



# Newsletter

BELGIAN MATHEMATICAL  
SOCIETY

# 147, March 14, 2024

Comité National de Mathématique CNM

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NCW Nationaal Comité voor Wiskunde



By Andreas Weiermann

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

Belgian Mathematical Society ASBL/VZW  
ULB Campus Plaine, C.P. 218/01,  
Bld du Triomphe, B-1050 Brussels, Belgium

Website: [bms.ulb.ac.be](https://bms.ulb.ac.be)

Newsletter: [wendy.goemans@kuleuven.be](mailto:wendy.goemans@kuleuven.be)

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The next edition of this newsletter appears on May 15. Send your content (on PhD defenses, seminars, conferences, workshops, meetings, interaction with other sciences or companies, popular lectures, school initiatives, math exhibitions, job opportunities, ...) to [wendy.goemans@kuleuven.be](mailto:wendy.goemans@kuleuven.be).

## Foreword by the president of the BMS

Dear fellow mathematicians,

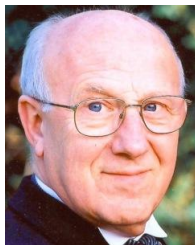
As you all know, our world is going through turbulent times. It should be no surprise that unfortunately also the academic world is sometimes affected by this. At this moment, the situation is particularly difficult for many of our colleagues in Argentina, where the new government decided to take several draconian measures that have a huge impact on universities and research institutions, and in particular on the people working there. For this reason, the BMS, along with many other mathematical societies, wrote a letter to express its support and solidarity with our colleagues in Argentina. You can find more info as well as the various support letters on the following website. Let us hope that the situation in Argentina will improve soon. [https://www.imas-uba-conicet.gob.ar/?page\\_id=1809](https://www.imas-uba-conicet.gob.ar/?page_id=1809)

Some more pleasant news is coming from our own society, as we will have the next edition of our PhD day on May 24 in Antwerp. We warmly encourage everyone to attend this day, and PhD students to participate actively. In contrast to the previous editions, we decided not to organize a job fair during the PhD day, but instead to ask some of our former PhD students and postdocs, who have left the academic world over the last years, to share their experience in a friendly and informal atmosphere with the next generation during the closing reception.

Best wishes and hoping to see many of you in May,  
Joost.

## 1 News from the BMS & NCM

### 1.1 Annual meeting of the National Committee for Mathematics – April 15, 2024 – ULB, Campus de la Plaine, Bâtiment NO 5th floor, Salle Solvay



Lieven Vanhecke



Piet Wuyts

### Program

- 14.00 h: Meeting of the national committee (only for members of the committee)
- 14.30 h: Coffee break (for everybody)
- 15.00 h: Welcome, followed by a tribute to Prof. Em. Piet Wuyts (+2023) by Bob Lowen and Eva Colebunders
- 15.30 h: Lecture by Sam Mattheus; title: Recent progress on off-diagonal Ramsey numbers
- 16.30 h: Tribute to Prof. Em. Lieven Vanhecke (+2023) by Eric Boeckx and Joeri Van der Veken
- 17.00 h: Reception

Date: April 15, 2024, 2-6 pm

Location: ULB, Campus de la Plaine, Bâtiment NO 5th floor, Salle Solvay (not the Palace of the Academies as previously announced).  
Everybody is cordially invited, but preliminary registration is mandatory.  
You can register at <https://bms.ulb.ac.be/annualmeetingncm/> until April 10, 2024

Organizers: Françoise Bastin (ULiège) and Stefaan Caenepeel (VUB)

## 1.2 PhD Day 2024 of the Belgian Mathematical Society

Welcome everybody! The next PhD day of the BMS will take place on 24 May 2024 at the University of Antwerp on Campus Middelheim in Building G ("Gebouw G").

Registration is now open. The registration link, the (preliminary) program, and the travel directions are posted on the webpage of the BMS PhD day 2024, see

<https://bms.ulb.ac.be/conferences/phd-day-2024/>

A preliminary overview of the activities:

- 09:30-10:00 Welcome coffee and registration [entrance hall of building G].
- 10:00-10:50 Godeaux lecture [abstract] by Mirna Džamonja (Paris) [auditorium G.010].
- 10:50-11:10 Questions & short break (i.e. no coffee break) [auditorium G.010].
- 11:10-11:45 Poster pitch talks (1 min per person, 1 slide) [auditorium G.010].
- 11:45-12:15 Poster session part 1 [entrance hall of building G].
- 12:15-13:15 Lunch break [entrance hall of building G].
- 13:15-13:45 Poster session part 2 [entrance hall of building G].
- 13:45-14:45 Parallel sessions of contributed talks by PhD students [auditorium G.010, lecture hall G.004, lecture hall G.006].
- 14:45-15:15 Coffee break (and jury decision for best poster award)
- 15:15-16:15 Parallel sessions of contributed talks by PhD students [auditorium G.010, lecture hall G.004, lecture hall G.006].
- 16:15-17:00 Talk [abstract] by Sam Mattheus (VUB), the BMS Young Scholar Award winner 2023 [auditorium G.010].
- 17:00-17:10 Best poster award [auditorium G.010].
- 17:10-17:25 Pitch presentations by alumni [auditorium G.010].
- 17:30-18:30 Reception and possibility to discuss with alumni about experience in the work field [entrance hall of building G].

## 1.3 Membership dues for 2024

See all the information in the previous newsletter and on our website <https://bms.ulb.ac.be/about-the-belgian-mathematical-society/membership-dues-and-reciprocity-agreements/>.

## 1.4 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 electron-

ically available issues of the bulletin, free of charge. If you have any trouble logging in or accessing the journal, please contact [customer\\_support@projecteuclid.org](mailto:customer_support@projecteuclid.org).

