



Newsletter

BELGIAN MATHEMATICAL
SOCIETY

134, September 15, 2021

Comité National de Mathématique CNM

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NCW Nationaal Comité voor Wiskunde



Newsletter of the Belgian Mathematical Society and the National Committee for Mathematics

Belgian Mathematical Society ASBL/VZW
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Foreword

Dear BMS members,

While last year's foreword to the academic year's first Newsletter was rather grim, I write this one with a lighter heart. I hope the success of the vaccines allow us to return to some form of sobered normalcy; I also wish that this scientific achievement aids us towards the victory of reason and kindness over foolishness and bigotry. Most of all, I wish you all a pleasant academic year, filled with cheerful moments, enjoyable surprises and, of course, many beautiful lemmas and corollaries.

On the BMS side of affairs, we have a few announcements that make for an interesting new academic year. First, on December 15th, we will have our yearly General Assembly and, at this occasion, we will also organize a "Recent breakthroughs event" in the afternoon, during which we will have the chance to hear two talks by none other than the Abel prize winner Avi Wigderson (online) and the Shaw prize winner Jean-Michel Bismut (hopefully in person). We will also host our first "BMS early career award", about which more will be said in the next Newsletter. Our second main event is planned on Friday May the 13th, namely the PhD day which shall be organized in Liège University. Again, more information will be provided in due course. Both events will be free for BMS members, so all the more reason to make sure you are a registered member of our old, but still lively society.

Philippe, Wendy and Yvik

The next edition of this newsletter will appear on November 15th, hence, till November 8th all content can be sent to wendy.goemans@kuleuven.be.

1 News from the BMS & NCM

1.1 Save the date!

In the next academic year, the BMS organizes live events again, so save the following dates:

- **Recent breakthroughs in mathematics (including our general assembly)** December 15th, 2021
- **PhD Day** May 13th, 2022

1.2 Bulletin of the Belgian Mathematical Society - Simon Stevin

Starting from Volume 28 the Bulletin of the Belgian Mathematical Society - Simon Stevin only appears online and is not printed any more. As a member of the BMS you have electronic access to all electronically available issues of the bulletin, free of charge. You have received instructions for this by e-mail. If you have any trouble logging in or accessing the journal, please contact

customer_support@projecteuclid.org.

For the table of contents of previous issues, see <https://projecteuclid.org/all/euclid.bbms>.

2 News from the EMS

2.1 EMS Jobs and Events Pages are in use again

The listings pages for mathematical job vacancies <https://euromathsoc.org/jobs> and upcoming mathematical events <https://euromathsoc.org/events> are now up and running on the EMS's new website <http://euromathsoc.org>! Click through to view the current listings. These pages are also accessible through "Services" in the website's top menu.

To submit a job or event, you will first be invited to login or register with the EMS website. Registration is separate from EMS membership and is not carried over from the old website.

Job listings are also streamed to Twitter, via the dedicated account @EuroMathJobs <https://twitter.com/euromathjobs>

(separate from the main EMS Twitter account @EuroMathSoc <https://twitter.com/euromathsoc>).

For more jobs listings see also our list of national job boards <https://euromathsoc.org/european-job-boards> and MathHire.org <https://mathhire.org/>.

For upcoming mathematical outreach events, see Pop Math <https://www.popmath.eu/> administered by the EMS's committee for Raising Public Awareness of Mathematics <https://euromathsoc.org/committee-rpa>.

3 Announcements

3.1 AMS Memorial Tribute: Remembering Jean Bourgain

The *Notices* of the AMS (Volume 68, Number 6, June/July 2021, pp 942-957) contains, among others, papers by Ingrid Daubechies and Freddy Delbaen with a lot of interesting stories and anecdotes about Jean Bourgain when he was a student at the VUB.

The volume is accessible at <https://www.ams.org/notices/202106/rnoti-p942.pdf>.

3.2 zbMATH Open - an Invitation to the Mathematical Community

zbMATH has been open access since 1st January 2021. See the information at the end of this newsletter.

4 (Online) Meetings, Conferences, Lectures, ...

4.1 Meetings and conferences

Cycle de conférences Altaïr

Campus Plaine (ULB)

See all information at the end of the newsletter.

