SwissMAP
The Mathematics of Physics
National Centre of Competence in Research

SwissMAP Perspectives

Issue 3 | 2018

Contents

Gravitational Waves:
a new window on the Universe

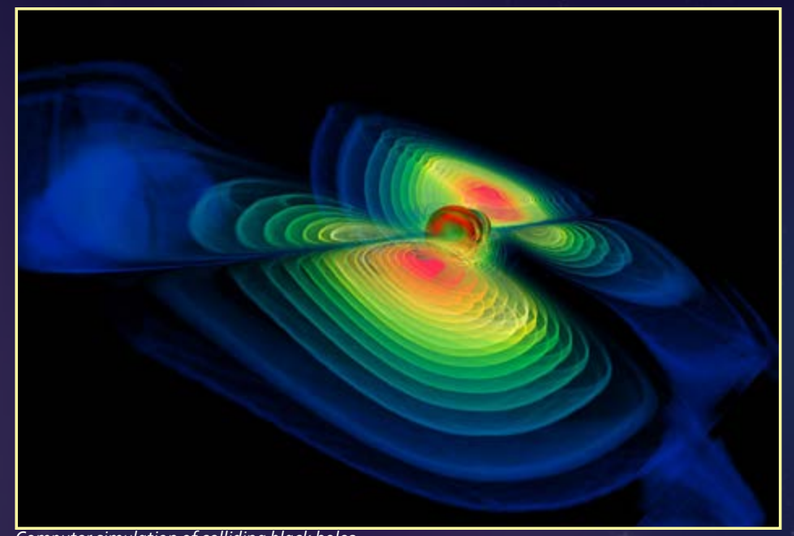
Gravitational waves are one of the most spectacular predictions of General Relativity: tiny oscillations of space-time itself, generated by some of the most violent events in the Universe. Their detection has always been considered a "Holy Grail" of physics, not only because it allows us to test one of the most spectacular predictions of General Relativity but, even more importantly, because gravitational waves allow us to explore the Universe through a completely new probe, carrying information that is inaccessible with electromagnetic signals.

The quest for the detection of gravitational waves began as early as the 1960s. Finally, on September 14, 2015, the two detectors of the LIGO Observatory, at the very beginning of the first observational run in the advanced LIGO configuration, detected the gravitational waves emitted by the coalescence of a black hole (BH) binary. To have a feeling for how awesome such an event is, consider that in this coalescence we had two black holes of about 30 solar masses each that, in the last stage of the coalescence, were rotating around each other with an instantaneous orbital frequency corresponding to about 70 orbits per second, eventually merging at a fully relativistic speed and converting in gravitational waves, in just a few milliseconds, the energy E=Mc2 corresponding to a mass M of about 3 solar masses. The peak luminosity of the event was about a factor of 10 larger than the estimated combined electromagnetic luminosity of all stars and galaxies in the observable Universe. This first detection was followed by a few more BH-BH coalescences, including a triple coincidence between the two LIGO detectors in the US and the Virgo detector in Italy. Then, in August 2017, another spectacular event was detected, the coalescence of a binary system of two neutron stars. Besides their gravitational waves, also detected was the gamma-rays burst emitted in this coalescence (proving that gamma-ray bursts are indeed emitted in neutron star coalescences) and the source was identified and followed in all bands of the electromagnetic spectrum. This event then marked the era of the so-called "multi-messenger" astronomy.

Gravitational waves are one of the most spectacular predictions of General Relativity.

Together with the spectacular experimental developments of the last few decades that have led to these detections, the theory of gravitational waves and the understanding of their sources has in parallel undergone remarkable developments. Gravitational wave theory is a rich and fascinating subject, where all the subtleties and the non-linearity's of General Relativity come into play.

Given the vigorous experimental and theoretical developments of the last few decades, this is an ideal period for summarizing and systematizing the advancements in the field. This has been the aim of the two-volume set "Gravitational Waves" by Michele Maggiore. The first volume: "Gravitational Waves. Vol. 1: Theory and Experiments", 574 pages, Oxford University Press, came out in 2007 and quickly established itself as the standard reference in the field. After 10 additional years of work, the second volume: "Gravitational Waves. Vol. 2: Astrophysics and Cosmology", 848 pages, Oxford University Press, has just recently been published. While the first volume deals with gravitational waves theory (part I) and with the experiments (part II), the second volume discusses what we can learn from them in astrophysics (part III) and in cosmology (part IV).



Computer simulation of colliding black holes.
Credit: Bernd Brügmann, University of Jena, Germany

Some reviews:

"Recently, when writing a review of major developments in gravitational physics over the past four decades, I found myself, time and again, sending readers to this wonderful book by Michele Maggiore. Simply put, this is the best and most complete treatment I have ever seen of gravitational wave sources, their underlying physics, and ways of analyzing them. It is superb."

Kip S. Thorne, Nobel laureate in Physics 2017, Caltech.