### Content *New trends in Hopf algebras and monoidal categories* Volume 30 (5) December 2023

- On isomorphisms between certain Yetter-Drinfel'd Hopf algebras **Yevgenia Kashina, Yorck Sommerhäuser** DOI: 10.36045/j.bbms.
- The cardinality of Kiselman's semigroups grows double-exponentially **Alessandro D'Andrea, Salvatore Stella** DOI: 10.36045/j.bbms.221112
- Bosonization of curved Lie bialgebras **Istvan Heckenberger, Leandro Vendramin** DOI: 10.36045/j.bbms.221202
- Braided shuffle algebras and Lyndon words **Bogdan Ion** DOI: 10.36045/j.bbms.230206
- Isomorphisms of fusion subcategories on permutation algebras **Tiberiu Coconet, Constantin-Cosmin Todea** DOI: 10.36045/j.bbms.
- Quotient Hopf algebras of the free bialgebra with PBW bases and GK-dimensions **Huan Jia, Naihong Hu, Rongchuan Xiong, Yinhuo Zhang** DOI: 10.36045/j.bbms.230408
- A remark on the Galois-type correspondence between ideal coideals and comodule subrings of a Hopf algebroid **Paolo Saracco** DOI: 10.36045/j.bbms.230816
- Lie and Nijenhuis brackets on affine spaces **Tomasz Brzeziński, James Papworth** DOI: 10.36045/j.bbms.231013

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

## 2 (Online) Meetings, Conferences, Lectures, ...

### 2.1 March/April 2024

#### Inaugural lecture of the Francqui Chair 2023-2024

**Prof. Dr. Stéphane Jaffard "Detection and characterization of the singularities of functions"**

28 March 2024, 5 p.m., Room D.0.07, VUB Main Campus Etterbeek, Pleinlaan 2, Elsene

The Department of Mathematics and Data Science of the Vrije Universiteit Brussels is pleased to invite you to the inaugural lecture of the Francqui Chair 2023-2024, awarded to Prof. Dr. Stéphane Jaffard from the Laboratory of Analysis and Applied Mathematics of the Paris-East Créteil University (UPEC). The lecture is entitled: Detection and characterization of the singularities of functions.

The lecture will take place on Thursday 28 March 2024 at 5 p.m. in Room D.0.07, VUB Main Campus Etterbeek, Pleinlaan 2, Elsene, and is followed by a reception. Participation is free, but registration is required. For more information and to register, please visit <https://www.vub.be/en/event/francqui-inaugural-lecture-detection-and-characterization-singularities-functions>.

The inaugural lecture will be followed by a mini-course of four lectures taking place from 16-19 April 2024. More information can be found on the above webpage.

Please contact [andreas.debrouwere@vub.be](mailto:andreas.debrouwere@vub.be) if you would like to attend this mini-course.

See also the poster at the end of this newsletter.

## 2.2 April 2024

### Annual meeting of the National Committee for Mathematics

15 April 2024 - ULB, Campus de la Plaine, Bâtiment NO 5th floor, Salle Solvay

See earlier in this newsletter and on <https://bms.ulb.ac.be/annualmeetingncm/>.

## 2.3 May 2024

### Workshop: Women in Mathematics

13 May 2024, Universiteit Gent, Campus Sterre, Building S8, Lecture room 3.2 (third floor)

The theme of our Women in Mathematics Workshop centers around “Celebrating Diversity and Advancing Mathematical Frontiers.” Through this theme, we aim to spotlight the great contributions of women mathematicians across a spectrum of specialized fields, including partial differential equations, logic, combinatorics, analysis, graph theory, statistics, algebra, and geometry. This theme reflects our commitment to breaking gender barriers and challenging longstanding stereotypes within the field of mathematics. By showcasing the remarkable diversity of talent among female researchers, we seek to inspire, empower, and foster a sense of inclusivity within the mathematical community.

The primary objective of our workshop is to provide a platform for accomplished female mathematicians to share their expertise and insights with a diverse audience. There will be 8 talks by female colleagues working in different areas of mathematics. Additionally, there will be a talk by Prof Colette Guillopé addressing the gender gap in STEM sciences.

Additionally, we strive to create an environment conducive to networking and knowledge exchange, particularly for PhD students, postdocs, and other researchers. By connecting aspiring mathematicians with established role models, we aspire to ignite enthusiasm and encourage a broader participation in the field. Ultimately, our goal is to contribute to a more inclusive and innovative mathematical community.

**Registration link:** <https://forms.gle/SLtFuxkNWmUfmzTk8>

(Registration is free but mandatory)

#### Organising Committee

Marianna Chatzakou, Jozefien D’haeseleer, Michael Ruzhansky

#### Scientific Committee

Jan De Beule, Claudia Garetto, Sylvie Paycha, Michael Ruzhansky, Leo Storme

#### Confirmed Speakers

Aida Abiad (Eindhoven University of Technology, The Netherlands),

Gianira Alfarano (University College Dublin, Ireland),

Paula Cerejeiras (University of Aveiro, Portugal),

Claudia Garetto (Queen Mary University of London, UK),

Els Goetghebeur (Ghent University, Belgium),

Colette Guillopé (Université Paris-Est-Créteil-Val-de-Marne, France),

Smiljana Jaksic (University of Belgrade, Serbia),  
Elena Shabalina (Technology Center E-Textiles and Acoustics, Germany).

**Website**

<https://analysis-pde.org/women-in-mathematics-2024/>

See also the poster at the end of this newsletter.

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**PhD Day 2024 of the Belgian Mathematical Society**

24 May 2024 - UAntwerpen

See earlier in this newsletter and on <https://bms.ulb.ac.be/conferences/phd-day-2024/>

**2.4 June 2024****Equadiff 2024**

10-14 June 2024 - Karlstad, Sweden

Karlstad is proud to organize Equadiff 2024 (during June 10-June 14) at its university campus.

The Equadiff is a series of biennial conferences on theoretical aspects of differential equations (broadly seen) held in rotation in various countries of Western and Eastern Europe. Recent editions in Western Europe include Berlin (1999), Hasselt (2003), Vienna (2007), Loughborough (2011), Lyon (2015), Leiden (2019), all of which attracted at least 400 participants.

The next Equadiff conference will be held in Karlstad (Sweden) from June 10 to 14, 2024.

The webpage of the 2024 event in Karlstad (Sweden) is <https://www.kau.se/equadiff>.

Both the registration to the event and the submission of abstracts is now open. Feel welcome to join!

