Newsletter

BELGIAN MATHEMATICAL SOCIETY

115, November 15, 2017

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

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Contents

Word from the president. . .

This November edition of the Newsletter brings a few announcements of importance to the Belgian Mathematical community. Thank you to all colleagues who sent their information. However, I am sure many more initiatives do exist and are announced in other places. I still think it would be extremely beneficial to all our readers if we could provide more information and announcements. So if you are organising a seminar or an event, you must please not forget to communicate it to our newsletter editor,

Wendy Goemans. We are also working on a new and more interactive website, where members will be able to post announcements. It should be operational in early 2018.

The academic year has started and I know that time of the year is always a bit hectic. I hope you survived well and that things have calmed down. As we can feel from the temperatures, Winter is coming and with that probably also January exams and all kinds of deadlines. Nevertheless I hope every one of you can find time to enjoy Mathematics in a cozy and warm office or at home.
The BMS is already planning its activities for 2018. In May, there will be a PhD day organised in Gent. On this day (25th of May, TBC), PhD students from all over the country will get the opportunity to present their research and to get to know each other.
I am delighted to see that a recent post from the AMS announces that the *2018 Steele Prize for Lifetime Achievement* will go to Jean Bourgain. This is great news and shows that Belgian Mathematicians keep being rewarded with the highest honours. Congratulations to Jean!

As this is the last Newsletter of 2017, I want to wish all of you a very nice and successful end of the year and a happy 2018.

And remember...

You can follow `BelgianMathS` on twitter and tweet announcements or other interesting information to @BelgianMathS.

We also have a facebook page: https://www.facebook.com/BelgianMathS. This page is your page! Please help us to keep it up to date and interesting by sending us nice links and information to Yvik Swan yvik.swan@ulg.ac.be.

Philippe Cara,
BMS president

Call for content for the next BMS Newsletter

The next BMS Newsletter will appear on January 15. The deadline for contributions is January 8. Please send your contributions to wendy.goemans@kuleuven.be.

1 Meetings, Conferences, Lectures, ...

1.1 November 2017

école doctorale thématique organisée par les
Services d'Analyse Mathématique et de Probabilités et Statistique

November 16, 2017

University of Mons

See the announcement and the summaries at the end of this Newsletter for more information on this école doctorale thématique.

Showférence : Very Math Trip

November 13-18, 2017

Hôtel de Ville de Quaregnon

A one-man-show about Mathematics by the founder and the director of the "Maison des Maths" (http://maisondesmaths.be). No mathematical knowledge required, from 14 years old. All information is available on:

http://maisonculturellequaregnon.be/evenements/showference-very-math-trip

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1.2 December 2017

Getaltheorie in het Vlakkeland - Arithmétique en Plat Pays

December 11, 2017

Louvain-la-Neuve

On Monday, December 11, 2017, the Fall meeting of the workshop series "Getaltheorie in het Vlakkeland - Arithmétique en Plat Pays" will take place in Louvain-la-Neuve. The scientific program consists of four plenary talks given by Karim Becher (Antwerp), Martin Deraux (Grenoble), Anne Quéguiner (Paris) and Alexander Gorodnik (Bristol). For details and registration, see

http://www.mathconf.org/app-gvl-autumn2017

Everybody is most welcome!

1.3 Methusalem Lecture Series

Lectures and Mini-Courses in Pure Mathematics

KU Leuven, Department of Mathematics

A series of colloquium talks for a broad pure mathematics audience and specialized mini-courses in algebra, analysis and geometry.

Upcoming colloquium talks (Heverlee Campus in Leuven):

Alberto Cattaneo (University of Zurich)	November 30, 2017	16:15-17:15
Jean-Baptiste Teyssier (KU Leuven)	February 15, 2018	16:15-17:15
Jorge Castillejos Lopez (KU Leuven)	March 15, 2018	16:15-17:15
Thibault Pillon (KU Leuven)	April 12, 2018	16:15-17:15

For titles and abstracts, room number and the full schedule, please visit

https://wis.kuleuven.be/methusalem-pure-math/activities

2 PhD theses

Spacelike submanifolds, their umbilical properties and applications to gravitational physics