4.2 October 2021

Coryfeeën met ideeën: visies op wiskundeonderwijs

October 2, 2021 (Nederlandse Vereniging van Wiskundeleraren)

De werkgroep Geschiedenis van de Nederlandse Vereniging van Wiskundeleraren organiseert ook in 2021 een symposium, op 2 oktober. Het thema dit jaar is Coryfeeën met ideeën. We hebben sprekers uitgenodigd die hun licht laten schijnen op de vakdidactische visie van vedettes uit het wiskundeonderwijs, zowel in Nederland als daarbuiten. Evenals vorig jaar zal het symposium online plaatsvinden. Wie zich aanmeldt voor dit symposium ontvangt half september een link naar de vijf opgenomen lezingen op de site van de NVvW, met het verzoek deze vóór 2 oktober te bekijken, en eventuele vragen en opmerkingen digitaal in te dienen. Op zaterdag 2 oktober vindt er een live online panelgesprek plaats tussen de sprekers, waarbij ook inbreng van de kijkers zeer op prijs wordt gesteld. De sprekers en onderwerpen zijn:

- Margriet van der Heijden: *Tatiana Afanassjewa en de wiskundededidactiek*
- Harm Jan Smid: *Jan Versluys als exponent van zijn tijd*
- Danny Beckers: *Suus Freudenthal en haar man: onderwijsvernieuwing en onderwijs-idealen als uitgangspunt voor nieuw wiskunde-onderwijs*
- Dirk de Bock en Bert Zwaneveld: *Piet Vredenduin, wiskundeleraar en selfmade didacticus*
- Hilde Eggermont en Michel Roelens: *Afgeleiden, integralen en continuïteit definiëren: de historische weg in de klas*

Meer informatie is te vinden op de website van de vereniging

<https://nvvw.nl/werkgroepen/werkgroep-geschiedenis/>.

Voor toegang tot de lezingen en deelname aan het live-gedeelte is aanmelden verplicht. Deelname is gratis, met de mogelijkheid tot een vrijwillige bijdrage.



Services d'Analyse Mathématique et de Probabilités et Statistique

October 15, 2021 (UMons)

See all information on this école doctorale at the end of the newsletter.

4.3 November 2021

Belgian Network Research Meeting (BENet)

November 18, 2021 (University of Namur)

The 10th edition of the Belgian Network Research Meeting (BENet) will be organised by the naXys Institute at the University of Namur on November 18, 2021. The purpose of this annual event is to foster communication predominantly among Belgian researchers employing network science on their work. The workshop is strongly interdisciplinary, but mainly oriented towards mathematics, physics, computer science and engineering. This year we will host two keynote speakers, Ginestra Bianconi (Queen Mary University of London) and Alice C. Schwarze (University of Washington), who will deliver their talks online. Submission of abstracts is open (deadline October 25) and registration is free but mandatory (deadline November 10). More information at the following link <https://www.naxys.be/benet/>.

4.4 Seminars and colloquia

Analysis & Geometry Seminar (UAntwerpen)

Wednesdays 16.00 - 17.00

This is the weekly research seminar of the analysis & geometry-interested people in Antwerpen. During the semester, we'll have once per week a research talk in analysis and/or geometry and/or related topics. The list of speakers comprises researchers from Antwerpen as well as other universities. Depending on the state of the art of the corona measures, the talks will take place either in M.G.017 or ONLINE via ZOOM. It will be announced/posted for each talk individually. All information is available on

<https://www.uantwerpen.be/nl/personeel/sonja-hohloch/private-webpage/seminars/analysis—geometry/>

On Trends in Pure and Applied Model Theory -

Tame Geometry, Transseries and Applications to Analysis and Geometry

(Fields Institute for Mathematical Sciences in Toronto)

Currently there is a thematic program "on Trends in Pure and Applied Model Theory" in the Fields Institute for Mathematical Sciences in Toronto (Canada) July 1 - December 31, 2021. Up to now seminars and the coming December conferences are planned in an hybrid format. In particular Ehud Hrushovski will be giving the Coxeter lectures (December 13-15, 2021).

This program is followed by a thematic program on "Tame Geometry, Transseries and Applications to Analysis and Geometry", next semester (January 1 till June 30, 2022).

Further informations may be found at <http://www.fields.utoronto.ca>.

Ghent Methusalem Junior Seminar

Tuesdays 4.30 PM (ZOOM)

The Ghent Methusalem Junior Seminar is run by PhD students and postdocs at the **Ghent Analysis & PDE Center** (<https://analysis-pde.org>).

It provides an ideal opportunity for young researchers in mathematics to share their ideas and to learn about new trends in a wide range of fields. Targeting a mainly (though not exclusively) young audience has meant for the organizers to ensure a relaxed atmosphere and to encourage the audience to engage in stimulating discussions with the speakers, ideally leading to new collaborations.

The seminar currently takes place every Tuesday at 4.30 PM (CET) on ZOOM. For more information about our activity and about past and future talks, please visit the dedicated webpage:

<https://analysis-pde.org/ghent-methusalem-junior-seminar/>

If you would like to give a talk or to invite someone to give a talk, please contact:

- Duvan Cardona Sanchez (Duvan.CardonaSanchez@UGent.be)
- Serena Federico (Serena.Federico@UGent.be)
- Vishvesh Kumar (Vishvesh.Kumar@UGent.be)
- David Rottensteiner (David.Rottensteiner@UGent.be)
- Bolys Sabitbek (b.sabitbek@qmul.ac.uk).

