schnappschüssen" werden aktuell diskutierte mathematische Ideen, Konzepte und Probleme für die mathematisch interessierte Öffentlichkeit zugänglich gemacht.

Im Kapitel 3.11 sind sämtliche im Berichtsjahr erschienen Publikationen aufgelistet.

## Preise

**Oberwolfach Preis.** Der Oberwolfach Preis wird etwa alle drei Jahre von der Oberwolfach Stiftung in Kooperation mit dem MFO an exzellente Nachwuchsforscherinnen und -forscher verliehen. Der Preis ist für ausgezeichnete Errungenschaften in jeweils wechselnden Gebieten der Mathematik ausgelobt und mit 10.000 Euro dotiert. Die Auswahl aus den Nominierten trifft die Wissenschaftliche Kommission der Gesellschaft für Mathematische Forschung.

**John Todd Award.** Das MFO verleiht ebenfalls etwa alle drei Jahre zusammen mit der Oberwolfach Stiftung den John Todd Award für Nachwuchsforscherinnen und -forscher auf dem Gebiet der numerischen Analysis. Der John Todd Award ist mit 1.000 Euro dotiert.

## Teilnahme am Leibniz MMS Netzwerk

Als Mitglied der Leibniz-Gemeinschaft nimmt das MFO am Netzwerk „Mathematical Modelling and Simulation" (MMS) teil. Das Thema spielt in vielen Aktivitäten des Instituts eine Rolle. Im Jahr 2023 fanden insgesamt 28 einwöchige Veranstaltungen statt, die verschiedene Aspekte dieses Forschungsfeldes aufgriffen.

**Oberwolfach Seminars.** This is a book series in collaboration with the Birkhäuser program of Springer (Basel). In this series, the material of the Oberwolfach Seminars is made available to an even larger audience.

**Oberwolfach Preprints.** The Oberwolfach Preprints mainly contain research results related to a longer stay in Oberwolfach (OWRF and OWLF).

**Snapshots of modern mathematics from Oberwolfach.** In the "Snapshots", currently discussed mathematical ideas, concepts and problems are made accessible to the mathematically interested public.

Chapter 3.11 lists all publications published in the reporting year.

## Prizes

**Oberwolfach Prize.** The Oberwolfach Prize is awarded by the Oberwolfach Foundation in cooperation with the MFO to excellent early career researchers. The prize is awarded for excellent achievements in changing fields of mathematics. It amounts to 10,000 Euro. The selection from the nominees is made by the Scientific Committee of the Gesellschaft für Mathematische Forschung.

**John Todd Award.** The Oberwolfach Foundation awards in cooperation with the MFO approximately every three years the John Todd Award to early career scientists in numerical analysis. The John Todd Award amounts to 1,000 Euro.

## Participation in the Leibniz MMS Network

As a member of the Leibniz Association, the MFO participates in the Leibniz network "Mathematical Modelling and Simulation" (MMS). The topic is present in many activities at Oberwolfach. In 2023 a total of 28 week-long events which covered various aspects of the MMS area of research took place.

## 3.2. Jahresprogramm 2023

Im Jahr 2023 wurden 42 Workshops während 41 Wochen, 14 Mini-Workshops während 6 Wochen, 3 Arbeitsgemeinschaften während 3 Wochen, 6 Oberwolfach Seminare während 3 Wochen und 2 weitere Fortbildungsveranstaltungen während 2 Wochen durchgeführt. Alle kurzzeitigen Veranstaltungen sind jeweils mit einer kurzen Beschreibung in den Kapiteln 3.3 – 3.8. dargestellt.

Im Programm Oberwolfach Research Fellows wurden 45 Projekte mit einem Forschungsaufenthalt am MFO gefördert. 6 Personen verbrachten eine Oberwolfach Leibniz Fellowship am MFO. Die Gruppen und Einzelpersonen aus den längerfristigen Programmen sind mit ihren Aufenthaltsdaten in den Kapiteln 3.9 und 3.10 gelistet.

Ingesamt nahmen ca. 2800 Personen an allen Programmen des MFO teil, davon ca. 24% aus Deutschland, 43% aus anderen europäischen Ländern und 32% aus dem nicht-europäischen Ausland.

Die überwiegende Mehrheit der Forscherinnen und Forscher nahm vor Ort an den Programmen teil. Die virtuellen Teilnahmen verringerten sich auf etwa 11%.

Das Institut legt großen Wert darauf, dass alle Gebiete der Mathematik und ihre Grenzgebiete, auch im Hinblick auf Anwendungen, vertreten sind. Das nachfolgende Tagungsprogramm belegt diese Politik.

## 3.2. Annual schedule 2023

In the year 2023, 42 Workshops during 41 weeks, 14 Miniworkshops during 6 weeks, 3 Arbeitsgemeinschaften during 3 weeks, 6 Oberwolfach Seminars during 3 weeks and 2 further training activities during 2 weeks have taken place. All short-term events are presented with a short description in sections 3.3 – 3.8.

In the Oberwolfach Research Fellows program, 45 projects were supported with a research stay at the MFO. 6 people spent an Oberwolfach Leibniz Fellowship at the Institute. The groups and individuals from the longer-term programs are listed with their stay dates in chapters 3.9 and 3.10.

In total, around 2800 persons attended the Oberwolfach programs, about 24% from Germany, 43% from other European countries, and 32% from non-European countries.

The majority of researchers participated on site. Virtual participation decreased to around 11%.

The Institute emphasizes that all fields of mathematics and related areas are represented, including applications. The following schedule of meetings gives proof of this policy.

## Workshops

| ID | Date | Title |
| --- | --- | --- |
| 2301 | 1 Jan – 7 Jan 2023 | Combinatorics |
| 2302 | 8 Jan – 14 Jan 2023 | Model Theory: Combinatorics, Groups, Valued Fields and Neostability |
| 2303 | 15 Jan – 21 Jan 2023 | Low-dimensional Topology |
| 2304 | 22 Jan – 28 Jan 2023 | Morphisms in Low Dimensions |
| 2305 | 29 Jan – 4 Feb 2023 | Arithmetic of Shimura Varieties |
| 2306 | 5 Feb – 11 Feb 2023 | Resolutions in Local Algebra and Singularity Theory |
| 2307 | 12 Feb – 18 Feb 2023 | Representation Theory of Quivers and Finite-Dimensional Algebras |
| 2308 | 19 Feb – 25 Feb 2023 | Design and Analysis of Infectious Disease Studies |

| 2310a | 5 Mar – 10 Mar 2023 | MATRIX-MFO Tandem Workshop: Stochastic Reinforcement Processes and Graphs |
|-------|---------------------|-----|
| 2310b | 5 Mar – 10 Mar 2023 | Optimization Problems for PDEs in Weak Space-Time Form |
| 2311 | 12 Mar – 17 Mar 2023 | Real Algebraic Geometry with a View toward Koopman Operator Methods |
| 2312 | 19 Mar – 24 Mar 2023 | New Directions in Real Algebraic Geometry |
| 2313 | 26 Mar – 31 Mar 2023 | Random Graphs: Combinatorics, Complex Networks and Disordered Systems |
| 2315 | 9 Apr – 14 Apr 2023 | Komplexe Analysis — Differential and Algebraic methods in Kähler spaces |
| 2316 | 16 Apr – 21 Apr 2023 | Representations of Finite Groups |
| 2317 | 23 Apr – 28 Apr 2023 | Mathematical Foundations of Biological Organisation |
| 2318 | 30 Apr – 5 May 2023 | Tomographic Inverse Problems: Mathematical Challenges and Novel Applications |
| 2319 | 7 May – 12 May 2023 | Group Actions and Harmonic Analysis in Number Theory |
| 2320 | 14 May – 19 May 2023 | Tropical Methods in Geometry |
| 2321 | 21 May – 26 May 2023 | Hypoelliptic Operators in Geometry |
| 2323 | 4 Jun – 9 Jun 2023 | Incidence Problems in Harmonic Analysis, Geometric Measure Theory, and Ergodic Theory |
| 2324 | 11 Jun – 16 Jun 2023 | Machine Learning for Science: Mathematics at the Interface of Data-driven and Mechanistic Modelling |
| 2325 | 18 Jun – 23 Jun 2023 | Recent Trends in Algebraic Geometry |
| 2326 | 25 Jun – 30 Jun 2023 | Algebraische Zahlentheorie |
| 2327 | 2 Jul – 7 Jul 2023 | Differentialgeometrie im Grossen |
| 2328 | 9 Jul – 14 Jul 2023 | Dynamische Systeme |
| 2329 | 16 Jul – 21 Jul 2023 | Transport and Scale Interactions in Geophysical Flows |
| 2330 | 23 Jul – 28 Jul 2023 | Partial Differential Equations |
| 2331 | 30 Jul – 4 Aug 2023 | Teichmüller Theory: Classical, Higher, Super and Quantum |
| 2332 | 6 Aug – 11 Aug 2023 | Homotopy Theory |
| 2333 | 13 Aug – 18 Aug 2023 | Mixed-integer Nonlinear Optimization: A Hatchery for Modern Mathematics |
| 2334 | 20 Aug – 25 Aug 2023 | Geometric Spectral Theory |
| 2335 | 27 Aug – 1 Sep 2023 | Aspects of Aperiodic Order |
| 2336 | 3 Sep – 8 Sep 2023 | Classical and Quantum Mechanical Models of Many-Particle Systems |
| 2337 | 10 Sep – 15 Sep 2023 | Many-Body Quantum Systems |

| 2338a | 17 Sep – 22 Sep 2023 | Tensor-Triangular Geometry and Interactions |
| 2339a | 24 Sep – 29 Sep 2023 | MFO-RIMS Tandem Workshop 2023: Arithmetic Homotopy and Galois Theory |
| 2340 | 1 Oct – 6 Oct 2023 | New Challenges in the Interplay between Finance and Insurance |
| 2345 | 5 Nov – 10 Nov 2023 | Control Methods in Hyperbolic Partial Differential Equations |
| 2346 | 12 Nov – 17 Nov 2023 | Mathematical Logic: Proof Theory, Constructive Mathematics |
| 2349 | 3 Dec – 8 Dec 2023 | Variational Methods for Evolution |
| 2350 | 10 Dec – 15 Dec 2023 | Geometric, Algebraic, and Topological Combinatorics |

## Miniworkshops

| ID | Date | Title |
| --- | --- | --- |
| 2309a | 26 Feb – 4 Mar 2023 | Mini-Workshop: Skew Braces and the Yang–Baxter Equation |
| 2309b | 26 Feb – 4 Mar 2023 | Mini-Workshop: New Horizons in Motions in Random Media |
| 2309c | 26 Feb – 4 Mar 2023 | Mini-Workshop: Free Boundary Problems Arising in Fluid Mechanics |
| 2338b | 17 Sep – 22 Sep 2023 | Mini-Workshop: Interpolation and Over-parameterization in Statistics and Machine Learning |
| 2339b | 24 Sep – 29 Sep 2023 | Mini-Workshop: Multivariate Orthogonal Polynomials: New synergies with Numerical Analysis |
| 2342a | 15 Oct – 20 Oct 2023 | Mini-Workshop: Poisson and Poisson-type algebras |
| 2342b | 15 Oct – 20 Oct 2023 | Mini-Workshop: Felix Klein's Foreign Students: Opening Up the Way for Transnational Mathematics |
| 2342c | 15 Oct – 20 Oct 2023 | Mini-Workshop: Nonlinear Approximation of High-dimensional Functions in Scientific Computing |
| 2344a | 29 Oct – 4 Nov 2023 | Mini-Workshop: Mathematics of Many-body Fermionic Systems |
| 2344b | 29 Oct – 3 Nov 2023 | Mini-Workshop: Standard Subspaces in Quantum Field Theory and Representation Theory |
| 2344c | 29 Oct – 3 Nov 2023 | Mini-Workshop: Positivity and Inequalities in Convex and Complex Geometry |
| 2348a | 26 Nov – 2 Dec 2023 | Mini-Workshop: Combinatorial and Algebraic Structures in Rough Analysis and Related Fields |
| 2348b | 26 Nov – 1 Dec 2023 | Mini-Workshop: Homological Aspects for TDLC-Groups |
| 2348c | 26 Nov – 1 Dec 2023 | Mini-Workshop: Flavors of Rabinowitz Floer and Tate Homology |

## Arbeitsgemeinschaften

| ID | Date | Title |
|---|---|---|
| 2314 | 2 Apr – 7 Apr 2023 | Arbeitsgemeinschaft: Twistor D-Modules and the Decomposition Theorem |
| 2341 | 8 Oct – 13 Oct 2023 | Arbeitsgemeinschaft: Cluster Algebras |
| 2351 | 17 Dec – 22 Dec 2023 | Arbeitsgemeinschaft: QFT and Stochastic PDEs |

## Oberwolfach Seminars

| ID | Date | Title |
|---|---|---|
| 2322a | 28 May – 2 Jun 2023 | Oberwolfach Seminar: Analysis of Automorphic Forms and L-Functions in Higher Rank |
| 2322b | 28 May – 2 Jun 2023 | Oberwolfach Seminar: Metric Algebraic Geometry |
| 2343a | 22 Oct – 27 Oct 2023 | Oberwolfach Seminar: Recent Topics on the Navier-Stokes Equations |
| 2343b | 22 Oct – 27 Oct 2023 | Oberwolfach Seminar: Control of PDEs Models for Living Systems |
| 2347a | 19 Nov – 24 Nov 2023 | Oberwolfach Seminar: Scattering Resonances in Quantum Mechanics, General Relativity and Hyperbolic Dynamics |
| 2347b | 19 Nov – 24 Nov 2023 | Oberwolfach Seminar: Variational and Information Flows in Machine Learning and Optimal Transport |

## Further training activities

| ID | Date | Title |
|---|---|---|
| 2346b | 12 Nov – 17 Nov 2023 | Banach Center – Oberwolfach Graduate Seminar: Optimal Transport Theory and Hydrodynamics (from Euler to Monge and vice versa) |
| 2320a | 13 May – 20 May 2023 | Trainings- und Abschlussseminar für die Internationale Mathematik-Olympiade |

### Workshop 2301



**01.01. – 07.01.2023**                    **Combinatorics**
Organizers:                                Peter Keevash, Oxford
                                           Wojciech Samotij, Tel Aviv
                                           Benny Sudakov, Zürich

## Abstract
Combinatorics is an area of mathematics primarily concerned with counting and studying properties of discrete objects such as graphs, set systems, partial orders, polyhedra, etc. Combinatorial problems naturally arise in many areas of mathematics, such as algebra, geometry, probability theory, and topology, and in theoretical computer science. Historically, such questions were often studied using ad hoc arguments. However, over the last few decades, the development of general and powerful methods have elevated combinatorics to a thriving branch of mathematics with many connections to other subjects. The workshop brought together the established leading experts and the brightest young talents from different parts of this very broad area in order to discuss the most exciting recent developments, current themes and trends, and the most promising new directions for future research.

## Participants
Adiprasito, Karim (Jerusalem), Allen, Peter (London), Alon, Noga (Princeton), Balogh, József (Urbana), Barvinok, Alexander (Ann Arbor), Böttcher, Julia (London), Bucić, Matija (Princeton), Chudnovsky, Maria (Princeton), Conlon, David (Pasadena), Diestel, Reinhard (Hamburg), Ferber, Asaf (Irvine), Fox, Jacob (Stanford), Friedgut, Ehud (Rehovot), Gamarnik, David (Cambridge), Haxell, Penny E. (Waterloo), Heckel, Annika (Uppsala), Jenssen, Matthew (Birmingham), Kang, Mihyun (Graz), Keevash, Peter (Oxford), Knierim, Charlotte (Zürich), Král, Daniel (Brno), Krivelevich, Michael (Ramat Aviv, Tel Aviv), Kwan, Matthew (Klosterneuburg), Letzter, Shoham (London), Lifshitz, Noam (Jerusalem), Linial, Nathan (Jerusalem), Łuczak, Tomasz (Poznań), Montgomery, Richard (Coventry), Munhá Correia, David (Zürich), Narayanan, Bhargav (New Brunswick), Norin, Sergey (Montréal), Pach, János (Budapest), Perkins, Will (Chicago), Pikhurko, Oleg (Coventry), Pokrovskiy, Alexey (London), Riordan, Oliver (Oxford), Rödl, Vojtěch (Atlanta), Sah, Ashwin (Cambridge), Sahasrabudhe, Julian (Cambridge), Samotij, Wojciech (Ramat Aviv, Tel Aviv), Sauermann, Lisa (Cambridge), Sawhney, Mehtaab (Cambridge), Schacht, Mathias (Hamburg), Schülke, Bjarne (Pasadena), Scott, Alex (Oxford), Shapira, Asaf (Ramat Aviv, Tel Aviv), Solymosi, József (Vancouver), Spirkl, Sophie (Waterloo), Sudakov, Benjamin (Zürich), Szabó, Tibor (Berlin), Tomon, Istvan (Zürich), Verstraete, Jacques (La Jolla), Vu, Van H. (New Haven), Wagner, Uli (Klosterneuburg), Zhao, Yufei (Cambridge)

| 08.01. – 14.01.2023 | **Model Theory: Combinatorics, Groups, Valued Fields and Neostability** |
| Organizers: | Itay Kaplan, Jerusalem |
| | Silvain Rideau-Kikuchi, Paris |
| | Katrin Tent, Münster |
| | Frank Wagner, Villeurbanne |

## Abstract

The scope of contemporary model theory has expanded enormously over the last several decades, helped by the development of new tools applicable to an ever wider range of structures. In the spirit of the previous meetings in the series, this workshop will bring together researchers from apparently separate subfields of model theory whose work is linked by common themes, with a particular emphasis on intrinsic model theoretic questions motivated by the classification of approriately 'tame' groups and fields and new developments in asymptotic combinatorics.

## Participants

Alouf, Eran (Jerusalem), Altinel, Tuna (Villeurbanne), Amelio, Marco (Münster), André, Simon (Münster), Anscombe, Sylvy (Paris), Aschenbrenner, Matthias (Wien), Bays, Martin (Münster), Ben Yaacov, Itaï (Villeurbanne), Bouscaren, Elisabeth (Orsay), Casanovas, Enrique (Barcelona), Chatzidakis, Zoé (Paris), Cherlin, Gregory L. (Princeton), Chernikov, Artem (Los Angeles), d'Elbee, Christian (Toronto), Dobrowolski, Jan (Manchester), Frécon, Olivier (Poitiers), Gallinaro, Francesco (Freiburg i. Br.), Halevi, Yatir (Haifa), Halupczok, Immanuel (Düsseldorf), Haskell, Deirdre (Hamilton), Hasson, Assaf (Beer-Sheva), Hils, Martin (Münster), Hoffmann, Daniel Max (Warszawa), Jahnke, Franziska (Münster), Kaplan, Itay (Jerusalem), Kim, Byunghan (Seoul), Krupinski, Krzysztof (Wrocław), Loeser, Francois (Paris), Macpherson, H. Dugald (Leeds), Martin-Pizarro, Amador (Freiburg i. Br.), Newelski, Ludomir (Wrocław), Onshuus, Alf (Bogotá), Palacín, Daniel (Madrid), Peterzil, Ya'acov (Haifa), Pillay, Anand (Notre Dame), Point, Francoise (Mons), Ramello, Simone (Münster), Ramsey, Nick (Los Angeles), Rideau-Kikuchi, Silvain (Paris), Rodriguez Fanlo, Arturo (Jerusalem), Scanlon, Thomas W. (Berkeley), Starchenko, Sergei S. (Notre Dame), Tent, Katrin (Münster), Tran, Chieu-Minh (Singapore), Valentin, Nadja (Düsseldorf), Wagner, Frank Olaf (Villeurbanne), Wolf, Julia (Cambridge), Zilber, Boris I. (Oxford), Zou, Tingxiang (Münster)

**15.01. – 21.01.2023**         **Low-dimensional Topology**
**Organizers:**         Stefan Friedl, Regensburg
         Yoav Moriah, Haifa
         Jessica Purcell, Melbourne
         Saul Schleimer, Warwick

## Abstract

The workshop brought together experts from across all areas of low-dimensional topology, including knot theory, computational topology, three-manifolds and four-manifolds. In addition to the standard research talks we had two survey talks by Marc Lackenby and Joel Hass, leading to discussions of open problems. Furthermore we had three sessions of five-minute talks by a total of roughly thirty participants.

## Participants

Avramidi, Grigori (Bonn), Baker, Kenneth L. (Coral Gables), Bell, Mark (Worcestershire), Blackwell, Sarah (Bonn), Boileau, Michel (Marseille), Boyer, Steven (Montréal), Burton, Benjamin (Brisbane), Chatterjee, Rima (Köln), Chu, Michelle (Minneapolis), de Mesmay, Arnaud (Marne-la-Vallée), Dunfield, Nathan M. (Urbana), Dynnikov, Ivan A. (Moscow), Friedl, Stefan (Regensburg), Futer, David (Philadelphia), Gabai, David (Princeton), Hall, Layne (Coventry), Hass, Joel (Davis), He, Alex (Brisbane), Howie, Joshua (Davis), Jackson, Adele (Oxford), Jin, Hyeonhee (Bonn), Kalelkar, Tejas (Pune), Kosanovic, Danica (Zürich), Lackenby, Marc (Oxford), Lazarovich, Nir (Haifa), Lecuona, Ana G. (Glasgow), Lee, Christine (San Marcos), Li, Tao (Chestnut Hill), Loving, Marissa (Madison), Marino, Laura (Paris), Miller, Maggie (Stanford), Minsky, Yair (New Haven), Moriah, Yoav (Haifa), Papadopoulos, Panagiotis (München), Parlak, Anna (Davis), Petersen, Kate (Duluth), Pinsky, Tali (Haifa), Powell, Mark A. (Glasgow), Purcell, Jessica S. (Clayton), Quintanilha, José Pedro (Bielefeld), Rasmussen, Sarah (Cambridge), Schleimer, Saul (Coventry), Segerman, Henry (Stillwater), Thompson, Abigail A. (Davis), Tillmann, Stephan (Sydney), Truöl, Paula (Zürich), Tsang, Chi Cheuk (Berkeley), Tsvietkova, Anastasiia (Newark), Uschold, Matthias (Regensburg), Webb, Richard (Manchester), Yarmola, Andrew (Princeton), Zibrowius, Claudius (Regensburg), Zupan, Alex (Lincoln)

**22.01. – 28.01.2023**          **Morphisms in Low Dimensions**
Organizers:                                        Andrew Lobb, Durham
                                                        Maggie Miller, Stanford
                                                        Arunima Ray, Bonn

## Abstract

This workshop brought together experts on interrelated topics in low-dimensional topology, centred around the common theme of 'morphisms'. Our goal was to improve community understanding of recent developments in the field and to promote new advances in the study of global properties of 4-manifolds.

## Participants

Auckly, Dave (Manhattan), Baykur, Inanc (Amherst), Blackwell, Sarah (Bonn), Brejevs, Vitalijs (Wien), Budney, Ryan (Victoria), Conway, Anthony (Cambridge), Craig, Isaac (Bonn), Dai, Irving (Stanford), Feller, Peter (Zürich), Gabai, David (Princeton), Galvin, Daniel (Glasgow), Gay, David T. (Athens), Harvey, Shelly L. (Houston), Hugelmeyer, Cole (Stanford), Jin, Hyeonhee (Bonn), Kang, Sungkyung (Pohang City), Kasprowski, Daniel (Bonn), Kegel, Marc (Berlin), Kim, Seungwon (Suwon), Kjuchukova, Alexandra (Notre Dame), Kohn, Michael (Durham), Kosanovic, Danica (Zürich), Kreck, Matthias (Bonn), Ladu, Roberto (London), Lewark, Lukas (Regensburg), Mallick, Abhishek (Bonn), Matic, Gordana (Athens), Matkovic, Irena (Uppsala), Merz, Alice (Pisa), Mezher, Fadi (København), Miller, Allison N. (Swarthmore), Miller, Maggie (Stanford), Moussard, Delphine (Marseille), Mrowka, Tomasz S. (Cambridge), Nonino, Isacco (Glasgow), Pacheco-Tallaj, Natalia (Cambridge), Piccirillo, Lisa M. (Cambridge), Pinzon-Calcedo, Juanita (Notre Dame), Powell, Mark A. (Glasgow), Raoux, Katherine (Fayetteville), Ray, Arunima (Bonn), Robert, Louis-Hadrien (Aubière), Ruberman, Daniel (Waltham), Sakai, Keiichi (Nagano), Santoro, Diego (Pisa), Schneiderman, Rob (Bronx), Sivek, Steven (Bonn), Sridhar, Shruthi (Berkeley), Szymik, Markus (Sheffield), Vesela, Simona (Bonn), Wakelin, Laura (London), Wang, Joshua (Cambridge), Warren, Terrin (Athens), Watanabe, Tadayuki (Kyoto), Wong, Biji (Durham), Zemke, Ian (Princeton), Zentner, Raphael (Durham), Zhang, Melissa (Davis)

| 29.01. – 04.02.2023 | **Arithmetic of Shimura Varieties** |
| Organizers: | Laurent Fargues, Paris |
| | Ulrich Görtz, Essen |
| | Eva Viehmann, Münster |
| | Torsten Wedhorn, Darmstadt |

## Abstract

The aim of this workshop was to discuss recent developments on the arithmetic of Shimura varieties and on related topics within the Langlands program, and to initiate and support further research in this direction. The talks presented new methods and results covering topics ranging from geometric questions on the reduction of Shimura varieties to representations in their cohomology, automorphic forms, and questions on the geometry and arithmetic of moduli spaces of bundles on the Fargues-Fontaine curve.

## Participants

Andreatta, Fabrizio (Milano), Bartling, Sebastian (Essen), Boyer, Pascal (Villetaneuse), Bruinier, Jan Hendrik (Darmstadt), Caraiani, Ana (London), Chen, Miaofen (Shanghai Shi), Dospinescu, Gabriel (Lyon), Fargues, Laurent (Paris), Fintzen, Jessica (Bonn), Fox, Maria (Eugene), Gleason, Ian (Bonn), Goren, Eyal Z. (Montréal), Görtz, Ulrich (Essen), Haines, Thomas (College Park), Hamann, Linus (Princeton), Hansen, David (Bonn), Hartl, Urs (Münster), He, Xuhua (Hong Kong), Hernandez, Valentin (Orsay), Hoff, Manuel (Essen), Howard, Benjamin V. (Chestnut Hill), Imai, Naoki (Tokyo), Ivanov, Alexander (Bonn), Kim, Wansu (Daejeon), Koshikawa, Teruhisha (Kyoto), Koskivirta, Jean-Stefan (Saitama), Lan, Kai-Wen (Minneapolis), Lang, Christopher (Darmstadt), Le Bras, Arthur-César (Villetaneuse), Lee, Si Ying (Bonn), Liu, Yifeng (Hangzhou), Madapusi Pera, Keerthi (Chestnut Hill), Mann, Lucas (Münster), Mantovan, Elena (Pasadena), Marrama, Andrea (Palaiseau), Mihatsch, Andreas (Bonn), Morel, Sophie (Lyon), Nguyen, Kieu Hieu (Münster), Pappas, Georgios (East Lansing), Pereira Lourenço, João Nuno (Münster), Rapoport, Michael (Bonn), Richarz, Timo (Darmstadt), Schremmer, Felix (Shatin, N.T., Hong Kong), Shankar, Ananth (Madison), Shin, Sug Woo (Berkeley), Trentin, Stefania (Münster), van den Hove, Thibaud (Darmstadt), van Hoften, Pol (Stanford), Viehmann, Eva (Münster), Wedhorn, Torsten (Darmstadt), Xiao, Liang (Beijing), Xiao, Luciena (Helsinki), Xu, Yujie (Cambridge), Xue, Cong (Paris), Zhang, Mingjia (Bonn), Zhang, Wei (Cambridge), Zhou, Rong (Cambridge), Zhu, Xinwen (Pasadena), Zhu, Yihang (College Park), Ziegler, Paul (Garching bei München)

**05.02. – 11.02.2023**        **Resolutions in Local Algebra and Singularity Theory**
Organizers:                    Aldo Conca, Genova
                               Steven Dale Cutkosky, Columbia
                               Eleonore Faber, Leeds
                               Srikanth B. Iyengar, Salt Lake City

## Abstract

Commutative algebra is a vast subject, with connections to many different areas of mathematics, and beyond. The focus of this workshop was on three areas, all concerned with resolutions in various forms. One is the resolution of singularities of algebraic varieties, which remains a vibrant topic of research. The second is the theory of noncommutative resolution of singularities. Introduced two decades ago, this subject has witnessed remarkable growth developing connections to algebraic geometry, commutative algebra, cluster algebras, and the representation theory of algebras, both commutative and noncommutative, among others. The third intended meaning of the world "resolution" is as in free resolutions of algebras and modules in commutative algebra. There is another sense in which the title is appropriate: recently three long standing open problems in commutative algebra have been resolved. This workshop brought together experts and early career researchers in these various fields, to facilitate exchange of ideas and to explore potential collaborations.

## Participants

Avramov, Luchezar L. (Sofia), Blickle, Manuel (Mainz), Bravo, Ana (Madrid), Brenner, Holger (Osnabrück), Briggs, Benjamin (Berkeley), Chardin, Marc (Paris), Conca, Aldo (Genova), Cutkosky, Steven Dale (Columbia), De Stefani, Alessandro (Genova), Duarte, Luís (Genova), Eisenbud, David (Berkeley), Erman, Daniel (Madison), Faber, Eleonore (Leeds), Grifo, Eloísa (Lincoln), Homs Pons, Roser (Bellaterra, Barcelona), Huneke, Craig (Charlottesville), Iyama, Osamu (Tokyo), Iyengar, Srikanth B. (Salt Lake City), Jeffries, Jack (Lincoln), Juhnke, Martina (Osnabrück), Kalck, Martin (Freiburg i. Br.), Kretschmer, Andreas (Magdeburg), Kuhlmann, Franz-Viktor (Szczecin), Letz, Janina C. (Bielefeld), Ma, Linquan (West Lafayette), Makonzi, Brian (Glasgow), McCullough, Jason G. (Ames), Miller, Claudia (Syracuse), Mourtada, Hussein (Paris), Nicklasson, Lisa (Genova), Polini, Claudia (Notre Dame), Polstra, Thomas (Tuscaloosa), Raicu, Claudiu (Notre Dame), Rossi, Maria Evelina (Genova), Sarkar, Parangama (Palakkad), Schober, Bernd (Oldenburg), Schwede, Karl (Salt Lake City), Singh, Anurag (Salt Lake City), Smith, Karen E. (Ann Arbor), Spenko, Spela (Bruxelles), Srinivasan, Hema (Columbia), Takagi, Shunsuke (Tokyo), Ulrich, Bernd (West Lafayette), Varbaro, Matteo (Genova), Verma, Jugal K. (Powai, Mumbai), Walker, Mark E. (Lincoln), Welker, Volkmar (Marburg), Wemyss, Michael (Glasgow), Weyman, Jerzy (Kraków)

**12.02. – 18.02.2023**  **Representation Theory of Quivers and Finite-Dimensional Algebras**

Organizers:  Claire Amiot, Gières
William Crawley-Boevey, Bielefeld
Osamu Iyama, Tokyo
Jan Schröer, Bonn

## Abstract

This workshop was about the representation theory of quivers and finite-dimensional (associative) algebras, and links to other areas of mathematics, including other areas of representation theory, homological algebra, cluster algebras, algebraic geometry and singularity theory. Particularly active topics included $\tau$-tilting theory, algebras arising from surface triangulations and the study of exact categories and their generalizations.

## Participants

Amiot, Claire (Saint-Martin-d'Hères), Angeleri Hügel, Lidia (Verona), Asai, Sota (Osaka), Baur, Karin (Leeds), Bobiński, Grzegorz (Toruń), Brüstle, Thomas (Sherbrooke), Buan, Aslak Bakke (Trondheim), Burban, Igor (Paderborn), Cerulli-Irelli, Giovanni (Roma), Chan, Aaron K. Y. (Nagoya-shi), Chen, Xiao-Wu (Hefei, Anhui Province), Conde, Teresa (Stuttgart), Crawley-Boevey, William (Bielefeld), Eckert, Sebastian (Bielefeld), Enomoto, Haruhisa (Osaka), Erdmann, Karin (Oxford), Garcia, Monica (Versailles), Geiss, Christof (Ciudad de México), Gratz, Sira (Aarhus), Hanihara, Norihiro (Kashiwa), Hennecart, Lucien (Edinburgh), Herschend, Martin (Uppsala), Hille, Lutz (Münster), Hubery, Andrew (Bielefeld), Iyama, Osamu (Tokyo), Jasso, Gustavo (Lund), Kalck, Martin (Freiburg i. Br.), King, Alastair (Bath), Klász, Viktória (Bonn), König, Steffen (Stuttgart), Kosakowska, Justyna (Toruń), Krause, Henning (Bielefeld), Külshammer, Julian (Uppsala), Kvamme, Sondre (Trondheim), Labardini-Fragoso, Daniel (Ciudad de México), Laking, Rosanna D. (Verona), Leclerc, Bernard (Caen), Marczinzik, Rene (Stuttgart), Nakaoka, Hiroyuki (Nagoya-shi), Nkansah, David (Aarhus), Palu, Yann (Amiens), Pauksztello, David (Lancaster), Perniok, Daniel (Bonn), Plamondon, Pierre-Guy (Versailles), Qin, Fan (Shanghai Shi), Reineke, Markus (Bochum), Sauter, Julia (Bielefeld), Schiffler, Ralf (Storrs), Schröer, Jan (Bonn), Schroll, Sibylle (Köln), Sen, Emre (Iowa City), Solberg, Oeyvind (Trondheim), Soto, Valentine (Gières), Thomas, Hugh R. (Montréal), Treffinger, Hipolito (Paris), Zvonareva, Alexandra (Stuttgart)

**19.02. – 25.02.2023**       **Design and Analysis of Infectious Disease Studies**
Organizers:               Caroline Colijn, Burnaby
                               M. Elizabeth Halloran, Seattle
                               Philip O'Neill, Nottingham
                               Pieter Trapman, Groningen

## Abstract

This was the sixth workshop on mathematical and statistical methods for the transmission of infectious diseases. Building on epidemiologic models which were the subject of earlier workshops, this workshop concentrated on disentangling who infected whom by analysing high-resolution genomic data of pathogens which are routinely collected during outbreaks. Following the trail of the small mutations which continuously occur in different places of pathogens' genomes, mathematical tools and computational algorithms were used to reconstruct transmission trees and contact networks. In the past three years these methods were developed and used particularly in the context of the SARS-Cov-2 (Covid-19) pandemic.