Nastassja Cipriani, KU Leuven
October 13, 2017

Thesis advisors: Prof. Dr. Joeri Van der Veken (KU Leuven) and Prof. Dr. José Senovilla (Universidad del Pais Vasco)

Summary

We give a characterization theorem for umbilical spacelike submanifolds of arbitrary dimension and co-dimension immersed in a semi-Riemannian manifold. Letting the co-dimension arbitrary implies that the submanifold may be umbilical with respect to some subset of normal directions. This leads to the definition of *umbilical space* and to the study of its dimension. The trace-free part of the second fundamental form, called *total shear tensor* in this thesis, plays a central role in the characterization theorems. It allows us to define shear objects (*shear operators*, *shear tensors* and *shear scalars*) that determine the umbilical properties of the spacelike submanifold with respect to a given normal vector field.

Given a group of conformal motions G acting on a semi-Riemannian manifold and an orbit $\mathcal{S}$, we apply the characterization results in order to find necessary and sufficient conditions for $\mathcal{S}$ to have a non-empty umbilical space. We prove that if the isotropy subgroup of G is trivial, then the umbilical condition depends on the scalar products of a set of generating conformal Killing vector fields. If the isotropy subgroup of G is non-trivial, we argue that, under specific assumptions, it is possible to prove that the umbilical condition is automatically satisfied so that the umbilical space is non-trivial. The

assumptions would depend on the co-dimension of $\mathcal{S}$, the dimension of the isotropy subgroup and the ranks of specific matrices defined in terms of the structure constants of G.

In the last part of the thesis we consider Lorentzian warped products $\mathcal{M} = M \times_f \mathcal{Y}$ and we analyse a particular class of spacelike submanifolds $\mathcal{S}$. We find a sufficient condition that allows us to prove, on one hand, the existence of focal points along timelike or null geodesics normal to $\mathcal{S}$ and, on the other hand, the null geodesic incompleteness of $\mathcal{M}$ under additional reasonable conditions. By assuming that we can split the immersion as $\mathcal{S} \to \Sigma \to \mathcal{M}$, where Σ is either $M \times \{q\}$ or $\{q\} \times \mathcal{Y}$, we find that the Galloway-Senovilla condition [1] can be written in terms of the warping function f and the Riemann tensor of either only M or $\mathcal{Y}$. This means that, for instance, in order to prove singularity theorems one can restrict the study to just one of the two manifolds defining the warped product rather than considering the warped product manifold itself. We translate the condition found to some specific situations, such as positive and constant sectional curvature, Einstein and Ricci-flat spaces and to a few subcases in terms of the co-dimension of $\mathcal{S}$. The same has been done in direct products ($f = 1$).

References

[1] G. J. Galloway and J. M. M. Senovilla, *Singularity theorems based on trapped submanifolds of arbitrary co-dimension*, Class. Quantum Grav. **27** no. 15 (2010) 152002

The Hunt for Mixed Octonion Algebras

Karsten Naert, UGent
October 17, 2017

Thesis advisor: Prof. Dr. Tom De Medts

Summary

The groups of mixed type are an exotic class of groups, discovered by Tits. The goal of the first part of this thesis was to investigate in particular mixed groups of type $\mathsf{G}_2(k, \ell)$, which are definable over a pair of fields k, ℓ of characteristic 3 such that $\ell^3 \subseteq k \subseteq \ell$. It is important to note that they are merely abstract groups with no algebraic group attached to them, in sharp contrast with the more familiar groups of type G_2. Since a group G_2 defined over a field k can be realized as automorphism group of an octonion k-algebra, the initial hope was to construct a variant on the theme of an octonion algebra such that its group of automorphisms would be one of these mixed groups.