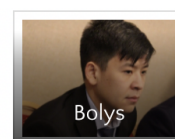
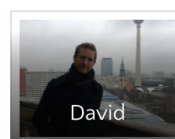
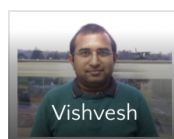
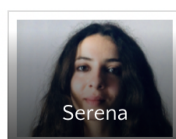
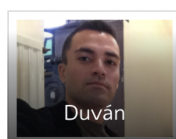
Scheduled talks are (to be updated):

- 31 August 2021, Yevgeny Liokumovich (University of Toronto, Canada).
- 7 September 2021, Xueying Yu (MIT, USA).
- 14 September 2021, Agnieszka Hejna (University of Wrocław, Poland).
- 21 September 2021, Joel Restrepo (Nazarbayev University, Kazakhstan).
- 12 October 2021, Alessandro Palmieri (University of Pisa, Italy).
- 16 November 2021, Elisa Affili (University of Deusto, Spain).

The Ghent Methusalem Junior Seminar is supported by FWO Odysseus 1 Project: Analysis and Partial Differential Equations, and by the Ghent University Methusalem Programme "Analysis & PDE".



Our organising committee





Some pictures of Ghent and of our Seminars

Geometry Seminar at Cal State Fullerton

Fridays (in Zoom)

The geometry seminar at Cal State Fullerton takes place online in a Zoom meeting (note that California is 9 hours behind the Western European time). See all information at the end of this newsletter.

5 PhD theses

Submanifolds of complex quadrics and Gauss maps

Anne Wijffels

KU Leuven

September 17, 2021

Thesis advisors: Prof. Dr. Joeri Van der Veken (KU Leuven)

Summary: The complex quadric and complex hyperbolic quadric are simply connected Kähler-Einstein manifolds. They can be constructed as Kähler submanifolds of the complex projective space and the complex anti-de Sitter space respectively, where the ambient spaces are equipped with the metric induced by the Hopf-fibration. The structure of the quadrics can be described in a very similar way and their curvature tensors are exactly opposite. In this thesis, we use a structural approach to investigate the Lagrangian submanifolds of these quadrics and we completely classify their totally geodesic surfaces. In addition, a detailed description of these quadrics is given in dimension two, where they are isometric to a product of two-spheres and hyperbolic planes respectively.

We also describe a Gauss map of hypersurfaces of spheres, introduced by Palmer, which is a Lagrangian immersion in the complex quadric. Similarly, we define a Gauss map for spacelike hypersurfaces of anti-de Sitter space and show that it is a Lagrangian immersion in the complex hyperbolic quadric. These Gauss maps then allow us to relate the classification results of the Lagrangian submanifolds to these hypersurfaces.

In particular, we provide known classification results for minimal Lagrangian submanifolds of the complex quadric. These then motivate studying the minimal Lagrangian submanifolds of the complex hyperbolic quadric. We provide a classification of the minimal Lagrangian submanifolds with constant sectional curvature and those with all angle functions constant. We also study the Lagrangian H -umbilical submanifolds of the complex quadric, and motivate the conjecture that all Lagrangian H -umbilical submanifolds of the complex quadric are Gauss maps of rotational hypersurfaces.

There exist only six types of totally geodesic surfaces in the complex quadric and the complex hyperbolic quadric, we give an explicit description of all the possible types. This result has been shown by Chen, Nagano and Klein, but in this thesis we also present a more structural proof to show that these are the only possibilities.

Expanding the Universe of (Restricted) Universal Groups over Right-Angled Buildings

Jens Bossaert
Ghent University

October 1, 2021

Thesis advisors: Prof. Dr. Tom De Medts (Ghent University) and Prof. Dr. Hendrik Van Maldeghem (Ghent University)

Summary: In a foundational paper in 2000, Burger and Mozes introduced the iconic universal group construction. Given a permutation group F of degree d , the universal group $\mathcal{U}(F)$ is the group of all

automorphisms of the d -regular tree such that the “local action” at every star of the tree is given by a permutation in the local group F . Equipped with the permutation topology, this construction yields a broad family of totally disconnected locally compact groups.

Following a suggestion of Caprace, Silva showed that this construction is also meaningful for automorphism groups of *right-angled buildings* — a class of buildings with exceptional local-to-global properties and rich combinatorial structure. We extend the results of Silva to the case where the local groups are not necessarily transitive or of finite degree. In particular, we characterise when the resulting universal group is transitive, primitive, and generated by chamber stabilisers. We provide sufficient conditions under which the universal group is compactly generated and, motivated by some partial results, conjecture these to be necessary as well. We proceed to establish and apply a general simplicity criterion for groups acting on right-angled buildings, in the same vein as Tits’s celebrated simplicity criterion for groups acting on trees. Finally, we formalise a way to glue together buildings along another building, and we show that the universal group is well-behaved with respect to this construction.