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**Summer school “Nonlinear Quantum Graphs”**

17-21 June 2024 - Valenciennes, France

A summer school entitled “Nonlinear Quantum Graphs” will be held in Valenciennes, France, from June 17 to 21, 2024.

Nonlinear quantum graphs are metric graphs, i.e. graphs whose edges are considered with a metric structure, endowed with a nonlinear Schrödinger equation. The aim of this school is to introduce participants to this subject.

There will be four lectures on the following topics covering both theoretical and numerical aspects :

- S. Dovetta (Politecnico di Torino, Turin, Italy): Variational methods for nonlinear Schrödinger equations on metric graphs

- R. Goodman (New Jersey Institute of Technology, U. Heights, Newark, NJ, USA): A consistent numerical approach to quantum graph computations
- D. Mugnolo (FernUniversität in Hagen, Hagen, Germany): Spectral geometry of metric graphs and further branched spaces
- D. Noja (Università di Milano Bicocca, Milan, Italy): Time dependent NLS equation on metric graphs: Standing waves and their stability

The school is aimed at doctoral students and advanced students as well as researchers in PDE.

More information can be found on the school page <https://nqg.sciencesconf.org>.

Scientific committee: Colette De Coster (UPHF, Valenciennes), Louis Jeanjean (Université de Franche-Comté, Besançon), Stefan Le Coz (Université Paul Sabatier, Toulouse)

Organizing committee: Colette De Coster, Damien Galant (UPHF, Valenciennes and UMONS, Mons, Belgium), Louis Jeanjean, Stefan Le Coz

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### Summer school “Adaptive methods and a posteriori error estimates”

24-27 June 2024 - Hasselt University Campus Hasselt

Organisers: Iuliu Sorin Pop, Jochen Schütz, Fred Vermolen, Hasselt University Koondanibha Mitra, Eindhoven University of Technology Christian Rohde, University of Stuttgart

Numerous mathematical models of high societal and technological relevance are (systems of) partial differential equations (PDEs). In the wide majority of cases of interest, finding an explicit solution is not possible, so one needs to use numerical methods. In this case, one has to guarantee that, on the one hand, the numerical approximation is accurate enough, and, on the other hand, the numerical method is efficient, limiting the computations to the minimum necessary. Some important questions in this regard are:

1. How large is the overall numerical simulation error (the difference between the exact solution and its approximation)?
2. Where is the error localized (in space and time)?
3. Which part/component is responsible for the error: numerical method, mathematical model, regularization, linearization, or the approximate solution of linear algebraic systems?
4. How can the numerical method be adapted to reduce the error (where to consider a finer mesh, and where a higher order scheme)?
5. How can the mathematical model, regularization, linearization, and algebraic resolution be adapted? In particular, how to design iterative schemes to ensure that the iteration error is reduced below a given tolerance, and with a minimal number of iterations?

In the a priori error analysis, a bound on the error is provided from the details of the numerical method without using the approximate solution. This is used to justify the method in the sense that an increase in the computational effort will lead to higher precision. However, these error estimates cannot be used to answer the first question above, as they are not sharp, have a global character and involve various unknown constants. Moreover, they do not shed light on the other four questions. This is why, in the past decades much attention was paid to a posteriori error analysis. In this case, the approximation itself is used to derive bounds that are fully computable, very precise, estimate the errors locally, and

allow to distinguish between different error components. In this way, efficient and adaptive solvers can be developed.

### Tentative program

- Day 1: Basic notions of the a posteriori error analysis (Martin Vohralik/INRIA Paris)  
Starting with the finite element approximation of linear elliptic problems, the difference between a priori and a posteriori analysis is explained, the Prager-Synge inequality is presented. Also, it is shown how to use the residuals to develop fully computable error indicators.  
Poster session and reception (complimentary to all participants)
- Day 2: Extend the knowledge acquired in the first day (Martin Vohralik/INRIA Paris)  
More general linear problems, mixed finite elements, linear solvers, and adaptivity for linear problems will be considered.
- Day 3: Nonlinear problems (Koondanibha Mitra/Eindhoven)  
The focus will be on iterative solvers, and in particular the adaptive choice of the scheme (a switch between Newton, which converges rapidly, but is very restrictive w.r.t. the initial guess, and more robust, fixed-point approaches), and of the parameters.  
Group dinner (complimentary to all participants)
- Day 4: Extended topics (details will be announced)

The theory will be accompanied by hands-on sessions where students learn to implement this into a (prepared) FreeFem++ framework for the Laplace equation, and straightforward extensions of it.

The summer school will be amenable to mathematicians, engineers and scientists. It will be open to participants having a knowledge in partial differential equations, numerical methods and scientific computing, as they are taught to engineers and scientists. The summer school is relevant in particular for early career researchers (PhD students and postdoctoral researchers). Participants from universities, research institutes, the industry and NGOs are welcome.

The number of places is limited, so priority will be given to early career participants (PhD and post-doctoral researchers), but this is not exclusive.

Registration will be possible after March 21, at <https://www.uhasselt.be/en/doctoral-schools/academic-research-competences-course-offer/summer-school-on-adaptive-methods-and-a-posteriori-error-estimation>.

## 2.5 July/August 2024

### Summer school "ATA 2024: Sub-Riemannian geometry and optimal transport"

29 July-7 August 2024 - Zakarpattya region (Kolochova), Ukraine

This school continues the tradition of Algebra, Topology and Analysis (ATA) summer schools in Ukraine. It combines scientific lectures and talks with informal communication and discussions. This year's edition will have minicourses on sub-Riemannian geometry and optimal transport along with other lectures delivered by the school participants. The aim of the School is to support talented students and post-graduates who are interested in fundamental mathematical research and to supply them with the newest information concerning the current status of research in these fields. There will also be some preliminary lectures on the basics of manifolds, foliations, spaces of jets, etc., aimed to help participants follow the subject. For all further information, see the [website](#).