During the hunt for these hypothetical Mixed Octonion Algebras we found that these groups and related geometrical objects can be described by a generalization of the idea of an equation, which does not express that a polynomial expression would be equal to zero, but rather that it takes values in a subfield. This leads us to consider a version of algebraic geometry where we can deal with such equations by constructing, for a given characteristic p, categories of twisted and mixed schemes. It turns out this framework has the following natural interpretation: one can think of the twisted schemes as, morally speaking, schemes over the field of $\sqrt{p}$ elements, and mixed schemes are the slice category of the twisted schemes over the field of p elements. In particular, all ordinary schemes in characteristic

p are also mixed schemes; but conversely there are mixed schemes that are not ordinary; we call these mixed schemes invisible. These invisible schemes come from purely insepar able phenomena: it is the fact that the Frobenius of a scheme is in general not an isomorphism that is responsible for these invisible mixed schemes. The group objects in these categories are called twisted and mixed group schemes and our main theorems state that the groups of mixed type, as well as other exotic phenomena from group theory, can be explained naturally as originating frome these twisted or mixed group schemes. More specifically, we prove the following theorems. (1) The twisted Chevalley groups ${}^2\mathsf{B}_2$, ${}^2\mathsf{G}_2$ and ${}^2\mathsf{F}_4$, also known as Suzuki-Ree groups, arise as rational points of twisted group schemes; i.e. they are algebraic groups over the field of $\sqrt{p}$ elements. (2) The mixed groups in the sense of Tits arise as groups of rational points of mixed group schemes over mixed fields, i.e. they are algebraic groups over an invisible field. (3) The exotic pseudo-reductive groups of Conrad, Gabber and Prasad are Weil restrictions of mixed group schemes, i.e. if one considers a Weil restriction from an invisible field to a visible (i.e. ordinary) field then the invisible group becomes visible and equal to a known exotic pseudo-reductive group.

3 Job announcements

3.1 From KU Leuven

At KU Leuven, we have several vacancies for postdocs and PhD students in several areas of pure mathematics, including Operator Algebras.

The announcements can be found on

https://wis.kuleuven.be/methusalem-pure-math/jobs

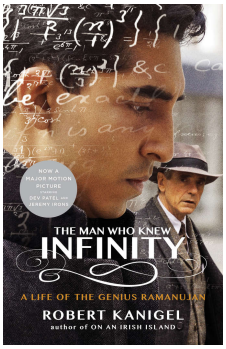
The application deadline is December 3, 2017. The positions start in September 2018 or later.

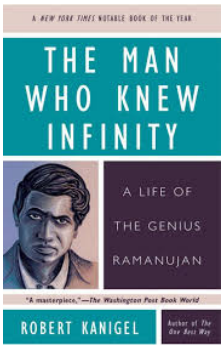
4 History, maths and art, fiction, jokes, quotations ...

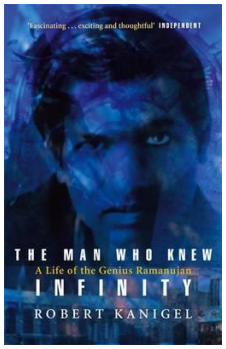
4.1 Adhemar's corner

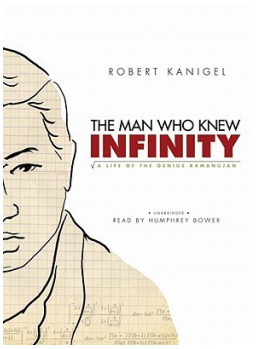
As usual, as always to be read with great pleasure, here are two reviews from Adhemar Bultheel. The first one, *The man who knew infinity*, is about the biography of Ramanujan by Robert Kanigel and the corresponding film directed by Matt Brown, as well as about *My search for Ramanujan*, a book by Ken Ono, with a parallel autobiography and advisor for the film. The second review is about two books by Iain Pears, *The instance of a fingerpost*, which has John Wallis as a main character, and *Arcadia* and one book by Blake Crouch, *Dark matter*. The latter two both involve multiverses.

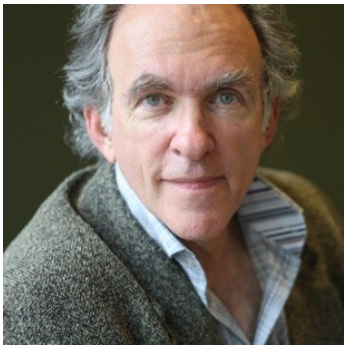
The man who knew infinity (book), *Robert Kanigel*, Charles's Scribner's Sons, (1991) ISBN 978-0-062-36359-6 (hbk), 368 p.
The man who knew infinity (film), Matt Brown (director), Pressman Film Xeitgeist Entertainment, 2015, 108 min.