## Participants

Auranen, Kari (University of Turku), Ball, Frank G. (Nottingham), Bootsma, Martin (Utrecht), Britton, Tom (Stockholm), Brizzi, Andrea (London), Colijn, Caroline (Burnaby), Cooper, Ben (Oxford), Earn, David (Hamilton), Edmunds, John (London), Eggo, Rosalind (London), Eichner, Martin (Tübingen), Frost, Simon (Redmond), Goldstein, Isaac (Irvine), Halloran, M. Elizabeth (Seattle), Hens, Niel (Diepenbeek), Ionides, Edward L. (Ann Arbor), Isham, Valerie S. (London), Kenah, Eben (Columbus), Kendall, Michelle (Coventry), King, Aaron (Ann Arbor), Klinkenberg, Don (Bilthoven), Kretzschmar, Mirjam (Utrecht), Kypraios, Theodore (Nottingham), Leung, KaYin (Bilthoven), Longini, Ira M. (Gainesville), McBryde, Emma (Townsville), Miller, Joel (Bundoora), Mollison, Denis (Musselburgh), Mulberry, Nicola (Burnaby), Müller, Johannes (Garching bei München), Müller, Nicola (Seattle), O'Neill, Philip D. (Nottingham), Palacios, Julia (Stanford), Pellis, Lorenzo (Manchester), Ratmann, Oliver (London), Roberts, Mick G. (Auckland), Scalia-Tomba, Gianpaolo (Roma), Spencer, Simon (Coventry), Struchiner, Claudio J. (Rio de Janeiro), Thompson, Alice (Nottingham), Touloupou, Panayiota (Birmingham), Trapman, Pieter (Groningen), van Boven, Michiel (Bilthoven), Wallinga, Jacco (Bilthoven), Wilson, Daniel (Oxford), Wolkewitz, Martin (Freiburg i. Br.), Wymant, Chris (Oxford), Xu, Jason (Durham), Zhang, Dongni (Stockholm)

| 05.03. – 10.03.2023 | **MATRIX-MFO Tandem Workshop: Stochastic Reinforcement Processes and Graphs** |
|---|---|
| Organizers: | Markus Heydenreich, München |
| | Mark Holmes, Melbourne |
| | Viktor Kleptsyn, Rennes |
| | Cécile Mailler, Bath |

## Abstract

Stochastic processes with reinforcement are the central theme of the present tandem workshop. We assembled a diverse group of international experts that worked on reinforcement dynamics from several different perspectives. We discussed progress and future strategies around a number of key open problems in the area of interacting urns with graph based interaction, preferential attachment, and reinforced random walks.

## Participants

Bertoin, Jean (Zürich), Cotar, Codina (London), Dean, Christopher (Bath), Deijfen, Maria (Stockholm), de Paula Reis, Guilherme (Garching bei München), Dereich, Steffen (Münster), Grosskinsky, Stefan (Augsburg), Heydenreich, Markus (München), Hirsch, Christian (Aarhus), Holmes, Mark (Parkville), Kleptsyn, Victor (Rennes), Laulin, Lucile (Talence), Limic, Vlada (Strasbourg), Lodewijks, Bas (Saint-Étienne), Mailler, Cécile (Bath), Maitra, Neeladri (Eindhoven), Mönch, Christian (Mainz), Mörters, Peter (Köln), Raimond, Olivier (Nanterre), Ray, Rounak (Eindhoven), Rolles, Silke (Garching bei München), Sabot, Christophe (Villeurbanne), Schapira, Bruno (Aix-en-Provence), Tarrès, Pierre (Shanghai), van der Hofstad, Remco (Eindhoven), Volkov, Stanislav (Lund)

| 05.03. – 10.03.2023 | **Optimization Problems for PDEs in Weak Space-Time Form** |
| Organizers: | Helmut Harbrecht, Basel |
| | Angela Kunoth, Köln |
| | Valeria Simoncini, Bologna |
| | Karsten Urban, Ulm |

**Abstract**

Optimization problems constrained by time-dependent PDEs are challenging from a computational point of view. Specifically for PDEs with a long time horizon, conventional time-stepping methods require an enormous amount of computer memory allocations for the respective other variables. In contrast, adaptive-in-time-and-space methods aim at distributing the available degrees of freedom in an a-posteriori fashion to capture singularities and are, therefore, most promising. Recently, well-posed weak variational formulations have been introduced for time-dependent PDEs such as the heat equation, linear transport and the wave equation. Those formulations also allow for a sharp relation between the approximation error and the residual, which is particularly relevant for model reduction. Moreover, for those tensor-basis formulations, advanced algebraic solvers designed to take into account these multiarray (tensorial) formulations appear to be particularly competitive with respect to time-marching schemes, especially in higher dimensions. We discuss ed whether these techniques can be extended to nonlinear PDEs like Hamilton-Jacobi-Bellman equations, or stochastic PDEs and variational inequalities. Another topic were adaptive schemes which, when properly designed, inherit the stability of the continuous formulation. The central goals of the workshop are the analysis, fast solvers and model reduction for PDE-constrained control and optimization problems based on weak formulations of the underlying PDE(s).

**Participants**

Becker, Roland (Pau), Beranek, Nina (Ulm), Dambrine, Marc (Pau), Demkowicz, Leszek F. (Austin), Dolgov, Sergey (Bath), Glas, Silke (Enschede), Harbrecht, Helmut (Basel), Houston, Paul (Nottingham), Kaltenbacher, Barbara (Klagenfurt), Knoll, Sarah (Köln), Kunisch, Karl (Graz), Kunoth, Angela (Köln), Li, Buyang (Hong Kong), Neitzel, Ira (Bonn), Ohlberger, Mario (Münster), Oseledets, Ivan (Kaiserslautern), Oster, Mathias (Berlin), Rösch, Arnd (Essen), Schneider, Reinhold (Berlin), Simoncini, Valeria (Bologna), Steinbach, Olaf (Graz), Stevenson, Rob P. (Amsterdam), Tausch, Johannes (Dallas), Urban, Karsten (Ulm), Volkwein, Stefan (Konstanz), von Rickenbach, Remo (Basel)

| 12.03. – 17.03.2023 | **Real Algebraic Geometry with a View toward Koopman Operator Methods** |
| Organizers: | Didier Henrion, Toulouse |
| | Salma Kuhlmann, Konstanz |
| | Igor Mezic, Santa Barbara |
| | Victor Vinnikov, Be'er Sheva |

## Abstract

This workshop was dedicated to the newest developments in real algebraic geometry and their interaction with convex optimization and operator theory. A particular effort was invested in exploring the interrelations with the Koopman operator methods in dynamical systems and their applications. The presence of researchers from different scientific communities enabled an interesting dialogue leading to new exciting and promising synergies.

## Participants

Baldi, Lorenzo (Paris), Bauer, Mario (Konstanz), Blekherman, Greg (Atlanta), Bonnet-Weill, Benoit (Toulouse), Cimpric, Jaka (Ljubljana), Curto, Raúl E. (Iowa City), de Klerk, Etienne (Tilburg), di Dio, Philipp (Konstanz), Dressler, Mareike (Sydney), Froyland, Gary (Sydney), Ghasemi, Mehdi (Edmonton), Giannakis, Dimitris (Hanover), Goel, Charu (Nagpur), Gondard, Danielle (Paris), Helton, J. William (La Jolla), Henrion, Didier (Toulouse), Hermle, Patrick (Wuppertal), Hess, Sarah-Tanja (Konstanz), Infusino, Maria (Cagliari), Junge, Oliver (Garching bei München), Klep, Igor (Ljubljana), Kuhlmann, Salma (Konstanz), Kuna, Tobias (L'Aquila), Laurent, Monique (Amsterdam), Mai, Ngoc Hoang Anh (Konstanz), Mauroy, Alexandre (Namur), Michalek, Mateusz (Konstanz), Mourrain, Bernard (Sophia-Antipolis), Nagel, Rainer (Tübingen), Naldi, Simone (Limoges), Pascoe, James Eldred (Philadelphia), Plaumann, Daniel (Dortmund), Powers, Vicki (Atlanta), Reznick, Bruce (Urbana), Riener, Cordian (Tromsø), Safey El Din, Mohab (Paris), Sawall, David (Konstanz), Scheiderer, Claus (Konstanz), Schick, Moritz (Konstanz), Schlosser, Corbinian (Paris), Schmüdgen, Konrad (Leipzig), Schweighofer, Markus (Konstanz), Sinn, Rainer (Leipzig), Sutter, Tobias (Konstanz), Taveira Blomenhofer, Alexander (Amsterdam), Theobald, Thorsten (Frankfurt am Main), Vallentin, Frank (Köln), Vinnikov, Victor (Beer-Sheva), Vinzant, Cynthia (Seattle), Volčič, Jurij (København), Weigert, Julian (Konstanz)

**19.03. – 24.03.2023**  **New Directions in Real Algebraic Geometry**
Organizers:  Saugata Basu, West Lafayette
Mario Kummer, Dresden
Tim Netzer, Innsbruck
Cynthia Vinzant, Seattle

## Abstract
This workshop explored the forefront of connections of real algebraic geometry with convex analysis, combinatorics, and computational complexity. The 28 talks covered a wide range of topics in real algebraic geometry and its applications. Important aspects have been promising interactions with the fields of quantum information theory, discrete geometry, complex and random algebraic geometry.

## Participants
Al Ahmadieh, Abeer (Atlanta), Alon, Lior (Cambridge), Anari, Nima (Palo Alto), Baldi, Lorenzo (Paris), Basu, Saugata (West Lafayette), Bauer, Mario (Konstanz), Benoist, Olivier (Paris), Blekherman, Greg (Atlanta), Brändén, Petter (Stockholm), Brüser, Clemens (Dresden), Bürgisser, Peter (Berlin), Debus, Sebastian (Magdeburg), Dickenstein, Alicia (Buenos Aires), Draisma, Jan (Bern), Drescher, Tom (Innsbruck), Fawzi, Hamza (Cambridge), Helton, J. William (La Jolla), Hubert, Evelyne (Sophia-Antipolis), Knese, Gregory E. (St. Louis), Kummer, Mario (Dresden), Kurasov, Pavel (Stockholm), Leake, Jonathan (Waterloo), Lerario, Antonio (Trieste), Manzaroli, Matilde (Tübingen), Meroni, Chiara (Providence), Moustrou, Philippe (Toulouse), Natarajan, Abhiram (Coventry), Nechita, Ion (Toulouse), Netzer, Tim (Innsbruck), Nino-Cortes, Jonathan (Seattle), Pavlov, Dmitrii (Leipzig), Plaumann, Daniel (Dortmund), Raymond, Annie (Seattle), Riener, Cordian (Tromsø), Rosenblum, Alison (West Lafayette), Scheiderer, Claus (Konstanz), Schulze, Christoph (Dresden), Seigal, Anna (Cambridge), Shamovich, Eli (Beer-Sheva), Shankar, Isabelle (Portland), Shaw, Kris (Oslo), Shu, Kevin (Atlanta), Sinn, Rainer (Leipzig), Slofstra, William E. (Waterloo), Sottile, Frank (College Station), Sturmfels, Bernd (Leipzig), Thom, Andreas B. (Dresden), Thomas, Rekha R. (Seattle), van der Eyden, Mirte (Innsbruck), Vill, Julian (Magdeburg), Vinzant, Cynthia (Seattle), Welschinger, Jean-Yves (Villeurbanne), Wolf, Michael (Garching bei München)
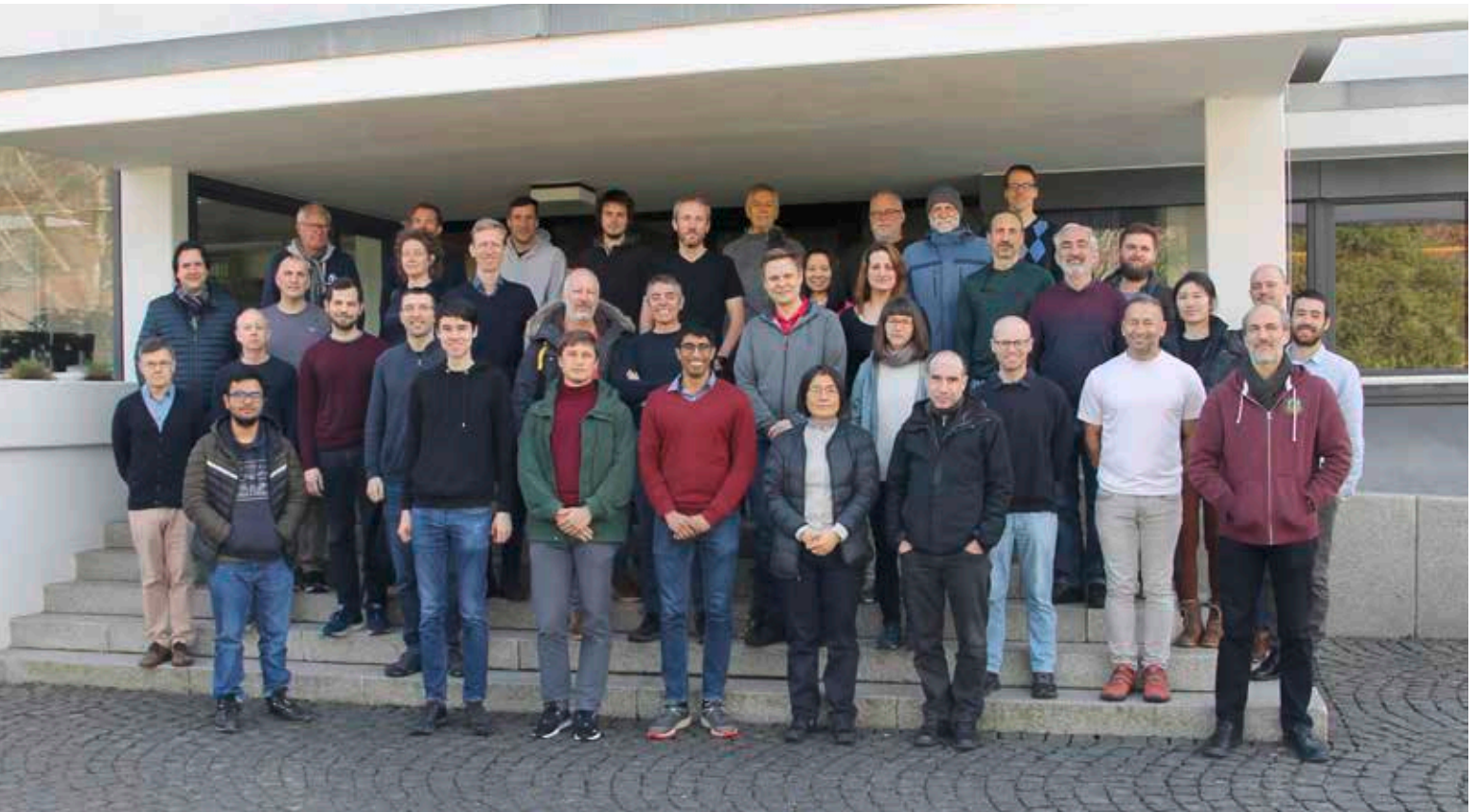
**26.03. – 31.03.2023**     **Random Graphs: Combinatorics, Complex Networks and Disordered Systems**

Organizers:     Amin Coja-Oghlan, Dortmund
Tobias Friedrich, Potsdam
Mihyun Kang, Graz
Konstantinos Panagiotou, München

## Abstract

Since the turn of the millennium the theory of random graphs has advanced by leaps and bounds. Random graphs have found very many applications, and many unexpected applications, in a remarkable variety of disciplines, and they are nowadays studied by mathematicians with various backgrounds, computer scientists and physicists. While this diversity has led to a proliferation of new models, questions and results, the community also has shattered, and by now different methods, terminologies and research agendas have come to coexist without much interaction. The workshop brought together distinct communities, who don't typically interact at their own intra-community events, but have each made significant contributions to the recent advancements in the theory. The workshop provided an effective platform for exchanging ideas, sharing insights, and building bridges across their respective domains.

## Participants

Anastos, Michael (Klosterneuburg), Angel, Omer (Vancouver), Berenbrink, Petra (Hamburg), Bovier, Anton (Bonn), Bringmann, Karl (Saarbrücken), Chen, Wei-Kuo (Minneapolis), Coja-Oghlan, Amin (Dortmund), Cooley, Oliver (Klosterneuburg), Cooper, Colin (London), Dandi, Yatin (Lausanne), Diskin, Sahar (Ramat Aviv, Tel Aviv), Fountoulakis, Nikolaos (Birmingham), Friedrich, Tobias (Potsdam), Frieze, Alan M. (Pittsburgh), Gao, Pu (Waterloo), Hahn-Klimroth, Max (Dortmund), Heckel, Annika (Uppsala), Heydenreich, Markus (München), Holmgren, Cecilia (Uppsala), Isaev, Mikhail (Clayton), Iyer, Tejas (Berlin), Jerrum, Mark R. (London), Kang, Mihyun (Graz), Krioukov, Dmitri (Boston), Krivelevich, Michael (Ramat Aviv, Tel Aviv), Kronenberg, Gal (Oxford), Krzakala, Florent (Lausanne), Kwan, Matthew (Klosterneuburg), Langhammer, Heide (Berlin), Lengler, Johannes (Zürich), Lo, Yin Yuan (Uppsala), Molloy, Mike (Toronto), Müller, Tobias (Groningen), Panagiotou, Konstantinos (München), Papadopoulos, Fragkiskos (Limassol), Pappik, Marcus (Potsdam), Pasch, Matija (München), Patel, Viresh (London), Pralat, Pawel (Toronto), Regts, Guus (Amsterdam), Ricci-Tersenghi, Federico (Roma), Sauerwald, Thomas (Cambridge), Semerjian, Guilhem (Paris), Skerman, Fiona (Uppsala), Sorkin, Gregory B. (London), Stufler, Benedikt (Wien), Warnke, Lutz P. (La Jolla)

**09.04. – 14.04.2023**        **Komplexe Analysis – Differential and Algebraic methods in Kähler spaces**

Organizers:        Philippe Eyssidieux, Saint Martin d'Hères
Jun-Muk Hwang, Daejeon
Stefan Kebekus, Freiburg
Mihai Paun, Bayreuth

## Abstract

Our workshop focused on recent results in our main field (complex geometry) and its connection with other branches of mathematics. The main theme of an important proportion of the talks was Hodge theory, combined with differential-geometric methods in the study of singular spaces. One special lecture was a very comprehensive introduction in Scholze-Clausen's theory of condensed mathematics.

## Participants

Bakker, Benjamin (Chicago), Bernasconi, Fabio (Lausanne), Braun, Lukas (Freiburg i. Br.), Brunebarbe, Yohan (Talence), Cadorel, Benoit (Vandoeuvre-lès-Nancy), Campana, Frédéric (Vandoeuvre-lès-Nancy), Cao, Junyan (Nice), Chen, Jiaming (Frankfurt am Main), Commelin, Johan (Freiburg i. Br.), Delcroix, Thibaut (Montpellier), Demleitner, Andreas (Freiburg i. Br.), Deng, Ya (Vandoeuvre-lès-Nancy), Di Nezza, Eleonora (Paris), Eyssidieux, Philippe (Saint-Martin-d'Hères), Filipazzi, Stefano (Lausanne), Finski, Siarhei (Palaiseau), Floris, Enrica (Poitiers), Graf, Patrick (Bayreuth), Greb, Daniel (Essen), Grossi, Annalisa (Orsay), Guenancia, Henri (Toulouse), Hein, Hans-Joachim (Münster), Hwang, Jun-Muk (Daejeon), Inchiostro, Giovanni (Seattle), Kebekus, Stefan (Freiburg i. Br.), Klingler, Bruno (Berlin), Kotonski, Julia (Bayreuth), Lehn, Christian (Chemnitz), Li, Chi (Piscataway), Lu, Hoang Chinh (Angers), Mauri, Mirko (Ann Arbor), Moraga, Joaquín (Los Angeles), Naumann, Philipp (Bayreuth), Neusser, Katharina (Brno), Núñez, Pedro (Freiburg i. Br.), Patel, Aryaman (Essen), Paul, Sean T. (Madison), Paun, Mihai (Bayreuth), Peternell, Thomas (Bayreuth), Reboulet, Rémi (Cambridge), Scheffler, Johannes (Bayreuth), Schnell, Christian (Stony Brook), Schreieder, Stefan (Hannover), Shentu, Junchao (Hefei), Spicer, Calum (London), Takayama, Shigeharu (Tokyo), Tasin, Luca (Milano), Tosatti, Valentino (New York), Villadsen, Mads Bach (Stony Brook), Witt Nyström, David (Göteborg), Yang, Ruijie (Bonn), Zhang, De-Qi (Singapore)

| 16.04. – 21.04.2023 | **Representations of Finite Groups** |
| Organizers: | Olivier Dudas, Marseille |
| | Meinolf Geck, Stuttgart |
| | Radha Kessar, Manchester |
| | Gabriel Navarro, València |

## Abstract

The workshop covered a wide variety of aspects of the representation theory of finite groups and related topics, and showcased several recent breakthrough results. Among other highlights, this meeting will be remembered as the occasion on which the solution to Brauer's Height Zero Conjecture was presented. Another driving force in our field is the McKay conjecture and its generalizations which need advancing our understanding of groups of Lie type and Deligne–Lusztig theory. Important progress in this direction was presented during the workshop. Besides the lectures, there was plenty of time for informal discussions among participants; furthermore, two evening sessions provided an informal forum for presenting open research problems.

## Participants

Benson, David J. (Aberdeen), Boltje, Robert (Santa Cruz), Bonnafe, Cedric (Montpellier), Bouc, Serge (Amiens), Broué, Michel (Paris), Brunat, Olivier (Paris), Cabanes, Marc (Paris), Carlson, Jon F. (Athens), Chuang, Joseph (London), Cia-Luvecce, Sergio David (Paris), Craven, David A. (Birmingham), Dabson, Alfred (London), Dudas, Olivier (Marseille), Eaton, Charles W. (Manchester), Eisele, Florian (Manchester), Fayers, Matthew (London), Feng, Zhicheng (Beijing), Geck, Meinolf (Stuttgart), Giannelli, Eugenio (Firenze), Grodal, Jesper (København), Hetz, Jonas (Aachen), Hiß, Gerhard (Aachen), Hone, Christopher (Sydney), Kessar, Radha (Manchester), Koshitani, Shigeo (Chiba-Shi), Külshammer, Burkhard (Jena), Lassueur, Caroline (Kaiserslautern), Linckelmann, Markus (London), Lübeck, Frank (Aachen), Lusztig, George (Cambridge), Malle, Gunter (Kaiserslautern), Margolis, Leo (Madrid), Maroti, Attila (Budapest), Martinez, J. Miquel (Burjassot), Mazza, Nadia (Lancaster), Michel, Jean M. (Paris), Morotti, Lucia (Düsseldorf), Murray, John (Maynooth, Co. Kildare), Navarro, Gabriel (Burjassot), Rizo, Noelia (Burjassot), Robinson, Geoffrey R. (Brampton), Ruhstorfer, Lucas (Wuppertal), Sambale, Benjamin (Hannover), Schaeffer Fry, Mandi A. (Denver), Semeraro, Jason (Loughborough), Späth, Britta (Wuppertal), Symonds, Peter (Manchester), Taylor, Jay (Manchester), Tiep, Pham (Piscataway), Tong-Viet, Hung P. (Binghamton), Vallejo Rodríguez, Carolina (Firenze)

**23.04. – 28.04.2023**  **Mathematical Foundations of Biological Organisation**
Organizers:   Jean-Pierre Eckmann, Genève
Karsten Kruse, Genève
Lai-Sang Young, New York

## Abstract
The workshop aimed to explore the use of new mathematical and computational approaches to investigate the fundamental principles governing the organization and dynamics of biological systems. This necessitated conversations among mathematical biologists working at different scales, from molecular to organismal levels. The meeting aimed to encourage interdisciplinary collaborations and showcase recent advances in diverse areas.

## Participants
Bakhtin, Yuri (New York), Bitbol, Anne-Florence (Lausanne), Eckmann, Jean-Pierre (Genève), Feinerman, Ofer (Rehovot), Fernandez, Bastien (Paris), Ghani, Naureen (London), Häring, Matthias (Göttingen), Josic, Kresimir (Houston), Jülicher, Frank (Dresden), Kaneko, Kunihiko (København), Klika, Vaclav (Praha), Koseska, Aneta (Bonn), Kruse, Karsten (Genève), Lesne, Annick (Paris), Lin, Kevin K. (Tucson), Manhart, Angelika (Wien), Milinkovitch, Michel (Genève), Morrison, Megan (New York), Nandan, Akhilesh (Bonn), Pham, Minh Tuan (København), Ramesan, Gayathri (Bonn), Rand, David (Coventry), Rao, Madan (Bangalore, Bengaluru), Rivoire, Olivier (Paris), Sauer, Tim (Fairfax), Siggia, Eric (New York), Stawyskyj, Zoe Rowe (Göttingen), Stevens, Angela (Münster), Thattai, Mukund (Bangalore, Bengaluru), Tlusty, Tsvi (Ulsan), Tu, Yuhai (Yorktown Heights), Wolf, Fred (Göttingen)

**30.04. – 05.05.2023**   **Tomographic Inverse Problems: Mathematical Challenges and Novel Applications**

Organizers:   Simon Arridge, London
Martin Burger, Erlangen
Bernadette Hahn, Stuttgart
Eric Todd Quinto, Medford

## Abstract

This workshop brought together researchers working on mathematical problems related to tomography, with a particular emphasis on novel applications and associated mathematical challenges. Examples of respective issues represented in the workshop were tomographic imaging with Compton cameras or coupled-physics imaging, resolution and aliasing, vector and tensor field tomography, diffraction tomography, magnetic particle tomography, and limited data, all of which are motivated by the many modern applications. These topics were complemented by novel algorithmic strategies in the solution of tomographic inverse problems, such as stochastic methods and machine learning techniques. Bringing together mathematical and scientific researchers working on these different mathematical problems created a fruitful interchange with novel ideas and strong impact for the future of the field.

## Participants

Abhishek, Anuj (Charlotte), Ambartsoumian, Gaik (Arlington), Arridge, Simon R. (London), Betcke, Marta M. (London), Blanke, Stephanie (Hamburg), Boman, Jan (Stockholm), Brune, Christoph (Enschede), Bubba, Tatiana (Bath), Burger, Martin (Erlangen), Courdurier, Matias (Santiago), Coyoli, Alejandro (Boston), Dong, Yiqiu (Lyngby), Feinler, Mathias (Stuttgart), Frikel, Jürgen (Regensburg), Hahn, Bernadette (Stuttgart), Haltmeier, Markus (Innsbruck), Hauptmann, Andreas (Oulu), Helin, Tapio (Lappeenranta), Jiang, Ming (Beijing), Kabri, Samira (Erlangen), Katsevich, Alexander (Orlando), Kuger, Lorenz (Erlangen), Kunyansky, Leonid (Tucson), Lionheart, William R.B. (Manchester), Louis, Alfred K. (Saarbrücken), Lucka, Felix (Amsterdam), Maaß, Peter (Bremen), Maxim, Voichita (Villeurbanne), Nitzsche, Marius (Stuttgart), Quinto, Eric Todd (Medford), Ramlau, Ronny (Linz), Rieder, Andreas (Karlsruhe), Rigaud, Gaël (Stuttgart), Salditt, Tim (Göttingen), Sauer Jørgensen, Jakob (Lyngby), Scherzer, Otmar (Wien), Schmutz, Denise (Wien), Schotland, John C. (New Haven), Schuster, Thomas (Saarbrücken), Seo, Jin Keun (Seoul), Sherina, Ekaterina (Wien), Siltanen, Samuli (University of Helsinki), Stefanov, Plamen (West Lafayette), Wald, Anne (Göttingen), Webber, James (Belmont), Wirth, Benedikt (Münster)

**07.05. – 12.05.2023**          **Group Actions and Harmonic Analysis in Number Theory**
Organizers:                                    Valentin Blomer, Bonn
                                               Manfred Einsiedler, Zürich
                                               Emmanuel Kowalski, Zürich
                                               Maryna Viazovska, Lausanne

## Abstract

This workshop focuses on new problems and new methods at the interface of harmonic analysis (taken in a very broad sense) and ergodic theory, with applications focused on number theory. Special emphasis is put on equidistribution problems on arithmetic symmetric spaces, effective methods in homogeneous dynamics, periods of automorphic forms, families of L-functions over number fields and function fields, and applications of Fourier uniqueness.

## Participants

Akka Ginosar, Menny (Zürich), Alfes-Neumann, Claudia (Bielefeld), Bengoechea, Paloma (Zürich), Blomer, Valentin (Bonn), Bortolotto, Cynthia (Zürich), Brumley, Farrell (Villetaneuse), Burrin, Claire (Zürich), Chandee, Vorrapan (Manhattan), Cohn, Henry (Cambridge), Einsiedler, Manfred (Zürich), Felber, Gilles (Bonn), Fouvry, Etienne (Orsay), Fresán, Javier (Palaiseau), Gariboldi, Bianca (Dalmine), Goncalves, Felipe (Bonn), Gorodetsky, Ofir (Oxford), Harcos, Gergely (Budapest), Hedenmalm, Hakan (Stockholm), Horesh, Tal (Zürich), Iwaniec, Henryk (Piscataway), Kim, Wooyeon (Zürich), Kontorovich, Alex (Piscataway), Kowalski, Emmanuel (Zürich), Li, Xiannan (Manhattan), Lindenstrauss, Elon (Jerusalem), Luethi, Manuel (Lausanne), Maga, Peter (Budapest), Marklof, Jens (Bristol), Matomäki, Kaisa (University of Turku), Matthiesen, Lilian (Stockholm), Matz, Jasmin (København), McAdam, Taylor (New Haven), Michel, Philippe Gabriel (Lausanne), Milićević, Djordje (Bryn Mawr), Miller, Stephen (Piscataway), Mohammadi, Amir (La Jolla), Nelson, Paul (Aarhus), Nordentoft, Asbjorn Christian (Paris), Oh, Hee (New Haven), Petrow, Ian (London), Pierce, Lillian Beatrix (Durham), Pohl, Anke (Bremen), Radchenko, Danylo (Villeneuve d'Ascq), Radziwill, Maksym (Pasadena), Ramos, João Pedro (Zürich), Saha, Abhishek (London), Sawin, Will (New York), Schindler, Damaris (Göttingen), Soundararajan, Kannan (Stanford), Strömbergsson, Andreas (Uppsala), Toma, Radu (Bonn), Viazovska, Maryna (Lausanne), Welsh, Matthew (College Park), Wieser, Andreas (Jerusalem), zur Verth, Svenja (Lausanne)

**14.05. – 19.05.2023**          **Tropical Methods in Geometry**
Organizers:                      Ilia Itenberg, Paris
                                 Hannah Markwig, Tübingen
                                 Kris Shaw, Oslo
                                 Ilya Tyomkin, Be'er Sheva

## Abstract
The workshop was devoted to a wide discussion and exchange of ideas between the leading experts representing various points of view on the subject including tropical methods in symplectic and Lagrangian geometry, topology of real algebraic varieties and tropical homology, tropical methods in algebraic, Berkovich analytic and log geometries, refined tropical enumerative geometry and enriched counting, and algebraic geometry and matroids.

## Participants
Abramovich, Dan (Providence), Adiprasito, Karim (Jerusalem), Aksnes, Edvard (Oslo), Amini, Omid (Palaiseau), Bertrand, Benoît (Tarbes), Blomme, Thomas (Genève), Brugallé, Erwan (Nantes), Cavalieri, Renzo (Fort Collins), Chan, Melody (Providence), Christ, Karl (Hannover), Cueto, Maria Angelica (Columbus), Demory, Aloïs (Paris), Dickenstein, Alicia (Buenos Aires), Geiger, Alheydis (Leipzig), Georgieva, Penka (Paris), Göttsche, Lothar (Trieste), Gross, Andreas (Frankfurt am Main), Gubler, Walter (Regensburg), Hahn, Marvin A. (Dublin), Itenberg, Ilia (Paris), Jaramillo Puentes, Andrés (Essen), Kalinin, Nikita (St. Petersburg), Kharlamov, Viatcheslav (Strasbourg), Lang, Lionel (Gävle), Len, Yoav (St. Andrews), Levine, Marc (Essen), López de Medrano Álvarez, Lucia (Cuernavaca Morelos), Maclagan, Diane (Coventry), Markwig, Hannah (Tübingen), Matessi, Diego (Milano), Mikhalkin, Grigory (Genève), Nguyen, Thi Ngoc Anh (Nantes), Nicaise, Johannes (London), Pauli, Sabrina (Düsseldorf), Rabinoff, Joseph (Durham), Ranganathan, Dhruv (Cambridge), Rau, Johannes (Bogotá), Rincon, Felipe (London), Ruddat, Helge (Stavanger), Shaw, Kris (Oslo), Shustin, Eugenii (Ramat Aviv, Tel Aviv), Siebert, Bernd (Austin), Silversmith, Rob (Coventry), Sinichkin, Uriel (Ramat Aviv, Tel Aviv), Temkin, Michael (Jerusalem), Toussaint, Antoine (Paris), Tyomkin, Ilya (Beer-Sheva), Ulirsch, Martin (Frankfurt am Main), Viro, Oleg J. (Stony Brook), Werner, Annette (Frankfurt am Main), Wickelgren, Kirsten G. (Durham), YU, Tony Yue (Pasadena), Zharkov, Ilia (Manhattan)

**21.05. – 26.05.2023**         **Hypoelliptic Operators in Geometry**
Organizers:                     Davide Barilari, Padova
                                Xiaonan Ma, Paris
                                Nikhil Savale, Köln
                                Yi Wang, Baltimore

## Abstract

The workshop was well attended by 55 participants, with 45 of them being present in person and 10 being online. The participants came from several continents, age groups and included male as well as female researchers. Several interesting themes were discussed including: analysis around Kohn's Laplacian in CR geometry, analogous covariant operators arising in conformal geometry, the spectral theory of the sub-Riemannian Laplacian, pseudodifferential calculi in non-commutative geometry and the geometric applications of Bismut's hypoelliptic Laplacians.