We also generalise recent work by Le Boudec to this framework of right-angled buildings and define a variant of the universal group allowing for a finite number of exceptional local actions. We find restrictions on where these singularities can occur and transfer properties of the standard universal groups to this setting.

A recurring theme is that the structure of the groups not only depends on the permutational properties of the local groups, but also on the combinatorial properties of the building’s diagram.

An averaging formula for Nielsen numbers on infra-solvmanifolds

Iris Van den Bussche

KU Leuven Campus Kulak Kortrijk

October 4, 2021, 4pm, room B422, E. Sabbelaan 53, 8500 Kortrijk

Thesis advisors: Prof. dr. K. Dekimpe (KU Leuven Campus Kulak Kortrijk) and dr. J. Deré (KU Leuven Campus Kulak Kortrijk)

Summary: We prove an averaging formula for Nielsen numbers of self-maps on any (compact) infra-solvmanifold. Our formula generalises the well-known averaging formulas for Nielsen numbers on infra-nilmanifolds and infra-solvmanifolds of type (R). We present three applications of our averaging formula.

We say that a compact manifold satisfies the N_0 property if the Nielsen number of every self homotopy equivalence is zero. Geometrically, this means that every self homotopy equivalence is homotopic to a fixed point free map. We classify all (compact) solvmanifolds up to dimension four satisfying the N_0 property.

Every infra-solvmanifold can be realised as a quotient space $M = \mathbb{R}^n / \Gamma$ where Γ is a virtually polycyclic group acting freely and properly discontinuously on \mathbb{R}^n via polynomial diffeomorphisms. In this setting, any self-map of M is homotopic to a map \bar{p} induced by a polynomial $p : \mathbb{R}^n \rightarrow \mathbb{R}^n$. We express our averaging formula in terms of the polynomial lift p . Additionally, we study the number of fixed points of these polynomial maps and find that polynomial maps have either infinitely many fixed points or exactly $N(\bar{p})$ fixed points.

Finally, we employ our averaging formula to study the rationality of the Nielsen zeta function on a

(compact) solvmanifold. The Nielsen zeta function is known to be rational on solvmanifolds of type (E). We extend this result to the class of \mathcal{NR} -solvmanifolds, which were introduced by Keppelmann and McCord as a class of solvmanifolds satisfying the Anosov relation. We next verify that Nielsen zeta functions on any solvmanifold up to dimension five are rational, and conjecture rationality in any dimension.

6 News from the universities

6.1 UGent

Dr. Fedor Pakhomov (FWO senior Postdoc) will join the Department of Mathematics: Analysis, Logic and Discrete Mathematics as research professor in logic after he won a very prestigious FWO Odysseus II grant: <https://www.fwo.be/media/1024349/results-odysseusprogramme-2020.pdf>

Moreover the distinguished professor Harvey M. Friedman joined our department as a guest professor.

Finally Fatemeh Mohammadi from the Department of Mathematics: Algebra and Geometry won a very prestigious FWO Odysseus I grant:

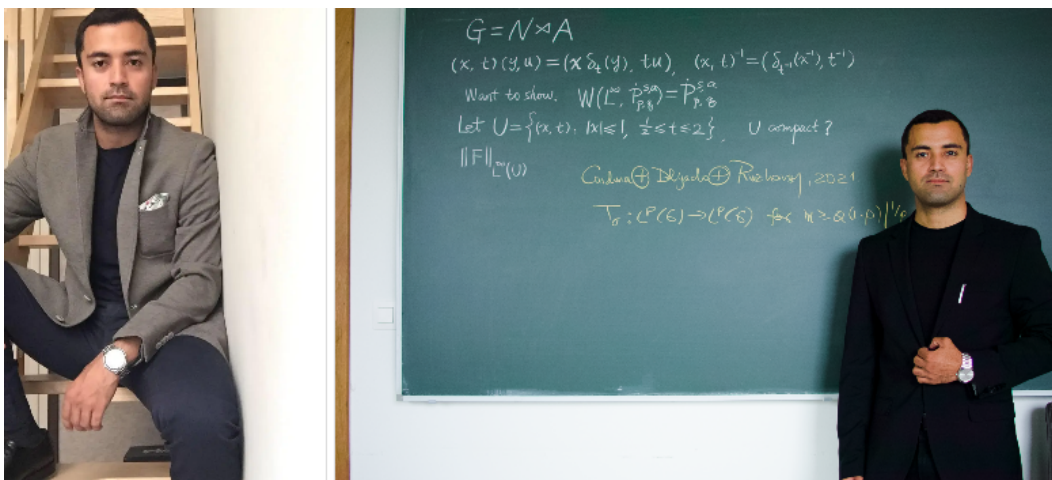
<https://www.fwo.be/media/1024349/results-odysseusprogramme-2020.pdf>

Congratulations!