Robert Kanigel

Robert Kanigel, born in 1946, was a mechanical engineer but at his 24th he decided to become a freelance writer. His book on Ramanujan from 1991 was his second major publication that confirmed his fame as a biographer and science writer. In 1999 he became a professor of science writing at MIT, from which he retired in 2011.

The book. I reviewed before the 2008 novel *The Indian clerk* by David Leavitt[1] about the life of Ramanujan. It is only now that the film was released that I also read the original biography written by Kanigel in 1991.

The story of Ramanujan is well known and it has been covered in my review of *The Indian clerk*. Ramanujan, a poor Brahmin from Southern India discovers as a teenager a mathematical synopsis book written by G.S. Carr which contains a collection of formulas and theorems without proofs. Being mathematically gifted, he discovers many formulas on his own by intuition, or he being very religious, revealed by the goddess Namagiri Tayar. He excels in mathematical tests but fails in English and other exams. Not being admitted to study, he works like mad on his formulas, but having no proofs, nobody seems to understand him. He has a strong bond with his mother and her way of forcing him to find a job is by arranging a marriage with Janakiammal. She is still a child, being 12 years younger than Ramanujan, so she will stay with her family until puberty.


Ramanujan's house in his birthplace

Kumbakonam

Ramanujan travels all over the country looking for a job and he finally got one because some mathematicians of the starting-up Indian Mathematical Society recognized his mathematical skills. Trying to bring his work to the attention of British mathematicians, Ramanujan writes them letters

[1]See the review in this Newsletter issue 72, March 2009 or see nalag.cs.kuleuven.be/papers/ade/n035/.

with excerpts from his notebooks. G.H. Hardy was the first one to react. He asked Neville, then teaching in Madras (now Chennai) to contact Ramanujan and convince him to come to Cambridge. According to his religion, a Brahmin could not cross the ocean. His mother also objected, but was ordered in a dream by the family goddess to let him go. Ramanujan left for England in 1914, leaving his wife with his parents. He stayed for five years in Cambridge working with Hardy and Littlewood. He got eventually a BA degree for his work and was elected for the London Mathematical Society and later became an FRS (Fellow of the Royal Society) and of Trinity College.

However, Ramanujan, was lonely, cooking on his own being a strict vegetarian, and working intensely, not being very sociable. Moreover his way of approaching mathematics was still a problem and he could not always solve the problems as was expected from him. His intuitive approach had flaws or formulas were approximations holding only under certain conditions. He got sick, probably he caught TBC, and spent time in different sanatoriums. He even attempted suicide. Moreover the link with his family in India was broken. One reason was that the letters from and to his wife were intercepted by his mother. His mother used Janakiammal as a servant, which was not unusual because it was considered part of the preparation to become a descent housewife. But the quarrels ran high and Janakiammal, under the pretext of attending the marriage of her brother returned home not to come back.

By now Ramanujan was a star in Southern India and when he returned home in 1919 he was celebrated as a hero. However, he never recovered from his sickness and the next year he died at the age of 32. There was a big dispute among his wife and the rest of his family about the legacy, both scientifically and most of all financially. The notebooks of Ramanujan were a treasure trove for mathematicians and it took Bruce Berndt and coworkers many years to find proofs for the formulas. They were published in 5 volumes (1985-1998). The so called Lost Notebook with Ramanujan's notes from a very productive period at the end of his life in 1919-1920 were again elaborated in 4 more books (2009-2013).

Of course Leavitt's novel and this biography overlap greatly, except that this is much more of a biography with a thick appendix with notes referring to the sources, an extensive index, and a bibliography.