## 2.6 August 2024

### International Conference on Nonlinear Analysis and Computational Techniques (ICNACT-2024)

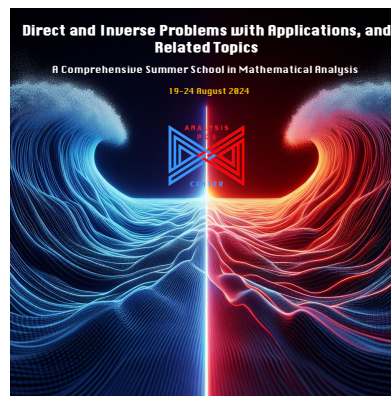
8-10 August 2024, Hybrid

Organized by School of Advanced Sciences and Languages, VIT Bhopal University, Madhya Pradesh, India. For information contact [icnact@vitbhopal.ac.in](mailto:icnact@vitbhopal.ac.in).

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### Summer school “Direct and Inverse Problems with Applications, and Related Topics: A Comprehensive Summer School in Mathematical Analysis”

Tentative days: August 19-24, 2024 Ghent Analysis & PDE Center, Ghent University



**Description:** The school aims to explore comprehensive mathematical tools for solving direct and inverse problems across various fields, fostering new methods and techniques through lectures, exercises, and participant interactions. The lectures will also include broader related topics of mathematical analysis and partial differential equations.

**Targeted Audience:** PhD candidates from Ghent University and partner universities are invited to participate, along with postdoctoral researchers and interested individuals from various scientific backgrounds.

**Information for participants:** For attending the school, the charge is 10 euro per day to cover organisational expenses. The participation of PhD candidates from Doctoral Schools at UGent, colleagues from UGent, and lecturers is free of charge. If you need administrative support (visa, accommodation, etc.) for your attendance, please let us know in advance.

Contact person: Ms Kim Verbeeck, [kimpj.verbeeck@ugent.be](mailto:kimpj.verbeeck@ugent.be).

**Organisers:** Michael Ruzhansky, Karel Van Bockstal, Joel Restrepo, Hendrik De Bie

**Support:** The summer school is recognised as specialist course (seasonal school) as part of Ghent University's doctoral training programme.

It is also partially supported by the Flemish Government and UGent Methusalem project “Analysis and Partial Differential Equations”.

**More information:** see our [website](#).

## 2.7 Seminars and colloquia

**Analysis & Geometry Seminar**  
UAntwerpen  
(usually Wednesdays 16-17h during term)

This is the weekly research seminar of the analysis & geometry-interested people in Antwerp. During the semester, we have once per week a research talk in analysis and/or geometry and/or related topics. The list of speakers comprises researchers from Antwerp as well as other universities. Details (schedule, speakers, titles, abstracts, seminar room/ online/ hybrid etc.) can be found on the seminar webpage <https://www.uantwerpen.be/nl/personeel/sonja-hohloch/private-webpage/seminars/analysis-geometry/>

To be added/deleted from the mailing list, please send an email to:  
sonja dot hohloch AT uantwerpen dot be

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### **Ghent Geometric Analysis Seminar**

See all information at <https://analysis-pde.org/seminars/ghent-on-geometric-analysis/>

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### **Ghent Methusalem Junior Seminar**

See all information at <https://analysis-pde.org/ghent-methusalem-junior-seminar/>.

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### **Seminar of Analysis and PDE**

See all information at <https://analysis-pde.org/seminars/>.

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### **Ghent Methusalem Colloquium**

See all information at <https://analysis-pde.org/ghent-methusalem-colloquium/>.

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### **Methusalem Colloquia**

KU Leuven

- 12 March 2024 Sasha Viktorova (KU Leuven) An introduction to hypersurface singularities followed by a lecture series “An introduction to hypersurface singularities”. See [https://wis.kuleuven.be/methusalem-pure-math/colloquia\\_seminars\\_lectures/lecture-series](https://wis.kuleuven.be/methusalem-pure-math/colloquia_seminars_lectures/lecture-series).
- 18 April 2024 Simon Telen (Max Planck Institute, Leipzig) “Euler discriminants in physics and statistics”. See [https://wis.kuleuven.be/methusalem-pure-math/colloquia\\_seminars\\_lectures](https://wis.kuleuven.be/methusalem-pure-math/colloquia_seminars_lectures).

## Seminar on Quantum groups, Hopf algebras and monoidal categories

We welcome everyone to our seminar on quantum groups, Hopf algebras and monoidal categories. This seminar treats all topics related to quantum groups in the broad sense (Hopf algebras, tensor categories, non-commutative symmetries, ...). The seminar alternates between the universities of Louvain-La-Neuve, Université Libre de Bruxelles and Vrije Universiteit Brussel. The seminar takes place once every month, with on average two sessions per seminar. The concrete schedule can be found on the following website:

<https://hopfalgb.ulb.be/index.html>

We hope to see you soon!

Kenny De Commer (VUB), Pedro Vaz (UCL), Joost Verduyn (ULB)

### 3 PhD theses

#### Floer Homology for $b$ -symplectic manifolds

Joaquim Brugués  
UAntwerpen & UPC Barcelona  
20 March 2024, UPC Barcelona

Thesis advisors: Prof. Dr. Eva Miranda (UPC Barcelona) and Prof. Dr. Sonja Hohloch (UAntwerpen)

#### Summary:

In this thesis, we investigate various aspects of the dynamics of Hamiltonian vector fields in singular symplectic manifolds. We concentrate on two questions: first, we investigate a generalization of the Arnold conjecture in the setting of singular symplectic geometry. Second, we explore constructions for integrable systems in this context.

*In Chapter 2*, we provide the background material required for this thesis. We start by delving into the theory of symplectic geometry. Then, we present the Arnold conjecture, which asserts that there is a lower bound on the number of 1-periodic orbits for a non-degenerate Hamiltonian system, and that this lower bound can be formulated strictly in topological terms. We also present a tool used in the investigation of this conjecture: Floer theory.

Then, we explain some notions of Poisson geometry before we explore a notion fundamental to this thesis: that of a  $B^m$ -symplectic manifold. These are manifolds with a structure that is symplectic almost everywhere but 'blows up' at a hypersurface, which we call the singular hypersurface. We lay out some techniques used in the study of  $b^m$ -symplectic manifolds, with an emphasis on a procedure called desingularization. Finally, we give a summary of the theory of integrable systems and the study of their singular points.