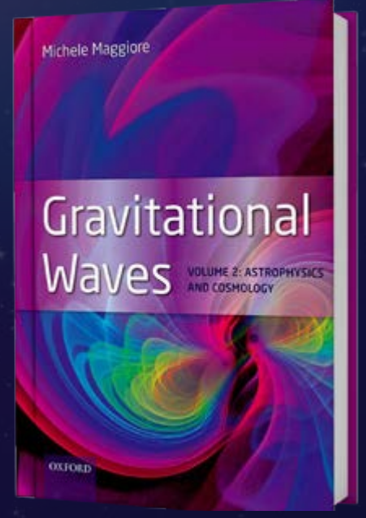
"This book complements in an excellent way the first volume of Gravitational Waves, on their theory and experiments, by Prof. Maggiore. The two volumes constitute a monumental effort coming out at the right time. They will be the standard text and reference books for years to come […]."

Kostas Kokkotas, Department of Theoretical Astrophysics, Eberhad Karls University of Tuebingen, Germany

Given the vigorous experimental and theoretical developments of the last few decades, this is an ideal period for summarizing and systematizing the advancements in the field.

"This second volume of Michele Maggiore's gravitational wave treatise is a must-read for anyone (student, teacher, researcher) interested in comprehending and/or entering the exciting field of gravitational-wave research. Like the first volume, it is written with an exceptional clarity and covers in depth all the important ideas and techniques underlying our current understanding of the generation of gravitational waves by various sources. It keeps abreast of the latest exciting observational discoveries of the LIGO-Virgo collaboration and will allow any reader to enter the frontier of gravitational-wave research."

Thibault Damour, Institut des Hautes Etudes Scientifiques.



Author: Michele Maggiore
Professor, UNIGE

You can find more information on both editions on the authors website: http://fiteoweb.unige.ch/~maggiore/

Conversation with Jean-Pierre Eckmann

Jean-Pierre Eckmann is a mathematical physicist in the department of theoretical physics at the University of Geneva and a pioneer of chaos theory and social network analysis.

Eckmann is the son of mathematician Beno Eckmann. He completed his Ph.D. in 1970 under the supervision of Marcel Guenin at the University of Geneva.

He has been a member of the Academia Europaea since 2001 and in 2012 he became a fellow of the American Mathematical Society.

His research interests include: statistical mechanics, partial differential equations, and graph theory.

- What is your experience of working at the borderline between physics and mathematics? How, in your view, do the two subjects stand in relation to one another?

I enjoy working in this field. Since I'm sitting in the physics department, I have contact with many experimental people, so there are always new questions coming up. I like this exploration of many subjects.

I like the tension between physics and mathematics: In particular, while mathematical physics is often viewed as applying the results of mathematics to problems from physics, it would often happen that new questions from physics led to new mathematics.

One advantage of being retired is that I can afford to do things which don't necessarily lead to a result. I also don't have to be mainstream. That's how I see my current position.

- How do you see the current state of your field? Are there certain current "hot topics"?

Stochastic problems have taken over a lot of mathematical physics, but I like to do my own thing, so I am not so much aware of the current hot topics. My own interests lie in carrying mathematics to new subjects.

I got my ERC grant after I was fully retired, and in a way, this saved my life after retirement. I had another five years of very adequate funding, and this gave me many possibilities. It is important to me to continue my research.

- What has been for you the most rewarding experience of working in this field?

Well I'm just happy to be able to work in this field. I've been in this business for a very long time, like 50 years. That's half a century. And I always remember that when I was young, I saw things that happened half a century ago, and now that's a part of History. I touched upon many subjects over the years and all of them were fascinating. So I don't think there is such a thing as a singular rewarding experience.

- Your former student Martin Hairer received a Fields medal. Did you foresee this possibility? In your opinion, was the research destined to succeed from the beginning or was there much work involved to make it evolve into a successful finding?

No, you don't foresee such things. I have had many good students, and Martin was one of them. But I'm proud of all my students.

I was trying, in view of the interview, to find out how improbable it is that a student gets the Fields medal. With Martin we tried to find out how many people are potential candidates, but it's quite difficult. One number I found is that there's about 2'000 PhD's per year in the US, in mathematics. So worldwide there must be about 6'000. However, of these 6'000, probably only a third want to stay in academia. I don't know the exact number of course, but as an example, we can say only a third. This means that the chance of a PhD student to get the Fields medal is 1 out of 2'000. So even, if a PhD student is very good, getting the Fields medal also needs luck.

Martin's research was a series of questions from the beginning. And while he stayed in the general field, he built his own path and his own career. He's still working on stochastic problems and non-equilibrium questions, which was also the subject I was working on.

- How easy is it to predict the potential of a young researcher?

My theory is that's its always easier to predict the past than the future. So no, it's not easy to predict one's potential. And each person will develop themselves in a different way than others. And also different to what one might expect. That makes it much more interesting.

Young people nowadays are different. That does not mean that they are worse, just different and I don't judge them. When I was young, I was allowed to make mistakes, and so young people should also be able to make their own mistakes. Times have changed. For example, nowadays, they have to learn how to write grant proposals. I didn't have to do that. There was a professor who looked after us and that was it. Now, young people have to learn very early on how to get funding.

One thing I feel that has changed is that in my family, we liked to teach. It does not seem to me that people these days like to teach. I don't know why, but maybe there's more administration, more constraints now. On the other hand, there's also more money around. So it's not that people can't do things because the money is missing. That might be more the case in physics where an experiment costs a lot. In mathematics, you need a desk, some paper and a pen.