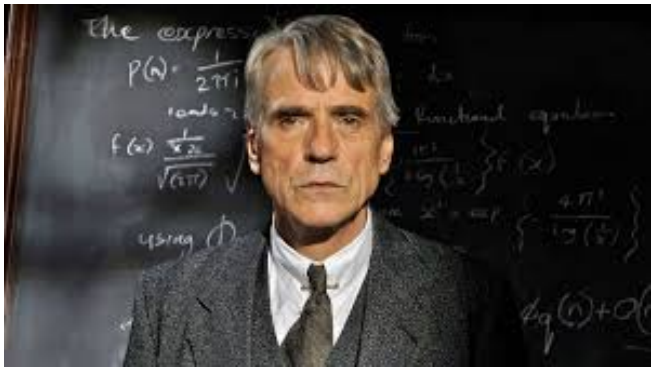
The first 100 pages are about the boyhood of Ramanujan, the background of his family, and an explanation of the caste, the religious, the educational, and the economic system in Southern India. The next 60 pages (and continued in an epilogue) are devoted to Hardy, the second protagonist of this book. Kanigel, like Leavitt, is an American and so he does a good job in explaining the unworldly English traditions at Cambridge, the tripos, the senior wranglers, the wooden spoon, the *Cambridge Apostles*, the boyish male world of the academia semi-detached from the rest of 'the world outside'. A climate in which an unspoken hidden homosexuality lured. Kanigel spends several pages on whether or not Hardy was 'a non-practicing homosexual' as Littlewood formulated it. There is no evidence though.

There are also some laudable attempts to explain some of the mathematics to the layman: what the book of Carr looked like, the number systems, including complex numbers, functions, summation sign and infinite series, Bernoulli numbers, integrals, continued fractions, logarithm, number theoretic partitions, prime numbers and the prime number theorem, limits, division by zero, Rogers-Ramanujan identities, the zeta, tau, theta, and mock theta functions, etc. Two of Ramanujan's conjectures about the tau function were proved by Mordell in 1917, the third one $|\tau(p)| \leq 2p^{11/2}$ by Deligne in 1974. Also the difference between the loose British kind of mathematics and the much more rigorous continental kind, which also Hardy adhered since he learned it in Jordan's book *Cours d'analyse de l'École Polytechnique*.

Of course Kanigel continues about the spreading of Ramanujan's fame after his death, which is where Leavitt's novel stops. It also contains two sections with photographs of the main characters in the book and of some of the buildings where Ramanujan lived and some of his scriptures.

The film. The film was made to commemorate the 125th anniversary of Ramanujan's birthday. Clearly the film is much less thorough than the book and starts when Ramanujan (Dev Pavel) gets a job as a clerk in Madras and is urged by Narayana Iyer (the secretary of the Indian Mathematical Society) to explain his work and to send it to professors in England. The rest of the film concentrates on the five years that Ramanujan spent in Cambridge. Much attention is paid to his relation with his lovely wife Janaki (Devika Bhise), which has not been so romantic in reality if we can believe Kanigel. Her mother in law intercepting the correspondence hence preventing Janaki to join Ramanujan because she was afraid that her son would never come back, is of course a dramatic element used in the film.

Matt Brown



Jeremy Irons (G.H. Hardy)

Dev Pavel (Ramanujan) & Devika Bhise (Janaki)

We see Ramanujan dropped in an academic world completely alien to him. The constant urge of Hardy (Jeremy Irons) giving him a hard time repeatedly pushing him to produce proofs, something that Ramanujan did not understand. His formulas were true, because he dreamed them up inspired by his goddess and because they were written down. Equations had no meaning unless they expressed the thoughts of god. He clearly adheres the Platonic view that mathematics is timeless and that we have to discover it. Hardy, an ardent atheist, is of an opposite idea and believes mathematics is the result of the human intellect. For Ramanujan, proofs are a waste of time, he just wants his results to get published. That is why he came to England.

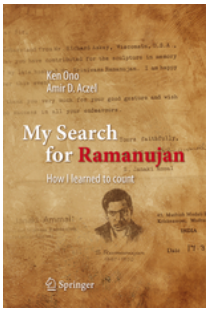
John Littlewood (Toby Jones) is the antipode of Hardy. He is the Sancho Panza, working in the shadow of Don 'Hardy' Quixote. He is kind to Ramanujan while Hardy, although a believer and admirer of Ramanujan is trying to squeeze the mathematics out of him 'for Ramanujan's own good'. Hardy's friend Bertrand Russell (Jeremy Northam) does not think this is the best approach.