## Participants

Albin, Pierre (Urbana), Androulidakis, Iakovos (Athens), Barilari, Davide (Padova), Bauer, Wolfram (Hannover), Bismut, Jean-Michel (Orsay), Boscain, Ugo (Paris), Bossio, Tania (Padova), Case, Jeffrey S. (University Park), Chang, Chin-Chia (Köln), Chang, Sun-Yung Alice (Princeton), Chen, Eric (Berkeley), Ewert, Eske (Hannover), Fischer, Veronique (Bath), Garofalo, Nicola (Padova), Ge, Yuxin (Toulouse), Gonzalez, Maria del Mar (Madrid), Gursky, Matthew (Notre Dame), Habermann, Karen (Coventry), Hochs, Peter (Nijmegen), Hsiao, Chin-Yu (Taipei), Leandre, Remi (Besançon), Li, Yihui (Paris), Li, Yuxiang (Paris), Liu, Bingxiao (Köln), Ludwig, Ursula (Münster), Ma, Xiaonan (Paris), Ma, Xi-Nan (Hefei), Malchiodi, Andrea (Pisa), Marinescu, George (Köln), Melrose, Richard B. (Cambridge), Mohsen, Omar (Orsay), Nier, Francis (Villetaneuse), Prandi, Dario (Gif-sur-Yvette), Qing, Jie (Santa Cruz), Rizzi, Luca (Trieste), Rodsphon, Rudy (St. Louis), Rossi, Tommaso (Bonn), Sang, Xinfeng (Villetaneuse), Savale, Nikhil (Köln), Schrohe, Elmar (Hannover), Shabtai, Ood (Paris), Shankar, Ravi (Princeton), Shen, Shu (Paris), Shen, Wei-Chuan (Köln), Thalmaier, Anton (Esch-sur-Alzette), Thangavelu, Sundaram (Bangalore, Bengaluru), Tralli, Giulio (Padova), Wang, Guofang (Freiburg i. Br.), Wang, Yi (Baltimore), White, Francis (Villetaneuse), Xu, Guangzhe (Paris), Yang, Paul C. (Princeton), Yung, Po-Lam (Canberra), Zhang, Ruobing (Princeton), Zielinski, Dominik (Köln)

| 04.06. – 09.06.2023 | **Incidence Problems in Harmonic Analysis, Geometric Measure Theory, and Ergodic Theory** |
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| Organizers: | Tuomas Orponen, Jyväskylä |
| | Pablo Shmerkin, Vancouver |
| | Hong Wang, Los Angeles |

## Abstract

The workshop "Incidence Problems in Harmonic Analysis, Geometric Measure Theory, and Ergodic Theory" covered interactions between geometric problems involving fractals, dimensions, patterns, projections and incidences, and on the other hand recent developments in Fourier analysis and Ergodic theory which have been inspired by fractal geometric problems, or have been instrumental in solving them.

## Participants

Algom, Amir (Haifa), Bárány, Balázs (Budapest), Becker, Lars (Bonn), Bejenaru, Ioan (La Jolla), Beltran, David (Burjassot), Chang, Alan (Princeton), Cladek, Laura (Los Angeles), Csörnyei, Marianna (Chicago), Dabrowski, Damian (Jyväskylä), de Saxcé, Nicolas (Villetaneuse), Du, Jiahan (Los Angeles), Du, Xiumin (Evanston), Durcik, Polona (Orange), Feng, De-Jun (Shatin, N.T., Hong Kong), Fu, Yuqiu (Cambridge), Gamburd, Alexander (New York), Gan, Shengwen (Cambridge), Gaspar, Attila (Budapest), Greenfeld, Rachel (Princeton), Guo, Shaoming (Madison), Harris, Terence (Ithaca), He, Weikun (Beijing), Hickman, Jonathan (Edinburgh), Hochman, Michael (Jerusalem), Iliopoulou, Marina (Birmingham), Iosevich, Alexander (Rochester), Johnsrude, Ben (Los Angeles), Keleti, Tamás (Budapest), Kovac, Vjekoslav (Zagreb), Laba, Izabella (Vancouver), Li, Zane (Madison), Lin, Yu-Hsiang (Bonn), Lin, Zuo (La Jolla), Lindenstrauss, Elon (Jerusalem), Liu, Bochen (Shenzhen, Guangdong Province), Maldague, Dominique (Cambridge), Mohammadi, Amir (La Jolla), Nadjimzadah, Arian (Los Angeles), Oh, Changkeun (Cambridge), O'Regan, William (Coventry), Orponen, Tuomas (Jyväskylä), Ou, Yumeng (Philadelphia), Pramanik, Malabika (Vancouver), Raz, Orit (Jerusalem), Rogers, Keith M. (Madrid), Rutar, Alex (St. Andrews), Seeger, Andreas (Madison), Shmerkin, Pablo (Vancouver), Srivastava, Rajula (Bonn), Stovall, Betsy (Madison), Streck, Lauritz (Cambridge), Tammen, Sarah (Cambridge), Thiele, Christoph (Bonn), Wang, Hong (Los Angeles), Wang, Zhiren (University Park), Wu, Meng (Oulu), Wu, Shukun (Pasadena), Yavicoli, Alexia (Vancouver), Zahl, Joshua (Vancouver), Zhang, Ruixiang (Berkeley)

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| **11.06. – 16.06.2023** | **Machine Learning for Science: Mathematics at the Interface of Data-driven and Mechanistic Modelling** |
| Organizers: | Neil Lawrence, Cambridge UK |
| | Jessica Montgomery, Cambridge UK |
| | Bernhard Schölkopf, Tübingen |

## Abstract

Rapid progress in machine learning is enabling scientific advances across a range of disciplines. However, the utility of machine learning for science remains constrained by its current inability to translate insights from data about the dynamics of a system to new scientific knowledge about why those dynamics emerge, as traditionally represented by physical modelling. Mathematics is the interface that bridges data-driven and physical models of the world and can provide a foundation for delivering such knowledge. This workshop convened researchers working across domains with a shared interest in mathematics, machine learning, and their application in the sciences, to explore how tools of mathematics can help build machine learning tools for scientific discovery.

## Participants

Bah, Bubacarr (Banjul), Benson, Vitus (Jena), Bosch, Nathanael (Tübingen), Büttner, Maren (South San Francisco), Cabrera Pacheco, Armando Jose (Tübingen), Camps-Valls, Gustau (Valencia), Cohrs, Kai-Hendrik (Valencia), Díaz, Emiliano (Valencia), Dietterich, Thomas (Corvallis), Ek, Carl Henrik (Cambridge), Eyring, Veronika (Weßling), Fischer, Asja (Bochum), Gregory, Wilson (Baltimore), Hennig, Philipp (Tübingen), Igel, Christian (København), Kappen, Bert (Nijmegen), Kaski, Samuel (Manchester), Katt, Sammie (Aalto), Kilbertus, Niki (Garching bei München), Kühbacher, Birgit (Oberpfaffenhofen-Wessling), Lalchand, Vidhi (Cambridge), Lawrence, Neil (Cambridge), Lindsey, Michael J. (Berkeley), Louppe, Gilles (Liège), Lu, Nan (Tübingen), Machuve, Dina (Arusha), Macke, Jakob (Tübingen), Mishra, Challenger (Cambridge), Montgomery, Jessica (Cambridge), Müller, Klaus-Robert (Berlin), Peters, Jonas (Zürich), Pfister, Niklas (København), Rahaman, Nasim (Tübingen), Reichstein, Markus (Jena), Reimers, Christian (Jena), Schölkopf, Bernhard (Tübingen), Weichwald, Sebastian (København), Wilkinson, Richard (Nottingham), Williamson, Bob (Tübingen), Winkler, Alexander (Jena)

**18.06. – 23.06.2023**  **Recent Trends in Algebraic Geometry**
Organizers:  Olivier Debarre, Paris
Gavril Farkas, Berlin
Yuri Tschinkel, New York
Ravi Vakil, Stanford

## Abstract

Algebraic geometry has grown into a broad subject, with many different streams often advancing quite independently of each other. Nonetheless, important advances have often come from visionary applications of ideas in one part of the subject to another. This workshop brought together leaders and future leaders in different areas of the subject, centered on geometric methods or geometric problems. It also brought together groups from different regions of the globe, in order to bridge communities of different sorts, and help new ideas quickly spread throughout algebraic geometry. Some of the best freshly-minted algebraic geometers were deliberately invited, so that they could meet their peers from around the world and learn about different perspectives on the subject.

## Participants

Addington, Nicolas (Eugene), Agostini, Daniele (Tübingen), Amerik, Ekaterina (Moscow), Bakker, Benjamin (Chicago), Beauville, Arnaud (Nice), Benoist, Olivier (Paris), Blanc, Jérémy (Basel), Brion, Michel (Gières), Canning, Samir (Zürich), Cantat, Serge (Rennes), Coskun, Izzet (Chicago), Debarre, Olivier (Paris), Eisenbud, David (Berkeley), Farkas, Gavril (Berlin), Gachet, Cecile (Berlin), Gibney, Angela (Philadelphia), Hartmann, Julia (Philadelphia), Hassett, Brendan (Providence), Holmes, David (Leiden), Hoskins, Victoria (Nijmegen), Hulek, Klaus (Hannover), Huybrechts, Daniel (Bonn), Kresch, Andrew (Zürich), Kuznetsov, Alexander (Moscow), Larson, Eric (Providence), Larson, Hannah (Berkeley), Lehn, Christian (Chemnitz), Lelli-Chiesa, Margherita (Roma), Lian, Carl (Berlin), Litt, Daniel (Toronto), Manivel, Laurent (Toulouse), Melo, Margarida (Roma), Murayama, Takumi (West Lafayette), Ortega, Angela (Berlin), Pandharipande, Rahul (Zürich), Payne, Sam (Austin), Perry, Alexander (Ann Arbor), Ranganathan, Dhruv (Cambridge), Rojas, Andrés (Berlin), Rudenko, Daniil (Chicago), Schreieder, Stefan (Hannover), Schreyer, Frank-Olaf (Saarbrücken), Song, Jieao (Berlin), Stenger, Isabel (Saarbrücken), Tanimoto, Sho (Nagoya), Torelli, Sara (Hannover), Totaro, Burt (Los Angeles), Tschinkel, Yuri (New York), Vakil, Ravi (Stanford), Verra, Alessandro (Roma), Vogt, Isabel (Providence), Voisin, Claire (Paris)

**25.06. – 30.06.2023**   **Algebraische Zahlentheorie**
Organizers:                        Guido Kings, Regensburg
                                         Ramdorai Sujatha, Vancouver
                                         Eric Urban, New York
                                         Otmar Venjakob, Heidelberg

## Abstract

Algebraic Number Theory is an area of Mathematics that has a legendary history and lies at the interface of Algebra and Number Theory. The last four decades of the last century witnessed rapid developments that led to connections with other areas such as Algebraic Geometry, Representation Theory, Harmonic Analysis, Iwasawa theory, to mention a few. In the last two decades, emergent areas such as p-adic Analysis, p-adic Geometry (p is a prime number) led to additional new facets. More recent developments in Arithmetic Geometry via Perfectoid Spaces and other emerging areas have added newer facets. The lectures in this workshop present current developments in these diverse areas.

## Participants

Andreatta, Fabrizio (Milano), Ardakov, Konstantin (Oxford), Bannai, Kenichi (Yokohama), Berger, Laurent (Lyon), Bertolini, Massimo (Essen), Bosco, Guido (Bonn), Bruinier, Jan Hendrik (Darmstadt), Burungale, Ashay A. (Pasadena), Büyükboduk, Kazim (Dublin), Caraiani, Ana (London), Castella, Francesc (Santa Barbara), Colmez, Pierre (Paris), Cornut, Christophe (Paris), Dospinescu, Gabriel (Lyon), Fintzen, Jessica (Bonn), Flach, Matthias (Pasadena), Grossi, Giada (Villetaneuse), Gulotta, Daniel (Boston), Hsieh, Ming-Lun (Taipei), Huber-Klawitter, Annette (Freiburg i. Br.), Hübner, Katharina (Heidelberg), Kakde, Mahesh (Bangalore, Bengaluru), Kezuka, Yukako (Paris), Kings, Guido (Regensburg), Kisin, Mark (Cambridge), Kobayashi, Shinichi (Fukuoka), Kriz, Daniel (Paris), Kufner, Han-Ung (Regensburg), Lang, Jaclyn (Philadelphia), Lee, Pak-Hin (Coventry), Lee, Yu-Sheng (New York), Lei, Antonio (Ottawa), Liu, Zheng (Santa Barbara), Loeffler, David A. (Coventry), Longo, Matteo (Padova), Ludwig, Judith (Heidelberg), Mundy, Samuel (Princeton), Niziol, Wieslawa (Paris), Paskunas, Vytautas (Essen), Ponsinet, Gautier (Heidelberg), Prader, Lukas (Regensburg), Prasanna, Kartik (Ann Arbor), Rodriguez Camargo, Juan Esteban (Bonn), Schneider, Marvin (Heidelberg), Schneider, Peter (Münster), Sharifi, Romyar (Los Angeles), Sprang, Johannes (Essen), Steingart, Rustam (Heidelberg), Stix, Jakob (Frankfurt am Main), Sujatha, Ramdorai (Vancouver), Sweeting, Naomi (Cambridge), Urban, Eric (New York), Venjakob, Otmar (Heidelberg), Wan, Xin (Beijing), Witzelsperger, Max (Heidelberg), Xu, Yujie (Cambridge), Zhang, Wei (Cambridge), Bergeron, Nicolas (Paris)
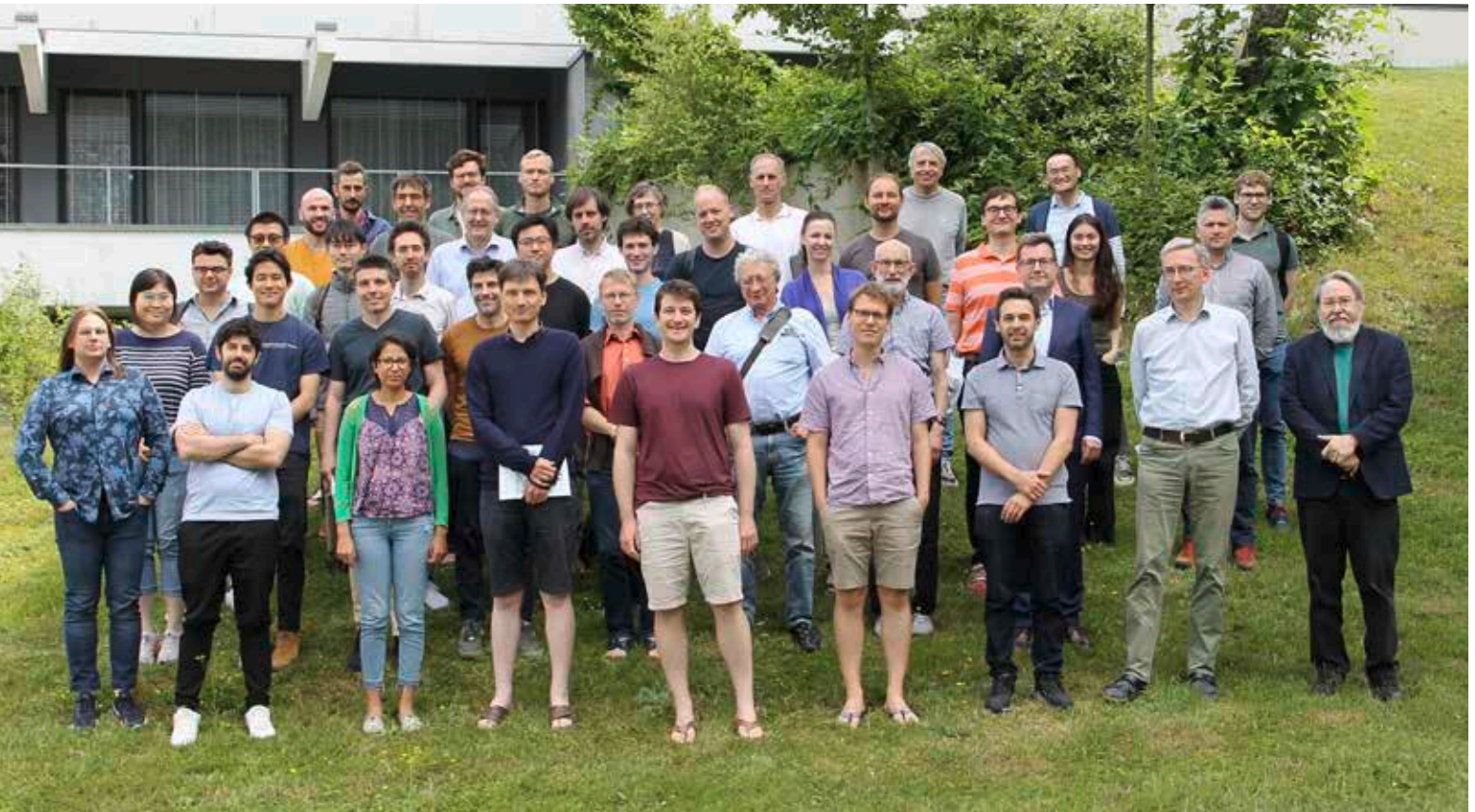
**02.07. – 07.07.2023**   **Differentialgeometrie im Grossen**
Organizers:   Richard Bamler, Berkeley
Otis Chodosh, Stanford
Urs Lang, Zürich
Ben Weinkove, Evanston

## Abstract

Over the past several decades, classical differential geometry has undergone a remarkable expansion, helped by the integration of tools and insights from neighboring fields like partial differential equations, complex analysis, and geometric topology. In keeping with the spirit of previous gatherings, this meeting aimed to bridge the gaps between researchers working in seemingly disparate subfields of differential geometry, illuminating the connections that unite them. Amongst other things, this meeting was centered around the theme of scalar curvature, which has recently emerged as a fundamental element across various fields, including differential geometry, metric geometry, topology, and complex geometry. This shared topic presented an ideal opportunity for scholars from these distinct areas to convene, discuss their individual progress, and foster a vibrant exchange of ideas.

## Participants

Bamler, Richard (Berkeley), Biquard, Olivier (Paris), Botvinnik, Boris (Eugene), Burkhardt-Guim, Paula (New York), Carlotto, Alessandro (Povo), Cecchini, Simone (College Station), Cederbaum, Carla (Tübingen), Chen, Eric (Berkeley), Chen, Shuli (Stanford), Chodosh, Otis (Stanford), Conlon, Ronan (Richardson), Deruelle, Alix (Paris), Frenck, Georg (Augsburg), Guo, Bin (Newark), Hamenstädt, Ursula (Bonn), Hanke, Bernhard (Augsburg), Kleiner, Bruce (New York), Konno, Hokuto (Cambridge), Lang, Urs (Zürich), LeBrun, Claude (Stony Brook), Liokumovich, Yevgeny (Toronto), Lott, John (Berkeley), Mantoulidis, Christos (Houston), Máximo, Davi (Philadelphia), Neumayer, Robin (Pittsburgh), Ozuch, Tristan (Cambridge), Pan, Chung-Ming (Toulouse), Perales, Raquel (Oaxaca de Juárez), Rosenberg, Jonathan M. (College Park), Sauer, Roman (Karlsruhe), Schick, Thomas (Göttingen), Schulze, Felix (Coventry), Semola, Daniele (Zürich), Sesum, Natasa (Piscataway), Sjöström Dyrefelt, Zakarias (Aarhus), Song, Jian (Piscataway), Spotti, Cristiano (Aarhus), Stern, Daniel (Chicago), Topping, Peter M. (Coventry), Waldron, Alex (Madison), Weinkove, Ben (Evanston), Wiemeler, Michael (Münster), Wiygul, David (Zürich), Yudowitz, Louis (London), Zeidler, Rudolf (Münster)

**09.07. – 14.07.2023**                **Dynamische Systeme**
Organizers:                             Marie-Claude Arnaud, Paris
Michael Hutchings, Berkeley
Vadim Kaloshin, Klosterneuburg

## Abstract

This workshop continues a series of workshops whose current format originated in 1981 under then-organizers Moser and Zehnder, and whose latest iteration took place in July 2023. The general goal of this series of workshops is to discuss the latest developments in the field of dynamical systems, broadly construed, and its connections with neighboring areas of mathematics such as differential geometry, partial differential equations, and more recently contact and symplectic geometry. We continued this tradition, bringing in new participants working in areas of dynamical systems and its connections with other areas of mathematics that are currently highly active and/or showing great promise for future development. Key focus areas for the 2023 workshop include spectral rigidity for planar domains, chaotic and oscillatory motions in celestial mechanics, conformal symplectic dynamics, and relations between dynamics.

## Participants

Abbondandolo, Alberto (Bochum), Albers, Peter (Heidelberg), Arnaud, Marie-Claude (Paris), Baldomá Barraca, Immaculada (Barcelona), Benedetti, Gabriele (Amsterdam), Berger, Pierre (Paris), Bramham, Barney (Bochum), Callis, Keagan (College Park), Chaidez, Julian (Princeton), Cieliebak, Kai (Augsburg), Colin, Vincent (Nantes), Cristofaro-Gardiner, Daniel (College Park), Crovisier, Sylvain (Orsay), Drach, Kostiantyn (Klosterneuburg), Edtmair, Oliver (Berkeley), Erchenko, Alena (Chicago), Féjoz, Jacques (Paris), Fierobe, Corentin (Klosterneuburg), Florio, Anna (Paris), Forni, Giovanni (College Park), Guardia Munarriz, Marcel (Barcelona), Hryniewicz, Umberto L. (Aachen), Hutchings, Michael (Berkeley), Irie, Kei (Kyoto), Kaloshin, Vadim Y. (Klosterneuburg), Koval, Illya (Klosterneuburg), Krikorian, Raphaël (Palaiseau), Le Calvez, Patrice (Paris), Massetti, Jessica Elisa (Roma), Miranda, Eva (Barcelona), Nelson, Jo (Houston), Pan, Yi (Klosterneuburg), Polterovich, Leonid V. (Ramat Aviv, Tel Aviv), Prasad, Rohil (Princeton), Rechtman, Ana (Strasbourg), Seara, Tere (Barcelona), Seyfaddini, Sobhan (Paris), Shelukhin, Egor (Montréal), Sorrentino, Alfonso (Roma), Su, Xifeng (Beijing), Tanny, Shira (Princeton), Terracini, Susanna (Torino), Turaev, Dmitry V. (London), van Koert, Otto (Seoul), Viterbo, Claude M. (Orsay), Weiler, Morgan (Ithaca), Zavidovique, Maxime (Paris)

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|---|---|
| **16.07. – 21.07.2023** | **Transport and Scale Interactions in Geophysical Flows** |
| Organizers: | Christian L. E. Franzke, Busan |
| | Marcel Oliver, Ingolstadt |
| | Jens Rademacher, Hamburg |
| | Irina Rypina, Woods Hole |

## Abstract

This interdisciplinary workshop brought together researchers working on different aspects of transport and scale interactions across the spectrum of geophysical fluid dynamics: geometry and computation of transport and exchange processes in geophysical flows, Lagrangian coherent structures, (geo-strophic) turbulence, nonlinear waves and coherent structures in the Eulerian description of fluids, and stochastic methods in multiscale systems. Each of these topics have their own vibrant communities as well as well-established and emerging connections. This meeting aimed to bridge across the entire span of topics from a dynamical systems perspective, and to connect classical approaches with new developments in data-driven modeling and stochastic modeling.

## Participants

Bagaeva, Ekaterina (Bremen), Balasuriya, Sanjeeva (Adelaide), Barkley, Dwight (Coventry), Beron-Vera, Francisco Javier (Miami), Budanur, Nazmi Burak (Dresden), Bühler, Oliver (New York), Chekroun, Michael D. (Los Angeles), Curbelo, Jezabel (Barcelona), Dotzel, Michael (Woods Hole), Encinas Bartos, Alex (Zürich), Frank, Jason E. (Utrecht), Franzke, Christian (Busan), Froyland, Gary (Sydney), Geyer, Anna (Delft), Gottwald, Georg A. (Sydney), Harlim, John (University Park), Hittmeir, Sabine (Wien), Holm, Darryl D. (London), Holst, Paul (Bremen), Huang, Yu (Ottobrunn), Huntley, Helga (Glassboro), Ionescu-Kruse, Delia (Bucharest), Jäger, Janin (Eichstätt), Junge, Oliver (Garching bei München), Juricke, Stephan (Bremen), Keßeböhmer, Marc (Bremen), Klein, Rupert (Berlin), Knobloch, Edgar (Berkeley), Kutsenko, Anton (Ingolstadt), Mancho, Ana Maria (Madrid), Meacham, Jamie (London), Meiss, Jim (Boulder), Meyer, David (Münster), Miron, Philippe (Tallahassee), Noethen, Florian (Hamburg), Olascoaga, Josefina (Miami), Oliver, Marcel (Ingolstadt), Ovsyannikov, Ivan (Bremen), Padberg-Gehle, Kathrin (Lüneburg), Rademacher, Jens (Hamburg), Resseguier, Valentin (Rennes), Rogers, Mason (Woods Hole), Rypina, Irina (Woods Hole), Satpathy, Susmit Subhransu (Busan), Schumacher, Jörg (Ilmenau), Shevchenko, Radomyra (Hamburg), Thiffeault, Jean-Luc (Madison), Timofeyev, Ilya (Houston), Tiofack Kenfack, Marc Aurele (Ingolstadt), van Veen, Lennaert (Oshawa), Wingate, Beth (Exeter), Wormell, Caroline (Canberra)

| 23.07. – 28.07.2023 | **Partial Differential Equations** |
| Organizers: | Guido De Philippis, New York |
| | Ailana M. Fraser, Vancouver |
| | Felix Schulze, Coventry |

## Abstract

This workshop focused on nonlinear elliptic and parabolic partial differential equations, touching topics such as geometric flows, geometric variational problems and minimal surfaces, free boundaries, and geometric measure theory. The meeting was attended by 45 participants with broad geographic representation. The program consisted of 21 talks and left sufficient time for discussions. A main theme of the workshop was around PDE related to geometric and variational problems.

## Participants

Bellettini, Costante (London), Carlotto, Alessandro (Povo), Choi, Beomjun (Pohang), Choi, Kyeongsu (Seoul), Daniels-Holgate, Joshua (Coventry), de Carvalho Freitas, Allan George (Torino), del Pino, Manuel (Bath), De Philippis, Guido (New York), De Rosa, Antonio (College Park), Fraser, Ailana M. (Vancouver), Guerra, Andre (Zürich), Haslhofer, Robert (Toronto), Hirsch, Jonas (Leipzig), Huisken, Gerhard (Tübingen), Johne, Florian (New York), Lai, Yi (Stanford), Lamm, Tobias (Karlsruhe), Laux, Tim (Bonn), Leder, Roee (Jerusalem), Li, Yangyang (Chicago), Lynch, Stephen (London), Mäder-Baumdicker, Elena (Darmstadt), Maggi, Francesco (Austin), Malchiodi, Andrea (Pisa), Mantoulidis, Christos (Houston), Mondino, Andrea (Oxford), Mooney, Connor (Irvine), Musso, Monica (Bath), Nguyen, Huy (London), Otto, Felix (Leipzig), Payne, Alec (Durham), Peachey, Luke (Coventry), Rivière, Tristan (Zürich), Rupflin, Melanie (Oxford), Saez, Mariel (Santiago), Schulze, Felix (Coventry), Stolarski, Maxwell (Coventry), Stuvard, Salvatore (Milano), Tonegawa, Yoshihiro (Tokyo), Topping, Peter M. (Coventry), Tsang, Tin Yau (Irvine), Velichkov, Bozhidar (Pisa), Wang, Guofang (Freiburg i. Br.), Wang, Lu (New Haven), Zhao, Zihui (Chicago)

**30.07. – 04.08.2023**      **Teichmüller Theory: Classical, Higher, Super and Quantum**

Organizers:

Ken'ichi Ohshika, Tokyo
Athanase Papadopoulos, Strasbourg
Robert C. Penner, Bures-sur-Yvette
Anna Wienhard, Heidelberg

## Abstract

Teichmüller spaces play a major role in many areas of mathematics and physical science. The subject of the conference was recent developments of Teichmüller theory with its different ramifications that include the classical, the higher, the super and the quantum aspects of the theory. The workshop was well attended with 47 participants with broad geographic representation from all continents.

## Participants

A'Campo, Norbert (Basel), Alessandrini, Daniele (New York), Baba, Shinpei (Osaka), Baik, Hyungryul (Daejeon), Basmajian, Ara (New York), Beyrer, Jonas (Bonn), Bourque, Andrea (Baton Rouge), Burger, Marc (Zürich), Chekhov, Leonid O. (East Lansing), Collier, Brian (Riverside), Dai, Xian (Bochum), Disarlo, Valentina (Heidelberg), Erlandsson, Viveka (Bristol), Farre, James (Heidelberg), Fenyes, Aaron (Rockaway (UNITED STATES)), Garoufalidis, Stavros (Shenzhen, Guangdong Province), Gongopadhyay, Krishnendu (Punjab), Greenberg, Zachary (Heidelberg), Hamano, Sachiko (Kyoto), Hamenstädt, Ursula (Bonn), Heller, Sebastian (Beijing), Huang, Yi (Beijing), Iozzi, Alessandra (Zürich), Ishibashi, Tsukasa (Sendai), Kashaev, Rinat M. (Genève), Kaufman, Dani (København), Kaufmann, Ralph (West Lafayette), Kawazumi, Nariya (Tokyo), Kim, Sang-hyun (Seoul), Kim, Youngju (Seoul), Koberda, Thomas Michael (Charlottesville), Kuno, Yusuke (Tokyo), Lee, Gye-Seon (Seoul), Li, Qiongling (Tianjin), Maret, Arnaud (Paris), Miyachi, Hideki (Kanazawa), Möller, Martin (Frankfurt am Main), Norbury, Paul (Melbourne), Ohshika, Ken'ichi (Tokyo), Papadopoulos, Athanase (Strasbourg), Parreau, Anne (Grenoble), Penner, Robert C. (Bures-sur-Yvette), Rogozinnikov, Eugen (Strasbourg), Sakasai, Takuya (Tokyo), Seppi, Andrea (Gières), Shapiro, Michael (East Lansing), Su, Weixu (Guangdong, P.R. of China), Sun, Zhe (Hefei), Suzuki, Masaaki (Tokyo), Thomas, Alexander (Heidelberg), Warakkagun, Sangsan (Beijing), Wienhard, Anna Katharina (Heidelberg), Yamada, Sumio (Tokyo), Zeinalian, Mahmoud (Bronx), Zeytin, Ayberk (Tuzla/Istanbul)

**06.08. – 11.08.2023**

Organizers:

**Homotopy Theory**

Jesper Grodal, Kobenhavn

Mike Hill, Los Angeles

Birgit Richter, Hamburg

## Abstract

The workshop brought together experts in homotopy theory from many areas, including chromatic homotopy theory, algebraic K-theory, derived algebra and equivariant homotopy theory. We had a lecture series on the recent disproof of the telescope conjecture. In addition to a total of 24 research talks we had two gong-shows where participants presented their research in 10-minute talks. A focus was the recent announcement in Oxford in June of the disproof of the telescope conjecture which has a huge impact on our view of the structure of chromatic homotopy theory.

## Participants

Bachmann, Tom (Mainz), Balmer, Paul (Los Angeles), Barthel, Tobias (Bonn), Ben Moshe, Shay (Jerusalem), Bergner, Julie (Charlottesville), Bobkova, Irina (College Station), Bohmann, Anna Marie (Nashville), Brantner, Lukas B. (Oxford), Burklund, Robert (København), Carmeli, Shachar (København), Castellana Vila, Natàlia (Bellaterra, Barcelona), Davies, Jack (Bonn), Greenlees, John (Coventry), Grodal, Jesper (København), Hahn, Jeremy (Cambridge), Haugseng, Rune (Trondheim), Hausmann, Markus (Stockholm), Heard, Drew K. (Gloshaugen), Heuts, Gijs (Utrecht), Hill, Michael (Los Angeles), Hilman, Kaif (Bonn), Kedziorek, Magdalena (Nijmegen), Kong, Hana Jia (Princeton), Krause, Achim (Münster), Land, Markus (München), Lesh, Kathryn (Schenectady), Levy, Ishan (Cambridge), Lundemo, Tommy (Wuppertal), May, Clover (Trondheim), Meier, Lennart (Utrecht), Merling, Mona (Philadelphia), Naumann, Niko (Regensburg), Ormsby, Kyle M. (Portland), Patchkoria, Irakli (Aberdeen), Ponto, Kathleen (Lexington), Pstragowski, Piotr (Cambridge), Ramzi, Maxime (København), Randal-Williams, Oscar (Cambridge), Raptis, Georgios (Regensburg), Ravenel, Douglas (Rochester), Richter, Birgit (Hamburg), Sagave, Steffen (Nijmegen), Schlank, Tomer (Jerusalem), Schwede, Stefan (Bonn), Shi, XiaoLin (Danny) (Seattle), Stapleton, Nat (Lexington), Stojanoska, Vesna (Urbana), Whitehouse, Sarah (Sheffield), Xu, Zhouli (La Jolla), Yuan, Allen (Princeton), Zhang, Adela (YiYu) (Cambridge), Zou, Foling (Beijing)

**13.08. – 18.08.2023**

Organizers:

**Mixed-integer Nonlinear Optimization: A Hatchery for Modern Mathematics**

Leo Liberti, Palaiseau
Sebastian Sager, Magdeburg
Angelika Wiegele, Klagenfurt

## Abstract

Mixed-integer nonlinear programming (MINLP) is concerned with finding optimal solutions to mathematical formulations of optimization problems combining discrete and nonlinear phenomena. The scientific program was organized around three areas: convex envelopes and relaxation hierarchies, mixed-integer optimal control, and current trends. These topics were addressed with a variety of tutorials, talks, and short research announcements.