Duvan Cardona's interview from Mexico

The August 2021 edition of the Mexican magazine **Revista D Escenarios** dedicated an interview to the Colombian mathematician and currently a PhD student and a member of our Ghent Analysis and PDE Center, Duvan Cardona Sanchez. The Interview was prepared by the international press officer Alejandra Suárez Giraldo.

Duvan talked about some of his responsibilities as a young mathematician. He serves from 2020 as a 'Par evaluador' (academic reviewer) for the Colombian Science Ministry and for Colciencias (the group of validation of the scientific investigation in Colombia) in view of his experience as a reviewer for Mathematical Reviews, and his recognised achievements awarded by the Colombian Academy of Sciences.



7 History, maths and art, fiction, jokes, quotations ...

Manneken π

24 09 2021

Everybody is welcome

Manneken Pis heeft stijl, maar in zijn grote garderobe van kostuums ontbrak er nog een ode aan de wiskunde! Daarom creëerde de Vakgroep Wiskunde & Data Science van de VUB samen met Julie De Kezel, Nicolas de Coster en Quentin Bolsée het allereerste wiskundig geïnspireerd kostuum voor Manneken Pis. Onze inspiratiebron was Pythagoras, één van de oudste en bekendste wiskundigen, wiens naam bovendien voor iedereen gekoppeld is aan zijn fundamentele stelling in de meetkunde. Met “Manneken Psthagoras” zetten we wiskunde in eigen land en daarbuiten nog eens op de kaart! Afspraak op 24 september om 11u bij het standbeeld van Manneken Pis. Iedereen is welkom.

Manneken Pis a du style, mais dans sa grande garde-robe de costumes, il manquait une ode aux mathématiques! C’est pourquoi le Département de Mathématiques & Data Science de la VUB a créé, en collaboration avec Julie De Kezel, Nicolas de Coster et Quentin Bolsée, le tout premier costume d’inspiration mathématique pour Manneken Pis. Notre source d’inspiration était Pythagore, l’un des mathématiciens les plus anciens et les plus célèbres, dont le nom est également lié à son théorème fondamental en géométrie. “Manneken Psthagore” célèbre les mathématiques dans notre propre pays et au-delà ! Rendez-vous le 24 septembre à 11h devant la statue du Manneken Pis. Tout le monde est le bienvenu.

Manneken Pis has style, but his large wardrobe of costumes lacked an ode to mathematics! That is why the Department of Mathematics & Data Science of the VUB created, together with Julie De Kezel, Nicolas de Coster and Quentin Bolsée, the very first mathematically inspired costume for Manneken Pis. Our source of inspiration was Pythagoras, one of the oldest and best-known mathematicians, whose name is also linked to his fundamental theorem in geometry. With “Manneken Peethagoras” we promote mathematics in our own country and beyond! See you on 24th Septembre at 11h in front of the statue of Manneken Pis. Everybody is welcome.

7.1 Gold medal women cycling in Tokyo 2020: Congratulations!!

Anna Kiesenhofer, PhD in mathematics, has won the gold medal women cycling in Tokyo 2020. She obtained her PhD at the Universitat Politècnica de Catalunya with her thesis on integrable systems on b-symplectic manifolds.

7.2 Adhemar’s corner

Also in this new academic year we are grateful to Adhemar for his reviews. Here follows one on *It All Adds Up: The Story of People and Mathematics* of Mickaël Launay.

It All Adds Up: The Story of People and Mathematics, William Collins, 2019 (272 p.) (transl.)
Le grand roman des maths, Flammarion, 2016, (304 p.) (orig.); J'ai Lu, 2018 (320 p.)
De wetten van de wereld, Balans, 2019 (267 p.) (transl.) by *Mickaël Launay*

Because of the success of the French original, the book has been translated and is now also available in English. Launay writes both a survey of the history of mathematics as is obvious from the subtitles, but he does that using the usual topics that one can find in many books on popular mathematics.