People should be given more opportunities to explore non-conventional things. But since they need jobs, they have to be known in a sub-field and go to conferences about this field. I don't need to do this anymore so it is easier for me to explore different fields. But I think everybody should have the chance to do something out of the common at least once in their life. But then many people don't want to be uncommon. Maybe they are scared or they have to think about their careers. There's also this new problem that I like to call the "2-body problem": the husband and wife are both young PhD's and they have to find jobs together, if possible in the same place, and this is difficult.

I've also decided that I don't want to take on new students, unless someone really exceptional shows up. I think young people should go to young professors. Experience is good but being young is also good. I remember when I was young, my idea was that nobody above 40 should do research because they are too old, especially in mathematics. I've since changed my mind of course.

As a small anecdote, there's a picture of me with my parents and Georges de Rham which is proof that I was once young. When I was that age, about 2 years old, De Rham bought me a wooden cow. He said to me in German since I couldn't speak French at the time, "wir wollen dir eine Kuh kaufen" (we want to buy you a cow).

- What is your view of the role of creativity in mathematics?

For me it's very important. I'm not a fan of very formal mathematics. This might be because of my contact with physics. So I enjoy the many new questions that arise and I try to stay current with what is going on in these fields.

For the last 15-20 years I've been looking at fields which are not naturally related to mathematics. Like biology. I think the time will come when mathematics will play a similar role in biology or maybe humanities, than what it played in physics.

> My theory is that's its always easier to predict the past than the future.

> People should be given more opportunities to explore non-conventional things. [...] Everybody should have the chance to do something out of the common at least once in their life.

I like to discuss these things with a fellow mathematical physicist, Giovanni Jona-Lasinio, and he summarized better than I could the state of mathematics outside physics. I want to cite from one of his papers: "Models and mathematical language in the study of biological problems", where he says that after all, it's not so long ago that theoretical physics has been defined as a science.

Original: *La physica teorica e' stata riconosciuta come disciplina autonoma solo alla fine del diciannovesimo secolo poco prima delle grandi svolte concettuali della relativita' e della meccanica quantistica e le sue forme oggi sono molteplici. Penso che i tempi siano maturi per una piu' precisa caratterizzazione della ricerca teorica in biologia e dei suoi scopi. **

Translation: *Theoretical physics was recognised as an independent field of research only at the end of the 19th century, shortly before the great conceptual revolutions of relativity and quantum mechanics. Today theoretical physics has multiple facets. I think that the time has come for a more precise characterisation of the research field of theoretical biology, and for an assessment of its scope.*

* *Lettera Matematica Pristem 83, novembre 2012, p 14-20*

A photo from 1945: (from left to right)
Georges de Rham; Beno and Doris Eckmann with their son Jean-Pierre Eckmann; Anne, Charles and Jean-Marc Ehresmann.

I was not involved in developing SwissMAP but I'm very happy that it exists. I think it brings people together. That's probably what its aim is.

I don't know about the other cities, but at least in Geneva there are so many famous people around that all have their own grants. So what really counts is what you get in addition to these grants. And SwissMAP gives the liberty to do things that are not only individual projects. Some mathematicians like to work alone.

I think the time will come when mathematics will play a similar role in biology or maybe humanities, than what it played in physics.

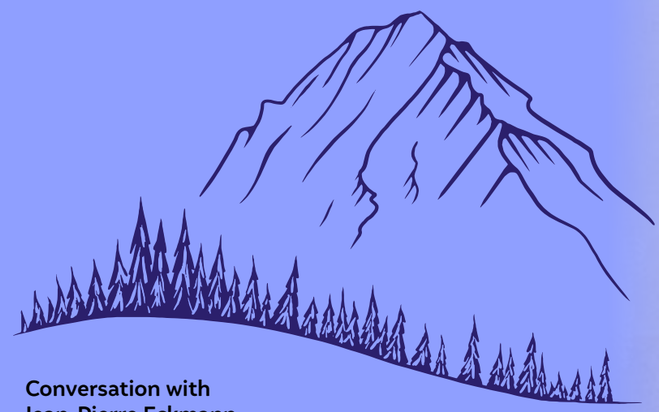
- What is your view of SwissMAP and its activities? What in your opinion could promote or encourage cross-project collaborations?

Others, like me, if you consider me as a mathematician, enjoy interacting with many different fields.

- Are there things that could be improved in the future?

My opinion about research is that you should live and let live. There is a tendency in modern research and its funding to put too many constraints on how people should do things.

And in that sense, when there is criticism about SwissMAP's activities, the question is "well what do they all want?" After all, as long as people do good research, and try their best this is what they want.