## Participants

Ahmadi, Amir Ali (Princeton), Anstreicher, Kurt M. (Iowa City), Bekker, Bram (Delft), Belotti, Pietro (Milano), Bodur Cevik, Merve (Toronto), Brosch, Daniel (Klagenfurt), Buchheim, Christoph (Dortmund), Cebulla, Dominik H. (Braunschweig), Cerulli, Martina (Fisciano), Cifuentes, Diego (Atlanta), de Klerk, Etienne (Tilburg), Dey, Santanu S. (Atlanta), Diehl, Moritz (Freiburg i. Br.), Fampa, Marcia (Rio de Janeiro), Fischer, Anja (Dortmund), Fischer, Frank (Mainz), Galli, Laura (Pisa), Hante, Falk M. (Berlin), Helmberg, Christoph (Chemnitz), Henke, Dorothee (Dortmund), Kaibel, Volker (Magdeburg), Khajavirad, Aida (Bethlehem), Kilinc-Karzan, Fatma (Pittsburgh), Kirches, Christian (Braunschweig), Kronqvist, Jan (Stockholm), Küçükyavuz, Simge (Evanston), Lee, Jon (Ann Arbor), Leyffer, Sven (Argonne), Liberti, Leo (Palaiseau), Liers, Frauke (Erlangen), Linderoth, Jeffrey T. (Madison), Manns, Paul (Dortmund), Martensen, Julius (Magdeburg), Merkert, Maximilian (Braunschweig), Misener, Ruth (London), Pfetsch, Marc (Darmstadt), Plate, Christoph (Magdeburg), Potschka, Andreas (Clausthal-Zellerfeld), Puges, Diane (Klagenfurt), Rolfes, Jan (Erlangen), Rösel, Florian (Erlangen), Sager, Sebastian (Magdeburg), Sahinidis, Nick (Atlanta), Schwiddessen, Jan (Klagenfurt), Sotirov, Renata (Tilburg), Tacchi, Matteo (Saint-Martin-d'Hères), Tawarmalani, Mohit (West Lafayette), Vallentin, Frank (Köln), Wiegele, Angelika (Klagenfurt), Xu, Liding (Palaiseau), Zhao, Shudian (Stockholm)

**20.08. – 25.08.2023**          **Geometric Spectral Theory**
Organizers:                              Asma Hassannezhad, Bristol
                                              Luc Hillairet, Orléans
                                              Konstantin Pankrashkin, Oldenburg
                                              Iosif Polterovich, Montréal

## Abstract
Spectral geometry is a rapidly developing field with new classes of operators, boundary value problems and geometric objects arising in different applications. At the same time, classical problems continue gaining novel flavors. The main focus of the workshop was on some of the most significant recent developments in geometric spectral theory including geometry of eigenvalues and eigenfunctions, singular spectral problems, and spectral optimization. The talks were complemented by three thematic open problem sessions on the main topics of the meeting.

## Participants
Aldana, Clara Lucia (Barranquilla), Baskin, Dean (College Station), Behrndt, Jussi (Graz), Berge, Stine Marie (Hannover), Bilyk, Dmitriy (Minneapolis), Bonnet-Bendhia, Anne-Sophie (Palaiseau), Bucur, Dorin (Le Bourget-du-Lac), Chakradhar, Tirumala (Bristol), Charron, Philippe (Genève), Colbois, Bruno (Neuchâtel), Exner, Pavel (Rež), Farinelli, Sara (Paris), Fedosova, Ksenia (Freiburg i. Br.), Frank, Rupert L. (München), Freitas, Pedro (Lisboa), Funano, Kei (Sendai), Girouard, Alexandre (Québec), Gittins, Katie (Durham), Gordon, Carolyn S. (Hanover), Grieser, Daniel (Oldenburg), Hassannezhad, Asma (Bristol), Helffer, Bernard (Nantes), Henrot, Antoine (Vandoeuvre-lès-Nancy), Hillairet, Luc (Orléans), Judge, Christopher (Bloomington), Karpukhin, Mikhail (London), Lagacé, Jean (London), Laugesen, Richard S. (Urbana), Levitin, Michael (Reading), Logunov, Aleksandr (Genève), Lotoreichik, Vladimir (Rež), Malinnikova, Eugenia (Stanford), Mangoubi, Dan (Jerusalem), Mayboroda, Svitlana (Minneapolis), Metras, Antoine (Bristol), Mondal, Sugata (Reading), Nigam, Nilima (Burnaby), Nitsch, Carlo (Napoli), Ourmières-Bonafos, Thomas (Marseille), Pankrashkin, Konstantin (Oldenburg), Parnovski, Leonid (London), Petrides, Romain (Paris), Polterovich, Iosif (Montréal), Post, Olaf (Trier), Rizzi, Luca (Trieste), Rossi, Tommaso (Bonn), Sher, David (Chicago), Siffert, Anna (Münster), Steinerberger, Stefan (Seattle), Trombetti, Cristina (Napoli), van den Berg, Michiel (Bristol), Vogel, Marco (Oldenburg), Weich, Tobias (Paderborn)

**27.08. – 01.09.2023**          **Aspects of Aperiodic Order**
Organizers:                              Michael Baake, Bielefeld
                                              María Isabel Cortez, Santiago de Chile
                                              David Damanik, Houston
                                              Nicolae Strungaru, Edmonton

## Abstract

The theory of aperiodic order expanded and developed significantly since the discovery of quasi-crystals, and continues to bring many mathematical disciplines together. The focus of this workshop was on harmonic analysis and spectral theory, dynamical systems and group actions, Schrödinger operators, and their roles in aperiodic order - with links into a full range of problems from number theory to operator theory.

## Participants

Akiyama, Shigeki (Tsukuba), Arnoux, Pierre (Marseille), Baake, Michael (Bielefeld), Band, Ram (Haifa), Beckus, Siegfried (Potsdam), Berthé, Valérie (Paris), Bustos, Álvaro (Macul, Santiago), Cecchi-Bernales, Paulina (Santiago), Coons, Michael (Chico), Cortez, Maria Isabel (Santiago), Damanik, David (Houston), Donoso, Sebastián (Santiago), Embree, Mark (Blacksburg), Emilsdottir, Iris (Houston), Feichtinger, Hans Georg (Wien), Fillman, Jake (San Marcos), Frank, Natalie P. (Poughkeepsie), Fuhrmann, Gabriel (Durham), Gähler, Franz (Bielefeld), García-Ramos, Felipe (San Luis Potosí), Gohlke, Philipp (Lund), Gorodetski, Anton (Irvine), Greenfeld, Rachel (Princeton), Hartnick, Tobias (Karlsruhe), Haynes, Alan (Houston), Jäger, Tobias (Jena), Kellendonk, Johannes (Villeurbanne), Keller, Gerhard (Erlangen), Klick, Anna (Edmonton), Korfanty, Emily Rose (Edmonton), Kra, Bryna (Evanston), Lagarias, Jeffrey C. (Ann Arbor), Lee, Jeong-Yup (Gangwon-do), Lenz, Daniel (Jena), Lukina, Olga (Leiden), Maass, Alejandro (Región Metropolitana de Santiago), Manibo, Neil (Bielefeld), Mazác, Jan (Bielefeld), Mei, May (Granville), Miro, Eden Delight (Quezon City), Mitchell, Andrew (Birmingham), Petite, Samuel (Amiens), Pogorzelski, Felix (Leipzig), Richard, Christoph (Erlangen), Rust, Dan (Milton Keynes), Sadun, Lorenzo A. (Austin), Schindler, Tanja (Wien), Sing, Bernd (Bridgetown), Solomyak, Boris (Ramat-Gan), Strungaru, Nicolae (Edmonton), Treviño, Rodrigo (College Park), Walton, Jamie (Nottingham), Whittaker, Michael (Glasgow), Yassawi, Reem (London)

| 03.09. – 08.09.2023 | **Classical and Quantum Mechanical Models of Many-Particle Systems** |
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| Organizers: | Klemens Fellner, Graz |
| | Isabelle Gallagher, Paris |
| | Pierre-Emmanuel Jabin, University Park |

**Abstract**

The workshop focused on the collective behavior of many-particle systems in various application fields: physics (gas dynamics, plasmas, quantum mechanics), mathematical biology (cell mobility, evolution of trait-structured species), and social sciences (wealth distribution). This includes famous models such as the Boltzmann equation of gas dynamics, Vlasov equation for plasmas, Fokker-Planck equations, Smoluchowski and related equations, Keller-Segel system of chemotaxis.

**Participants**

Alonso, Ricardo J. (Doha), Arnold, Anton (Wien), Ayi, Nathalie (Paris), Bodineau, Thierry (Bures-sur-Yvette), Borsoni, Thomas (Paris), Brenier, Yann (Orsay), Bresch, Didier (Le Bourget-du-Lac), Brocchieri, Elisabetta (Graz), Carlen, Eric A. (Piscataway), Carrillo de la Plata, Jose Antonio (London), Degond, Pierre (Toulouse), Demattè, Elena (Bonn), Desvillettes, Laurent (Paris), Dolmaire, Théophile (Bonn), Duerinckx, Mitia (Bruxelles), Einav, Amit (Durham), Escobedo, Miguel (Lejona), Esposito, Raffaele (Roma), Fellner, Klemens (Graz), Gabetta, Ester (Pavia), Gallagher, Isabelle (Paris), Gamba, Irene M. (Austin), Golse, Francois (Palaiseau), Guo, Yan (Providence), Herau, Frederic (Nantes), Iacobelli, Mikaela (Zürich), Jabin, Pierre Emmanuel (University Park), Jüngel, Ansgar (Wien), Le Bris, Pierre (Bures-sur-Yvette), Li, Qin (Madison), Li, Yue (Wien), Lods, Bertrand (Torino), Marra, Rossana (Roma), Mazzucato, Anna (University Park), Mecherbet, Amina (Paris), Mouhot, Clément (Cambridge), Negulescu, Claudia (Toulouse), Niethammer, Barbara (Bonn), Nouri, Anne (Marseille), Paul, Thierry (Paris), Pavic-Colic, Milana (Novi Sad), Pickl, Peter (Tübingen), Pulvirenti, Mario (Roma), Raoul, Gael (Palaiseau), Saffirio, Chiara (Basel), Saint-Raymond, Laure (Bures-sur-Yvette), Schlein, Benjamin (Zürich), Scholten, Jens (Bonn), Simonella, Sergio (Roma), Soler, Juan (Granada), Strain, Robert M. (Philadelphia), Taskovic, Maja (Atlanta), Toshpulatov, Gayrat (Wien), Wolfram, Marie-Therese (Coventry)

| 10.09. – 15.09.2023 | **Many-Body Quantum Systems** |
| Organizers: | Christian Hainzl, München |
| | Benjamin Schlein, Zürich |
| | Robert Seiringer, Klosterneuburg |
| | Simone Warzel, München |

## Abstract

This workshop brought together experts on the analysis of quantum many-body problems and quantum statistical mechanics, with the goal of discussing the state-of-the-art of the field, recent developments as well as challenges for the future. The main topics of discussion concerned the equilibrium and dynamical behavior of (bosonic or fermionic) quantum gases, quantum spin systems, as well as quantum field theory models like the Nelson or Fröhlich model.

## Participants

Bachmann, Sven (Vancouver), Basti, Giulia (L'Aquila), Benedikter, Niels (Milano), Boßmann, Lea (München), Brennecke, Christian (Bonn), Brooks, Morris (Zürich), Caporaletti, Marco (Zürich), Caraci, Cristina (Zürich), Cenatiempo, Serena (L'Aquila), Christiansen, Martin Ravn (München), Correggi, Michele (Milano), de Roeck, Wojciech (Leuven), Deuchert, Andreas (Zürich), Fournais, Soeren (København), Fraas, Martin (Davis), Giacomelli, Emanuela (München), Gontier, David (Paris), Graf, Gian Michele (Zürich), Griesemer, Marcel (Stuttgart), Haberberger, Florian (München), Hainzl, Christian (München), Jauslin, Ian (Piscataway), Joye, Alain (Grenoble), Knowles, Antti (Genève), Lampart, Jonas (Dijon), Lemm, Marius (Tübingen), Lewin, Mathieu (Paris), Lundholm, Douglas (Uppsala), Manai, Chokri (Garching bei München), Napiórkowski, Marcin (Warszawa), Ogata, Yoshiko (Tokyo), Olgiati, Alessandro (Zürich), Phan Thanh, Nam (München), Pickl, Peter (Tübingen), Pizzo, Alessandro (Roma), Porta, Marcello (Trieste), Rademacher, Simone (München), Roos, Barbara (Klosterneuburg), Rougerie, Nicolas (Lyon), Saffirio, Chiara (Basel), Salmhofer, Manfred (Heidelberg), Schlein, Benjamin (Zürich), Seiringer, Robert (Klosterneuburg), Solovej, Jan Philip (København), Teufel, Stefan (Tübingen), Triay, Arnaud (München), Ueltschi, Daniel (Coventry), Warzel, Simone (Garching bei München)

**17.09. – 22.09.2023**       **Tensor-Triangular Geometry and Interactions**
Organizers:                   Paul Balmer, Los Angeles
                              Tobias Barthel, Bonn
                              John Greenlees, Coventry
                              Julia Pevtsova, Seattle

## Abstract

The workshop brought together experts in a rapidly growing field of tensor triangular geometry highlighting applications to and techniques coming from homotopy theory, algebraic geometry, modular representation theory, motivic homotopy theory and noncommutative algebra. Structurally the workshop consisted of five integral components: hour-long research talks reporting on the most recent developments in tt-geometry; shorter talks on Thursday morning given by all the graduate student participants; a motivic master class on Monday evening; a problem session on Wednesday evening; and wide ranging and unrestricted discussions and collaborations during all the remaining unscheduled time.

## Participants

Bachmann, Tom (Mainz), Balchin, Scott (Belfast), Balmer, Paul (Los Angeles), Barthel, Tobias (Bonn), Benson, David J. (Aberdeen), Castellana Vila, Natàlia (Bellaterra, Barcelona), Chedalavada, Anish (Baltimore), Dell'Ambrogio, Ivo (Villeneuve d'Ascq), Gallauer, Martin (Coventry), Gomez, Juan Omar (Bielefeld), Gratz, Sira (Aarhus), Greenlees, John (Coventry), Grodal, Jesper (København), Hausmann, Markus (Stockholm), Heard, Drew K. (Gloshaugen), Heller, Jeremiah (Urbana), Iyengar, Srikanth B. (Salt Lake City), Kedziorek, Magdalena (Nijmegen), Krause, Henning (Bielefeld), Lau, Eike (Bielefeld), Letz, Janina C. (Bielefeld), May, Clover (Trondheim), Nakano, Daniel K. (Athens), Naumann, Niko (Regensburg), Neeman, Amnon (Canberra), Negron, Cris (Los Angeles), Pevtsova, Julia (Seattle), Plavnik, Julia (Bloomington), Pollitz, Josh (Syracuse), Ramzi, Maxime (København), Rickard, Jeremy (Bristol), Sanders, Beren (Santa Cruz), Stevenson, Greg (Aarhus), Stojanoska, Vesna (Urbana), Stovicek, Jan (Praha), Vashaw, Kent (Cambridge), Verasdanis, Charalampos (Glasgow), Vishik, Alexander (Nottingham), Witherspoon, Sarah (College Station), Zou, Changhan (Santa Cruz)

| 24.09. – 29.09.2023 | **MFO-RIMS Tandem Workshop 2023: Arithmetic Homotopy and Galois Theory** |
| Organizers: | Benjamin Collas, Kyoto |
| | Pierre Dèbes, Villeneuve d'Ascq |
| | Yuichiro Hoshi, Kyoto |
| | Ariane Mézard, Paris |

## Abstract

This workshop presented a general panorama of recent progress in the arithmetic-geometry theory of Galois and homotopy groups and its ramifications. While still relying on Grothendieck's original pillars, the present program has now evolved beyond the classical group-theoretic legacy to result in an autonomous project that exploits a new geometrization of the original insight and sketches new frontiers between homotopy geometry, homology geometry, and diophantine geometry. This panorama "closes the loop" by including the last twenty-year progress of the Japanese arithmetic-geometry school via Ihara's program and Nakamura–Tamagawa–Mochizuki's anabelian approach, which brings its expertise in terms of algorithmic, combinatoric, and absolute reconstructions. These methods supplement and interact with those from the classical arithmetic of covers and Hurwitz spaces and the motivic and geometric Galois representations. This workshop has brought together the next generation of arithmetic homotopic Galois geometers, who, with the support of senior experts, are developing new techniques and principles for the exploration of the next research frontiers.

## Participants

Assoun, Antonin (Villeneuve d'Ascq), Bary-Soroker, Lior (Tel Aviv), Behajaina, Angelot (Haifa), Betts, Alexander (Cambridge), Bleher, Frauke M. (Iowa City), Boughattas, Elyes (Villetaneuse), Chinburg, Ted C. (Philadelphia), Collas, Benjamin (Kyoto), Combe, Noémie (Leipzig), Corwin, David (Beer-Sheva), Dèbes, Pierre (Villeneuve d'Ascq), Demarche, Cyril (Paris), Dittmann, Philip (Dresden), Fehm, Arno (Dresden), Harari, David (Orsay), Hoshi, Yuichiro (Kyoto), Karemaker, Valentijn (Utrecht), Legrand, François (Shantou), Lepage, Emmanuel (Paris), Litt, Daniel (Toronto), Lüdtke, Martin (Groningen), Mezard, Ariane (Paris), Nakamura, Hiroaki (Osaka), Neftin, Danny (Haifa), Patrikis, Stefan (Columbus), Pop, Florian (Philadelphia), Pries, Rachel (Fort Collins), Quick, Gereon (Trondheim), Rasmussen, Christopher (Middletown), Seguin, Beranger (Villeneuve d'Ascq), Shmueli, Roy (Tel Aviv), Takao, Naotake (Kyoto), Topaz, Adam (Edmonton), Westerland, Craig (Minneapolis)

| 01.10. – 06.10.2023 | **New Challenges in the Interplay between Finance and Insurance** |
|---|---|
| Organizers: | Beatrice Acciaio, Zürich |
| | Hansjörg Albrecher, Lausanne |
| | Francesca Biagini, München |
| | Thorsten Schmidt, Freiburg |

## Abstract

The aim of this workshop was to convene experts for fostering the discussion and the development of innovative approaches in insurance and financial mathematics. New challenges like price instability, huge insurance claims and climate change are affecting the markets, while at the same time the possibility of using large volumes of data and continuously increasing computer power as well as recently developed mathematical methods offer new opportunities for modelling and risk assessment. Here we present an overview of these recent developments by providing the abstracts of the talks that were given during the week, together with a brief summary of the covered topics.

## Participants

Acciaio, Beatrice (Zürich), Aksamit, Anna (Sydney), Albrecher, Hansjörg (Lausanne), Barrieu, Pauline (London), Bäuerle, Nicole (Karlsruhe), Bernard, Carole (Grenoble), Biagini, Francesca (München), Ceci, Claudia (Roma), Chavez-Demoulin, Valérie (Lausanne), Chen, An (Ulm), Chukwudum, Queensley Chidimma (Uyo), Cretarola, Alessandra (Perugia), Criens, David (Freiburg i. Br.), Cuchiero, Christa (Wien), Deelstra, Griselda (Bruxelles), Eghan, Rhydal Esi (Kumasi), Filipovic, Damir (Lausanne), Fontana, Claudio (Padova), García Flores, Brandon Israel (Lausanne), Gaudlitz, Sascha (Berlin), Goffard, Pierre-Olivier (Strasbourg), Grbac, Zorana (Paris), Guo, Xin (Berkeley), Hieber, Peter (Lausanne), Hillairet, Caroline (Palaiseau), Horvath, Blanka (Oxford), Jeanblanc, Monique (Évry), Källblad, Sigrid (Stockholm), Klein, Irene (Wien), Korn, Ralf (Kaiserslautern), Kupper, Michael (Konstanz), Lindskog, Filip (Stockholm), Loisel, Stéphane (Lyon), Meyer-Brandis, Thilo (München), Munari, Cosimo (Zürich), Neumann, Berenice Anne (Trier), Nutz, Marcel (New York), Oberpriller, Katharina (München), Pammer, Gudmund (Zürich), Pesenti, Silvana (Toronto), Platen, Eckhard (Kilaben Bay), Riedel, Frank H. (Bielefeld), Ritter, Moritz (Freiburg i. Br.), Rosazza Gianin, Emanuela (Milano), Schmidt, Thorsten (Freiburg i. Br.), Schmutz, Michael (Bern), Steffensen, Mogens (København), Tankov, Peter (Palaiseau), Teichmann, Josef (Zürich), Vanmaele, Michèle (Gent), Walter, Niklas (München), Ziegel, Johanna (Bern)

**05.11. – 10.11.2023**

Organizers:

**Control Methods in Hyperbolic Partial Differential Equations**

Fabio Ancona, Padua
Bani Anvari, London
Olivier Glass, Paris
Michael Herty, Aachen

## Abstract
Control of hyperbolic partial differential equations (PDEs) is an interdisciplinary area of research in applied mathematics nurtured by challenging problems arising in applications ranging from road traffic, gas pipeline management, blood circulation, to opinion dynamics and socio-economical models, as well as in environmental and biological issues, or more recently in the analysis of deep learning and machine learning methods. The topic has gained an increasing attraction of research-ers due to fundamental theoretical as well as numerical advances achieved in the field of nonlinear hyperbolic PDEs. The hyperbolic and the control of PDEs communities, while pursuing separate interests in their respective range of action with a different focus and, often, with a different array of technical tools, do share a substantial body of common knowledge and background. We brought those communities together at a joint workshop, for a marked advancement of this area of research.

## Participants
Alabau-Boussouira, Fatiha (Paris), Alberti, Giovanni S. (Genova), Albi, Giacomo (Verona), Ancona, Fabio (Padova), Andreianov, Boris (Tours), Anvari, Bani (London), Bailo, Rafael (Oxford), Bentaibi, Mohamed (Padova), Bianchini, Stefano (Trieste), Bonandin, Sabrina (Aachen), Bressan, Alberto (University Park), Cannarsa, Piermarco (Roma), Caravenna, Laura (Padova), Carrillo de la Plata, Jose Antonio (London), Chen, Gui-Qiang G. (Oxford), Chiri, Maria Teresa (Kingston), Christoforou, Cleopatra (Nicosia), Cliffe, Alex (Oxford), Colombo, Rinaldo M. (Brescia), Corli, Andrea (Ferrara), Coron, Jean Michel (Paris), Donadello, Carlotta (Besançon), Garavello, Mauro (Milano), Glass, Olivier (Paris), Goatin, Paola (Sophia-Antipolis), Göttlich, Simone (Mannheim), Guerra, Graziano (Milano), Gugat, Martin (Erlangen), Hayat, Amaury (Champs-sur-Marne), Herty, Michael (Aachen), Hintermüller, Michael (Berlin), Kalise, Dante (London), Lukáčová-Medvidová, Mária (Mainz), Marconi, Elio (Padova), Olive, Guillaume (Kraków), Pareschi, Lorenzo (Ferrara), Perrollaz, Vincent (Tours), Riedl, Konstantin (Garching bei München), Rosini, Massimiliano D. (Ferrara), Rossi, Francesco (Padova), Segala, Chiara (Aachen), Spurgeon, Sarah (London), Talamini, Luca (Padova), Tse, Oliver (Eindhoven), Veneruso, Sara (Aachen), Verma, Deepanshu (Atlanta), Wolfram, Marie-Therese (Coventry), Zanella, Mattia (Pavia), Zuazua, Enrique (Erlangen)

| 12.11. – 17.11.2023 | **Mathematical Logic: Proof Theory, Constructive Mathematics** |
|---|---|
| Organizers: | Samuel R. Buss, La Jolla |
| | Rosalie Iemhoff, Utrecht |
| | Ulrich Kohlenbach, Darmstadt |
| | Michael Rathjen, Leeds |

## Abstract

The Workshop "Mathematical Logic: Proof Theory, Constructive Mathematics" focused on proof-theoretic research on the foundations of mathematics, on the extraction of explicit computational content from given proofs in core areas of ordinary mathematics using proof-theoretic methods as well as on topics in proof complexity. The workshop contributed to the following research strands: interactions between foundations and applications, proof mining, constructive and semi-constructive reasoning, proof theory and theoretical computer science, structural proof theory.

## Participants

Aguilera, Juan (Wien), Akbar Tabatabai, Amir (Groningen), Arai, Toshiyasu (Tokyo), Baaz, Matthias (Wien), Beckmann, Arnold (Swansea), Beklemishev, Lev D. (Moscow), Berger, Ulrich (Swansea), Brattka, Vasco (Neubiberg), Buss, Samuel (La Jolla), Cheng, Yong (Wuhan), Cheval, Horatiu (Bucharest), Ferreira, Fernando (Lisboa), Freund, Anton (Würzburg), Frittaion, Emanuele (Darmstadt), Fujiwara, Makoto (Tokyo), Jäger, Gerhard (Bern), Jalali, Raheleh (Utrecht), Jeřábek, Emil (Praha), Joosten, Joost J. (Barcelona), Kahle, Reinhard (Tübingen), Khaniki, Erfan (Praha), Kohlenbach, Ulrich (Darmstadt), Kolodziejczyk, Leszek (Warszawa), Kolokolova, Antonina (St. John's), Leigh, Graham E. (Göteborg), Leustean, Laurentiu (Bucharest), Maietti, Maria Emilia (Padova), Müller, Moritz (Passau), Negri, Sara (Genova), Nemoto, Takako (Hiroshima), Neri, Morenikeji (Bath), Nicolae, Adriana (Cluj-Napoca), Normann, Dag (Oslo), Oitavem, Isabel (Caparica), Oliva, Paulo (London), Pinto, Pedro (Darmstadt), Pischke, Nicholas (Darmstadt), Powell, Thomas (Bath), Pudlak, Pavel (Praha), Rathjen, Michael (Leeds), Sanders, Sam (Bochum), Schuster, Peter M. (Verona), Sipos, Andrei (Bucharest), Thapen, Neil (Praha), Towsner, Henry (Philadelphia), van der Giessen, Iris (Birmingham), Visser, Albert (Utrecht), Weiermann, Andreas (Gent), Yokoyama, Keita (Sendai), Zorzi, Margherita (Verona)

**03.12. – 08.12.2023**          **Variational Methods for Evolution**
Organizers:                      Franca Hoffmann, Bonn
                                 Alexander Mielke, Berlin
                                 Mark Peletier, Eindhoven
                                 Dejan Slepcev, Pittsburgh

## Abstract

Variational principles for evolutionary systems arise in many settings, both in those describing the physical world and in man-made algorithms for data science and optimization tasks. Variational methods for evolution allow for the usage of the rich toolbox provided by the calculus of variations, metric-space geometry, partial differential equations, and other branches of applied analysis. Over the last two decades the variational methods for evolution have seen a rapid growth. This workshop continued the successful line of meetings, while evolving and branching into new directions. We have brought together a wide scope of researchers from calculus of variations, partial differential equations, numerical analysis, and stochastics, as well as researchers from data science and machine learning, to exchange ideas, foster interaction, develop new avenues, and generally bring these communities closer together.

## Participants

Braides, Andrea (Trieste), Brenier, Yann (Orsay), Bungert, Leon (Würzburg), Chambolle, Antonin (Paris), Erbar, Matthias (Bielefeld), Esposito, Antonio (Oxford), Fathi, Max (Paris), Fischer, Julian (Klosterneuburg), Hoeksema, Jasper (Eindhoven), Hoffmann, Franca (Pasadena), Hopf, Katharina (Berlin), Hraivoronska, Anastasiia (Villeurbanne), Jüngel, Ansgar (Wien), Laux, Tim (Regensburg), Lelmi, Jona (Los Angeles), Leonard, Christian (Nanterre), Maas, Jan (Klosterneuburg), Matthes, Daniel (Garching bei München), Mielke, Alexander (Berlin), Nüsken, Nikolas (London), Park, Sangmin (Pittsburgh), Peletier, Mark A. (Eindhoven), Renger, D.R. Michiel (Garching bei München), Rossi, Riccarda (Brescia), Roubicek, Tomas (Praha), Savaré, Giuseppe (Milano), Scardia, Lucia (Edinburgh), Schlichting, André (Münster), Simonov, Nikita (Paris), Slepcev, Dejan (Pittsburgh), Sriperumbudur, Bharath (University Park), Stefanelli, Ulisse (Wien), Stephan, Artur (Berlin), Thomas, Marita (Berlin), Tse, Oliver (Eindhoven), van Gennip, Yves (Delft), von Renesse, Max (Leipzig), Westdickenberg, Michael (Aachen), Zimmer, Johannes (Garching bei München)

**10.12. – 15.12.2023**　　　　　**Geometric, Algebraic, and Topological Combinatorics**

Organizers:　　　　　　　　　　Gil Kalai, Jerusalem
Isabella Novik, Seattle
Francisco Santos, Santander
Volkmar Welker, Marburg

## Abstract

The meeting covered a wide variety of aspects of Discrete Geometry, Algebraic Combinatorics with geometric flavor, and Topological Combinatorics. Some of the highlights of the conference were (1) Federico Ardila and Tom Braden discussed recent exciting developments in the intersection theory of matroids; (2) Stavros Papadakis and Vasiliki Petrotou presented their proof of the Lefschetz property for spheres, and, more generally, for pseudomanifolds and cycles (this second part is joint with Karim Adiprasito); (3) Gaku Liu reported on his joint work with Spencer Backman that establishes the existence of a regular unimodular triangulation of an arbitrary matroid base polytope.

## Participants

Adiprasito, Karim (Jerusalem), Ardila, Federico (San Francisco), Athanasiadis, Christos A. (Athens), Babson, Eric (Davis), Benedetti, Bruno (Coral Gables), Blagojevic, Pavle (Berlin), Braden, Thomas C. (Amherst), Braun, Benjamin (Lexington), Carranza, Daniel (Baltimore), Crespo, Luis (Santander), Dorpalen-Barry, Galen (Eugene), Frick, Florian (Pittsburgh), Galashin, Pavel (Los Angeles), Goaoc, Xavier (Villers-lès-Nancy), Hersh, Patricia L. (Eugene), Joswig, Michael (Berlin), Juhnke, Martina (Osnabrück), Kalai, Gil (Jerusalem), Linial, Nathan (Jerusalem), Liu, Gaku (Seattle), Loho, Georg (Enschede), Maclagan, Diane (Coventry), Mantovani, Chiara (Palaiseau), Meshulam, Roy (Haifa), Mu, Lili (Xuzhou), Nevo, Eran (Jerusalem), Novik, Isabella (Seattle), Padrol, Arnau (Barcelona), Papadakis, Stavros (Ioannina), Petrotou, Vasiliki (Jerusalem), Pilaud, Vincent (Barcelona), Piterman, Kevin Ivan (Marburg), Poullot, Germain (Osnabrück), Reiner, Victor (Minneapolis), Rincon, Felipe (London), Samper Casas, José Alejandro (Macul, Santiago), Santos, Francisco (Santander), Sanyal, Raman (Frankfurt am Main), Soberón, Pablo (New York), Steinmeyer, Johanna (Jerusalem), Swartz, Edward B. (Ithaca), Wachs, Michelle L. (Coral Gables), Wagner, Uli (Klosterneuburg), Welker, Volkmar (Marburg), Woodroofe, Russ (Koper), Xue, Lei (Ann Arbor), Yashfe, Geva (Jerusalem), Zheng, Hailun (Houston)

## 3.4. Miniworkshops

### Miniworkshop 2309a



| 26.02. – 04.03.2023 | **Skew Braces and the Yang–Baxter Equation** |
|---|---|
| Organizers: | Tomasz Brzeziński, Swansea |
| | Ilaria Colazzo, Exeter |
| | Anastasia Doikou, Edinburgh |
| | Leandro Vendramin, Brussels |

**Abstract**

The workshop was focused on the interplay between set-theoretic solutions to the Yang-Baxter equation and several algebraic structures used to construct and understand new solutions. In this vein, the Yang-Baxter equation and properties of these algebraic structures are used as a source of inspiration to study other mathematical problems not directly related to the Yang-Baxter equation. A particular accent in some talks was made on open questions and conjectures, which were then discussed among participants.

**Participants**

Ballester-Bolinches, Adolfo (Burjassot), Brzezinski, Tomasz (Swansea), Byott, Nigel P. (Exeter), Colazzo, Ilaria (Exeter), Dietzel, Carsten (Stuttgart), Doikou, Anastasia (Edinburgh), Eick, Bettina (Braunschweig), Iyudu, Natalia (Edinburgh), Lebed, Victoria (Caen), Lechner, Gandalf (Erlangen), Letourmy, Thomas (Bruxelles), Okninski, Jan (Warszawa), Piterman, Kevin Ivan (Marburg), Puljic, Dora (Edinburgh), Rump, Wolfgang (Stuttgart), Rybolowicz, Bernard (Edinburgh), Stefanelli, Paola (Lecce), Stefanello, Lorenzo (Pisa), Trappeniers, Senne (Brussels), Tsang, Cindy (Sin Yi) (Tokyo), Van Antwerpen, Arne (Bruxelles), Vendramin, Leandro (Brussels)

**26.02. – 04.03.2023**       **New Horizons in Motions in Random Media**
Organizers:                          Sebastian Andres, Manchester
                                           Marek Biskup, Los Angeles
                                           Alessandra Faggionato, Rome
                                           Martin Slowik, Mannheim

## Abstract

The general topic of the mini-workshop was the study of random walks in random environments, both in their own right and in relation to stochastic homogenization and to models in statistical mechanics, in particular spin system. This is a subject at the intersection of probability, analysis and mathematical physics, and the workshop brought together leading researchers from those areas. While each of these areas has been quite active for decades with many remarkable breakthroughs obtained throughout the years, the workshop provided a unique opportunity to identify principal new objectives and initiate new collaborations.