*In Chapter 3*, we investigate the dynamical behaviour of certain vector fields in  $b^m$ -symplectic geometry, coming from  $b^m$ -Hamiltonians. We focus on the study of their dynamics in a neighbourhood of the singular hypersurface, and find a family of  $b^m$ -Hamiltonians where a version of the Arnold conjecture can be formulated. Then, we explore new aspects of the desingularization procedure in relation to the  $b^m$ -Hamiltonian dynamics, and provide some techniques that allow us to relate these dynamics to

those of classical symplectic geometry. We conclude with two results yielding partial versions of the Arnold conjecture for  $b^m$ -Hamiltonian vector fields.

*In Chapter 4*, we show the existence of a Floer homology for  $b^m$ -symplectic manifolds. This we manage through an investigation of the Floer equation for the family of  $b^m$ -Hamiltonians presented in Chapter 3.

*In Chapter 5*, we introduce the notion of the classes of  $b$ -integrable and  $b$ -semitoric systems. We study the features of  $b$ -semitoric systems using some interesting examples and the investigation of their singular points.

## 4 News from the universities and other societies

### 4.1 Research Perspectives Ghent Analysis and PDE Center

First book of our series!

We are thrilled to announce the release of the first book in the series “Research Perspectives Ghent Analysis and PDE Center”! This series is dedicated to publishing extended abstracts of seminars, conferences, workshops, and other scientific events associated with the Ghent Analysis and PDE Center.

Series Information: “Research Perspectives Ghent Analysis and PDE Center” is a subseries within the esteemed book series “Trends in Mathematics”. Every contribution featured in this series undergoes a review process, ensuring the highest standards of scientific literature.

Book Details: Title: Extended Abstracts 2021/2022, Methusalem Lectures;

Editors: Duván Cardona, Joel Restrepo, and Michael Ruzhansky.

<https://analysis-pde.org/2024/03/01/%f0%9f%93%a2-first-book-of-our-series-%f0%9f%93%9a/>

## 5 History, maths and art, fiction, jokes, quotations ...

### 5.1 Problem of the week

Ali Imad Raad ([ali.imadraad@kuleuven.be](mailto:ali.imadraad@kuleuven.be)) runs a “Problem of the week”, see below instructions on how to be put on the mailing list to receive this weekly during the semester in your mailbox.

# Problem of the Week

## *45 Rings*

Week 11 - 2024

To subscribe to the mailing list, send an email to [listserv@ls.kuleuven.be](mailto:listserv@ls.kuleuven.be) with the message (in place of Your Name you put your actual name):

SUBSCRIBE ProblemOfTheWeek Your Name

**Problem.** *In front of you are three poles. One of them has 45 rings of different weights stacked on top of each other in order of weight, with the heaviest at the bottom. The other poles are empty. Your task is to make the exact same configuration of rings on another pole. In every step you are allowed to move any ring lying on the top of a stack to another pole as long as you don't place it on top of a lighter ring. What is the minimum number of steps you need to complete your task? For instance for two rings we would need 3 steps: grab the lighter ring and put it on a pole, grab the heavier ring and put it on the remaining empty pole, then grab the light ring again and place it on top of the heavy ring.*

## 5.2 $\pi$ -trivia

Thank you Paul Levrie for the  $\pi$ -trivia at the end of this newsletter.

## 5.3 Adhemar's corner

To conclude follow two reviews by Adhemar. The first on *Putting two and two together* by B. Polster and M. Ross, containing a collection of 64 columns of the authors, aka the Math Masters. While E. Thompson in *Escape from model land* warns us against the use of imperfect models in society using many examples.

### pi trivia

Did you know ...

- ... that today is  $\pi$ -day? Why? Because in American spelling, the date March 14 is written as 3/14 and 3.14 is an approximation for the number  $\pi$ .
- ... that you should definitely eat cake ('pie') today, or even better: treat your colleagues at work with pie?
- ... that since 26 November 2019, thanks to UNESCO:



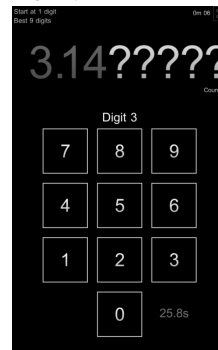
- ... that the number  $\pi$  is a constant that gives the ratio of the circumference of a circle to its diameter? Or the ratio of the area of the circle to the square of its radius? To 500 decimal places,  $\pi$  looks like this:

3.141592653589793238462643383279502  
 88419716939937510582097494459230781  
 64062862089986280348253421170679821  
 48086513282306647093844609550582231  
 72535940812848111745028410270193852  
 11055596446229489549303819644288109  
 75665933446128475648233786783165271  
 20190914564856692346034861045432664  
 82133936072602491412737245870066063  
 15588174881520920962829254091715364  
 36789259036001133053054882046652138  
 41469519415116094330572703657595919  
 53092186117381932611793105118548074  
 46237996274956735188575272489122793  
 818301194913

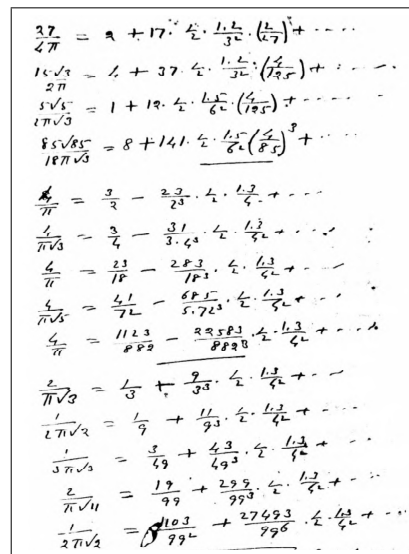
- ... that since  $\pi$ -day 2023 no one broke the record set in 2022 by Emma Haruka Iwao of calculating 100,000,000,000 digits of the number  $\pi$ ? The calculation took her the equivalent of 158 days. What did happen was that these digits were recalculated in less time: 55 days. The calculation ended on April 10, 2023. The 'last' 50 digits are given by: 2656719174 5255431487 2142102057 7077336434 3095295560
- ... that on September 12, 2012 five airplanes with dot-matrix skywriting technology wrote thousand digits of  $\pi$  in the sky of the San Francisco Bay Area at a 10,000-foot altitude? The digits of  $\pi$  written in the sky each stood nearly a quarter-mile tall and stretched for a 100-mile loop.
- ... that the number  $\pi$  played a part in the episode The Wolf in the Fold of the television series Star Trek? In this episode an entity from another planet had taken over the computer of the starship Enterprise. Spock was able to get the thing out by com-

manding the computer to "compute to the last digit the value of  $\pi$ ".