Conversation with
Jean-Pierre Eckmann
May 2018, Geneva

Interviewed by Maria Kondratieva
On behalf of the NCCR SwissMAP

Presenting the 4th annual

SwissMAP General Meeting 2017

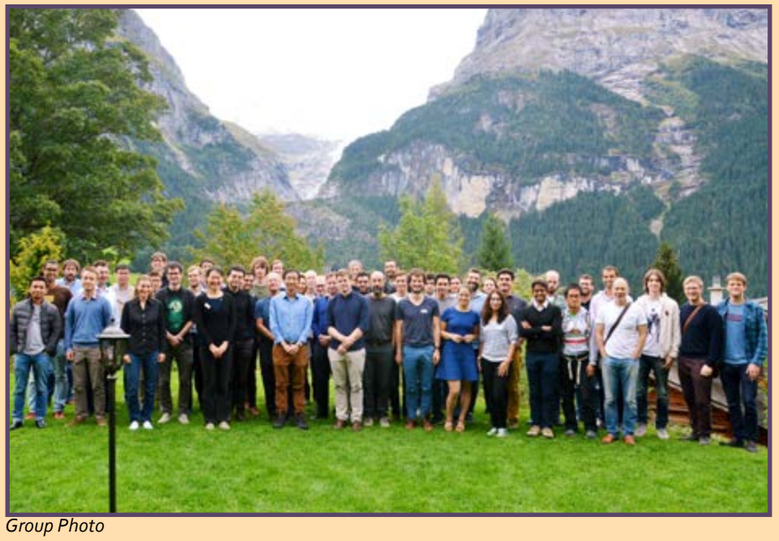
The fourth edition of the SwissMAP General Meeting took place in September 2017 in the mountain village of Grindelwald nestled among some of Switzerland's most spectacular scenery.

The Sunstar hotel provided conference rooms along with ample communal space for around 80 participants to meet and talk over the 3-day event.

The meeting brought together management, project leaders, group leaders, senior researchers, post-docs and PhD students.

Indeed one of the major aims of the gathering is to provide a platform for interaction and exchange of ideas across the different SwissMAP projects and sites.

On the following pages you will find the continuation of Paul Turner's article relating the event, as well as highlights on the SwissMAP Innovator prze, and the Mathscope activity that was organsed.



Group Photo

The scientific programme began on Sunday morning with the presentation of the SwissMAP Innovator prize. This prize is awarded annually to up to two post-docs or PhD students in recognition of exceptional work in one of SwissMAP's research areas. In 2017 the two recipients were:

During the conference

- **Florian Naef**, for his significant contributions in non-commutative Poisson geometry and Kashiwara-Vergne theory.

Florian is a PhD student at the University of Geneva in Anton Alekseev's research group.

- **Wei Qian**, for her innovative work in two-dimensional random geometry related to the Gaussian Free Field, and in particular on decompositions of two-dimensional Brownian loop-soup clusters.

Wei is a former PhD student of Wendelin Werner at the ETH Zurich and currently SNF research fellow at the University of Cambridge.

During the award ceremony, presided over by Prof. Fröhlich (ETH), certificates were presented to the winners, who then gave talks on their respective work.

Florian Naef's talk entitled "From MZVs and Lie theory to topology of surfaces" covered a panorama of subjects including finite type knot invariants, the quantization of Poisson manifolds, multiple zeta values and Kashiwara-Vergne theory.

Wei Qian's talk "Decomposition of two-dimensional Brownian loop-soup clusters" began by introducing two dimensional Brownian loop-soups and outlining the connection to Schramm-Loewner evolution, before moving on to her own results on the decomposition of the critical Brownian loop-soup.

The conference talks consisted of four hour-long colloquia and thirteen 20-minute presentations.

The colloquium talks were given by senior researchers aiming to provide a broad overview of a subject and the short talks were presentations by SwissMAP post-docs and PhD students reporting on progress in their individual research projects.

Jürg Fröhlich (ETH) began his colloquium with the disclaimer that "it is the prerogative of retired professors to dream". He then proceeded to present his fascinating vision of modern cosmology.

Stas Smirnov's talk gave a broad brush overview of lattice models in statistical mechanics leading to an application to understanding the development of colour patterns in the quasi-hexagonal lattice of skin scales in ocellated lizards.

Marcos Mariño's contribution was a masterful review of how the ideas of string theory have influenced certain aspects of modern geometry, sometimes leading to surprising mathematical results.

The final colloquium talk was given by Ilia Itenberg (Paris) who described his interesting work with Zvonkine on Hurwitz numbers for real polynomials.

Jürg Fröhlich

Ilia Itenberg

In addition to the scientific programme participants were treated to a Mathscope workshop on Monday evening led by Shaula Fiorelli-Vilmart. Geneva's Mathscope is a SwissMAP-funded outreach facility which offers hands-on maths workshops typically aimed at school

During the Conference

groups. The aim is to present a vision of mathematics somewhat different from that encountered at school. By way of understanding the kind of activities available at the Mathscope, conference participants took part in the workshop "Area Comparison" in which the sizes of various polygons are compared by a process of decomposition and reassembly.

On the Saturday evening, before most participants had arrived, there was a meeting of the SwissMAP board of directors and on Monday evening the SwissMAP group leaders met with management to be keep abreast of the latest developments. It is an important year in which the proposal to extend SwissMAP into the second phase will be submitted to the Swiss National Science Foundation.

Tuesday late afternoon was kept free of talks leaving time for participants to take advantage of the magnificent location. Unfortunately, the weather was not ideal, but this did not stop some participants making their way by foot or train to Kleine Scheidegg at the base of the trio of mountains Eiger, Mönch and Jungfrau. The meeting concluded on Wednesday after lunch, bringing to an end three intensive days of fruitful interaction and exchange across all SwissMAP projects.