## Participants

Andres, Sebastian (Manchester), Bauerschmidt, Roland (New York), Bella, Peter (Dortmund), Berger, Noam (Garching bei München), Biskup, Marek (Los Angeles), Croydon, David (Kyoto), Dario, Paul (Créteil), Disertori, Margherita (Bonn), Faggionato, Alessandra (Roma), Gantert, Nina (Garching bei München), Neukamm, Stefan (Dresden), Rodriguez, Pierre-Francois (London), Rolles, Silke (Garching bei München), Sapozhnikov, Artem (Leipzig), Slowik, Martin (Mannheim), Sousi, Perla (Cambridge), Taggi, Lorenzo (Roma), Tarrès, Pierre (Shanghai), Tóth, Bálint (Bristol), Weng, Weile (Berlin), Zeitouni, Ofer (Rehovot)

**26.02. – 04.03.2023**      **Free Boundary Problems Arising in Fluid Mechanics**
Organizers:              Diego Alonso Orán, La Laguna
Claudia García, Granada
Juan J. L. Velázquez, Bonn

## Abstract

Fluid mechanics is one of the classical areas in the study of partial differential equations and has been a vast subject of research in the last centuries. A relevant class of problems are those in which the evolution of fluids of different nature and their interaction is described through the dynamics of their common boundary. Such problems are called free-boundary problems. The key topic of this workshop deals with recent advances on the analysis of free-boundary problems which open up a whole new area of research activity. More precisely, we will address problems as the vortex-patch, the study of water waves, interface flows in porous media and Hele-Shaw cells as well as atmospheric front dynamics where the formation of finite time singularities is a fundamental open question.

## Participants

Abels, Helmut (Regensburg), Alonso-Orán, Diego (La Laguna), Gancedo, Francisco (Sevilla), García, Claudia (Granada), Garcia-Juarez, Eduardo (Sevilla), Grubić, Nastasia (Madrid), Hassainia, Zineb (Abu Dhabi), Haziot, Susanna (Providence), Kepka, Bernhard (Bonn), Liao, Xian (Karlsruhe), López Velázquez, Juan José (Bonn), Magliocca, Martina (Sevilla), Mateu, Joan (Bellaterra, Barcelona), Matioc, Bogdan (Regensburg), Wahlén, Erik (Lund), Wu, Sijue (Ann Arbor), Zillinger, Christian (Karlsruhe)

**17.09. – 22.09.2023**

Organizers:

**Interpolation and Over-parameterization in Statistics and Machine Learning**

Mikhail Belkin, San Diego
Alexandre Tsybakov, Palaiseau
Fanny Yang, Zürich

**Abstract**

In recent years it has become clear that, contrary to traditional statistical beliefs, methods that interpolate (fit exactly) the noisy training data, can still be statistically optimal. In particular, this phenomenon of "benign overfitting" or "harmless interpolation" seems to be close to the practical regimes of modern deep learning systems, and, arguably, underlies many of their behaviors. This workshop brought together experts on the emerging theory of interpolation in statistical methods, its theoretical foundations and applications to machine learning and deep learning.

**Participants**

Bartlett, Peter (Berkeley), Belkin, Misha (La Jolla), Bietti, Alberto (Brooklyn), Boyer, Claire (Paris), Donhauser, Konstantin (Zürich), Hsu, Daniel (New York), Lecué, Guillaume (Cergy-Pontoise), Mammen, Enno (Heidelberg), Muthukumar, Vidya (Atlanta), Shamir, Ohad (Rehovot), Srebro, Nathan (Chicago), Telgarsky, Matus (New York), Thrampoulidis, Christos (Vancouver), Tsybakov, Alexandre B. (Palaiseau), van de Geer, Sara (Zürich), Yang, Fanny (Zürich)

**24.09. – 29.09.2023**

Organizers:

**Multivariate Orthogonal Polynomials: New synergies with Numerical Analysis**

Annie Cuyt, Stirling
Markus Melenk, Wien
Stefan Sauter, Zürich
Yuan Xu, Eugene

## Abstract
Multivariate polynomials and, in particular, multivariate orthogonal polynomials (MOPs) are research areas within the fields of special functions, Lie groups, quantum groups, computer algebra to name only some of them. However, there are many important areas in the field of numerical analysis where multivariate polynomials (of high order) play a crucial role: approximation by spectral methods and finite elements, discrete calculus, polynomial trace liftings, exact sequence properties, sparsity, efficient and stable recursions, analysis of the geometry of the zeros. The miniworkshop brought together experts from the fields of MOPs and numerical analysis of partial differential equations.

## Participants
Bohne, Nis-Erik (Zürich), Braess, Dietrich (Bochum), Cuyt, Annie (Stirling), Hackbusch, Wolfgang (Molfsee), Haubold, Tim (Hannover), Iliev, Plamen (Atlanta), Koornwinder, Tom H. (Amsterdam), Melenk, Jens M. (Wien), Olver, Sheehan (London), Pinar, Miguel (Granada), Plonka-Hoch, Gerlind (Göttingen), Rapetti, Francesca (Nice), Sauer, Tomas (Passau), Sauter, Stefan A. (Zürich), Schöberl, Joachim (Wien), Shen, Jie (West Lafayette), Xu, Yuan (Eugene)

**15.10. – 20.10.2023**              **Poisson and Poisson-type algebras**
Organizers:                          Ana Agore, Brussels/Bucharest
                                     Li Guo, Newark
                                     Ivan Kaygorodov, Covilhã
                                     Stephane Launois, Canterbury

## Abstract

The first historical encounter with Poisson-type algebras is with Hamiltonian mechanics. With the abstraction of many notions in Physics, Hamiltonian systems were geometrized into manifolds that model the set of all possible configurations of the system, and the cotangent bundle of this manifold describes its phase space, which is endowed with a Poisson structure. Poisson brackets led to other algebraic structures, and the notion of Poisson-type algebra arose, including transposed Poisson algebras, Novikov-Poisson algebras, or commutative pre-Lie algebras, for example. These types of algebras have long gained popularity in the scientific world and are not only of their own interest to study, but are also an important tool for researching other mathematical and physical objects.

## Participants

Abdurasulov, Kobiljon (Covilha), Agore, Ana (Bruxelles), Bai, Chengming (Tianjin), Burde, Dietrich (Wien), Dzhumadildaev, Askar S. (Almaty), Fernandez Ouaridi, Amir (Coimbra), Guo, Li (Newark), Kaygorodov, Ivan (Covilha), Khrypchenko, Mykola (Porto), Launois, Stéphane (Canterbury), Lopes, Samuel (Porto), Siciliano, Salvatore (Lecce), Sierra, Susan J. (Edinburgh), Usefi, Hamid (St. John's), Yakimova, Oksana (Jena), Zusmanovich, Pasha (Ostrava)

| 15.10. – 20.10.2023 | **Felix Klein's Foreign Students: Opening Up the Way for Transnational Mathematics** |
|---|---|
| Organizers: | Danuta Ciesielska, Warsaw |
| | Renate Tobies, Jena |

## Abstract

Extending existing analyses of the topic, the workshop aimed to investigate the influence of Felix Klein on the development of mathematics (especially number theory, algebra, geometry, analysis, applications of mathematics in scientific and technical fields as well as in mathematics education) in countries other than Germany. The goal of the workshop was to take a look at mathematicians of foreign origin who studied with Klein that have received little attention so far (including Czech, Greek, Hungarian, Japanese, Polish, Russian, and Ukrainian mathematicians) and uncover how Klein guided them through his lectures and seminars. The protocols of the lectures held in Klein's seminars (from 1872 to 1912 in Göttingen, Erlangen, and Leipzig), which are a unique and so far largely unexplored source, were the basis for the workshop.

## Participants

Barrow-Green, June (Milton Keynes), Becvárová, Martina (Praha), Ciesielska, Danuta (Warszawa), Hänel, Jule (Wuppertal), Heller, Henning (Leuven), Kümmerle, Harald (Tokyo), Lugaresi, Maria Giulia (Ferrara), Michel, Nicolas (Wuppertal), Mühlhausen, Elisabeth (Krebeck), Phili, Christine (Athens), Ramírez Ogando, Grodecz Alfredo (Wuppertal), Rowe, David E. (Mainz), Siegmund-Schultze, Reinhard (Kristiansand), Stenhouse, Brigitte (Milton Keynes), Tobies, Renate (Jena), Ullrich, Peter (Koblenz), Zwierzynska, Joanna (Katowice)

| 15.10. – 20.10.2023 | **Nonlinear Approximation of High-dimensional Functions in Scientific Computing** |
|---|---|
| Organizers: | Mathias Oster, Aachen |
| | Janina Schütte, Berlin |
| | Philipp Trunschke, Nantes |

## Abstract

Approximation techniques for high dimensional PDEs are crucial for contemporary scientific computing tasks and gained momentum in recent years due to the renewed interest in neural networks. It seems that especially nonlinear parametrizations will play an essential role in efficient and tractable approximations of high dimensional problems. We held a mini-workshop on the relation and possible synergy of neural networks and tensor product approximation. To reliably evaluate the prospect of different numerical experiments, the traditional talks were accompanied by live coding sessions.

## Participants

Alexandrov, Boian (Los Alamos), Bachmayr, Markus (Aachen), Cipriani, Cristina (Garching bei München), Cohen, Nadav (Ramat Aviv, Tel Aviv), Dolgov, Sergey (Bath), Eigel, Martin (Berlin), Grüne, Lars (Bayreuth), Höveler, Bernhard (Berlin), Langer, Sophie (Enschede), Le, Thong (Aachen), Miranda, Charles (Berlin), Nouy, Anthony (Nantes), Oseledets, Ivan (Kaiserslautern), Oster, Mathias (Aachen), Rauhut, Holger (München), Saluzzi, Luca (Pisa), Schütte, Janina (Berlin), Trunschke, Philipp (Nantes)
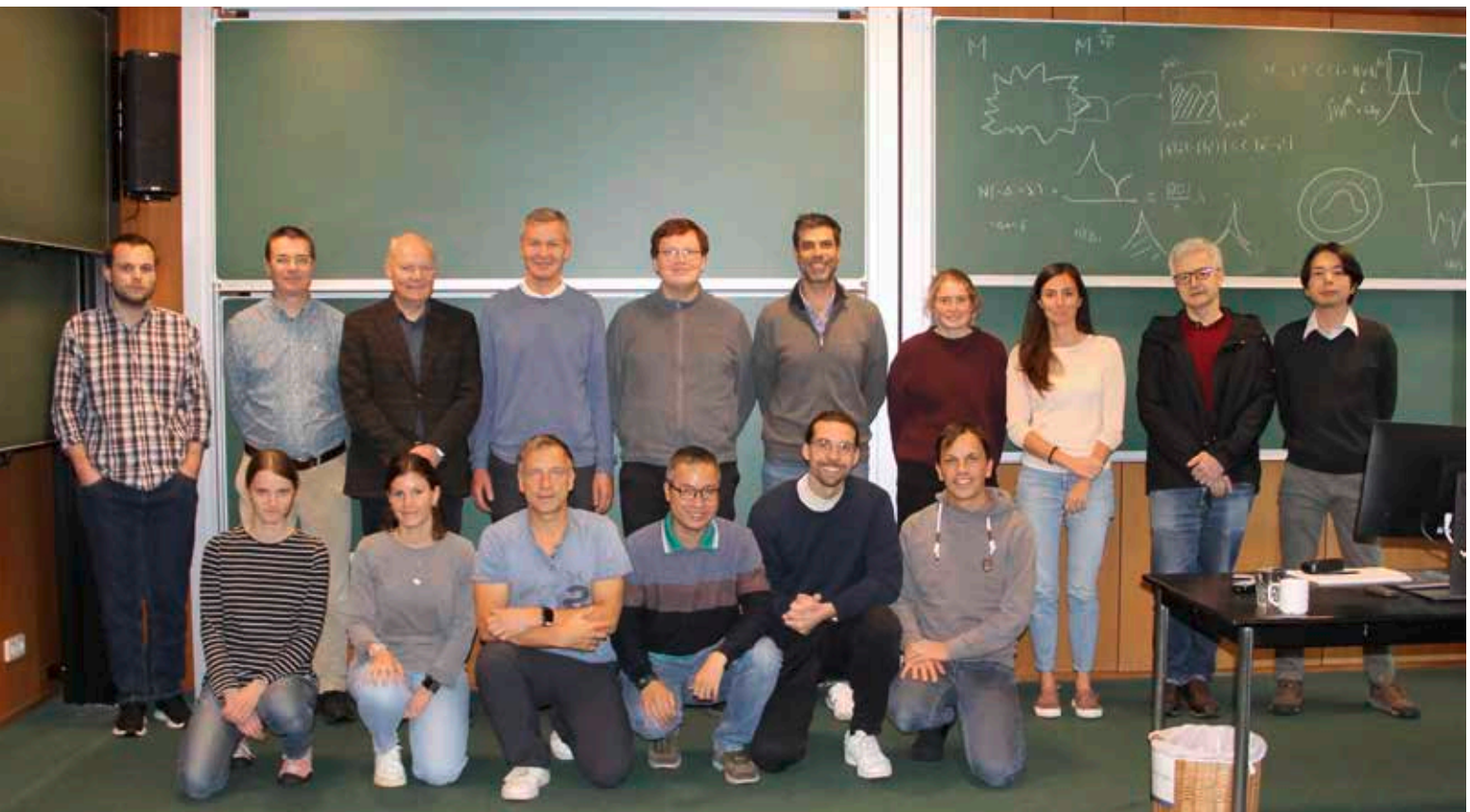
**29.10. – 04.11.2023**  **Mathematics of Many-body Fermionic Systems**
Organizers:   Nikolai Leopold, Basel
 Phan Thành Nam, Munich
 Chiara Saffirio, Basel

## Abstract

Fermionic quantum systems are well described by the linear many-body Schrödinger equation. For interacting systems the full Schrödinger theory is extremely complicated and theoretical as well numerical investigations are not feasible. In practice, macroscopic properties of large systems can therefore only be accessed by means of approximate theories. The intention of this workshop was to showcase the most recent advances in the mathematical study of many-body interacting fermionic systems and to stimulate discussions among different research groups.

## Participants

Bach, Volker (Braunschweig), Christiansen, Martin Ravn (München), Dietze, Charlotte (München), Giacomelli, Emanuela (München), Golse, Francois (Palaiseau), Hainzl, Christian (München), Leopold, Nikolai (Basel), Lewin, Mathieu (Paris), Lukkarinen, Jani (Helsinki), Miyao, Tadahiro (Sapporo), Phan Thanh, Nam (München), Pickl, Peter (Tübingen), Rademacher, Simone (München), Ruba, Blazej Teofil (København), Saffirio, Chiara (Basel), Salmhofer, Manfred (Heidelberg)

| 29.10. – 04.11.2023 | **Standard Subspaces in Quantum Field Theory and Representation Theory** |
|---|---|
| Organizers: | Maria Stella Adamo, Tokyo |
| | Gandalf Lechner, Erlangen |
| | Roberto Longo, Rom |
| | Karl-Hermann Neeb, Erlangen |

## Abstract

Real standard subspaces of complex Hilbert spaces are long known to provide the right language for Tomita-Takesaki modular theory of von Neumann algebras. In recent years they have also become an object of prominent interest in mathematical quantum field theory (QFT) and unitary representation theory of Lie groups. This workshop brought together mathematicians and physicists working with standard subspaces, particularly in QFT (construction of QFT models, characterization of entropy, information-theoretic aspects), nets of standard subspaces on causal homogeneous spaces and aspects of reflection positivity and euclidean models related to standard subspaces and modular theory.

## Participants

Adamo, Maria Stella (Tokyo), Beltita, Daniel (Bucharest), Buchholz, Detlev (Göttingen), Cadamuro, Daniela (Leipzig), Correa da Silva, Ricardo (Erlangen), Jaekel, Christian D. (São Paulo), Janssens, Bas (Delft), Lechner, Gandalf (Erlangen), Longo, Roberto (Roma), Morinelli, Vincenzo (Roma), Morsella, Gerardo (Roma), Neeb, Karl-Hermann (Erlangen), Olafsson, Gestur (Baton Rouge), Ranallo, Alessio (Roma), Sanders, Jacobus Ambrosius (Erlangen), Tanimoto, Yoh (Roma)

| 29.10. – 04.11.2023 | **Positivity and Inequalities in Convex and Complex Geometry** |
| Organizers: | Andreas Bernig, Frankfurt |
| | Julius Ross, Chicago |
| | Thomas Wannerer, Jena |

## Abstract

The workshop convened researchers from algebraic geometry, convex geometry, and complex geometry to explore themes arising from the Alexandrov-Fenchel and Brunn-Minkowski inequalities. It featured three introductory talks delving into the basics of Lorentzian polynomials, valuations in convex geometry, and plurisubharmonic functions, that served as a foundation for the subsequent research talks. As anticipated, significant overlap emerged among the varied perspectives within these three areas, evident in the presentations and ensuing discussions.

## Participants

Alesker, Semyon (Ramat Aviv, Tel Aviv), Berndtsson, Bo (Göteborg), Bernig, Andreas (Frankfurt am Main), Dang, Nguyen-Bac (Orsay), Faifman, Dmitry (Ramat Aviv, Tel Aviv), Fu, Joseph (Athens), Jochemko, Katharina (Stockholm), Juhnke, Martina (Osnabrück), Kim, Dano (Seoul), Knörr, Jonas (Wien), Kotrbaty, Jan (Frankfurt am Main), Ross, Julius (Chicago), Solanes Farres, Gil (Bellaterra, Barcelona), Süß, Hendrik (Jena), Szusterman, Maud (Paris), Toma, Matei (Vandoeuvre-lès-Nancy), Wang, Xu (Trondheim), Wannerer, Thomas (Jena)

| 26.11. – 02.12.2023 | **Combinatorial and Algebraic Structures in Rough Analysis and Related Fields** |
| --- | --- |
| Organizers: | Carlo Bellingeri, Berlin |
| | Yvain Bruned, Vandoeuvre-lès-Nancy |
| | Ilya Chevyrev, Edinburgh |
| | Rosa Preiß, Potsdam |

## Abstract
Recent years have seen an explosion of algebraic methods to study singular stochastic and rough dynamics. These include developments in geometric rough path theory based on the algebra of words, the introduction of decorated trees in regularity structures, and the recent approach to singular stochastic partial differential equations based on multi-indices. These developments have furthermore led to important links with numerical analysis, machine learning, stochastic quantisation, and the study of symmetries of physical systems. The aim of this mini-workshop was to bring together experts working on these fields using algebraic structures that appear in rough dynamics. The goal was to facilitate the exchange of ideas and encourage further connections to be established.

## Participants
Alama Bronsard, Yvonne (Paris), Bellingeri, Carlo (Berlin), Bruned, Yvain (Vandoeuvre-lès-Nancy), Chevyrev, Ilya (Edinburgh), Combe, Noémie (Leipzig), Diehl, Joscha (Greifswald), Klose, Tom (Berlin), Linares Ballesteros, Pablo (London), Nadeem, Muhammad Usama (Edinburgh), Preiß, Rosa (Potsdam), Rahm, Ludwig (Trondheim), Rossi Ferrucci, Emilio (Oxford), Schratz, Katharina (Paris), Tamaroff, Pedro (Berlin), Tapia, Nikolas (Berlin), Tempelmayr, Markus (Münster)

**26.11. – 02.12.2023**  **Homological Aspects for TDLC-Groups**
Organizers:  Ilaria Castellano, Bielefeld
Nadia Mazza, Lancaster
Brita Nucinkis, London
Roman Sauer, Karlsruhe

## Abstract

This mini-workshop aimed at bringing together experts and early career researchers on finiteness conditions for discrete groups, and experts on varying aspects of locally compact groups to find a common framework to develop a systematic theory of homological finiteness conditions for totally disconnected locally compact groups. Whereas the homological theory of finiteness conditions of discrete groups is well developed and the structure theory of totally disconnected locally compact groups has seen some important breakthroughs in the last decade, the homological theory for (non-compact) totally disconnected locally compact groups is an emerging research area. Specific topics include finiteness conditions for locally compact groups, Mackey functors and Bredon cohomology for topological groups, connections to condensed mathematics, connections to $\ell^2$-invariants and $\Sigma$-invariants.

## Participants

Biswas, Rudradip (Bielefeld), Bonn, Laura (Karlsruhe), Castellano, Ilaria (Bielefeld), Corob Cook, Ged (Lincoln), Kielak, Dawid (Oxford), Kropholler, Peter H. (Southampton), Leary, Ian J. (Southampton), Marchionna, Bianca (Bielefeld), Mazza, Nadia (Lancaster), Molyneux, Lewis (Egham), Nucinkis, Brita E.A. (London), Santos Rego, Yuri (Magdeburg), Sauer, Roman (Karlsruhe), Weigel, Thomas (Milano), Witzel, Stefan (Gießen), Yatsyna, Sofiya (Egham)

**26.11. – 02.12.2023**　　　　　　**Flavors of Rabinowitz Floer and Tate Homology**
Organizers:　　　　　　　　　　　Kai Cieliebak, Augsburg
　　　　　　　　　　　　　　　　　Alexandru Oancea, Strasbourg
　　　　　　　　　　　　　　　　　Nathalie Wahl, Copenhagen

## Abstract

Rabinowitz Floer homology originated 15 years ago in symplectic geometry. Recent developments have related it to algebraic topology via string toplogy and Tate homology, and to mirror symmetry via Fukaya categories. This mini-workshop brought together researchers from these different communities, in order to foster exchange and collaborations across research fields. The mornings were generally dedicated to individual talks by the participants, with an intended duration time of 30 min. and 30 min. discussion time for each talk. The afternoons were generally dedicated to discussions on topics that arose during the morning talks. This ensured an intense atmosphere of exchange during the whole duration of the workshop.

## Participants

Abouzaid, Mohammed (Stanford), Bae, Hanwool (Seoul), Bianchi, Andrea (Bonn), Cieliebak, Kai (Augsburg), Dimitroglou Rizell, Georgios (Uppsala), Fourel, Colin (Strasbourg), Frauenfelder, Urs Adrian (Augsburg), Gao, Zhen (Augsburg), Hedenlund, Alice (Uppsala), Hirschi, Amanda (Cambridge), Klang, Inbar (Amsterdam), Legout, Noémie (Göteborg), Liu, Shuaipeng (Augsburg), Oancea, Alexandru (Strasbourg), Takeda, Alex (Uppsala), Wahl, Nathalie (København)

## 3.5. Simons Visiting Professors

Die folgenden Forscherinnen und Forscher kombinierten eine Teilnahme an einem Workshop in Oberwolfach mit einem Aufenthalt an einer europäischen Universität, unterstützt durch die Simons Foundation.

The following researchers combined their participation in an Oberwolfach Workshop with a stay at a European University, supported by the Simons Foundation.



**Jószef Balogh, Urbana**
Workshop 2301: Combinatorics
Host: Wojciech Samotij, Tel Aviv



**Frank Sottile, College Station**
Workshop 2312: New Directions in Real Algebraic Geometry
Host: Bernd Sturmfels, Leipzig



**Mareike Dressler, Sydney**
Workshop 2311: Real Algebraic Geometry with a View toward Koopman Operator Methods
Host: Salma Kuhlmann, Konstanz



**Jeffrey S. Case, University Park**
Workshop 2321: Hypoelliptic Operators in Geometry
Host: Andrea Malchiodi, Pisa
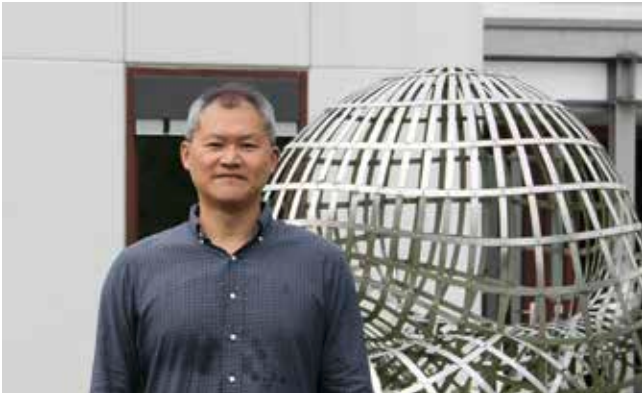
**Chin-Yu Hsiao, Taipei**
Workshop 2321: Hypoelliptic Operators in
Geometry
Host: Nikhil Savale, Köln

**Edgar Knobloch, Berkeley**
Workshop 2329: Transport and Scale Interactions in Geophysical Flows
Host: Marcel Oliver, Ingolstadt
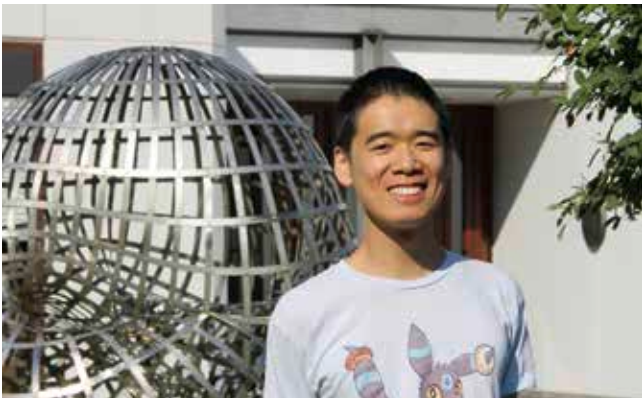
**Alan Chang, Princeton**
Workshop 2323: Incidence Problems in Harmonic Analysis, Geometric Measure Theory, and Ergodic Theory
Host: Tuomas Orponen, Jyvaskylä

**Lennaert van Veen, Oshawa**
Workshop 2329: Transport and Scale Interactions in Geophysical Flows
Host: Jens Rademacher, Bremen
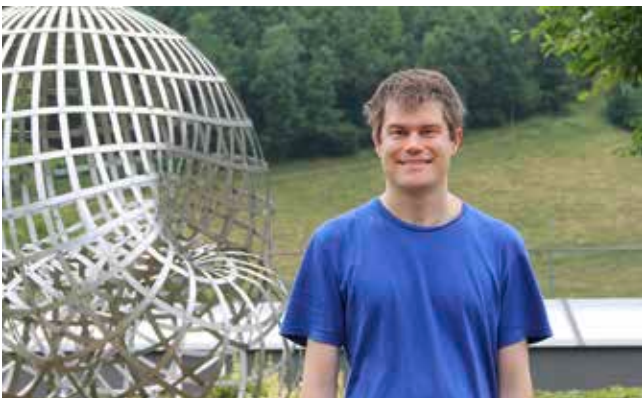
**Eric Larson, Providence**
Workshop 2325: Recent Trends in Algebraic
Geometry
Host: Gavril Farkas, Berlin
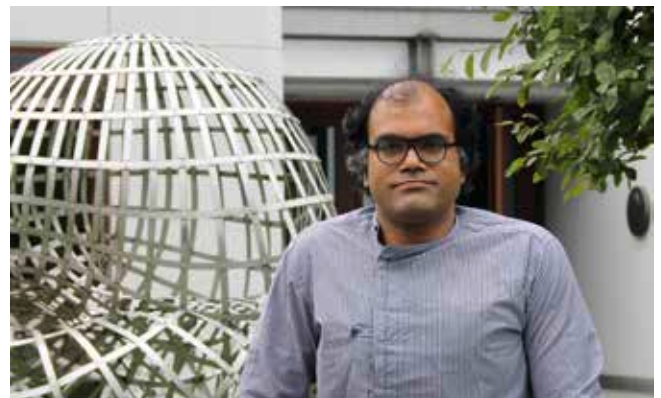
**Krishnendu Gongopadhyay, Punjab**
Workshop 2331: Teichmüller Theory: Classical Higher, Super and Quantum
Host: Anna Wienhard, Heidelberg
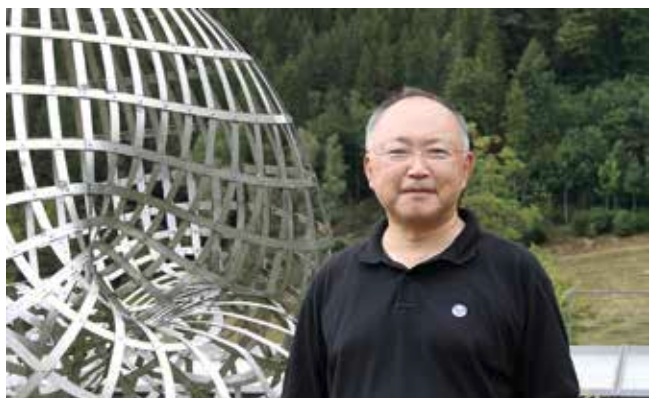
**Sumio Yamada, Tokyo**
Workshop 2331: Teichmüller Theory: Classical
Higher, Super and Quantum
Host: Athanase Papadopoulos, Strasbourg

**Eckhard Platen, Kilaben Bay**
Workshop 2340: New Challenges in the Inter-
play between Finance and Insurance
Host: Thorsten Schmidt, Freiburg

**Gestur Olafsson, Baton Rouge**
Workshop 2344b: Standard Subspaces in Quan-
tum Field Theory and Representation Theory
Host: Karl-Hermann Neeb, Erlangen

**Bharath Sriperumbudur, University Park**
Workshop 2349: Variational Methods for
Evolution
Host: Florence d'Alché-Buc, Palaiseau

# 3.6. Arbeitsgemeinschaften

## Arbeitsgemeinschaft 2314



**02.04. – 07.04.2023**          **Twistor D-Modules and the Decomposition Theorem**
Organizers:                              Takuro Mochizuki, Kyoto
                                                Claude Sabbah, Palaiseau

## Abstract
The purpose of this Arbeitsgemeinschaft is to introduce the notion of twistor D-modules and their main properties. The guiding principle leading this discussion is Simpson's "meta-theorem", which gives a heuristic for generalizing (mixed) Hodge-theoretic results into (mixed) twistor-theoretic results. The strength of the twistor approach is that it enables to enlarge the scope of Hodge theory not only to arbitrary semi-simple perverse sheaves, equivalently semi-simple regular holonomic D-modules via the Riemann-Hilbert correspondence, but also to possibly semi-simple irregular holonomic D-modules. An overarching goal for this session is Mochizuki's proof of the decomposition theorem for semi-simple holonomic D-modules on a smooth complex projective variety, first conjectured by Kashiwara in 1996.

## Participants
Aoki, Ko (Bonn), Chen, Jiaming (Frankfurt am Main), Chen, Qianyu (Ann Arbor), D'Agnolo, Andrea (Padova), Dutta, Yajnaseni (Bonn), Faergeman, Joakim (College Station), Hepler, Brian (Madison), Hertling, Claus (Mannheim), Hien, Marco (Augsburg), Hohl, Andreas (Paris), Huang, Pengfei (Heidelberg), Klingler, Bruno (Berlin), Krämer, Thomas (Berlin), Li, Qiongling (Tianjin), Mochizuki, Takuro (Kyoto), Morrissey, Benedict (Chicago), Neumann, Carsten (Augsburg), Ong, Marielle (Philadelphia), Oono, Takashi (Osaka), Porta, Mauro (Strasbourg), Qin, Yichen (Berlin), Reichelt, Thomas (Mann-heim), Reinecke, Emanuel (Bonn), Sabbah, Claude (Palaiseau), Scholze, Peter (Bonn), Szabo, Szilard (Budapest), Takeda, Alex (Bures-sur-Yvette), Teyssier, Jean-Baptiste (Paris), Uze, Berkan (İstanbul), Villadsen, Mads Bach (Stony Brook), Wei, Chuan-hao (Hangzhou), Yang, Ruijie (Berlin)

**08.10. – 13.10.2023**  **Cluster Algebras**
Organizers:  Roger Casals, Davis
Bernhard Keller, Paris
Lauren Williams, Cambridge MA

## Abstract

Cluster algebras, invented by Sergey Fomin and Andrei Zelevinsky around the year 2000, are commutative algebras endowed with a rich combinatorial structure. Fomin-Zelevinsky's original motivations came from Lie theory but in the past two decades, cluster algebras have had strikingly fruitful interactions with a large array of other subjects including Poisson geometry, discrete dynamical systems, (higher) Teichmüller spaces, commutative and non-commutative algebraic geometry, representation theory,.... In this Arbeitsgemeinschaft, we have focused on 1) basic definitions and theorems, 2) cluster structures on algebraic varieties and 3) the recent connection between cluster algebras and symplectic topology, with its recent application to the construction of cluster structures on braid varieties.