He starts somewhat surprisingly with the biface or hand axe which he considers a geometric object and with the pottery decorations in the style of one of the seven friezes. More conventional is the start of mathematics by counting, first using stones (*calculi*) or tallying like on the Ishango bones. The history is told chronologically by topic per chapter that may stretch over several centuries. Of course prehistoric people did not have a clue about seven friezes, and the history of counting also includes the invention of digits and different number systems, an insight that came only much later. For the coherence of the text, these facts are obviously brought together in one chapter. Early geometry is introduced in Egypt and Greece, and soon we see theorems appearing about solids and many about plain geometry, in particular about triangles and circles. Geometry was the first mathematical theory that the Greek conceived as an axiomatic system using an approach with definitions, theorems, and proofs. The parallel postulate gave rise to a lot of speculation during many centuries.



biface

The Greek were using a principle of commensurability: there is some smallest unit so that all measures can be expressed as integer multiples of that unit. They however were well aware that π and $\sqrt{2}$ resisted this principle. So that brings the story back to numbers, and more precisely the history of zero, first as a place holder in the representation of numbers, but more importantly as a number on its own. Zero as a number is on the boundary between the positive and the negative numbers. It also took a while before the negative numbers were accepted as numbers.

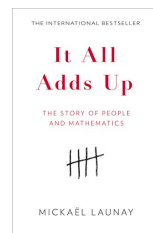
With the Arabs we learn more about tilings like in the Alhambra, but also about triangles and trigonometry used in measuring areas and distances, and nowadays in computer graphics. The Arabs also brought us algebra to solve equations. After a short section about sequences (from Fibonacci to trigonometric series), the story returns to the solution of equations of second or third degree (here comes the classic story of Tartaglia) which entailed the introduction of imaginary numbers, first as an anomaly that miraculously gave the correct result, but later as part of complex numbers.

When books were being printed, some symbols were introduced to denote equations and also geometry could be handled with equations and algebra after Descartes introduced a coordinate system. And then people started modelling physical phenomena. Of course astronomy was studied since antiquity, but also crystallography became fashionable. It required the introduction of infinitesimals by Newton and Leibniz to introduce differential equations. This difficult concept of something infinitesimally small and yet not zero, caused a lot of controversy, but it was eventually also the reason to reconsider the set of numbers that is on a continuous interval and the different orders of infinity.

Next comes the introduction of probability and the introduction of machines: the abacus, the Pascaline, and all kinds of mechanical calculators, up to the Babbage machine. Subsequently programmable computers and proofs by machines (the four colour problem) are discussed and eventually the computer winning in chess and go from a human champion player.

In the last chapter, the fundamentals of the last century for current and future mathematics are explained: Hilbert's problems, the Fields medal, the *Principia Mathematica* by Whitehead and Russell and the incompleteness theorems of Gödel, and fractals introduced by Mandelbrot.

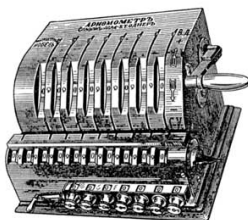
This is a popular science book, and thus Launay stays for most subjects on the surface so that anybody can understand. In fact he writes in his preface that he started writing the book out of frustration because many people take some pride in admitting they are not good in math, while when Launay has some pop-up stand on a market place doing card tricks, origami, games, riddles, and other things based on mathematics, people do not consider that as mathematics. Like one can love music without being a musician, it is



Mickaël Launay

equally possible to be interested in or to even love mathematics without being a mathematician. Like artists, mathematicians explore and create mathematics out of curiosity, and that can be admired or appreciated without being a buff at all the technicalities of mathematics.

Thus Launay is an entertaining story teller, taking the reader along on his visits to museums, and he explains the mathematics where needed, but always as one would explain it to a (young) neophyte. The topics that are traditional stumble stones in math education are particularly handled with care, like the Zeno paradox of Achilles and the tortoise, or why minus times minus is plus. Because of a limited number of pages that is digestible, Launay also had a choice to make, and only few topics are explained in more details, which may depend on personal interest with a slight French bias. For example his discussion of probability can be explained because he has a PhD in probability (2009) from the *Ecole Normale Supérieure*. In many cases there exist complete books devoted to each of the items that are only explored skin-deep here. He refers to several examples, but also to museums, and websites. Also the list of papers used gets a two-letter key, referring to the historical time period and the mathematical subject that is discussed.



Odhner's arithmometer

I liked his account of how the town currently known as Baghdad was founded that quickly became the scientific and cultural center of the known world with the library of the *Bayt al-Hikma* (House of Wisdom), reminding of the legendary library of Alexandria. The example where a non-commutative binary operation is defined for a set of symbols via a table, and then some algebra is done with these symbols can also work very inspiring for the layperson. His exposition of how to operate the arithmometer constructed by Willgodt Theophil Odhner (1877) is rarely found.