Author: Paul Turner
Senior Lecturer, UNIGE

The Event

The four colloquia:

- **Jürg Fröhlich**, *The statistical mechanics of the universe*
- **Stanislav Smirnov**, *2d statistical mechanics from conformal field*
- **Marcos Mariño**, *Quantum geometry*
- **Ilia Itenberg**, *Hurwitz numbers for real polynomials*

The 20-minute talks:

- **Shouvik Datta**, *Monstrous entanglement*
- **Wellington Galleas**, *Riccati equations in the six-vertex model*
- **Andrea Agazzi**, *Large deviations theory for chemical reaction networks*
- **Krzysztof Putyra**, *One step closer towards categorified 3-manifold invariants*
- **Iuliya Beloshapka**, *Irreducible representations of finitely generated nilpotent groups*
- **Nezhla Aghaei**, *Quantization of super Teichmueller spaces*
- **Fiona Seibold**, *Poisson-Lie duals of deformed symmetric space sigma models*
- **Ida Zadeh**, *Genus two partition functions and Renyi entropies*
- **Kaloyan Slavov**, *An application of random plane slicing to counting points on hypersurfaces*
- **Marc Gillioz**, *Scale anomalies in conformal field theory*
- **Reimar Hecht**, *Maximally extended sl(2|2) and 3D kappa-Poincaré*
- **Alessandro Sfondrini**, *Computing four-point functions with integrability*
- **Marco Falconi**, *Cylindrical Wigner measures in Bosonic systems*

The Innovator Prize

The SwissMAP Innovator Prize is awarded once a year to PhD students or postdocs for important scientific achievements in the research areas of the NCCR SwissMAP.

The prize ceremony takes place at the beginning of the annual SwissMAP General Meeting which is held in September.

The first Prize was awarded in 2015 to Alba Grassi and Vincent Tassion. The 2016 prize went to Emily Clader and Angnis Schmidt-May. And finally, the most recent prize in 2017 went to Florian Naef and Wei Qian.

We sat down with the latest prize winners to ask them a few questions.

1: Could you tell us about your current position, where you are now ?

Wei: I am currently a postdoc in the maths department of the University of Cambridge, funded by SNF mobility fellowship. At the same time, I am also a Junior Research Fellow of Churchill college.

Florian: I am currently a postdoc at the math department of MIT, funded by SNF Early Postdoc.Mobility fellowship.

2: What are your current research interests ? What are you working on ?

Wei: My research interests lie in probability and statistical mechanics. I have mainly been working on Schramm-Loewner evolutions, Gaussian Free field and Brownian loop soups. I have also recently started to work on dimer models.

Florian: My research interests are non-commutative geometry and string topology.

3: What are your plans for the future ?

Wei: I will stay in Cambridge as a postdoc for one or two more years. I will try to get the most out of it by working with people there. After that, I wish to find another academic job to continue my work.

Florian: I plan to stay in academia for the foreseeable future.

Wei Qian and Florian Naef

Mathscope Workshop

Participants during the Mathscope Workshop

Mathscope is an out-of-school learning place, offering exhibits and activities about mathematics and its applications. They are intended to convey the many intellectual, esthetical and emotional values of mathematics to various audiences, from general public to school classes of various age.

It is based on several features considered as state-of-the-art in mathematics and science education and outreach:

Participants during the Mathscope Workshop

1. Out-of-school learning places as a particular way of creating authentic, motivating and cognitively engaging contexts for learning;
2. A focus on active participation of visitors, in particular school classes, based on real experiences and data gathered during the visit;
3. The opportunity to get in contact with mathematicians and other professionals using mathematics, in order to complement stimulating content with the “human touch” of a lively, sometimes passionate scientific discipline.

Participants during the Mathscope Workshop

During the SwissMAP General Meeting, a Mathscope workshop was organised by Shaula Fiorelli-Vilmart.

The aim was to show the participants how a Mathscope activity is given to the younger generations.

The conference participants were able to take part in the workshop called “Area Comparison” and get an idea of the various activities that Mathscope organises.

Shaula Fiorelli-Vilmart

All photos by: Maria Kondratieva

Events 2018

Past Events: Autumn-Winter 2017
During the second half of 2017, SwissMAP held a high number of successful events.
The 3rd SwissMAP Site Visit was held in Geneva and included a poster session. In June, the next Swiss Knots conference was held in Bern. SwissMAP organised the conference "Women in Geometry and Topology" at the ETH Zurich bringing together leading experts and young researchers. In September, the 4th annual SwissMAP General Meeting was held in a new location - Grindelwald and included the Innovator Prize ceremony and a special workshop showcasing Mathscope's activities (see page 12).

For the complete list, please visit:
http://nccr-swissmap.ch/events

January

07 - 12 January
Winter School in Mathematical Physics
Les Diablerets
The annual Winter School in Mathematical Physics of 2017 will take place in Les Diablerets in January 2018.

14 - 19 January
Algebraic Structures in Topology and Geometry
Riederalp
This is an informal meeting aimed to stimulate collaborations and exchange of ideas with SwissMAP.

Feb - Mar

11 - 16 February
Topics in Geometric Function Theory
Les Diablerets
Dmitry Belyaev, Ilia Binder, Marianna Russkikh, Stanislav Smirnov are organising this conference which will take place in Les Diablerets.