## Participants

An, Byung Hee (Daegu), Auyeung, Shamuel (Hartford), Bakshi, Sarjick (Mumbai), Barmeier, Severin (Köln), Bertozzi, Maria (Bochum), Bobrova, Irina (Reims), Bodin, Pierre (Versailles), Boretsky, Jonathan (Cambridge), Bose, Jishnu (Los Angeles), Burcroff, Amanda (Cambridge), Casals, Roger (Davis), Chen, Xiaofa (Hefei), Christ, Merlin (Hamburg), Ciliberti, Azzurra (Roma), Contu, Alessandro (Paris), Côté, Laurent (Cambridge), Dal Martello, Davide (Birmingham), de Saint Germain, Antoine (Hong Kong), Deshmukh, Yash Uday (New York), Faber, Eleonore (Leeds), Fan, Li (Beijing), Fu, Zenan (Ann Arbor), Garcia, Monica (Versailles), Gorsky, Mikhail (Wien), Greenberg, Zachary (Leipzig), Heng, Edmund Xian Chen (Bures-sur-Yvette), Heuberger, Liana (Bath), Hörmayer, Julia (Leeds), Hu, Mingyuan (Evanston), Huang, Min (Zhuhai), Janssens, Geoffrey (Louvain-la-Neuve), Kaufman, Dani (København), Keller, Bernhard (Paris), Klász, Viktória (Bonn), Koshevoy, Gleb (Moscow), Krawchuk, Colin (Cambridge), Lee, Eunjeong (Cheongju), Li, Fang (Hangzhou, Zhejiang), Li, Zijun (Durham), Liu, Tianle (Los Angeles), Mousavand, Kaveh (Okinawa), Neville, Scott (Ann Arbor), Nho, Yoon Jae (Cambridge), Niemeyer, Merik (Leipzig), Pan, Yu (Tianjin), Pavlov, Dmitrii (Leipzig), Perniok, Daniel (Paderborn), Pinet, Théo (Paris), Pirio, Luc (Versailles), Pressland, Matthew (Glasgow), Reisinger, Dee Ann (Bryn Mawr), Roy, Agniva (Baton Rouge), Schoonheere, Michael (Amiens), Scroggin, Tonie (Davis), Spacek, Peter (Chemnitz), Suchodoll, David (Berlin), Thom, Andreas B. (Dresden), Webster, Lilly (Minneapolis), Williams, Lauren K. (Cambridge), Wright, Kayla (Minneapolis), Wu, Yilin (Hefei), Yildirim, Emine (Leeds)

**17.12. – 22.12.2023**  **QFT and Stochastic PDEs**
Organizers:  Roland Bauerschmidt, Cambridge UK
  Massimiliano Gubinelli, Oxford
  Martin Hairer, London/Lausanne
  Hao Shen, Madison

## Abstract

The link between QFT and SPDE was first observed by the physicists Parisi and Wu (1981), known as Stochastic Quantisation. The study of solution theories and properties of solutions to these SPDEs derived from the Stochastic Quantisation procedure has stimulated substantial progress of the solution theory of singular SPDE. We explored some of the advances made in recent years. The focus was QFT models such as the Φ4, sine-Gordon and Yang-Mills models as examples to discuss stochastic quantisation and SPDE methods and their applications in these models. We introduced the key ideas, results and applications of regularity structure and paracontrolled distributions, construction of solutions of the SPDEs corresponding to these models, and use the PDE method to study some qualitative behaviors of these QFTs, and connections with the corresponding lattice or statistical physical models.

## Participants

Bauerschmidt, Roland (New York), Bhattacharya, Bhaswar (East Lansing), Bonicelli, Alberto (Pavia), Broux, Lucas (Leipzig), Cao, Sky (Cambridge), Chen, Hongyi (Chicago), Chiusole, Gideon (Garching bei München), Dagallier, Benoit (New York), Di, Xingjian (New York), Elad Altman, Henri (Villetaneuse), Esquivel Calzada, Salvador Cesar (Münster), Ferdinand, Léonard (Orsay), Földes, Juraj (Charlottesville), Gabriel, Simon (Münster), Ghosh, Subhroshekhar (Singapore), Gloria, Antoine (Paris), Gubinelli, Massimiliano (Oxford), Hairer, Martin (Lausanne), Höfer, Fabian (Münster), Hofstetter, Michael (Rehovot), Huang, Wei (Berlin), Jahandideh, Azam (Poznań), Janjigian, Christopher (West Lafayette), Ji, Xiaohao (Berlin), Jorgensen, Palle E. T. (Iowa City), Korzhenkova, Aleksandra (Lausanne), Kroschinsky, Wilhelm (Bonn), Kuzgun, Sefika (Rochester), Laarne, Petri (Helsinki), Lee, David (Paris), Liang, Rui (Birmingham), Lin, Jiasheng (Paris), Liu, Ruoyuan (Edinburgh), Liu, Shao (Bonn), Losev, Ilya (Cambridge), Lv, Huaxiang (Beijing), Meyer, Sarah-Jean (Oxford), Mohamed, Abdulwahab (Edinburgh), Morfe, Peter (Leipzig), Peev, Martin (London), Pompili, Lorenzo (Bonn), Qi, Siguang (Paris), Rajasekaran, Fred (Stanford), Rodriguez, Pierre-Francois (London), Schweiger, Florian (Genève), Seong, Kihoon (Ithaca), Shen, Hao (Madison), Simonov, Nikita (Paris), Singh, Harprit (London), Song, Chunqiu (Münster), Tempelmayr, Markus (Münster), Tran, Hoang Son (Singapore), Wang, Zhituo (Harbin), Weng, Weile (Berlin), Wildemann, Peter (Cambridge), Wu, Xuan (Urbana), Xu, Qiang (Lanzhou City), Yi, Jaeyun (Lausanne), Yuan, Shenglan (Augsburg), Zanello, Fabrizio (Göttingen), Zeng, Xiaolin (Strasbourg), Zhao, Wenhao (Lausanne), Zine, Younes (Lausanne)

# 3.7. Oberwolfach Seminare

## Oberwolfach Seminar 2322a
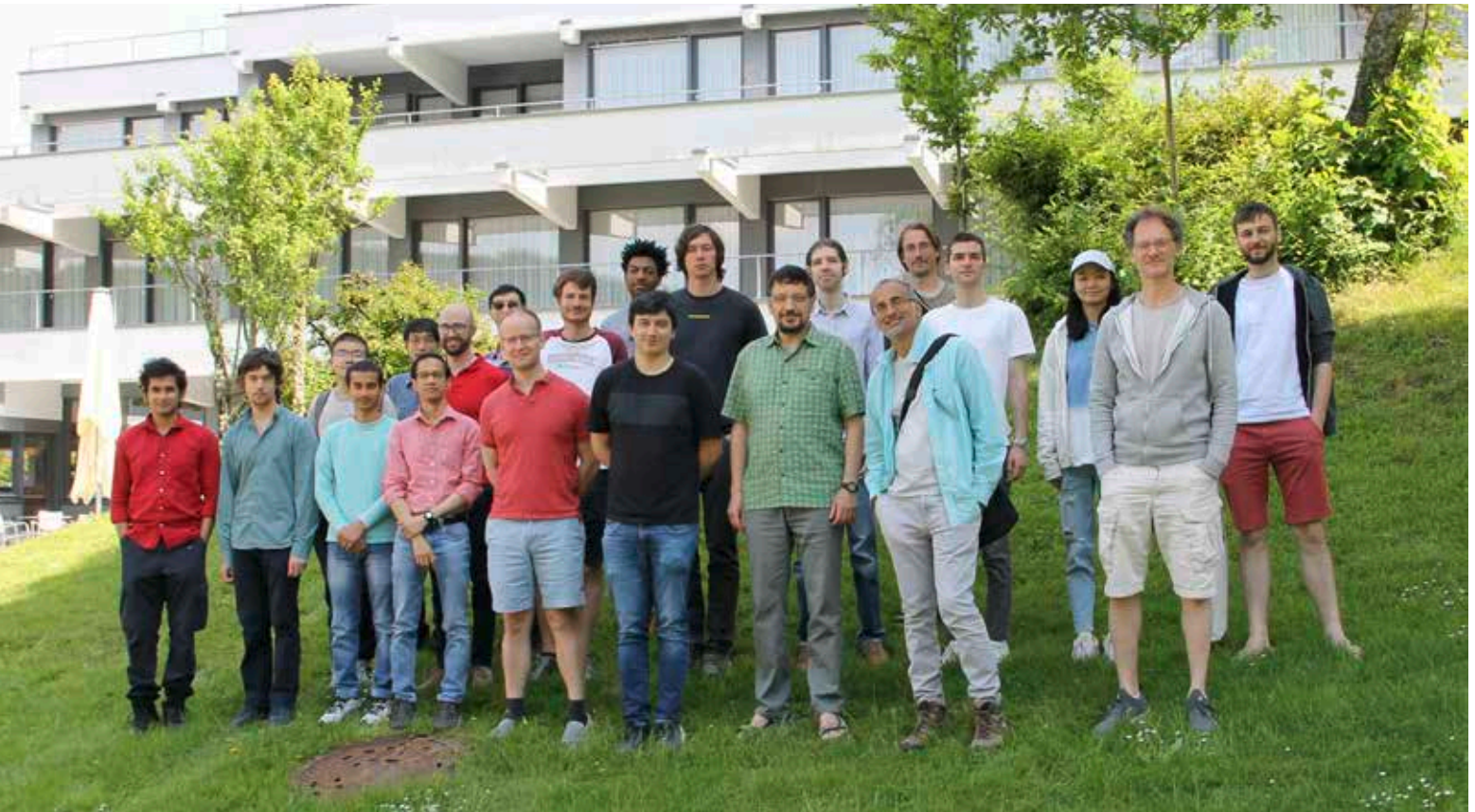


**28.05. – 02.06.2023**

Organizers:

**Analysis of Automorphic Forms and L-Functions in Higher Rank**

Farrell Brumley, Paris
Paul D. Nelson, Aarhus
Andre Reznikov, Ramat Gan
Akshay Venkatesh, Princeton

## Abstract

The orbit method is a tool for reducing problems in the representation theory of Lie groups to simpler problems in symplectic geometry, invariant theory and linear algebra. We will introduce to young researchers how this tool may be applied to analytic problems in the theory of automorphic forms, highlighting recent progress on the subconvexity problem for L-functions of large degree.

## Participants

Aggarwal, Keshav (Budapest), Assing, Edgar (Bonn), Berta, Filippo (Lausanne), Brumley, Farrell (Paris), Comtat, Félicien (London), Felber, Gilles (Bonn), Ganguly, Soumendra (College Station), Gu, Miao (Pam) (Durham), Hammonds, Trajan (Princeton), Harris, Phillip (Madison), Jääsaari, Jesse (London), Kwan, Chung-Hang (London), Lesesvre, Didier (Villeneuve d'Ascq), Leung, Wing Hong (Joseph) (Bonn), Lu, Weixiao (Cambridge), Maiti, Gopal (Marseille), Nelson, Paul (Aarhus), Nordentoft, Asbjorn Christian (Paris), Pandey, Mayank (Princeton), Peng, Yunjian (Beijing), Reznikov, Andre (Ramat Gan), Steiner, Raphael (Zürich), Toma, Radu (Bonn), Venkatesh, Akshay (Princeton), Ye, Liyuan (Beijing)

**28.05. – 02.06.2023**     **Metric Algebraic Geometry**
Organizers:                          Paul Breiding, Leipzig/Osnabrück
                                            Kathlén Kohn, Stockholm
                                            Bernd Sturmfels, Leipzig

## Abstract

How can we compute the distance from a point in 3-space to a given curve or surface? This question arises for many geometric shapes and in many contexts, notably in optimization and data science. Metric algebraic geometry studies real algebraic varieties, with focus on metric properties – distances, volumes, angles, and curvature. The aim is to compute these from defining equations. This seminar offers a hands-on introduction to this field.

## Participants

Ablett, Patience (Coventry), Breiding, Paul (Osnabrück), Cao, Yueqi (London), Dewaele, Nick (Leuven), Fiorindo, Luca (Genova), Garzon Mora, Sofia (Berlin), Hess, Sarah-Tanja (Konstanz), Horobeţ, Emil (Târgu-Mureş), Kaihnsa, Nidhi (København), Kohn, Kathlén (Stockholm), Polak, Elzbieta (Austin), Rahkooy, Hamid (Oxford), Reinke, Bernhard (Liverpool), Rosana, Andrea (Trieste), Rydell, Felix (Stockholm), Santarsiero, Pierpaola (Osnabrück), Schleis, Victoria (Tübingen), Sturmfels, Bernd (Leipzig), Sverrisdóttir, Svala (Berkeley), Teixeira Turatti, Ettore (Tromsø), Telek, Máté László (København), Torres Bustos, Angelica Marcela (Bellaterra, Barcelona), van der Eyden, Mirte (Innsbruck), Yuan, Beihui (Swansea)

**22.10. – 27.10.2023**          **Recent Topics on the Navier-Stokes Equations**
Organizers:                         Tristan Buckmaster, Maryland/New York
                                 Hideo Kozono, Sendai/Tokyo
                                 Senjo Shimizu, Kyoto

## Abstract

The seminar is addressed to the recent development of research on the Navier-Stokes equations. In the non-stationary case, Leray constructed a global weak solution in the 3D space with finite energy and dissipation for arbitrary initial data. In a surprising result, Buckmaster and Vicol proved the non-uniqueness of weak solutions in the class of finite energy. The proof is based on convex integration. In the stationary case, it is a fundamental question whether the solution does exist for the prescribed inhomogeneous boundary data in multi-connected domains. Such a problem is closely related to the $L^p$-Helmholtz-Weyl decomposition of vector fields in 3D interior and exterior domains. The free boundary problem of two phase flow is also fundamental in the fluid mechanics, and the approach in terms of maximal $L^p$-regularity theorem has been fully developed.

## Participants

Arslan, Ali (Zürich), Becker, Lars (Bonn), Binz, Tim (Darmstadt), Boutros, Daniel (Cambridge), Brandt, Felix (Darmstadt), Buckmaster, Tristan J. (New York), Eguchi, Taichi (Tokyo), Haardt, Luca (Karlsruhe), He, Zihui (Bielefeld), Hou, Hedong (Orsay), Hurm, Christoph (Regensburg), Iida, Yoshiki (Tokyo), Koizumi, Yuta (Tokyo), Kozono, Hideo (Sendai), Lenz, Jonas (Mainz), Liu, Shao (Bonn), Liu, Yadong (Regensburg), Markfelder, Simon (Würzburg), Noda, Kei (Kyoto), Rapajic, Isidora (Novi Sad), Roy, Arnab (Darmstadt), Shimizu, Senjo (Kyoto), Tan, Jin (Cergy-Pontoise), Zöchling, Tarek (Darmstadt)

**22.10. – 27.10.2023**          **Control of PDEs Models for Living Systems**
Organizers:                            Debayan Maity, Bangalore
                                       Gisèle Mophou, Pointe-à-Pitre Guadeloupe
                                       Marius Tucsnak, Talence
                                       Michael Winkler, Paderborn

**Abstract**
The PDE (partial differential equations) based modelling of systems involving living organisms is an extremely active mathematical research domain, with major applications in ecology, epidemiology, biology or medicine. One of the particularities encountered in many applications is that such systems involve structuring according to age or to the size. The week-long seminar will be devoted to the analysis and control of this type of system, with emphasis on controllability and stabilizability questions.

**Participants**
Acosta Soba, Daniel (Puerto Real), Agbo Bidi, Kala (Paris), Ahamed, Sakil (Kanpur), Bhandari, Kuntal (Praha), Columbu, Alessandro (Cagliari), Fricke, Torben Jonathan (Paderborn), Fuest, Mario (Hannover), Hasenohr, Ivan (Paris), Hosfeld, René (Berlin), Lankeit, Johannes (Hannover), Le, Minh (East Lansing), Lv, Huilin (Beijing), Maity, Debayan (Bangalore, Bengaluru), Majumdar, Subrata (Powai, Mumbai), Meyer, Felix (Paderborn), Mophou, Gisèle M. (Pointe-à-Pitre), Pan, Xu (Chongqing), Simon, John Sebastian (Praha), Su, Pei (Praha), Takeuchi, Taiki (Tokyo), Winkler, Michael (Paderborn), Wu, Duan (Xi'an), Zhang, Jing (Chongqing), Zhang, Mingyue (Paris), Zhang, Wenji (Xiangtan)

**19.11. – 24.11.2023**

Organizers:

**Scattering Resonances in Quantum Mechanics, General Relativity and Hyperbolic Dynamics**

Semyon Dyatlov, Cambridge MA
Colin Guillarmou, Orsay
Peter Hintz, Zürich
Maciej Zworski, Berkeley

## Abstract

Scattering resonances replace eigenvalues in problems where energy can escape to infinity and are elegantly encoded as poles of Green's functions or scattering matrices: the real part presents the rest energy and the imaginary part the rate of decay. They appear under different names in different subjects: scattering poles (obstacle scattering), resonances (molecular dynamics, nuclear physics, MEMS,…), poles of Eisenstein series (automorphic scattering), quasinormal modes (general relativity), normal modes (seismology), Pollicott–Ruelle resonances (chaotic dynamical systems).

## Participants

Dyatlov, Semyon (Cambridge), Guillarmou, Colin (Orsay), Haghshenas, Mahdi (London), Hintz, Peter (Zürich), Humbert, Tristan (Paris), Kangabire, Alain (Cambridge), Kim, Elena (Cambridge), Labbi, Hodayfa (Saint-Martin-d'Hères), Lequen, Félix (Aalto), Li, Zexing (Cambridge), Li, Zhenhao (Cambridge), Liang, Guangqiu (Atlanta), Lohr, Nicholas (Evanston), Maas, Leo (Utrecht), Malagutti, Marcello (London), Oltman, Izak (Berkeley), Peters, Pieter-Bart (Zürich), Pineau, Benjamin (Berkeley), Taboada, Romeo (Orsay), Tang, Ning (Berkeley), Tao, Zhongkai (Berkeley), Taylor, Mitchell (Zürich), Zworski, Maciej (Berkeley)

| 19.11. – 24.11.2023 | **Variational and Information Flows in Machine Learning and Optimal Transport** |
| --- | --- |
| Organizers: | Wuchen Li, Columbia |
| | Bernhard Schmitzer, Göttingen |
| | Gabriele Steidl, Berlin |
| | Francois-Xavier Vialard, Paris |

## Abstract

Variational and stochastic flows are now ubiquitous in machine learning and generative modeling. Indeed, many such models can be interpreted as flows from a latent distribution to the sample distribution and training corresponds to finding the right flow vector field. Optimal transport and diffeomorphic flows provide powerful frameworks to analyze such trajectories of distributions with elegant notions from differential geometry, such as geodesics, gradient and Hamiltonian flows. Recently, mean field control and mean field games offer a general optimal control variational problems on the learning problem. How do these tools lead us to a better understanding and further development of machine learning and generative models? The Oberwolfach Seminar addressed the topic from different points of view taking in particular recent developments in machine learning into account.

## Participants

Delalande, Alex (Paris), Dumont, Théo (Marne-la-Vallée), Fazeny, Ariane (Hamburg), Gruhlke, Robert (Berlin), Haasler, Isabel (Lausanne), Hartwig, Florine (Bonn), Hertrich, Johannes (London), Jansson, Erik (Göteborg), Khurana, Varun (San Diego), Kroshnin, Aleksei (Berlin), Li, Wuchen (Columbia), Luckhardt, Jonas (Göttingen), Malamut, Hugo (Paris), Mascherpa, Michele (Stockholm), Matt, Hannes (Eichstätt), Matveev, Maria (München), Mordant, Gilles (Göttingen), Neumayer, Sebastian (Lausanne), Pedrotti, Francesco (Klosterneuburg), Rai, Pratik (Eindhoven), Schmitzer, Bernhard (Göttingen), Steidl, Gabriele (Berlin), Vialard, Francois-Xavier (Paris), Zhou, Bohan (Santa Barbara), Zhu, Jia-Jie (Berlin)

## 3.8. Weitere Fortbildungsveranstaltungen / Further training weeks

### Internationale Mathematik-Olympiade 2320a



| 22.05. – 28.05.2022 | **Trainings- und Abschlussseminar für die Internationale Mathematik-Olympiade** |
|---|---|
| Organizers: | Patrick Bauermann, Bonn |
| | Uwe Leck, Flensburg |
| | Jürgen Prestin, Lübeck |

### Abstract

The Institute hosted again the final week of the preparation seminars for the German candidates for the International Mathematical Olympiad (IMO). Sixteen young people made it to the final round of the selection competition. Six of them became part of the team that traveled to Chiba (Japan) and participated at the IMO. The German selection competition and the preparatory seminars are organized by "Bildung & Begabung", the talent promotion center of the federal and state governments.

### Participants

Elbrandt, Florian (Hannover), Galatenko, Dimitrii (Göttingen), Gaulke, Johann (Geisenheim), Glüsen, Janne (Düsseldorf), Kaganskiy, Juri (Berlin), Kottisch, Leonard (Oldenburg), Krabbenhöft, Lars (Höchstadt), Lavrova, Vera (Göttingen), Mann, Boldiszar (Essen), Mintken, Tammo (Oldenburg), Raitz von Frentz, Johannes (Lehrte), Rehdorf, August (Berlin), Schlüter, Henrik (München), Schmidt, Paul (Osterode), Siegert, Philipp (Erlangen), Wagener, Réka (Siegen)

*with kind permission of the Banach Center*

| | |
|---|---|
| **12.11. – 17.11.2023** | **Optimal Transport Theory and Hydrodynamics (from Euler to Monge and vice versa)** |
| Organizers: | Yann Brenier, Paris |
| | Mikaela Iacobelli, Zurich |
| | Filippo Santambrogio, Villeurbanne |

## Abstract

Optimal transport theory is a very successful field of mathematics connecting calculus of variations, probability theory, differential geometry, partial differential equations, functional analysis, statistics and computer sciences. Going back to Monge around 1780, this theory has deep connections with the earlier work of Euler on Hydrodynamics around 1750. This connection has recently known a strong revival on many different sides, leading to various non trivial generalizations of the concept of optimal transport.

## Participants

Bolbotowski, Karol (Warszawa), Borza, Samuel (Trieste), Brenier, Yann (Orsay), Brizzi, Camilla (Garching bei München), Cozzi, Giacomo (Padova), Dumas, Annette (Villeurbanne), Elbar, Charles (Paris), Fanch, Coudreuse (Villeurbanne), Gagnebin, Antoine (Zürich), Galtung, Sondre Testal (Trondheim), Georgiadis, Stefanos (Thuwal), Iacobelli, Mikaela (Zürich), Krawczyk, Krzysztof (Wrocław), Lavier, Theo (Edinburgh), Malamut, Hugo (Paris), Masson, Nicolas (Orsay), Meugang Toukam, Kevine (Bonn), Moraschi, Riccardo (Brescia), Mörschell, Therese (Zürich), Parker, Guy M. (Durham), Pieroni, Francesca (Roma), Santambrogio, Filippo (Villeurbanne), Skrzeczkowski, Jakub (London), Stepien, Lukasz (Wrocław), Tadej, Maciej Tomasz (Wrocław), Tamanini, Luca (Brescia), Toshpulatov, Gayrat (Wien), Weng, Liangjun (Roma)

# 3.9. Oberwolfach Research Fellows



**Gabriele Ciaramella, Milan** (left)
**Martin J. Gander, Genève** (middle)
**Tommaso Vanzan, Lausanne** (right)
08.01. – 21.01.2023
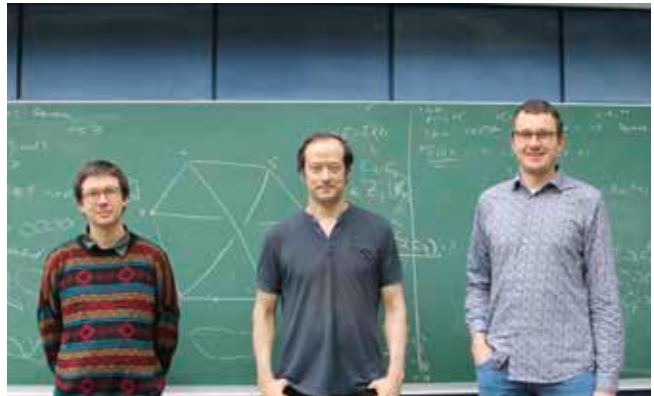


**Nick Early, München** (middle)
**Lukas Kühne, Bielefeld** (right)
**Leonid Monin, Leipzig** (left)
05.02. – 18.02.2023



**Ana Maria Botero, Regensburg** (left)
**José Ignacio Burgos Gil, Madrid** (right)
**David Holmes, Leiden** (middle right)
**Robin Sander de Jong, Leiden** (middle left)
08.01. – 21.01.2023



**Kevin Piterman, Marburg** (right)
**Leandro Vendramin, Brussels** (left)
19.02. – 25.02.2023



**Eveliina Peltola, Espoo** (right)
**Ellen Powell, Durham** (left)
22.01. – 04.02.2023



**Marius Crainic, Utrecht** (middle)
**Rui Loja Fernandes, Urbana Champaign**
(right)
**David Martinez-Torres, Madrid** (left)
19.02. – 11.03.2023

**Adrien Deloro, Paris** (middle)
**Ulla Karhumäki, Helsinki** (left)
**Pınar Ugurlu Kowalski, Beyoglu** (right)
19.02. – 25.02.2023



**Didier Henrion, Toulouse** (right)
**Maria Infusino, Cagliari** (left)
**Salma Kuhlmann, Konstanz** (middle left)
**Victor Vinnikov, Beer Sheva** (middle right)
19.03. – 25.03.2023



**Ilia Itenberg, Paris** (right)
**Eugenii Shustin, Tel Aviv** (left)
26.02. – 11.03.2023



**Andrei Moroianu, Orsay** (right)
**Carlos Shahbazi, Madrid** (left)
19.03. – 01.04.2023



**Tim Keil, Münster** (right)
**Roland Maier, Jena** (left)
05.03. – 18.03.2023



**Spencer Bloch, Chicago** (right)
**Robin Sander de Jong, Leiden** (left)
**Emre Can Sertöz, Hannover** (middle)
26.03. – 08.04.2023

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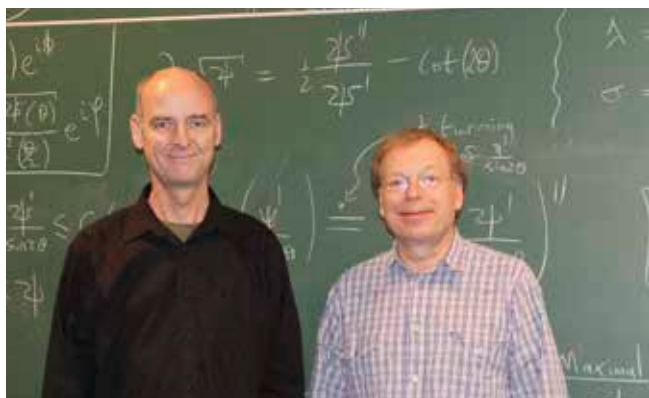
**Brendan Guilfoyle, Munster (IE)** (left)
**Wilhelm Klingenberg, Durham** (right)
02.04. – 15.04.2023
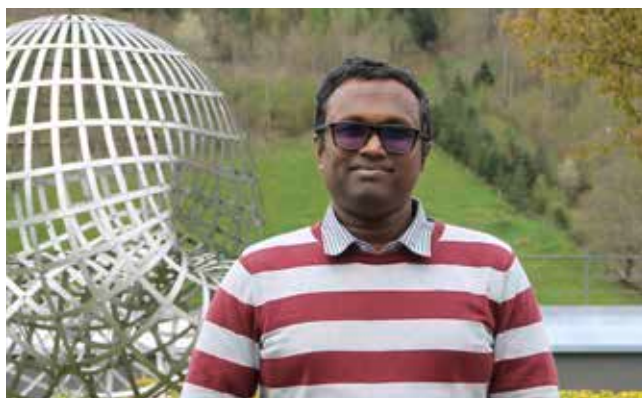


**Pani W. Fernando, Sri Lanka**
23.04. – 29.04.2023



**Matheus Brito, Parana** (right)
**Vyjayanthi Chari, Riverside** (middle left)
**Deniz Kus, Bochum** (middle right)
**Rajendran Venkatesh, Bangalore** (left)
02.04. – 15.04.2023



**Michael Bate, York** (middle)
**Benjamin M.S. Martin, Aberdeen**
(middle right)
**Gerhard Röhrle, Bochum** (middle left)
**Damian Sercombe, Bochum** (right)
**Sören Böhm, Bochum** (left)
30.04. – 13.05.2023



**Volker Diekert, Stuttgart** (left)
**Murray Elder, Sydney** (right)
**Markus Lohrey, Siegen** (middle)
**Armin Weiß, Stuttgart**
16.04. – 28.04.2023



**Claude Sabbah, Palaiseau** (right)
**Christian Schnell, Stony Brook** (left)
14.05. – 27.05.2023
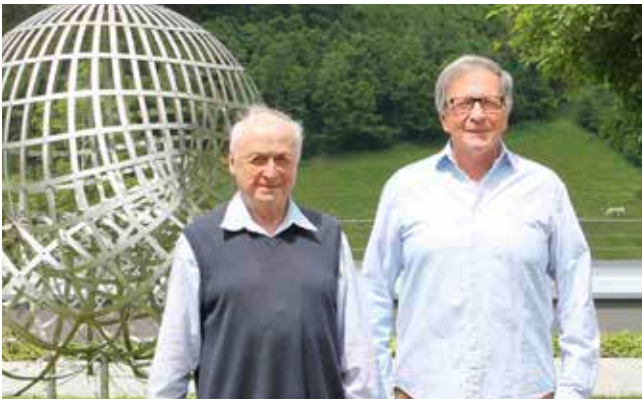
**Andrei Gabrielov, West Lafayette** (left)
**Nicolai Vorobjov, Bath** (right)
21.05. – 03.06.2023
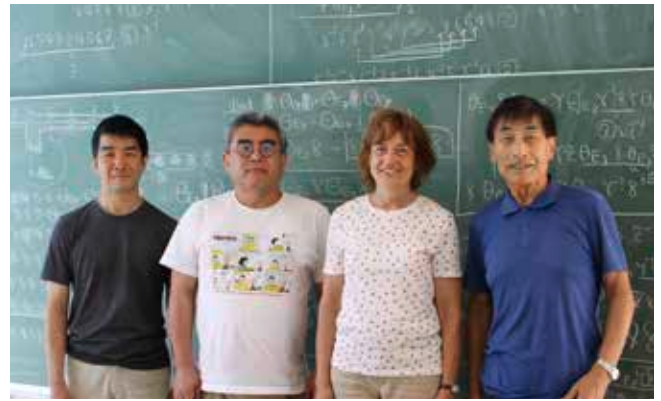


**Alice Fialowski, Budapest** (middle right)
**Kenji Iohara, Villeurbanne** (left)
**Kyoji Saito, Kyoto** (right)
**Yoshihisa Saito, Tokyo** (middle left)
04.06. – 01.07.2023



**Michael Gekhtman, Notre Dame** (left)
**Michael Shapiro, East Lansing** (middle)
**Alek Vainsthein, Haifa** (right)
21.05. – 03.06.2023
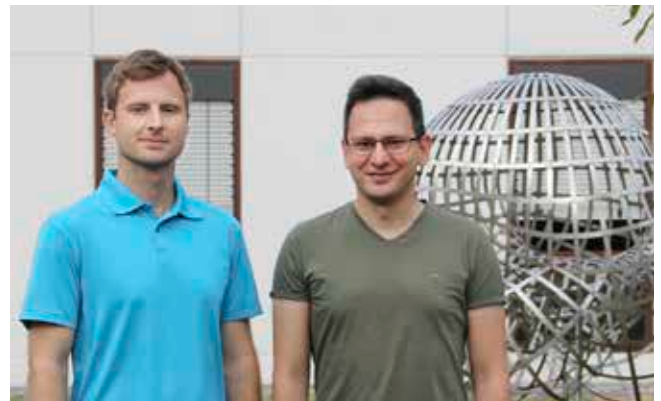


**Christian Kümmerle, Charlotte** (right)
**Tomas Masak, Lausanne** (left)
25.06. – 07.07.2023



**Mikhail Khovanov, New York** (left)
**Jozef H. Przytycki, Washington** (right)
**Louis-Hadrien Robert, Aubière** (middle left)
**Marithania Silvero Casanova, Huelva**
(middle right)
28.05. – 16.06.2023



**Igor Kukavica, Los Angeles** (right)
**Amjad Tuffaha, Sharja** (left)
25.06. – 30.06.2023
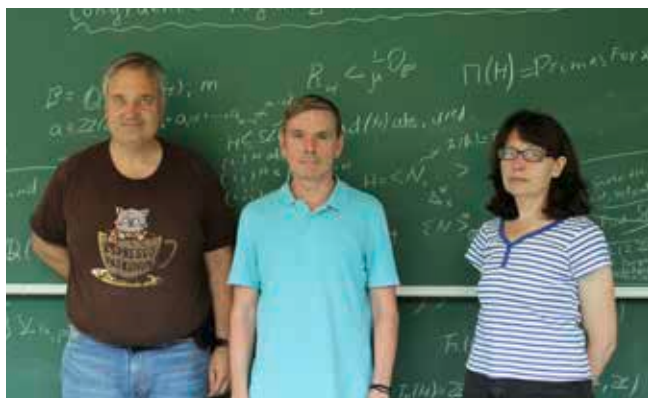
**Alla Detinko, Huddersfield** (right)
**Dane Flannery, Galway** (middle)
**Alexander Hulpke, Fort Collins** (left)
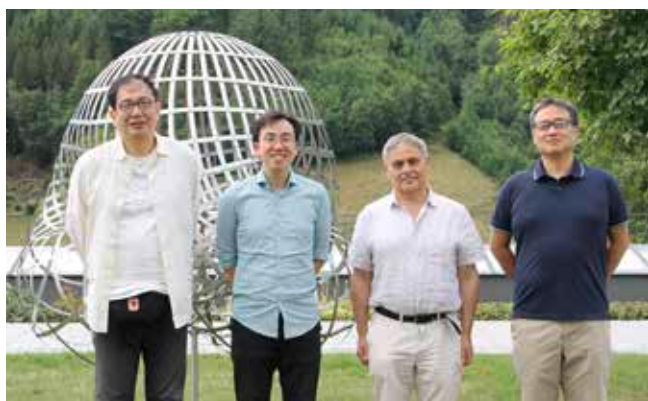02.07. – 15.07.2023
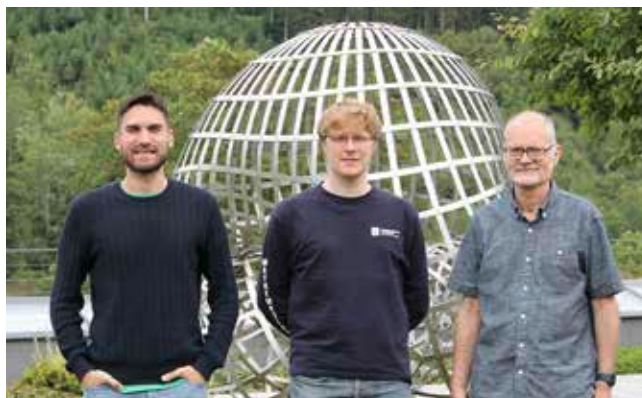