Joseph Mazur's *Enlightening Symbols* (2014) and F. Cajori's *A history of mathematical notation* (first edition 1922) are devoted to the origins of many symbols that, besides numbers, we are used to in our modern mathematical notation like $\pi, e, i, 0, +, -, =$, exponents and square roots. Johannes Widmann (1460) was the first to use $+$ and $-$ for the binary operations, Tartaglia (1550) the first using parenthesis $()$, and Robert Recorde (1557) introduced $=$, and Thomas Harriot (1631) used the $<$ and $>$ with their current meaning. William Oughtred (1631) had the \times for multiplication, $:$ for division and was the first to use π for 3.1415... but Euler popularized it later. The obelus \div for division is coined by Johann Rahn (1659) and combines the Arab horizontal line and the $:$ of Oughtred and Christoff Rudolff (1525) used $\sqrt{\quad}$ for the square root and Descartes added the roof: $\sqrt{\quad}$. All that happened in the 15th and 16th to early 17th century. Other proposals have been made, that did not become standard, and it sometimes took many years before a notation got accepted by the majority. Symbols for $+$ and $-$ were known earlier by the Arabs. Also variants of the radix sign existed earlier. So some of the origins are fuzzy and the above mentioned origins by Launay do not always coincide with what is mentioned by Mazur or Cajori. Sometimes these symbols had subtly different meanings and they still do today. The $=$ can stand for an equality or define an equation and it can be bidirectional or unidirectional. In the latter case $a + x = b$ is not the same as $x = b - a$. In definitions one sometimes uses $:=$ to indicate that the left is defined by the right. Also in programming languages it can have a unidirectional meaning when $x = x + y$ indicates that the place containing the value of x is replaced by the value of the sum. It was also Descartes who started using letters a, b, c, \dots for constants and x, y, z, \dots for variables or unknowns, a distinction previously assigned to vowels and consonants. It is remarkable how much mathematicians could achieve in a period that mathematics was very verbose and they had to figure out the solution without all these symbols. This is quite the opposite of the illustration above of a short section of the *Principia Mathematica* that is quasi unreadable because it has only symbols.

*54.43. $\vdash :. a, \beta \in 1. \supset : a \wedge \beta = \Lambda. \equiv. a \vee \beta \in 2$
Dem.
 $\vdash. *54.26. \supset \vdash :. a = t'x. \beta = t'y. \supset : a \vee \beta \in 2. \equiv. x \neq y.$
 $[*51.231] \quad \equiv. t'x \wedge t'y = \Lambda.$
 $[*13.12] \quad \equiv. a \wedge \beta = \Lambda \quad (1)$
 $\vdash. (1). *11.11.35. \supset$
 $\vdash :. (\exists x, y). a = t'x. \beta = t'y. \supset : a \vee \beta \in 2. \equiv. a \wedge \beta = \Lambda \quad (2)$
 $\vdash. (2). *11.54. *52.1. \supset \vdash. \text{Prop}$
 From this proposition it will follow, when arithmetical addition has been defined, that $1 + 1 = 2$.

Principia Mathematica, page 379

From this proposition it will follow that $1 + 1 = 2$

zbMATH Open

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Klaus Hulek (Editor-in-Chief)

CYCLE DE CONFÉRENCES ALTAÏR

Programme 2021-2022

Le Centre d'Histoire des Sciences et des Techniques de l'ULB propose :

25 septembre 2021 :	Marc Moyon (Univ. Limoges, CNRS, XLIM) <i>«Al-Khwârizmî en Europe ou la résolution des équations en latin»</i>
9 octobre 2021 :	Vinciane Debaille (ULB) <i>«Mission vers Mars»</i>
16 octobre 2021 :	Jacques Demongeot (Université de Grenoble Alpes) <i>« Propagation de la peste en Europe au Moyen-Âge : Approche par modélisation mathématique. Analogies et différences avec la propagation actuelle de la Covid-19 »</i>
27 novembre 2021 :	Franklin Lambert (VUB-Instituts Solvay) <i>«Nouveau coup de projecteur sur l'origine singulière des Conseils Solvay»</i>
5 février 2022 :	Emmanuelle Javaux (ULiège) <i>«À la recherche des premières traces de vie sur la Terre et sur Mars »</i>
12 février 2022 :	Frank Pattyn (ULB) <i>« Antarctique et la hausse du niveau marin : le joker dans le jeu de cartes »</i>
19 mars 2022 :	Philippe Dubois (UMons) <i>«La pollution de nos océans par les microplastiques : le rôle de la recherche scientifique»</i>
23 avril 2022 :	Damya Laoui (Lab of Cellular and Molecular Immunology VUB-VIB) <i>« Comment utiliser ses propres cellules immunitaires contre le cancer »</i>
7 mai 2022 :	Davy Paindaveine (ULB) <i>« Quelques paradoxes dans le monde de l'aléatoire»</i>