23 January
Improv Theatre for women scientists
Geneva
This workshop is dedicated to using improvisation theatre techniques to benefit presentation and interview skills.

22 - 24 January
Presentation skills workshops
Geneva and Zurich
NCCR SwissMAP, joined by NCCR MARVEL, NCCR PlanetS and NCCR QSIT, is organizing two workshops on presentation skills for PhD students, postdocs and young researchers.

Apr - May

07 March
Journée Georges de Rham 2018
Geneva
The aim is to offer doctoral students a modern high class perspective of mathematical sciences and to establish contacts on an international level and with other research groups.

08 - 13 April
Geometric aspects of momentum maps and integrability
Ascona
The conference Geometric aspects of momentum maps and integrability will take place at the CSF Ascona, Switzerland.

27 April
GeNeZiSS XXIII
Bern
The 23rd edition of the Mini-Conference Series of the Swiss String Theory Community will take place in the ExWi Building of the University of Bern.

Jun - Jul

04 - 07 June
SwissMAP PhD Meeting 2018
Leysin
The SwissMAP PhD Meeting aims at tightening the bonds in the department and learning what other groups are working on.

17 - 22 June
Patchworking of geometry and topology
Belalp
The conference is organised on the occasion of the 70th anniversary of Oleg Viro.

Aug - Sep

24 - 29 June
Geometry and Topology inspired by Physics
Belalp
This conference aims at focusing on some current trends in geometry and topology.

12 - 16 July
Supersymmetric theories, dualities and deformations
Bern
Topics include supersymmetric gauge theories, their string- and M-theory realizations, dualities and deformations.

09 - 12 September
SwissMAP General Meeting
Grindelwald
The 5th SwissMAP General Meeting will take place in Grindelwald. The SwissMAP Innovator Prize ceremony will be held during this event.

Awards

Hugo Duminil-Copin

Prix Jacques Herbrand and Loève Prize 2017

Congratulations to Hugo Duminil-Copin for receiving the Grand Prix Jacques Herbrand for his remarkable work in statistical physics, as well as the Loeve Prize, formally The Line and Michel Loeve International Prize in Probability.
Prof. Duminil-Copin is a permanent professor at the Institut des Hautes Études Scientifiques (IHÉS) and professor of mathematics at the University of Geneva. His research interests include: mathematical physics, probability, complex analysis and combinatorics.

Clément Hongler

Latsis University Prize

Congratulations to Clément Hongler who was awarded the Latsis University Prize for his work on statistical field theory.
Clément Hongler is the head of the Chair of Statistical Field Theory (CSFT) at EPFL. His current research focuses on the phase transitions of the two dimensional Ising model and the associated scaling limits and their symmetries.

Maryna Viazovska

SASTRA Ramanujan Prize and New Horizons in Mathematics Prize

Congratulations to Professor Maryna Viazovska who has been awarded the 2017 SASTRA Ramanujan Prize for her stunning solution in dimension 8 of the celebrated sphere packing problem. As well as the New Horizons in Mathematics prize for her remarkable application of the theory of modular forms to the sphere-packing problem in special dimensions.
Maryna Viazovska is a full professor at the EPF Lausanne and a new SwissMAP participant.

Anthony Conway

Henri Fehr Prize 2017

Congratulations to Anthony Conway who received the 2017 Henri Fehr Prize for the best thesis in mathematics. He received the prize for his thesis "Invariants of Colored Links and Generalizations of the Burau Representation" - under the direction of Dr. David Cimasoni.
Anthony Conway obtained his Ph.D at the University of Geneva and is currently a postdoc at Durham University (supported by the Swiss FNS).

Lorenz Eberhardt and Santiago Codesido Sánchez

CSF Award for best presentation

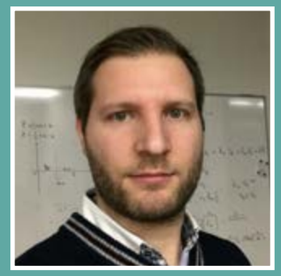
Congratulations to Lorenz Eberhardt and Santiago Codesido Sánchez for receiving the CSF Award for best presentation.
Lorenz Eberhardt is a Ph.D. at the ETH Zürich and Santiago Codesido Sánchez is a Postdoctoral Researcher at the University of Geneva.

Grants

Hugo Duminil-Copin

ERC Starting Grant

Hugo Duminil-Copin has received an ERC strating grant titled "Critical behavior of lattice models". The goal of the project is to use multiple techniques from probability, combinatorics, analysis and integrable systems to break new grounds in the understanding of phase transition.



Alessandro Vichi

ERC Starting Grant

Alessandro Vichi has received an ERC Starting Grant titiled "Charting the space of Conformal Field Theories: a combined nuMerical and Analytical aPproach". This project aims to explore new directions of conformal field theories, with the ultimate objective of a detailed classification and understanding of scale invariant systems and their properties.

Florian Naef

Early Postdoc.Mobility Fellowship

Congratulations to Florian Naef for receiving the Early Postdoc. Mobility grant of the Swiss National Science Foundation for the project "Quantization and the Kashiwara-Vergne Problem".

Anthony Conway

Early Postdoc.Mobility Fellowship

Congratulations to Anthony Conway for receiving an Early Postdoc.Mobility fellowship for his project entitled "Invariants of link concordance and their relation to braids".