**David Beltran, Burjassot** (left)
**Joris Roos, Lowell** (middle)
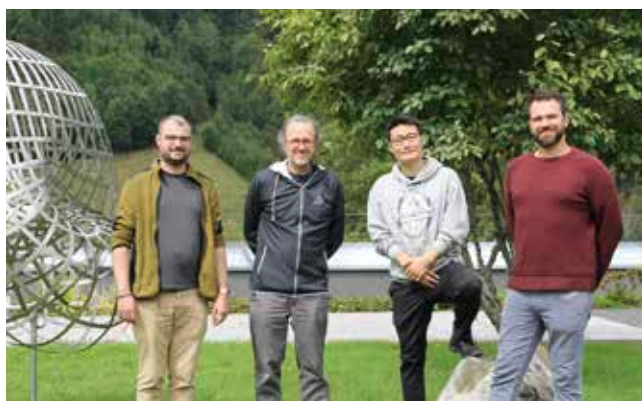**Andreas Seeger, Madison** (right)
23.07. – 19.08.2023



**Andrei Negut, Cambridge, MA** (right)
**Oleksandr Tsymbaliuk, West Lafayette** (left)
09.07. – 22.07.2023



**Toshiyuki Kobayashi, Tokyo** (left)
**Birgit Speh, Ithaca** (right)
30.07. – 11.08.2023



**Yi Huang, Beijing** (middle left)
**Hideki Miyachi, Kanazawa** (right)
**Ken'ichi Ohshika, Tokyo** (left)
**Athanase Papadopoulos, Strasbourg**
23.07. – 29.07.2023



**Francesco Locatello, Tübingen** (left)
**Bernhard Schölkopf, Tübingen** (middle left)
**Kun Zhang, Pittsburgh** (middle right)
**Julius von Kügelgen, Tübingen** (right)
06.08. – 11.08.2023
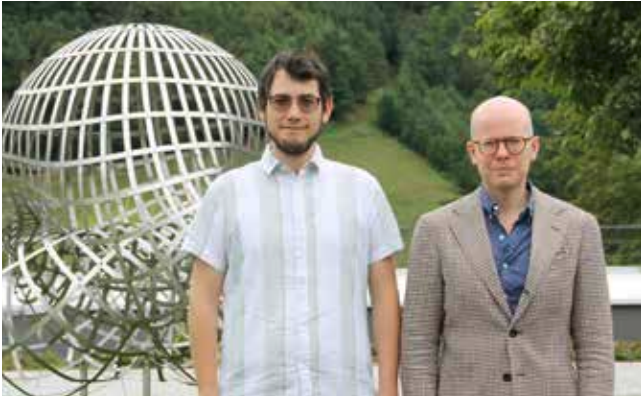
**Michael F. Herbst, Aachen** (left)
**Andre Laestadius, Oslo** (right)
20.08. – 01.09.2023
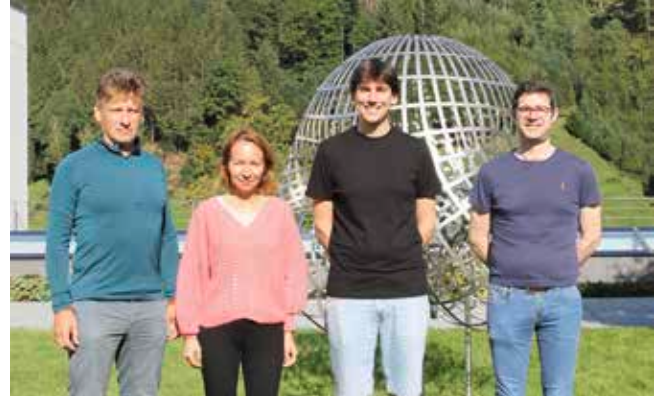


**Tomasz Dębiec, Warsaw** (middle right)
**Piotr Gwiazda, Warsaw** (left)
**Agnieszka Świerczewska-Gwiazda, Warsaw**
(middle left)
**Emil Wiedemann, Erlangen** (right)
17.09. – 29.09.2023
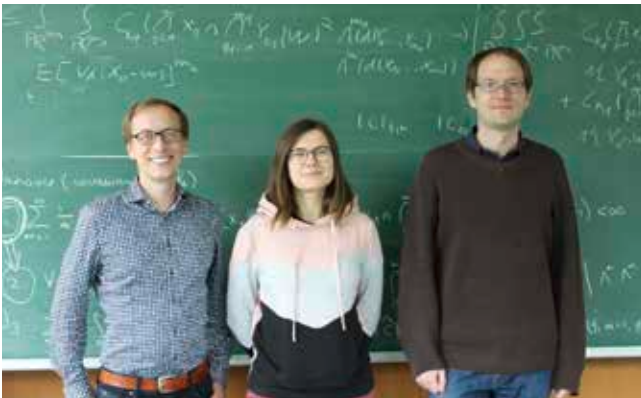


**Anna Gusakova, Münster** (middle)
**Matthias Schulte, Hamburg** (right)
**Christoph Thäle, Bochum** (left)
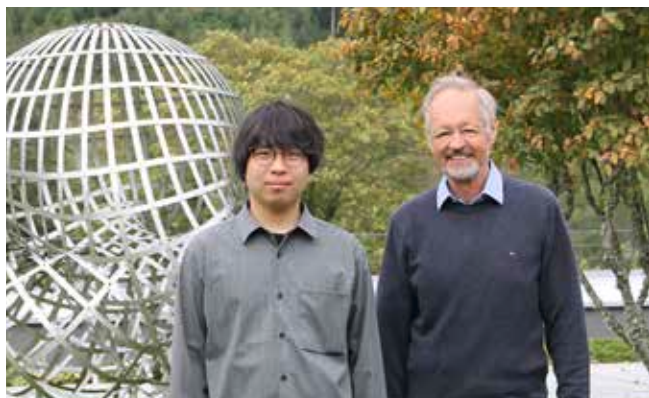03.09. – 16.09.2023



**Alexander Drewitz, Köln** (left)
**Pierre-Francois Rodriguez, London** (middle)
17.09. – 29.09.2023



**Daniele Bartoli, Perugia** (middle)
**Giuseppe Marino, Napoli** (left)
**Francesco Pavese, Bari** (right)
03.09. – 16.09.2023



**Ignacio Nahuel Zurrián, Sevilla** (left)
**F. Alberto Grünbaum, Berkeley** (right)
01.10. – 13.10.2023

**Klaus Hulek, Hannover** (right)
**Yota Maeda, Tokyo** (left)
01.10. – 13.10.2023



**Andrea Colesanti, Firenze** (middle left)
**Eugenia Saorin Gomez, Bremen** (left)
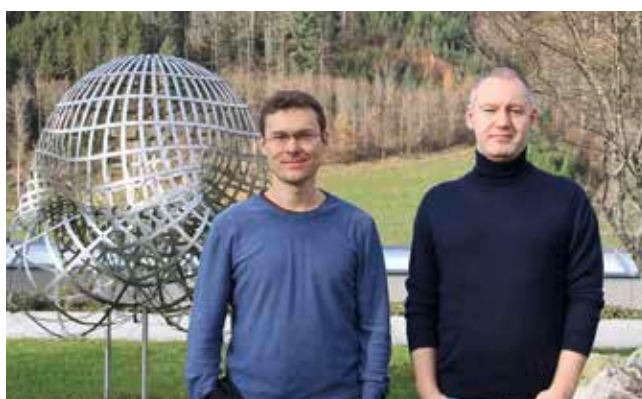**Jesus Yepes Nicolas, Murcia** (right)
05.11. – 17.11.2023



**Matheus Brito, Parana** (right)
**Vyjayanthi Chari, Riverside** (middle left)
**Deniz Kus, Bochum** (middle right)
**Rajendran Venkatesh, Bangalore** (left)
15.10. – 28.10.2023



**Zhen-Qing Chen, Seattle** (left)
**Shuaiqi Zhang, Xuzhou** (right)
05.11. – 24.11.2023



**Ivan Penkov, Bremen** (left)
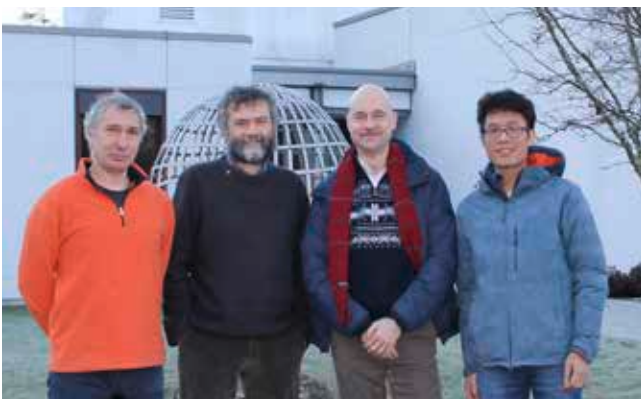**Vera Serganova, Berkeley** (right)
22.10. – 03.11.2023



**Feng Dai, Edmonton**
**Yurii Kolomoitsev, Lübeck** (right)
**Sergey Tikhonov, Barcelona** (left)
19.11. – 01.12.2023

**Mykola Matviichuk, London** (left)
**Brent Pym, Montreal** (middle)
**Travis Schedler, London** (right)
19.11. – 01.12.2023



**Jakob E. Björnberg, Göteborg** (right)
**Daniel Ueltschi, Coventry** (left)
03.12. – 15.12.2023



**Cheuk Yu Mak, Southampton** (right)
**Diego Matessi, Milano** (middle left)
**Helge Ruddat, Stavanger** (middle right)
**Ilia Zharkov, Manhattan KS** (left)
10.12. – 22.12.2023

## 3.10. Oberwolfach Leibniz Fellows



**Michael Landry, St. Louis**
08.01. – 04.02.2023



**Charu Goel, Nagpur**
12.03. – 24.03.2023

external guest researcher:

Sarah-Tanja Hess, Konstanz
19.03. - 24.03.2023



**Damiano Rossi, London**
12.03. – 02.06.2023



**Matthias Leopold Nickel, Pisa**
02.04. – 26.05.2023



**Alexis Prévost, Geneva**
03.09. – 29.09.2023



**Nico Lombardi, Vienna**
10.09. – 01.12.2023

## 3.11. Publikationen

Das MFO unterstützt die Idee von Open Access. Daher sind alle Publikationen auf der Webseite publications.mfo.de elektronisch frei verfügbar (mit Ausnahme der Buchreihe Oberwolfach Seminars beim Birkäuser Programm von Springer).

### Oberwolfach Reports (OWR)

OWR wird in Zusammenarbeit mit EMS Press veröffentlicht und enthält die Ergebnisse der Workshops, Miniworkshops und Arbeitsgemeinschaften in Form von erweiterten Abstracts der Vorträge. Für 2023 sind die Bände OWR 20.1 bis 20.4 mit mehr als 3.000 Seiten erschienen.

### Oberwolfach Preprints (OWP)

In OWP werden Resultate von längerfristigen Forschungsaufenthalten publiziert, aber auch von mathematischen Vorträgen im Rahmen von besonderen Veranstaltungen des MFO. 2023 sind die folgenden Preprints erschienen:

## 3.11. Publications

The MFO supports the idea of open access. Hence, all publications are freely available on the website publications.mfo.de (with the exception of the book series Oberwolfach Seminars from the Birkhäuser program at Springer).

### Oberwolfach Reports (OWR)

OWR is published in cooperation with EMS Press and contains extended abstracts of the talks in the Workshops, Mini-Workshops, and Arbeitsgemeinschaften. For 2023, the issues OWR 20.1 to 20.4 were published with more than 3,000 pages in total.

### Oberwolfach Preprints (OWP)

OWP mainly contains research results related to a longer stay in Oberwolfach, but this can also include lectures held during special occasions in Oberwolfach. The following Preprints were published in 2023:

- Flag-Accurate Arrangements
  [OWP-2023-01] Mücksch, Paul; Röhrle, Gerhard; Tran, Tan Nhat

- Real Enumerative Invariants Relative to the Anti-Canonical Divisor and their Refinement
  [OWP-2023-02] Itenberg, Ilia; Shustin, Eugenii

- Computer Algebra with GAP
  [OWP-2023-03] Piterman, Kevin I.; Vendramin, Leandro

- Edifices: Building-like Spaces Associated to Linear Algebraic Groups; In memory of Jacques Tits
  [OWP-2023-04] Bate, Michael; Martin, Benjamin; Röhrle, Gerhard

- Semantic Factorization and Descent
  [OWP-2023-05] Lucatelli Nunes, Fernando

- Cauchy Completeness, Lax Epimorphisms and Effective Descent for Split Fibrations
  [OWP-2023-06] Lucatelli Nunes, Fernando; Prezado, Rui; Sousa, Lurdes

- Automatic Differentiation for ML-Familiy Languages: Correctness via Logical Relations
  [OWP-2023-07] Lucatelli Nunes, Fernando; Vákár, Matthijs

- Lax Comma Categories of Ordered Sets
  [OWP-2023-08] Clementino, Maria Manuel; Lucatelli Nunes, Fernando

- Logical Relations for Partial Features and Automatic Differentiation Correctness
  [OWP-2023-09] Lucatelli Nunes, Fernando; Vákár, Matthijs

- Hypergroups and Twin Buildings, I
  [OWP-2023-10] French, Christopher; Zieschang, Paul-Hermann

- Rank Deviations for Overpartitions
  [OWP-2023-11] Lovejoy, Jeremy; Osburn, Robert

- The Simplicial Complex of Brauer Pairs of a Finite Reductive Group
  [OWP-2023-12] Rossi, Damiano

- Multi-Dimensional Summation-by-Parts Operators for General Function Spaces: Theory and Construction
  [OWP-2023-13] Glaubitz, Jan; Klein, Simon-Christian; Nordström, Jan; Öffner, Philipp

- The Brown Complex in Non-Defining Characteristic and Applications
  [OWP-2023-14] Rossi, Damiano

- The Character Triple Conjecture for Maximal Defect Characters and the Prime 2
  [OWP-2023-15] Rossi, Damiano

- Bochner-Riesz Means at the Critical Index: Weighted and Sparse Bounds
  [OWP-2023-16] Beltran, David; Roos, Joris; Seeger, Andreas

- A Note on Endpoint Bochner-Riesz Estimates
  [OWP-2023-17] Beltran, David; Roos, Joris; Seeger, Andreas

- Ground State of Bose Gases Interacting through Singular Potentials
  [OWP-2023-18] Boßmann, Lea; Leopold, Nikolai; Petrat, Sören; Rademacher, Simone

## Schnappschüsse moderner Mathematik aus Oberwolfach

In den „Schnappschüssen moderner Mathematik aus Oberwolfach" bereiten Teilnehmerinnen und Teilnehmer der wissenschaftlichen Programme des MFO einen besonders spannenden Aspekt ihrer Forschung für die interessierte Öffentlichkeit auf. Im Jahr 2023 sind insgesamt 8 Schnappschüsse aus unterschiedlichen mathematischen Gebieten erschienen:

## Snapshots of modern mathematics from Oberwolfach

In the "snapshots of modern mathematics from Oberwolfach" participants of the scientific programs at the MFO explain an especially exciting aspect of their research to an interested public. 8 snapshots from distinct mathematical areas have been published in 2023:

- Patterns and Waves in Theory, Experiment, and Application
  (No. 1/2023) Bramburger, Jason J.

- The Periodic Tables of Algebraic Geometry
  (No. 2/2023) Belmans, Pieter

- Felder und Räume: Symmetrie und Lokalität in Mathematik und theoretischen Wissenschaften
  (No. 3/2023) Saberi, Ingmar

- Algebras and Quantum Games
  (No. 4/2023) Paulsen, Vern I.

- Cutoff Phenomenon: Surprising Behaviour in Card Shuffling and other Markov Chains
  (No. 5/2023) Baraquin, Isabelle; Lafrenière, Nadia; Schuh, Katharina

- $4 = 2 \times 2$, or the Power of Even Integers in Fourier Analysis
  (No. 6/2023) Negro, Giuseppe; Oliveira e Silva, Diogo

- The Geometry of Fair Division
  (No. 7/2023) Frick, Florian

- Geproci Sets: a New Perspective in Algebraic Geometry
  (No. 8/2023) Chiantini, Luca; Harbourne, Brian

# 4. Infrastruktur und Finanzen

## 4.1. Übersicht der Bereiche

Die wissenschaftliche Arbeit der Forschungs-gäste wird durch eine effiziente Infrastruktur ermöglicht.

Von besonderer Bedeutung ist die Bibliothek, die in der mathematischen Forschung eine ähnliche Rolle spielt wie das Labor in den Naturwissenschaften. Die Bibliothek des MFO zählt zu den weltweit besten Spezialbibliotheken in der Mathematik und steht den Gästen rund um die Uhr zur Verfügung.

Daneben spielt der Bereich der Informationstechnologie eine wichtige Rolle, sowohl direkt für die wissenschaftliche Arbeit, als auch für die weltweite Kommunikation der Forschenden untereinander.

Zur Planung, Durchführung und Begleitung der wissenschaftlichen Programme waren am Institut etwa 23 Stellen in den Bereichen der wissenschaftlichen und allgemeinen Verwaltung, Bibliothek, IT-Abteilung, Öffentlichkeitsarbeit, Gästebetreuung und Hauswirtschaft besetzt. Für die effiziente, konzentrierte Arbeit der Gäste am MFO sind dabei die abgeschiedene Lage, die hervorragende wissenschaftliche Infrastruktur, und nicht zuletzt auch die ideale Betreuung einschließlich Unterbringung und Verpflegung im Gästehaus, direkt neben dem Tagungs- und Bibliotheksgebäude, wichtige Faktoren.

## 4.2 Bibliothek

Die Bibliothek des MFO ist für die Forschungs-gäste in Oberwolfach das wichtigste Arbeitsmittel. Sie wird intensiv von Teilnehmenden aller Programme genutzt. Viele ziehen eine Einladung nach Oberwolfach anderen Einladungen vor, da sie am MFO Literatur vorfinden, die für sie sonst nicht zugänglich ist. Neben dem hohen internationalen Standard des wissenschaftlichen Programms und den exzellenten Rahmenbedingungen für den persönlichen Gedankenaustausch ist die Bibliothek ein wichtiger Grund für das hohe Ansehen des MFO weltweit.

Der hohe Stellenwert der Bibliothek wird auch deutlich in dem großen Engagement verschiedener Stiftungen wie der Klaus Tschira Stiftung gGmbH, der Marga und Kurt Möllegaard-Stiftung, der VolkswagenStiftung sowie der Carl Friedrich von Siemens Stiftung. So haben die Klaus Tschira Stiftung und die VolkswagenStiftung zu gleichen

# 4. Facilities and Finances

## 4.1. Overview on the divisions

The MFO has set up an excellent infrastructure for scientific research activities.

The library represents a vital part of this infrastructure and plays an important role, similar to laboratories in experimental sciences. The MFO's library is one of the world's most excellent libraries in mathematics and can be used by the guest researchers 24 hours a day.

But also information technology is of great importance for assisting research activities, and also to ensure worldwide communication among the scientific community.

For the planning and realization of the scientific program approximately 23 positions in various divisions, such as scientific and administration management, library, IT-service, outreach and media, guest service, and housekeeping are provided. Besides the excellent scientific infrastructure it is also the Institute's remote location, and the excellent service with board and lodging in our guest house close to the conference and library building, that guarantees efficient and concentrated working conditions for our guests.

## 4.2 Library

The library is the most important working tool for scientific research in Oberwolfach. It is used intensively by participants of all scientific programs. Many mathematicians prefer an invitation to Oberwolfach to other invitations because they find literature here that is otherwise unavailable for them. In addition to the high international standard of the scientific program and the excellent conditions for the face-to-face exchange of ideas, the library is an important factor for the high reputation of the MFO worldwide.

The high significance of the library is also reflected in the great commitment of various foundations, such as the Klaus Tschira Stiftung gGmbH, the Marga and Kurt Möllegaard-Foundation, the Volkswagen Foundation and the Carl Friedrich von Siemens Foundation. For example, the Klaus Tschira Stiftung and the Volkswagen

Teilen den Erweiterungsbau der Oberwolfacher Bibliothek finanziert und damit Platz für etwa 20 weitere Jahre geschaffen. Die Carl Friedrich von Siemens Stiftung unterstützt die Oberwolfacher Bibliothek seit 1999 mit einem regelmäßigen Betrag für den Erwerb von Büchern. In 2015-2016 konnte durch Mittel der VolkswagenStiftung die Informations- und Kommunikations-Infrastruktur der Bibliothek modernisiert und eine Kompaktanlage für die gebundenen Zeitschriften eingerichtet werden. Darüber hinaus hat die Deutsche Forschungsgemeinschaft (DFG) seit 2004 zahlreiche Projekte im Rahmen des Förderprogramms „Wissenschaftliche Literaturversorgungs- und Informationssysteme" finanziert.

## Bibliotheksprofil

Die Oberwolfacher Bibliothek hat die Aufgabe, die Fachliteratur aus allen Bereichen der Mathematik sowie aus angrenzenden Gebieten so vollständig wie möglich zu erwerben und bereit zu stellen. Im Fokus stehen dabei insbesondere mathematische Fachzeitschriften sowie Monographien und Kongressberichte der relevanten Fachverlage. Schwerpunktmäßig werden Bücher in gedruckter Form angeschafft, Zeitschriften hingegen bevorzugt elektronisch. Aber auch E-Books werden seit 2014 gezielt und in Ergänzung zum gedruckten Bestand erworben. Die relevante Literatur wird gekauft, im Tausch gegen institutseigene Publikationen erworben oder als Geschenk empfangen.

Die Bibliothek des MFO ist eine reine Präsenzbibliothek und für die Forschungsgäste rund um die Uhr geöffnet. Sämtliche Bestände stehen innerhalb der Bibliothek ohne Einschränkung zur Verfügung. Es findet keinerlei Ausleihe statt, auch Fernleihe ist nur in begründeten Einzelfällen möglich (z.B. bei Alleinbesitz).

Das MFO nimmt seit 1995 am Südwestdeutschen Bibliotheksverbund (SWB) teil. Die Arbeit im Verbund sowie die durch das Bibliotheksservice-Zentrum Baden-Württemberg (BSZ) als betreuende Institution bereitgestellte Software bedeuten für das Institut eine erhebliche Erleichterung bei der Verwaltung der Bibliotheksbestände.

## Bestand

Zum Bestand der Bibliothek gehörten zum Jahresende 2023 ca. 70.700 gedruckte Bücher, darunter 50.100 Monographien und 10.200 Kongressberichte. 152 Bücher konnten mit Mitteln der Carl Friedrich von Siemens Stiftung erworben werden. Die Zahl der E-Books konnte auf etwa 30.500 gesteigert werden.

Foundation have funded the extension of the library building in equal parts, creating space for another 20 years. The Carl Friedrich von Siemens Foundation has supported the Oberwolfach library since 1999 with a regular amount for the purchase of books. In 2015-2016 the MFO received support from the Volkswagen Foundation to modernize the library infrastructure of information and communication and to install compact shelves for the bound journal volumes. In addition, since 2004, the Deutsche Forschungsgemeinschaft (German Research Foundation, DFG) has financed numerous projects within the funding program "Scientific Library Services and Information Systems".

## Library profile

The task of the library in Oberwolfach is to acquire and to provide specialist literature from all fields of mathematics and its neighboring areas as complete as possible. In particular, the acquisition focuses on mathematical journals and monographs as well as on conference proceedings of the relevant academic publishers. Books are primarily acquired in printed form, while journals are preferred electronically. However, since 2014 e-books have also been sytematically acquired in addition to the printed stock. The relevant literature is either purchased, acquired in exchange for publications of the Institute, or received as a gift.

The library of the MFO is a reference library and can be used by our research guests 24 hours a day. The complete collection is available within the library without restriction. There is no lending system, interlibrary lends are only possible in justified individual cases (e.g. in the case of exclusive possession).

Since 1995 the MFO has been a member of the Südwestdeutscher Bibliotheksverbund (SWB), which, together with the software provided by the Bibliotheksservice-Zentrum Baden-Württemberg (BSZ) as supporting institution, facilitates the cataloging of our library collection enormously.

## Library Holdings

The library's collection at the end of 2023 included approximately 70,700 printed books, including 50,100 monographs and 10,200 congress proceedings. 152 books were acquired with funds from the Carl Friedrich von Siemens Foundation. The number of e-books has increased to about 30,500.

Vor allem durch DFG-Nationallizenzen sowie die DEAL-Verträge und weitere Konsortiallizenzen stehen am MFO über 10.000 E-Journals zur Verfügung. Die Zahl der Print-Abonnements blieb konstant bei 150 Titeln. In den Kompaktregalen befanden sich darüberhinaus ca. 33.000 gedruckte Zeitschriftenbände, nicht alles davon ist digital erhältlich.

Mainly through DFG National Licences as well as the DEAL contracts and other consortia licences, more than 10,000 e-journals are available at the MFO. The number of print subscriptions has decreased to 150 titles. Additionally, the compact shelves of the library contain about 33,000 bound journal volumes, where not all of them are also electronically available.



*Buchausstellung im Bibliotheksgebäude / Book exhibition at the library building*

## Buchausstellung

Die ständige Buchausstellung gibt interessierten wissenschaftlichen Verlagen die Möglichkeit, ihre Neuerscheinungen im Bereich Mathematik am MFO über einen längeren Zeitraum zu präsentieren. Die Bibliothek des MFO profitiert von dieser Kooperation, indem sie die kostenlos gelieferten Neuerscheinungen in ihren Bestand integrieren kann. 2023 gingen insgesamt 748 Bücher im Rahmen der Buchausstellung in den Bibliotheksbestand ein. Wir danken den folgenden Verlagen für ihre Unterstützung und ihr Mitwirken in unserem Buchausstellungsprogramm:

- American Mathematical Society (AMS)

- Atlantis Press (Co-publishing with Springer)

- Birkhäuser Science

- Cambridge University Press

- CRC Press/Taylor & Francis Group

- De Gruyter GmbH & Co. KG

- EMS Press

- International Press of Boston, Inc.

## Book exhibition

The permanent book exhibition enables academic publishers to present their new publications in the field of mathematics at the MFO for a certain period of time. The library of the MFO benefits from this cooperation, because all books from the exhibition can be included free of charge into the inventory of the library. In the year 2023 the library received a total of 748 books this way. We wish to thank the following publishers for taking part in our book exhibition program:

- Iwanami Shoten Publishers

- Mathematical Society of Japan

- Oxford University Press

- Princeton University Press

- Société Mathématique de France (SMF)

- Springer Nature

- Springer Spektrum

- XYZ Press by AwesomeMath (distributed by AMS)

## Oberwolfach Photo Collection

Zum Bibliotheksbestand gehört eine umfangreiche Sammlung an Porträts von Mathematikern und Mathematikerinnen, zusammengetragen durch Herrn Prof. Dr. Konrad Jacobs, Erlangen. Diese Sammlung ist im Jahr 2004 mit Hilfe des Springer Verlags Heidelberg digitalisiert worden; sie steht im Internet mit verschiedenen Recherche-Funktionen frei zur Verfügung. Die zugrunde liegende Datenbank ist eine Eigenentwicklung des MFO. Die Sammlung wird laufend ergänzt durch eigene Aufnahmen sowie durch externe Beiträge. Sie wird unter anderem für den Bereich Mathematik in der Wikipedia unter den Bedingungen der Creative Commons License Attribution-Share Alike 2.0 Germany sowie in zunehmendem Maße von Verlagen für deren Publikationen genutzt. Ende 2023 waren ca. 23.480 Fotos in der Datenbank enthalten.

## Oberwolfach Leibniz Archive for Mathematics (OLAM)

Es konnten zwei weitere Verlage gewonnen werden, die zukünftig ihre Zeitschrifteninhalte zur Langzeitarchivierung an das Oberwolfach Leibniz Archive for Mathematics – OLAM abliefern möchten: der Heldermann-Verlag sowie das Münster Journal of Mathematics, das vom Mathematischen Institut der Universität Münster herausgegeben wird. Mit beiden Verlagen wurde eine entsprechende Vereinbarung geschlossen. OLAM bietet ein nachhaltiges digitales Archiv für die Langzeitarchivierung mathematischer elektronischer Zeitschriften. Das sogenannte „dark archive" sichert die langfristige Erhaltung der wissenschaftlichen Inhalte, wobei der Zugang für die Öffentlichkeit nur dann möglich ist, wenn ein sog. „Trigger-Ereignis" eintritt.

Weitere Informationen gibt es unter https://www.mfo.de/library/libservices/olam.

## Oberwolfach Photo Collection

The inventory of the library includes a large collection of mathematician portraits, collected by Prof. Dr. Konrad Jacobs, Erlangen. This collection has been digitized in the year 2004 with support of the publisher Springer Heidelberg. It is freely available on the internet with a variety of search functions. The underlying database is an in-house development of the MFO. The collection is continuously supplemented by in-house photographs and contributions by mathematicians worldwide. Among other things, the collection is used for the field of mathematics in Wikipedia according to the conditions of the Creative Commons License Attribution-Share Alike 2.0 Germany. Increasingly, publishers use the collection as well for their publications. By the end of 2023 the database contained approximately 23,480 photos.

## Oberwolfach Leibniz Archive for Mathematics (OLAM)

Two further publishers have been acquired who would like to submit their journal content to the Oberwolfach Leibniz Archive for Mathematics – OLAM for long-term preservation: Heldermann-Verlag and the Münster Journal of Mathematics, which is published by the Mathematical Institute of the University of Münster. A corresponding agreement has been concluded with both publishers. OLAM provides a sustainable closed digital archive for the preservation of mathematical e-journals. The so-called "dark archive" ensures the long-term survival of scholary content, with access provided to the public only when a "trigger event" occurs.

Further information can be found at https://www.mfo.de/library/libservices/olam.

## 4.3. IT

Die IT-Abteilung des MFO stellt den Institutsangehörigen, den Gremien und den Gästen effiziente IT-Arbeitsumgebungen zur Verfügung. Sie unterstützt die Bibliothek und den Bereich der Öffentlichkeitsarbeit bei Diensten für die mathematische Community und die interessierte Öffentlichkeit. Dabei sind Informationssicherheit und Datenschutz wichtige Aspekte, die entsprechend berücksichtigt werden.

Seit Ende des Jahres 2022 wird die IT-Abteilung des MFO von einem externen Unternehmen unterstützt, insbesondere im Hinblick auf die Informationssicherheit und die Weiterentwicklung der Software zur Tagungsverwaltung. Die Zusammenarbeit hilft dem Institut dabei, einen seit Beginn des Jahres 2022 bestehenden Personalengpass in der IT abzufedern.

### Verwaltungsbereich

Die Verwaltung der Tagungen und der längeren Forschungsaufenthalte erfolgt mit der am MFO entwickelten Software „owconf", die Anforderungen von wissenschaftlicher Begutachtung, Konferenzmanagement und Hotelsoftware in sich vereinigt. In den vergangenen Jahren wurde die Software stetig weiterentwickelt. Zahlreiche neue Anforderungen – sowohl in technischer Hinsicht als auch aus Benutzersicht – erforderten nun jedoch eine grundlegende Überarbeitung, so dass 2023 mit der Erstellung einer neuen Version begonnen wurde.

Kommerzielle Software wird in den Bereichen Finanzbuchhaltung, Personalverwaltung sowie beim Bibliothekskatalog und der Literaturrecherche eingesetzt.

Das Verwaltungspersonal arbeitet hauptsächlich mit Remote-Desktop-Sitzungen, die von den PC-Arbeitsplätzen oder per VPN von mobilen Arbeitsplätzen aus genutzt werden.

### Gästebereich

Wegen der relativ kurzen Aufenthalte der Gäste sind alle IT-Angebote so intuitiv wie möglich gestaltet. Die Gäste erhalten persönliche Nutzerkonten für die Online-Angebote der Bibliothek, drahtlosen und kabelgebundenen Internetzugang sowie Scan- und Druckmöglichkeiten.

Alle Vortragsräume sind mit moderner Präsentations- und Videokonferenztechnik ausgestattet. Auch für Kleingruppen und Einzelpersonen in den Langzeitprogrammen des MFO stehen Videokonferenzsysteme sowie Systeme zur Unterstützung der Zusammenarbeit vor Ort zur Verfügung.

The IT department of the MFO provides an efficient IT infrastructure for the employees of the Institute, the committees, and the visiting scientists. Furthermore, the IT department supports the library and the public relations of the MFO with regard to services for the mathematical community and the interested public. Data security and data protection are important tasks, taken into account throughout.

Since the end of 2022, the IT department of the MFO has been supported by an external company, in particular with regard to data security. The collaboration helps the Institute cushion a personnel shortage that has existed since the beginning of 2022.

### Administrative sector

The databased software "owconf", developed in-house, handles tasks arising from scientific management, conference management and guesthouse administration. The software has been continously enhanced over the past years. Numerous new requirements – both from a technical and user perspective – now afforded a fundamental revision, so work on a new version started in 2023.

Commercial software is used for financial accounting and human resources, for the library catalog and the literature search portal.

The administrative staff mainly works with remote desktop sessions, which are accessed from the PC workstations or from mobile workstations via VPN.

### Guests' working environments

Due to the relatively short stays of the guest scientists, all services are designed as easy to use as possible. Guest scientists are provided with personal accounts for the online services of the library, wifi and cable-bound ethernet connection as well as scan and print facilities.

The IT section maintains modern presentation and videoconference equipment in all lecture rooms. Video conference systems are also available for small groups and individuals in the long-term programs of the MFO for exchange with distant cooperation partners, likewise there are systems to support the cooperation on site.

## Webdienste

Die Webdienste für die Gäste und die weitere mathematische Community bieten Informationen über die Angebote des MFO, künftige und vergangene Forschungsprogramme und – in Zusammenarbeit mit der Bibliothek – freien Zugang zu Publikationen des Instituts. Der spezielle Webdienst „Oberwolfach Photo Collection" ist eine Eigenentwicklung des MFO.