- ... that there are  $\pi$ -related apps? For instance a game that challenges you to memorize digits of  $\pi$ :



- ... that the Indian mathematician Srinivasa Ramanujan (1887-1920) probably had a special bond with the number  $\pi$ ? He left some notebooks that were filled with mathematical formulas. The number  $\pi$  is on almost every page at least one time. Here you see one of the pages:



Note that all these series have a sum with  $\pi$  in the denominator.

- ... that the following result conjectured by Boris Gourevitch in 2002:

$$\sum_{n=0}^{\infty} \frac{1}{2^{20n}} \binom{2n}{n}^7 (168n^3 + 76n^2 + 14n + 1) = \frac{32}{\pi^3}$$

(with  $\binom{2n}{n} = C_{2n}^n$ ) was finally proved in december 2023 by Kam Cheong Au?

- ... that there are better series to use for the calculation of the digits of  $\pi$  than the well known and much used Chudnovsky series:

$$\frac{1}{\pi} = 12 \sum_{n=0}^{\infty} (-1)^n \frac{(6n)!(A + Bn)}{(n!)^3 (3n)! C^{3n+3/2}}$$

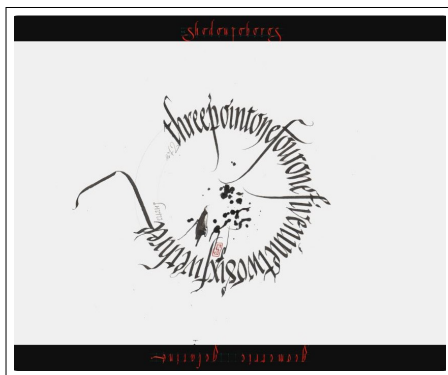
(with  $A = 13591409, B = 545140134, C = 640320$ )? This series gives 14 extra decimal digits per term. In 2013 Bagis and Glasser conjectured some other Chudnovsky-like series and these conjectures were proven to be true in February 2024 by Campbell. One of them is a series which sums to  $\frac{1}{\pi}$  adding 32 extra digits per term! On March 12 Campbell published a series for which each term gives 153 extra digits!

- ... that the square root of 7 makes an unexpected appearance when you rearrange the signs in the harmonic series and leave out the terms with denominator a multiple of 7? Indeed, it seems that:

$$\frac{\pi}{\sqrt{7}} = 1 + \frac{1}{2} - \frac{1}{3} + \frac{1}{4} - \frac{1}{5} + \frac{1}{6} + \dots$$

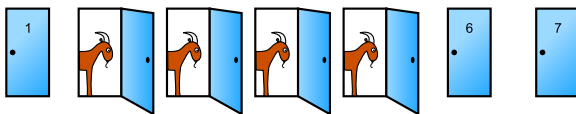
(minus-sign if the denominator is congruent to 3, 5 or 6 (mod 7)). Thank you Stijn, for bringing this to my attention!

- ... that artists continue to be inspired by the number  $\pi$ ? One of them is Andreas Stoffels, with his calligraphy work Shodouroboros:



Stoffels won the Grand Prize for Calligraphy Westerlo (Belgium) in 2022.

- ... in the Monty Hall problem with  $n$  doors ( $n$  odd) (if you don't know this problem: Google "Monty Hall") it's always better to change doors, especially in the case that the quizmaster keeps opening doors revealing a goat, and that each time you get the opportunity to change your choice :



The probability  $p$  of winning in that case is given by an expression containing the number  $\pi$ :

$$p \sim \sqrt{\frac{\pi}{2n}}$$

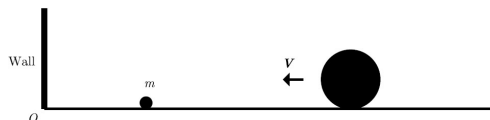
This is an immediate consequence of Wallis product formula for  $\pi$ , and one of the many instances where Wallis's formula plays a crucial role.

- ... that  $\pi$  appears in several episodes of the Simpsons? In one of them, Lisa's Sax, we see Homer and Marge visiting a school, where they encounter

two child prodigies in the playground, who have invented their own lyrics to a hand-clapping song:

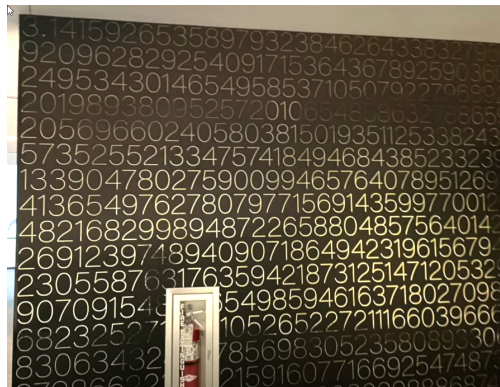
Cross my heart and hope to die,  
Here's the digits that make pi,  
3.14159265358979323846...

- ... that Buffon's Needle experiment isn't the only weird way to estimate the value of  $\pi$ ? Counting collisions in a simple dynamical system with two balls is another one. But this method is an entirely deterministic one and it can be used to estimate  $\pi$  to any accuracy. This is a picture of the situation:



The wall is assumed to be absolutely elastic. Push the big ball towards the small ball very fast. If the mass of the big ball is  $100^N$  times the mass of the small ball, then the number of collisions will be a number with  $N + 1$  digits. The first  $N$  digits of this number will be equal to the first  $N$  digits of  $\pi$  (starting with 3).

- ... that since 2023 there's a spherical building in Las Vegas called The Sphere? In it there's a  $\pi$ -wall:



- ... that more and more winemakers think it is interesting to put the number  $\pi$  on their wine bottles?



Thank you, Hilde and Stijn, for the empty, respectively full bottles!