New Collaborators

Amit Sever

CERN

Amit Sever obtained his Ph.D. in Physics at the Hebrew University in 2005. He was a postdoctoral fellow at the Brandeis University and then held a shared postdoctoral position at the Perimeter Institute for Theoretical Physics in Waterloo and the Institute for Advanced Studies in Princeton. His research interests include: mathematical physics, quantum field theory and string theory.

Maryna Viazovska

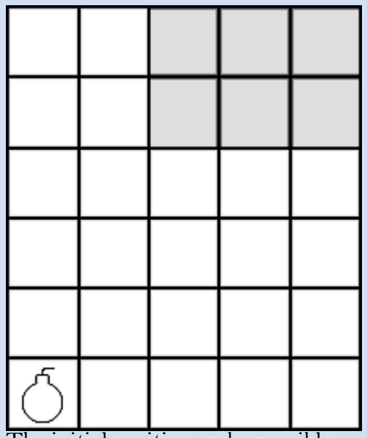
EPF Lausanne

Maryna Viazovska obtained her Ph.D. in Bonn in 2013, under the direction of Professor Don Zagier. She was a postdoctoral researcher at the Berlin Mathematical School and the Humboldt University of Berlin. Since January 2018 she is a full professor at the EPF Lausanne. Her research interests include: analytic number theory, sphere packing and modular forms.

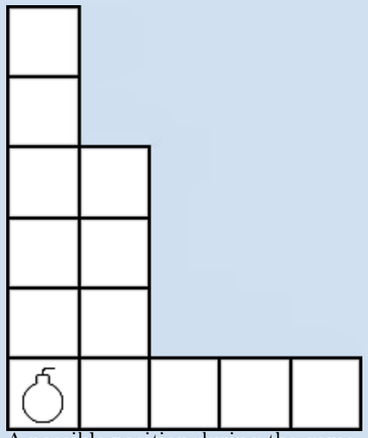
Puzzle Corner

1. Chomp

Alice and Bob take turns in playing the following game on a rectangular chocolate board, with Alice playing first.
The player on move chooses a square on the board and takes it, along with all other squares in the north-east quadrant from it. The player who is forced to take the bottom left square loses the game.
Who has a winning strategy?



The initial position and a possible first move.



A possible position during the game.

2. From Bixley to Quixley

Here is a problem which Sam Loyd figured out during a ride from Bixley to Quixley astride a razor-back mule. Let's hear his narrative:
I asked Don Pedro, a native guide who walked ahead of me pulling the mule forward by its reins, if my steed had another gait. He said it had but that it was much slower, so I pursued ma journey at uniform speed. To encourage Don Pedro, who was my chief propelling power, I said we would pass through Pixley, so as to get some liquid refreshments; and from that moment he could think of nothing but Pixley. After we had been travelling for forty minutes I asked how far we had gone. Don Pedro replied: "Just half as far as it is to Pixley." After creeping along for seven miles more I asked: "How far it is to Quixley?" He replied as before: "Just half as far as it is to Pixley."
We arrived at Quixley in another hour, which induces to me to ask you to determine the distance from Bixley to Quixley.

From Mathematical puzzles of Sam Loyd, Selected and Edited by Martin Gardner, Dover Publications, Inc., New York, 1959

3. Aliens

Explorers on an extrasolar planet find the following Alien message painted on the wall of a cave:

I X . O I
I X I O V
V X V O M
M X M O I .

How many fingers do you think those Aliens had?

4. A square problem

Can one find a number that is a square of an integer ending with three identical digits different from 0?

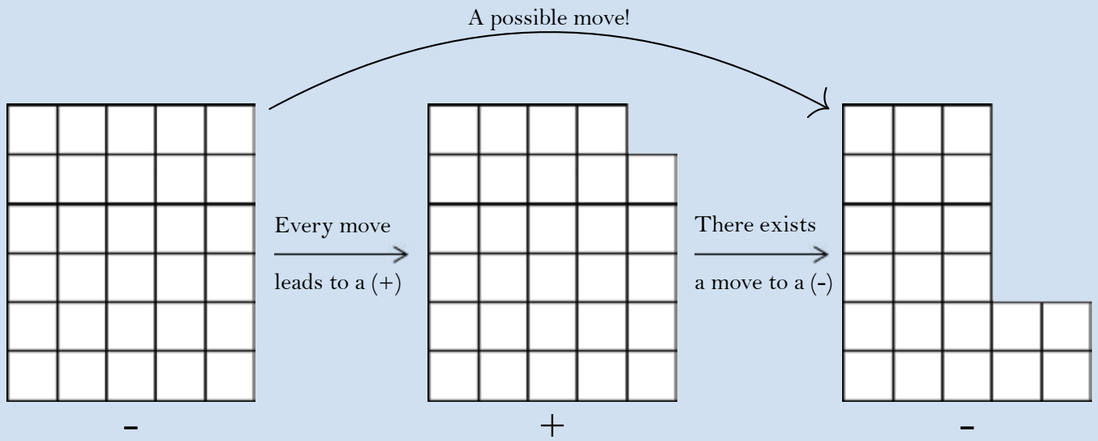
5. Water and Wine

A glass contains a certain amount of water, and another glass contains exactly the same amount of wine. We remove a spoonful from the glass of wine that we put in the glass of water, and we stir this glass. Then, we remove a spoonful (with the same spoon) from the mixture glass, and put it in the glass of wine. Is there more wine in the glass of water, or more water in the glass of wine? Or is there the same quantity?