## Unterstützung der Öffentlichkeitsarbeit

Die IT-Abteilung unterstützt die Öffentlichkeitsarbeit des MFO, insbesondere die „Schnappschüsse moderner Mathematik aus Oberwolfach", für deren Produktion sie die Infrastruktur bereitstellt. Außerdem betreut die IT des MFO das Oberwolfacher Museum für Mineralien und Mathematik „MiMa". Dieses wird von der Gemeinde Oberwolfach, dem Verein der Freunde von Mineralien und Bergbau Oberwolfach und dem MFO gemeinsam betrieben (s. Abschnitt 4.4.: Öffentlichkeitsarbeit). Ausgewählte Exponate werden auch direkt am Institut den Forschungsgästen über einen Touchscreen bereitgestellt.

## 4.4. Öffentlichkeitsarbeit

Das MFO richtet sich in seiner Öffentlichkeitsarbeit sowohl an wissenschaftliche als auch an nicht-wissenschaftliche Zielgruppen. Die wissenschaftliche Kernzielgruppe, bestehend aus Mathematikern und Mathematikerinnen sowie Forschenden in angrenzenden Gebieten, erhält regelmäßig Informationen über anstehende Veranstaltungen und wissenschaftliche Programme des MFO. Das MFO verschickt dazu einen halbjährlichen Rundbrief per Email, informiert auf der eigenen Webseite und verbreitet Flyer und Poster. Außerdem nutzt das Institut die angebotenen Informationskanäle der mathematischen Fachgesellschaften, z.B. von DMV und EMS.

Zusätzlich zur wissenschaftlichen Kernzielgruppe richtet sich das MFO an im weiteren Sinne forschungsinteressierte Gruppen, insbesondere an Schülerinnen und Schüler, Studierende, Lehrkräfte und Wissenschaftsredaktionen, sowie an die breite Öffentlichkeit. Das Ziel ist es, das Verständnis für die Bedeutung der Mathematik zu fördern. Das MFO verfolgt dazu drei miteinander vernetzte Aktivitäten: Das Institut ist Mitbetreiber des Museums für Mineralien und Mathematik in Oberwolfach, es ist Herausgeber der Open-Source Schriftenreihe „Schnappschüsse moderner Mathematik aus Oberwolfach" und es ist Teilhaber und Kooperationspartner der IMAGINARY gGmbH.

## Web services

Web services for the guest scientists and the wider mathematical community include information about MFO facilities, future and past research programs at the MFO and open access to publications of the Institute in collaboration with the MFO library. The special web service "Oberwolfach Photo Collection" has been developed in-house.

## Support of outreach activities

The IT section also supports the outreach activities of the MFO, in particular it supplies the infrastructure for producing the "snapshots of modern mathematics from Oberwolfach". Moreover, the IT section services the Museum for Minerals and Mathematics "MiMa". It is run jointly by the local authority, the association of the Friends of Minerals and Mining and the MFO – all seated at Oberwolfach (see section 4.4.: Outreach and Media). Selected exhibits are also provided to our research guests at the Institute on a touchscreen.

## 4.4. Outreach and Media

In its outreach the MFO addresses both academic and non-academic target groups. The core academic target group, consisting of mathematicians and researchers in adjacent areas, regularly receives information on forthcoming events and scientific programs of the MFO. The MFO sends a biannual newsletter via email, informs on its website and distributes posters and flyers. The Institute also uses the information channels offered by national and international mathematical societies, e.g. of the German Mathematical Society (DMV) and the European Mathematical Society (EMS).

In addition to the core academic target group, the MFO addresses groups interested in research in a broader sense, in particular pupils, students, teachers and science journalists, as well as the general public. The main objective with regard to these audiences is to promote the understanding of the importance of mathematics and modern mathematical research. The MFO pursues three interlinked activities: The Institute is co-operator of the Museum of Minerals and Mathematics in Oberwolfach, it is the publisher of the open-source article series "snapshots of modern mathematics from Oberwolfach" and it is shareholder and cooperation partner of the IMAGINARY gGmbH.

## Mathematik im MiMa

Das Mathematische Forschungsinstitut Oberwolfach betreibt seit 2010 gemeinsam mit dem Verein der Freunde von Mineralien und Bergbau und der Gemeinde Oberwolfach das MiMa – Museum für Mineralien und Mathematik. Das Museum zeigt eine einzigartige Sammlung an Mineralien aus dem gesamten Schwarzwald und erklärt ihre kristallinen Formen und Symmetrien in interaktiven mathematischen Installationen.

Der mathematische Teil der Ausstellung bietet kunstvolle Einblicke in die Mathematik und lädt dazu ein, mathematische Phänomene spielerisch zu erforschen. Sowohl Konzepte der angewandten als auch der reinen Mathematik werden in interaktiven Programmen, Hands-on-Exponaten und Bildern dargestellt. Ein deutlicher Schwerpunkt liegt auf den mathematischen Grundlagen der Kristallografie. Durch die Verknüpfung von Mathematik und Mineralogie bietet das Museum einen interdisziplinären Zugang zu beiden Wissenschaften und vereint zwei Besonderheiten der Region unter einem Dach.

Die Ausstellung richtet sich an ein breites Publikum. Ein besonderer Schwerpunkt liegt auf den Schulen der Region, für die spezielle Führungen angeboten werden. Im Rahmen der Reihe „Kultur im MiMa" finden außerdem Veranstaltungen zu unterschiedlichen Themen aus Mathematik und Mineralogie statt.

2023 erhielt das MiMa einen Anbau durch die Gemeinde Oberwolfach, in dem zukünftig die Tourist-Information der Gemeinde untergebracht wird. Aufgrund der Bauarbeiten war das Museum das ganze Jahr über geschlossen. Das MFO nutzte die Schließzeit für die Planung und Installation eines neuen Exponats zum Thema Künstliche Intelligenz in Zusammenarbeit mit IMAGINARY.

## Schnappschüsse moderner Mathematik

Das Ziel der „Schnappschüsse moderner Mathematik aus Oberwolfach" ist es, mathematische Ideen und Probleme in verständlicher Art und Weise einem breiten Publikum zu vermitteln. Sie sollen spannende Einblicke in die aktuelle mathematische Forschung bieten. Die Schnappschüsse werden von Teilnehmenden des wissenschaftlichen Programms am MFO geschrieben. Ein Team aus Editorinnen und Editoren unterstützt sie bei der Aufbereitung der komplizierten Sachverhalte für ein breites Publikum. Das MFO veröffentlicht die Schnappschüsse frei verfügbar unter einer Creative Commons Lizenz.

## Mathematics at the MiMa

Since 2010 the Mathematisches Forschungsinstitut Oberwolfach engages in the MiMa – Museum for Minerals and Mathematics, together with the association of the Friends of Minerals and Mining in Oberwolfach and the municipality Oberwolfach. The museum shows a one-of-a-kind collection of minerals from all over the Black Forest and explains their forms and symmetries with interactive mathematical applications.

The maths exhibition delivers aesthetic insights into mathematics and enables visitors to playfully explore mathematical phenomenons. Interactive programs, hands-on exhibits, and images depict concepts of both applied and pure mathematics. A clear focus is put on the mathematical foundations of crystallography. Through this combination of mathematics and mineralogy, the museum offers an interdisciplinary approach to both sciences and presents two unique features of the region in one single spot.

The exhibition is aimed at a broad audience. A special focus is on the schools of the region, for which special tours are offered. Within the "Culture in MiMa" series, there are also events on various topics from mathematics and mineralogy.

In 2023, the MiMa received an extension from the municipality of Oberwolfach, which will house the municipality's tourist information office in the future. Due to the construction work, the museum was closed for the whole year. The MFO used the closure period to plan and install a new exhibit on the subject of artificial intelligence in cooperation with IMAGINARY.

## Snapshots of modern mathematics

The aim of the "snapshots of modern mathematics from Oberwolfach" is to explain mathematical problems and ideas in an understandable way to a broad audience. They shall provide exiting insights into current mathematical research. The snapshots are written by participants of the scientific program at the MFO. A team of editors assists them in communicating complicated matters to a broad audience. The MFO publishes the snapshots for free download under a Creative Commons license.

Das Schnappschuss-Projekt hat zum Ziel, Verständnis und Wertschätzung für moderne Mathematik und mathematische Forschung in der interessierten Öffentlichkeit weltweit zu fördern. Die angestrebte Leserschaft besteht aus Mathematiklehrkräften, Wissenschaftsjournalistinnen und -journalisten, Studierenden sowie fortgeschrittenen Schülerinnen und Schülern.

Das Projekt wurde im Jahr 2023 von Dr. Anja Randecker koordiniert. Sie ist als Chefeditorin für das Editieren der Texte verantwortlich. Dr. Michela Egidi, Dr. Carina Geldhauser, Dr. Martin Günter, Daniel Kronberg, Dr. Marta Maggioni, Dr. Sara Munday, Anup Anand Singh, Dr. Matthew Tam und Joonas Mikael Vättö wirkten im Redaktionsteam mit. Im Laufe des Jahres wurden 8 Schnappschüsse publiziert (s. Abschnitt 3.11.: Publikationen).

## Zusammenarbeit mit IMAGINARY

IMAGINARY startete am MFO anlässlich des Wissenschaftsjahres der Mathematik 2008 als interaktive Wanderausstellung und entwickelte sich über die Jahre zu einer Online-Plattform für interaktive Mathematik-Vermittlung. Seit 2016 ist IMAGINARY eine selbständige gemeinnützige GmbH mit einem breiten Spektrum an Dienstleistungen in der Mathematikkommunikation. Das MFO ist Teilhaber der Gesellschaft und kooperiert mit IMAGINARY im Bereich seiner Öffentlichkeitsarbeit, insbesondere bei den Schnappschüssen und dem MiMa. Beide Projekte gingen als Teilprojekte aus IMAGINARY hervor und sind heute noch am MFO angesiedelt. Im MiMa unterstützt IMAGINARY das MFO bei der Auswahl und Implementierung neuer Exponate. Die Schnappschüsse werden maßgeblich über die IMAGINARY-Plattform verbreitet sowie auf IMAGINARY-Ausstellungen in der interaktiven Station „Snapshot-Slider" gezeigt und zum Ausdrucken oder Verschicken angeboten.

The snapshot project is designed to promote the understanding and appreciation of modern mathematics and mathematical research in the interested public world-wide. The targeted readership consists of mathematics teachers, science journalists, undergraduate and advanced high school students.

In 2023 the project was coordinated by Dr. Anja Randecker. As senior editor she is responsible for the editing process of the snapshots. The team of junior editors consisted of Dr. Michela Egidi, Dr. Carina Geldhauser, Dr. Martin Günther, Daniel Kronberg, Dr. Marta Maggioni, Dr. Sara Munday, Anup Anand Singh, Dr. Matthew Tam and Joonas Mikael Vättö. 8 snapshots were published in this year (see section 3.11.: Publications).

## Cooperation with IMAGINARY

IMAGINARY started at the MFO on the occasion of the science year of mathematics in 2008 as an interactive traveling exhibition and developed over the years to an online platform for interactive mathematics communication. In 2016 IMAGINARY became an independent non-profit company (gGmbH) offering a wide range of services in mathematics communication. The MFO is a shareholder of the company and cooperates with it within the scope of public relations – in particular, with regard to the snapshots and the MiMa. Both projects were once founded as subprojects of IMAGINARY and are continued by the MFO. With regard to the MiMa, IMAGINARY supports the MFO in the selection and implementation of new exhibits. The snapshots are largely distributed via the IMAGINARY platform. They are also presented at IMAGINARY exhibitions in the interactive "Snapshot-Slider" and offered for printing or mailing.

## 4.5. Verwaltung und Hauswirtschaft

Aufgrund der Beschlüsse der Gemeinsamen Wissenschaftskonferenz (GWK) erstellt das MFO als Mitglied der Leibniz-Gemeinschaft seit dem Haushaltsjahr 2006 ein Programmbudget als Grundlage für die gemeinsame Finanzierung durch Bund und Länder.

Das Tagungsgebäude liegt dem Gästehaus direkt gegenüber und wurde 1975 mit Mitteln der VolkswagenStiftung erbaut. Es bietet den Forschungsgästen exzellente Arbeitsmöglichkeiten und umfasst die Bibliothek, mehrere Vortragsräume sowie Computerarbeitsplätze. Ferner ist die wissenschaftliche Verwaltung dort untergebracht. Im Mai 2007 konnte der Erweiterungsbau der Bibliothek, finanziert von der Klaus Tschira Stiftung und der VolkswagenStiftung, feierlich eingeweiht werden. Die Nähe von Tagungsgebäude und Gästehaus erweist sich als sehr effizient, bietet sie den Gästen doch rund um die Uhr die Möglichkeit zu kreativer Arbeit, was intensiv genutzt wird. Im Frühjahr 2010 wurde die Sanierung des Gästehauses abgeschlossen.

Der Verwaltungsbereich umfasst derzeit 10,05 besetzte Stellen für die wissenschaftliche Verwaltung (Organisation der Workshops, Öffentlichkeitsarbeit, Drittmittelprojekte), die Bibliothek, die IT sowie für die allgemeine Verwaltung (Finanzverwaltung, Beschaffungswesen, Personalsachbearbeitung, Vertragswesen, usw.) und die Gästebetreuung.

Der Hauswirtschaftsbereich des Instituts unterstützt die Durchführung der wissenschaftlichen Programme, indem die Gastforscher im Gästehaus des Instituts Unterkunft und Verpflegung erhalten. Das Gästehaus wurde mit Mitteln der VolkswagenStiftung erbaut und 1967 eingeweiht. Die Wissenschaftler sind überwiegend in Einzelzimmern untergebracht, jedoch gibt es auch 8 größere Appartements sowie 5 Bungalows. Dadurch sind auch längere Aufenthalte im Rahmen der Programme Oberwolfach Research Fellows und Oberwolfach Leibniz Fellows möglich. Der Hauswirtschaftsbereich umfasst insgesamt 13,75 Stellen für Küche und Zimmerservice sowie für die Pflege von Gebäuden und Grundstück (davon waren 2023 13,31 Stellen besetzt).

## 4.5. Administration and housekeeping

According to the resolution of the Joint Science Conference (Gemeinsame Wissenschaftskonferenz GWK), the MFO as a member of the Leibniz Association, has established a budget-plan since 2006 as a basis for the common financing by the federation of Germany and the federal states.

The library building is located immediately opposite the guest house and was built with funds from the Volkswagen Foundation in 1975. Hosting the library, several lecture halls and numerous computer stations it offers excellent working conditions for scientific research. The offices of the scientific administration are also part of this building. The extension of the library, funded by the Klaus Tschira Stiftung and the Volkswagen Foundation was ceremonially inaugurated in May 2007. The short distance between the guest house and the library building has proofed very convenient as it offers scientists the possibility to work at any time, which is used extensively. Since spring 2010 the renovation measures in the guest house have been terminated.

The administration encompasses at the moment 10.05 positions, covering scientific administration (planning and organisation of the scientific programme, public relation, Third-party projects), library, IT-services and general administration (financial management, purchasing, personnel administration, contracts, renovation measures etc.) as well as guest liaison and support.

Since board and lodging is provided by the Institute, housekeeping is also an important part of the realisation of the scientific program at the MFO. The guest house was built with funds from the Volkswagen Foundation and inaugurated in 1967. Accommodation of the scientists is mainly provided in single rooms. In addition to that, 8 apartments and 5 bungalows enable a longer stay at the MFO within the programs Oberwolfach Research Fellows and Oberwolfach Leibniz Fellows. The housekeeping department comprises 13,75 positions for kitchen and room service as well as for the maintenance of the buildings and premises (13.31 positions staffed in 2023).

# 4.6. Finanzielle Übersicht

## 4.6. Financial overview

**Erlöse 2023**

**Revenues 2023**

(gerundet auf 1.000 €)

(rounded to 1,000 €)

| | | |
|---|---|---|
| Zuwendung Bund/Länder | Benefits from the federation/federal states | 3.481.000 |
| Selbstbewirtschaftungsmittel aus 2022 | Benefits from 2022 | 84.000 |
| Drittmittel | Third party funds | 99.000 |
| Spenden | Donations | 80.000 |
| Sonstige Einnahmen | Other income | 79.000 |
| Zweckgebundene Reste aus 2021 | Earmarked surpluses | 468.000 |
| **Summe Erlöse** | **Total revenues:** | **4.291.000** |

**Aufwendungen 2023**

**Expenses 2023**

(gerundet auf 1.000 €)

(rounded to 1,000 €)

| | | |
|---|---|---|
| Personalausgaben | Personnel department | 1.716.000 |
| Materialaufwand | Purchases | 396.000 |
| Aufwand für bezogene Leistungen | Expenses for drawn benefits | 116.000 |
| Sonstige Aufwendungen (inklusive Sachausgaben Bibliothek) | Other expenses (with material expenses for the library) | 1.347.000 |
| Rückstellungen für zweckgebundene Reste | Provisions for earmarked surpluses | 431.000 |
| Investitionen | Investments | 285.000 |
| **Summe Aufwendungen** | **Total expenses:** | **4.291.000** |

## Erläuterungen

Der Anteil von Drittmitteln, Spenden und sonstigen Einnahmen bezogen auf die Gesamtsumme der Erlöse liegt im Haushaltsjahr 2023 bei 6,9%. Die zweckgebundenen Reste und Selbstbewirtschaftungsmittel aus 2022 sind dabei nicht berücksichtigt.

## Öffentliche Mittel

Das MFO erhielt im Haushaltsjahr 2023 insgesamt 3,481 Mio. Euro Zuwendung von Bund und Ländern.

## Drittmittel

Die projektbezogenen Drittmittel rekrutierten sich im Haushaltsjahr 2023 insbesondere aus Mitteln der National Science Foundation (NSF) der USA, der Simons Foundation und der Carl Friedrich von Siemens Stiftung.

## Explanations

The third party funds were attributed to the fiscal year they were assigned to. The proportion of private resources (own income, third-party-funds and donations) of the total sum of revenues is 6.9%. Funds carried forward from 2022 are disregarded here.

## Public funding

In the fiscal year 2023 the MFO received 3.481 million Euro funding from the federation and the federal states.

## Third-party funds

Earmarked third party funds in the fiscal year 2023 are mainly composed of the grants from the US National Science Foundation (NSF), the Simons Foundation and the Carl Friedrich von Siemens Foundation.

## Förderverein und Oberwolfach Stiftung

Zweckgebundene Spenden erhielt das MFO auch im Haushaltsjahr 2023 vom Förderverein, der Oberwolfach Stiftung und der Carl Friedrich von Siemens Stiftung. Die Gelder wurden für Reisekostenzuschüsse in besonderen Fällen, für die Unterstützung von Kinderbetreuungskosten, die Beschaffung von Büchern in der Bibliothek und als Zuschuss zu Baumaßnahmen verwendet.

## Förderverein and Oberwolfach Foundation

Earmarked donations have been received by the Förderverein, the Oberwolfach Foundation, and the Carl Friedrich von Siemens Foundation. These funds have been used to support travel costs for scientists in special cases, for child support, for special literature, and as additional support for building measures.

## 4.7. Dank

Ein besonders herzliches Dankeschön gilt den Zuwendungsgebern (Bund und Länder). Weiter gilt unser Dank allen Drittmittelgebern wie der Carl Friedrich von Siemens Stiftung, der National Science Foundation (NSF) und der Simons Foundation. Ein besonderes Dankeschön gilt natürlich auch dem Förderverein und der Oberwolfach Stiftung für die großzügige Unterstützung des MFO.

## 4.7. Acknowledgement

A particular thank-you goes to the federation and the federal states for their financial support. We would also like to thank for the third-party funds received from the Carl Friedrich von Siemens Foundation, the National Science Foundation (NSF) and the Simons Foundation. Our special thank-you also goes to the Förderverein and the Oberwolfach Foundation for their important support of the MFO.

## 4.8. Organigramm
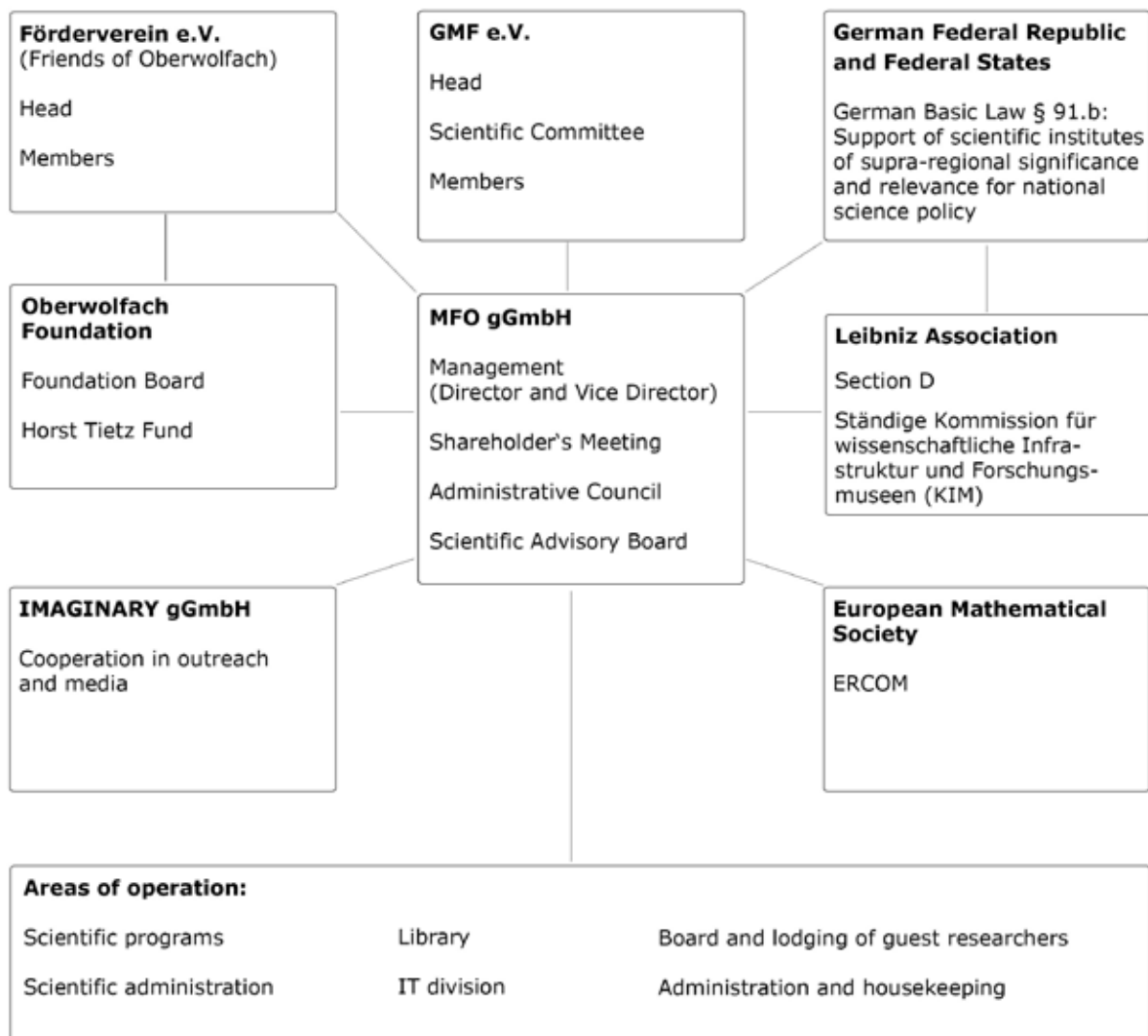
## Erläuterungen

Das Mathematische Forschungsinstitut Oberwolfach (MFO) ist seit April 2005 eine gemeinnützige GmbH. Die Geschäftsführung des MFO besteht aus Direktor und stellvertretendem Direktor. Alleiniger Gesellschafter des MFO ist die Gesellschaft für Mathematische Forschung e.V. (GMF), die durch ihren Vorstand vertreten wird. Das MFO wird von der Bundesrepublik Deutschland und den Bundesländern im Rahmen der Forschungsförderung nach Artikel 91b des Grundgesetzes gemeinschaftlich finanziert, wobei das Sitzland Baden-Württemberg eine besondere Rolle einnimmt. Dabei ist die Mitgliedschaft des MFO in der Leibniz-Gemeinschaft Bestandteil der gemeinschaftlichen Finanzierung. Die Zuwendungsgeber sind im Verwaltungsrat des MFO vertreten, der als wichtigstes Aufsichtsgremium über die mittel- und langfristige Finanz- und Budgetplanung entscheidet. Institut und Verwaltungsrat werden dabei vom Wissenschaftlichen Beirat des MFO beraten, dem 6 bis 8 international angesehene Mathematikerinnen und Mathematiker angehören. Ferner ist das MFO Mitglied in ERCOM (European Research Centres on Mathematics), einem Komitee der European Mathematical Society.

Die Gesellschaft für Mathematische Forschung e.V. (GMF) hat ca. 100 Mitglieder, darunter die vier institutionellen Mitglieder DMV (Deutsche Mathematiker-Vereinigung), GAMM (Gesellschaft für angewandte Mathematik und Mechanik), EMS (European Mathematical Society) und Förderverein. Die GMF ist Eigentümer des Grundstücks und der Institutsgebäude des MFO. Der Vorstand der GMF besteht aus dem Vorstandsvorsitzenden, dem Schatzmeister und dem Vorsitzenden der Wissenschaftlichen Kommission. Die Wissenschaftliche Kommission der GMF besteht aus ca. 20-25 international angesehenen Mathematikern und ist in Abstimmung mit der Geschäftsführung des MFO zuständig für die Forschungs- und Entwicklungsplanung sowie die aktuelle wissenschaftliche Arbeitsplanung des MFO.

Der Verein zur Förderung des Mathematischen Forschungsinstituts Oberwolfach e.V. (Förderverein) hat etwa 600 Mitglieder, die das MFO durch Mitgliedsbeiträge zusätzlich finanziell unterstützen. Die Oberwolfach Stiftung, die im Förderverein als nicht rechtsfähige Stiftung gegründet wurde, sammelt Stiftungskapital aus dem wirtschaftlichen und dem privaten Bereich. Dabei spielt der Horst Tietz Fund als Sondervermögen innerhalb der Oberwolfach Stiftung eine besondere Rolle.

## Explanations

Since April 2005 the Mathematisches Forschungsinstitut Oberwolfach has been registered as a non-profit corporation (gemeinnützige GmbH). The MFO is headed by a Director supported by a Vice Director. The sole associate of the MFO is the Gesellschaft für Mathematische Forschung e.v. (GMF), represented by its board. Financing of the MFO is shared by the Federal Republic of Germany and the federal states according to article 91b (research financing) of the Basic Law of the Federal Republic of Germany with emphasis on the local state of Baden-Württemberg. Being a member of the Leibniz Association is a prerequisite for the common financing. The financial partners are represented in the Administrative Council of the MFO, which in its function as most important supervisory panel decides on the medium- and long-term finance- and budget planning. The Institute and the Administrative Council are supported by the Scientific Advisory Board which is composed of 6 to 8 internationally renowned mathematicians. Moreover, the MFO is a member of ERCOM (European Research Centres on Mathematics), a committee of the European Mathematical Society.

The Gesellschaft für Mathematische Forschung e.V. (GMF) consists of about 80 members, including four institutional members, namely DMV (Deutsche Mathematiker-Vereinigung), GAMM (Gesellschaft für angewandte Mathematik und Mechanik), EMS (European Mathematical Society) and the Förderverein. The GMF is the legal owner of the site and of the buildings of the MFO. The head of the society is formed by the chairman, the treasurer, and the chairman of the Scientific Committee. The Scientific Committee of the GMF is composed of about 20 to 25 internationally renowned mathematicians and is responsible for the research and development planning, as well as for running decisions on scientific proposals, in agreement with the head of the MFO.

The Verein zur Förderung des Mathematischen Forschungsinstituts Oberwolfach e.V. (Förderverein, Friends of Oberwolfach) has about 600 members and provides additional financial support for the MFO by its membership fees. The Oberwolfach Foundation, a foundation of public utility within the Förderverein, provides further financial support by economic and private means. Within the Oberwolfach Foundation the Horst Tietz Fund plays an important role by providing special funds.

Das Institut ist außerdem Gesellschafter der IMAGINARY gGmbH und kooperiert mit dieser im Bereich der Öffentlichkeitsarbeit. IMAGINARY begann als Projekt des MFO im Jahr 2008 und wurde 2016 als selbständiger Dienstleister im Bereich der Mathematik-Kommunikation ausgegründet.

Furthermore the Institute is a shareholder of the IMAGINARY gGmbH and cooperates with the company in the field of public relations. IMAGINARY started in 2008 as a project of the MFO. Since 2016 it is an independent service provider in the field of mathematics communication.

## Beschäftigte des MFO / Staff of the MFO — 2023

| | | |
|---|---|---|
| **Wissenschaftliche Verwaltung** | **Scientific Administration** | |
| Direktor | Director | Prof. Dr. Gerhard Huisken |
| Stellvertretender Direktor | Vice Director | Prof. Dr. Matthias Hieber |
| Wissenschaftlicher Administrator | Scientific Administrator | apl. Prof. Dr. Stephan Klaus |
| Wissenschaftliche Mitarbeiterin | Scientific Assistant | Dr. Tatjana Ruf |
| Sekretärinnen für das wissenschaftliche Programm | Secretaries for the scientific program | Silke Okon, Andrea Schillinger |
| **Verwaltung** | **Administration** | |
| Verwaltungsleitung | Head of Administration | Susanne Riester |
| Sekretärinnen im Gästebüro | Secretaries in the guest services office | Petra Lein, Stefanie Reith, Katrin Schmid |
| Bibliothekarin | Librarian | Verena Franke |
| Fachangestellte für Medien- und Informationsdienste (FaMI) | Library Assistant | Jennifer Hinneburg |
| Auszubildende FaMi | Trainee in the library | Ronja Firner |
| IT | IT | Helmut Kastenholz, Christoph Weber |
| **Hauswirtschaft** | **Housekeeping** | |
| Hauswirtschaftsleiterin | Housekeeping Manager | Charlotte Endres |
| Hausmeister | Caretaker | Anton Herrmann |
| Weitere Beschäftigte | Further housekeeping staff | ca. 9 full time equivalents |

## Verwaltungsrat des MFO/Administrative Council of the MFO

(Mitglieder/Members 2023)

| | |
|---|---|
| Tania Bolius | Ministerium für Wissenschaft, Forschung und Kunst, Stuttgart, (Vorsitzende/Chair) |
| Jochen Leyendecker | Bundesministerium für Bildung und Forschung, Bonn, (stellvertretender Vorsitzender/Vice Chair) |
| Prof. Dr. Jean-Pierre Bourguignon | IHÉS/Past President of the European Research Council |
| Dr. Franz Dettenwanger | VolkswagenStiftung, Hannover |
| Prof. Dr. Friedrich Götze | Fakultät für Mathematik, Universität Bielefeld |
| Christian Mees | Ministerium für Wirtschaft, Innovation, Digitales und Energie des Saarlandes |
| Prof. Dr. Felix Otto | Direktor des Max-Planck-Instituts für Mathematik in den Naturwissenschaften, Leipzig |
| Prof. Dr. Thomas Schick | Universität Göttingen |
| Beate Spiegel/ Prof. Dr. Rafael Lang | Geschäftsführer/in der Klaus Tschira Stiftung gGmbH, Heidelberg |

## Wissenschaftlicher Beirat des MFO/Scientific Advisory Board of the MFO

(Mitglieder/Members 2023)

Prof. Dr. Maria Esteban, Paris
Prof. Dr. Barbara Fantechi, Trieste
Prof. Dr. Marlis Hochbruck, Karlsruhe
Prof. Dr. Annette Huber-Klawitter, Freiburg (vice chair)
Prof. Dr. Bảo Châu Ngô, Chicago/Hanoi
Prof. Dr. Thomas Schick, Göttingen (chair)
Prof. Dr. Bernd Sturmfels, Leipzig/Berkeley


## Gesellschaft für Mathematische Forschung e.V. (GMF)

### Vorstand der GMF/Head of the GMF
(Mitglieder/Members 2023)

| | |
|---|---|
| Prof. Dr. Friedrich Götze, Bielefeld | Vorstandsvorsitzender der GMF/<br>Chair of the GMF |
| Prof. Dr. Felix Otto, Leipzig | Vorsitzender der Wissenschaftlichen Kommission/<br>Chair of the Scientific Committee |
| Prof. Dr. Joachim Schwermer, Wien | Schatzmeister/Treasurer |

### Wissenschaftliche Kommission der GMF/Scientific Committee of the GMF
(Mitglieder/Members 2023)

Prof. Dr. Karen Aardal, Delft
Prof. Dr. Arthur Bartels, Münster
Prof. Dr. Jean-Benoit Bost, Orsay
Prof. Dr. Sébastien Boucksom, Paris
Prof. Dr. Eric Cancès, Paris
Prof. Dr. Thierry Coquand, Göteborg
Prof. Dr. Hugo Duminil-Copin, Genève/Bures-sur-Yvette
Prof. Dr. Alessio Figalli, Zürich
Prof. Dr. Colin Guillarmou, Orsay
Prof. Dr. Alice Guionnet, Lyon
Prof. Dr. Daniel Huybrechts, Bonn
Prof. Dr. Bernhard Keller, Paris
Prof. Dr. Gitta Kutyniok, München
Prof. Dr. Philippe Michel, Lausanne
Prof. Dr. Felix Otto, MIS Leipzig (chair)
Prof. Dr. Markus Reineke, Bochum
Prof. Dr. Eero Saksman, Helsinki
Prof. Dr. Karl-Theodor Sturm, Bonn
Prof. Dr. Benjamin Sudakov, Zürich
Prof. Dr. Andreas Thom, Dresden (vice chair)
Prof. Dr. Corinna Ulcigrai, Zürich
Prof. Dr. Sara van de Geer, Zürich
Prof. Dr. Eva Viehmann, Münster
Prof. Dr. Anna Wienhard, Leipzig
Prof. Dr. Barbara Wohlmuth, München