**Putting two and two together**, Burkhard Polster, Marty Ross, AMS, Providence, Rhode Island, 2021 (274 p.) isbn: 978-1-4704-6011-2.

This is a second collection of *Math Masters* columns that Polster and Ross published weekly between 2007 and 2014 in the Melbourne's newspaper *Age*. Since 2009 their columns moved online which allowed more illustrations and longer columns. A first collection was called *A dingo ate my math book*<sup>1</sup> (AMS, 2017). These columns are treating mathematics related issues from everyday life, addressing a general readership. While the previous collection were discussing typical Australian topics, the current collection is in general more international. They are arranged in seven parts focussing on a common theme.



B. Polster

M. Ross

In the opening of their introduction they announce that this book contains 1.000.000 columns from the 11.111.111 that they wrote already. This is a binary mathematical wink: it contains indeed 64 of their columns, and they probably had written 255 columns at the time they wrote this introduction. This sets the tone of the whole book: they clearly enjoy the math that is all around them and they want to convey this joy to every occasional reader, the regular readers are already hooked. I'll give some examples of the seven parts.

The first part is about general calculus issues. An error often made is  $\frac{a}{b} + \frac{c}{d} = \frac{a+c}{b+d}$ . This is obviously wrong with the usual meaning of addition, but it makes sense if it indicates the median of the two items summed. Geometrically the vector  $(b+d, a+c)$  is the sum of the vectors  $(b, a)$  and  $(d, c)$ . But that is considered dull mathematics. Here it is explained as mixing a container with fluid A and B in ratio  $a/b$  and another one in the ratio  $c/d$  giving a mixture in the ratio  $(a+b)/(c+d)$ . Another example shows that with the parabola  $y = x^2$ , one can find geometrically the prime numbers. Indeed, the chord joining the points  $(-a, a^2)$  and  $(b, b^2)$ ,  $a, b \in \mathbb{N}$  intersects the  $y$ -axis in the integer point  $y = ab$ , which allows to multiply integers. Therefore the integers on the  $y$ -axis that are not on any chord are the prime numbers.

Many of the columns actually contain (rather informal) proofs. For example in part two, which is mostly about geometric topics, it is proved that in an equilateral triangle, the sum of the distances from an internal point to all the sides does not depend on the point chosen (Viviani's theorem). The tractrix is related to the turning of a long vehicle and there are classical cycling problems where one has to derive the direction of the bicycle from its wheel trails. But there are also problems of wrapping a Mozartkugel and the surface of a dodecagon is shown to be  $3R^2$ , so that for dodecagon "circles"  $\pi$  equals 3.



And these fun topics go on and on. In the part devoted to sports topics, we can find classic problems about the design of tournaments. How to arrange the matches, and what will be the chance that Djokovic and Nadal will play the finale of the Australian Open? But it is also shown that even Hawk-Eye is not infallible, because it depends on the viewpoint of the observer to see a ball in or out and it is always an approximation. Should e.g. the height of the grass be taken into account? But other sports are represented as well: soccer (how round is a soccer ball?), running (mechanics of walking), cycling (gear ratios), etc.

Like in their first collection, there is an interesting part related to architecture. A discussion of Voronoi diagrams is triggered by the facade of the *Victorian College of Arts' Center for Ideas* in Melbourne. The catenary is related to hanging cables in the city. A skyscraper called Eureka

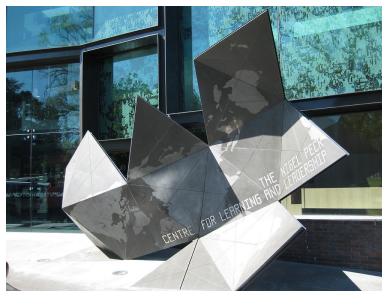
<sup>1</sup>Reviewed in this Newsletter, issue 123, 2019



Tower is an incentive to discuss results obtained by Archimedes. A sculpture at the entrance of the *Nigel Peck Centre for Learning and Leadership* is a map of the world in the form of an icosahedron. The AAMI Park Stadium is consisting of bubble domes around a square field. The bubbles consist



VCA's Center for Ideas



NPC for Learning and Leadership



AAMI football stadium

of iterated triangulations of an elementary icosahedron.

The next part is about probability and statistics. In the Penny game, a penny is tossed and two players each predict a sequence of three outcomes like for example HTT or TTT. The player whose outcome comes up first wins. It can be computed which triplet one has to choose to have a better chance to occur. Another problem occurs in blind purchasing a new set for your collection of different Playmobil figures (or Pokémon cards or football players, or whatever). The purchase is blind since it is packed up hiding the content. What is the chance that you will get one of the items that you are still missing? If you want to find the number of errors in a new course text you prepared, let it proofread by Bert (who finds 20 errors) and Ernie (who finds 30 errors) and 5 of these errors are the same, then it is explained that you might suspect some 120 errors in total.

Part six is about astronomical problems. For example the trajectory of our moon as it rotates around the earth which rotates around the sun or of other moons around other planets (assuming circular rotations). They explain also the position of the five



Machine with concrete, Arthur Ganson

Lagrange points of two bodies, and of course the strange computation of the Easter date, and the probability of getting a Friday the 13th. Exponential growth is illustrated by the mechanical sculpture *Machine with concrete* by Arthur Ganson. (You can find movies on YouTube.) It consists of a sequence of 24 gears connected with ratio  $14/120$ . The first gear wheel is turned at 9.24 rpm, so the second takes about 56 seconds etcetera till the last one will take about 594 trillion years, which explains why it can be safely embedded in concrete.

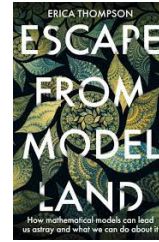
The last part is about some historical facts or persons. It is illustrated that many identities or theorems that are named after some mathematician, are very often not invented or proved for the first time by this mathematician, but they existed sometimes centuries earlier. Examples are Pythagoras theorem, Pascal's triangle, de l'Hôpital's rule, Möbius strip, Benford's law, and many more. Other items deal with the Babylonian number system, Julian and Gregorian calendars, Napier and his logarithm, the Goldbach conjecture, and Maria Agnesi and the curve that became known as the witch of Agnesi.