Answers

1. Chomp

We prove that Alice has a winning strategy. Suppose not. Then in particular, if Alice takes the **top right** square, Bob would be in a winning position. Therefore, he has a move with which he can in turn place Alice in a losing position. However, Alice could have played that move as her first move already, thus placing Bob in a losing position right after her first move. This is a contradiction, as we assumed that the initial position was a losing position.
Schematically, if a "+" represents a winning position and a "-" represents a losing position, then under the assumption that Bob has a winning strategy, we have the following diagram, leading to a contradiction:



2. From Bixley to Quixley

The distance between Bixley and Quixley is 10.5 miles.

3. Aliens

The answer is 8.

I X . O I	"1+0 = 1"		I = "1"
I X I O V	"1+1 = 2"	⟶	. = "0"
V X V O M	"2+2 = 4"		X = "+"
M X M O I .	"4+4 = 8"		O = "="

So we have:
V = "2"
M = "4"
I . = "10" (which would be 8)

4. A square problem

The answer is yes. The smallest example is $1444 = 38^2$.

5. Water and Wine

There's more water in the glass of wine.

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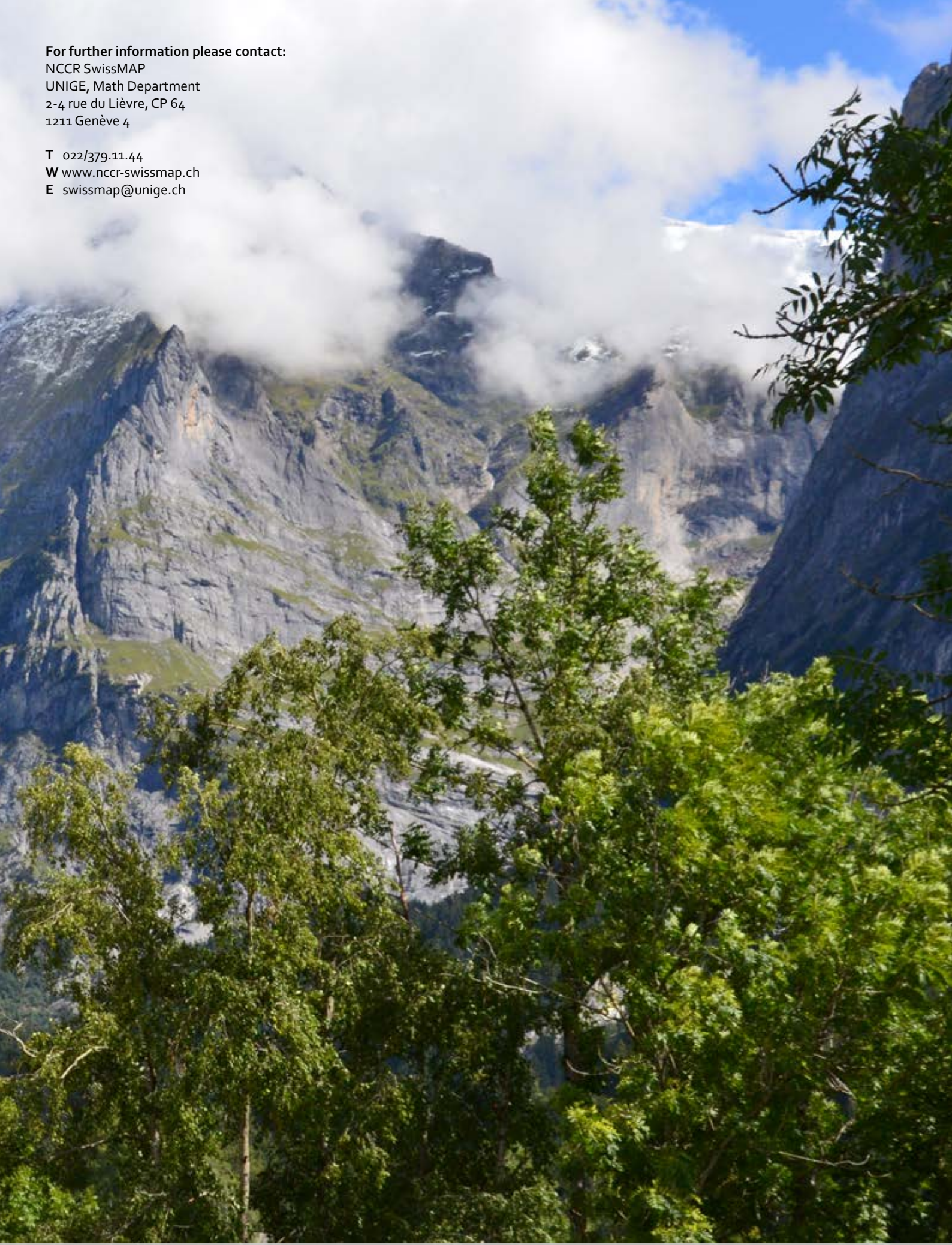

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