Horaire : le samedi matin de 10h à 12h

Localisation : ULB Campus Plaine, Forum Auditoire E, Boulevard du Triomphe

Tout public : 5 € par séance

Etudiants : entrée gratuite

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**JOURNEE ORGANISEE AVEC LE SOUTIEN DE
L'EDT MATH**

Services d'Analyse Mathématique et de Probabilités et Statistique

**13h45 – 15h00 Gilles Godefroy
(Sorbonne Université, Paris)
*La géométrie des espaces de Banach***

Le théorème de Pythagore nous donne l'expression de la distance géométrique naturelle, qu'on appelle la distance euclidienne. Cette distance est un outil polyvalent, qu'on rencontre dans toutes les mathématiques. Cependant, d'autres distances sont parfois mieux adaptées pour traiter un problème, ou définir un espace de fonctions. Nous sommes donc amenés à définir les espaces normés, puis à étudier leurs propriétés suivant la nature de leur norme. Nous allons examiner plus précisément la différentiabilité des normes et ses conséquences parfois surprenantes.

– pause café –

**15h45 – 17h00 Monia Mestiri
(Université d'Artois, Lens)
*Introduction à la dynamique linéaire***

Dans cet exposé, nous manipulerons des notions que vous avez déjà rencontrées dans vos cours : les applications linéaires et continues et les espaces de Banach. L'objectif sera de comprendre un des concepts de base de la dynamique linéaire : l'hypercyclicité.

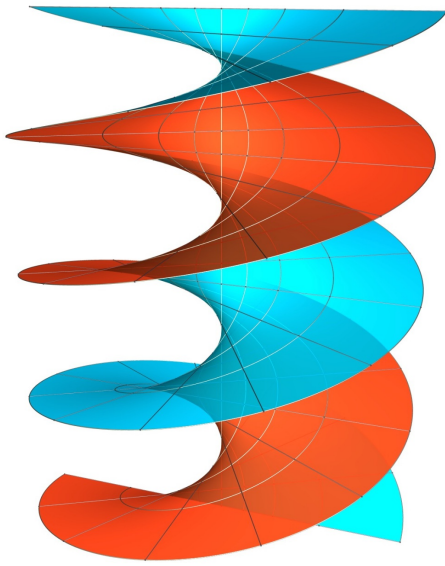
**VENDREDI 15 OCTOBRE 2021
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Avenue Victor Maistriau 15
7000 Mons**

Invitation cordiale à tous

GEOMETRY SEMINAR

Department of Mathematics
California State University Fullerton

Zoom meeting room: 893 4325 5295 Password: 112358



ABOUT THE SEMINAR

The Geometry Seminar at Cal State Fullerton was established in the Spring semester 2007, and the first speakers were Professors Zhiqin Lu and Ovidiu Munteanu (at that time both from UC Irvine). Since then, the seminar became the meeting place of faculty interested in Topology- and Geometry-related themes, and their students. We value very much the students' participation to our events, which we feel should guide our more motivated students interested to pursue a graduate career, where a good mastery of various topics in Topology and Geometry is welcome.

Many collaborative efforts were born out of the conversations among our participating faculty members. E.g. at the American Mathematical Society's Meeting 1167, which took place on May 1-2, 2021, the Special Session on Differential Geometry and Geometric PDE was organized by Professors Alfonso Agnew, Nicholas Brubaker, Thomas Murphy, Shoo Seto, and Bogdan Suceavă. Such efforts are the expression of our academic environment and our collaborating atmosphere.



SCHEDULED TALKS

Friday, September 3, 10:00 am

Peter Hästö, University of Turku, Turku, Finland

Friday, September 10, 9:00 am

Hayato Miyazaki, Kagawa University

Friday, September 17, 9:00 am

To be determined

Friday, September 24, 9:00 am

Cezar Oniciuc, Al.I. Cuza University, Iași, Romania

Friday, October 1, 9:00 am

Stuart Hall, Newcastle University, Newcastle, UK

Friday, October 8, noon

Xin Dong, University of Connecticut

Friday, October 15, 9:00 am

Mike Wong, Dartmouth University

Friday, October 22, 9:00 am

Marian Munteanu, Al.I. Cuza University, Iași, Romania

Friday, October 22, 10:00 am

Nelia Charalambous, University of Cyprus

Friday, October 29, noon

Alvaro Pámpano, Texas Tech University

Friday, November 5, 9:00 am

To be determined

Friday, November 12, 9:00 am

Xavier Ramos-Olive, Worcester Polytechnic Institute

Friday, November 19, 9:00 am

Milen Yakimov, Northeastern University

Friday, December 3, 9:00 am

To be determined

Friday, December 10, 9:00 am

Lihan Wang, California State University Long Beach

Friday, December 17, 9:00 am

Adara-Monica Blaga, Western University, Timișoara, Romania

VENUE

The symposium will take place virtually via Zoom.

2021-2022 ORGANIZERS

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Shoo Seto, CSUF

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