All of these relatively short chapters of only a few pages discuss the topic in a pleasant entertaining and thrilling manner, and are certainly accessible for a general public. Except for one with knowledge aversion, anybody will enjoy these columns. For the more dedicated, there is a puzzle or problem added after each chapter, and these get an explanation and solution at the end of the book. If you likes *A dingo ate my math book*, you will love this book too.

Adhemar Bultheel

**Escape from model land.** *Erica Thompson.* Basic Books, 2022 (228 p.), isbn: 978-1529364873.

Much of our social life depends on models that simulate reality. Think of the financial market, the weather and climate models and de modelling of a pandemic. The main message of this book is that no matter how accurate the model is, what happens in the real world is not the same as what happens in Model Land. The general meaning of a model is that it is just a metaphor of reality.



Erica Thompson

There are so many pitfalls because the model is believed to be real that some warnings are necessary. This should allow the politicians, bankers, and anyone who has to make decisions on the basis of the models to 'escape from model land' to make their decisions effective for the real world. There are obvious shortcomings like the simplification necessary in any model, the inaccuracy of the data on which it is built, but there is also the hidden bias of the beliefs of the designer or the purpose of the modelling that influences the model and its interpretation. For a topologist, a donut is like a coffee cut but that does not work for a barista. Many models are WEIRD (Western, Educated, Rich, Developed), but they do not apply in other circumstances. Data collected on fruit flies or mice, may not apply to mammals. Tests with only male test persons are not applicable for females. Big data models do not apply to small samples. The average person does not exist in the real world. Correlation is not the same as causality, probabilities may be conditional. And there are the models whose predictions may influence the outcome in the real world, something that is actively used in financial politics setting interest rates, or if banks take precautions because the model predicts a crisis, this may precipitate the crisis. Model predictions can be self-fulfilling prophecies. Most models may work reasonably well in a regime state of affairs, but there can always be some "black swan", i.e., some completely unexpected event that makes the model useless. On a less dramatic scale, a model based on data collected in the past may not be effective to predict the future. Elements that were not important in the past, and hence are not in the simplified model, may become important in the future due to a feedback loop. Other models are nonlinear and very sensitive to initial data resulting in chaotic behaviour like weather forecast that can only be trusted on a relative short time scale.

These and many more pitfalls are amply illustrated in this text. Towards the end there are some more warnings. Models are the primary source for planning. Planning is necessary but the modus operandi must be flexible. It is always wise to have a plan B. Models also bring a problem of accountability. If decisions are made by politicians on the basis of a model, and it turns out to be the wrong decision, they can say that the model was not good. The designer of the model can say that the data were insufficient, or the purpose was not correctly specified, or the situation has changed, or the prediction was misinterpreted. Most models will suggest solutions on the basis of a minimal cost. But how is cost expressed? The politician has to find a difficult balance between economic and financial cost on one hand and the excess mortality on the other hand to decide about vaccination and lock-down.

In a concluding chapter, the author gives some practical advice for decision makers: Communication is important. What people believe or accept is often intuitive. Most people have never been in Model Land. Think outside the box. Be aware of, and do not restrict yourself to the limitations of the model to make a decision. Know that the model is made for. A model can only be accurate for what it has been designed for but totally inaccurate for another purpose. Allow flexibility and adaptability in the decisions you make in case reality deviates from the prediction of the model. Use several models to give different views of the real world. Even if a model is not good, it makes you think about the situation, so that you gain insight.

This book is obviously directed towards the modelling that is directly related to our daily life. It is not discussing the mathematics or the technical aspects of sampling and the physical, financial or biological laws that form the backbone of the models. With many examples it is illustrated for anyone without any mathematical, statistical or technical background what the limitations are and what can be decided on the basis of these models. The reader is brought to the verge of believing that all models are completely useless in our real world, but then she tempers that by illustrating why it is still useful to have models and how we can deal with all their deficiencies.

Adhemar Bultheel



## Inaugural lecture Francqui Chair 2023-2024

28 March 2024, 5 p.m.



Prof. Dr. Stéphane Jaffard

The Department of Mathematics and Data Science of the Vrije Universiteit Brussels is pleased to invite you to the inaugural lecture of the Francqui Chair 2023-2024, awarded to Prof. Dr. Stéphane Jaffard from the Laboratory of Analysis and Applied Mathematics of the Paris-East Créteil University (UPEC). The lecture will take place on **Thursday 28 March 2024 at 5 p.m. in Room D.0.07, VUB Main Campus Etterbeek, Pleinlaan 2, Elsene**, and is followed by a reception. Participation is free, but registration is required.

[Click here to register](#)

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### Detection and characterization of the singularities of functions

Many types of signals display a very oscillatory behavior in the neighborhood of singularities. It is for example the case for gravitational waves, fully developed turbulence, or brain data. A major issue is to detect and characterize such behaviors (referred to as “oscillating singularities” or “chirps”) since they usually are the signature of important physical phenomena. We will show how recent techniques of harmonic analysis allow us to meet these challenges.

# Workshop "Women in Mathematics"

13 May 2024

Universiteit Gent, Campus Sterre, Building S8, Lecture room 3.2

Registration link: <https://forms.gle/SLtFuxkNWmUfmzTk8>



Arithmetic Personified: a female figure teaches arithmetic to a young boy. Renaissance fresco, Gentile da Fabriano. Marcello Fedeli/Getty Images

## Speakers

- Alda Abiad (Eindhoven University of Technology)
- Gianira Alfarano (University College Dublin)
- Paula Cerejeiras (University of Aveiro, Portugal)
- Claudia Garetto (Queen Mary University of London)
- Els Goetghebeur (Ghent University)
- Colette Guillopé (Université Paris-Est-Créteil-Val-de-Marne)
- Smiljana Jaksic (University of Belgrade)
- Elena Shabalina (Technology Center E-Textiles and Acoustics)

## Organisers

Marianna Chatzakou Jozefien D'haeseleer  
Michael Ruzhansky

## Scientific Committee

Jan De Beule Claudia Garetto  
Sylvie Paycha Leo Storme

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