Ramanujan is also the subject of racist physical atrocities by students as well as prejudices by professors. MacMahon (Kevin McNally) in particular, a whirlwind of a calculator himself, is an opponent of Hardy and Ramanujan. When Hardy proposes Ramanujan for a Trinity fellowship, the application is denied. 'He is Indian for god's sake.'

We see Ramanujan getting sick and more and more miserable while a war hospital is being installed in Trinity College. The film is working towards a climax while Ramanujan, more dead than alive is still producing results and Hardy realizes that he has not been as good a friend to Ramanujan as he should have been. He can move Ramanujan to beat MacMahon in producing a formula approximating the number of partitions of an integer. Hardy, trying to make up for his bluntness is proposing Ramanujan as a fellow of the Royal Society. With Littlewood returning from the war front, and MacMahon convinced too, the fellowship is approved. Ramanujan, now an FRS, can not be denied a fellowship from Trinity anymore.

In an obituary speech announcing the death of Ramanujan, Hardy says that he is proud to have worked with Littlewood and Ramanujan 'more or less on an equal basis'.

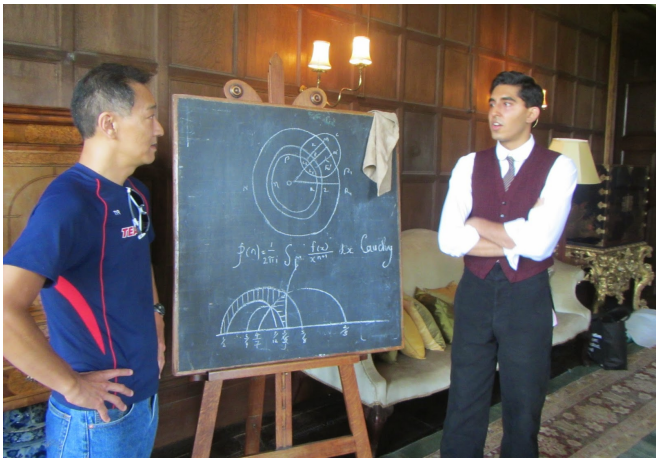
My Search for Ramanujan, *Ken Ono and Amir D. Aczel*, Springer Verlag, (2016) ISBN 978-3-319-25566-8 (hbk), xviii+238 p.



Ken Ono

Ken Ono is a number theorist and writes a kind of autobiography and a summary of a biography of Ramanujan and draws parallels between both. Ramanujan was picked up by Hardy and brought to Cambridge just before WWI, Ken's father was brought to Princeton by André Weyl just after WWII. The Ono family experienced some racist reactions in this post-war climate, but his father became a respected professor and raised his offspring like tiger-children. Performing at their utmost best was not good enough. Ken, the youngest rebelled and left home, like Ramanujan did at some point. He joined his older brother in Canada and was dedicated to cycling.

Ken Ono and Jeremy Irons



Ken Ono and Dev Pavel

He is accepted at the University of Chicago but without parental supervision he enjoys student life as an active member of the Psi Upsilon fraternity and becomes a semi-professional cyclist. Professor Paul Sally picks him up and can convince him to get his BA and pushes him to start doing mathematical research. He however feels stills insecure and when his first public lecture is a disaster, he falls into a depression. Fortunately he is talked out of it by UCLA professor Basil Gordon. He eventually got his PhD in 1993 and accepts a job at the University at Athens (Georgia), working on the legacy of Ramanujan, placing it in the context of work by Deligne and Serre. When Andrew Wiles proved Fermat's last theorem, number theory, his field, became a hype and it boosted his career.

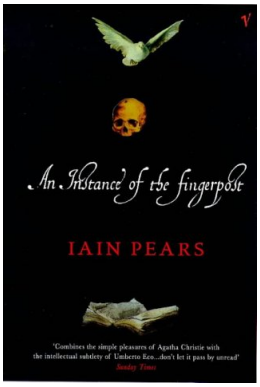
In 2005 he visits Ramanujan's home in India as a kind of pilgrimage and in 2011 he is invited to be the mathematics advisor for the film *The Man Who Knew Infinity* based on Kanigel's bio.

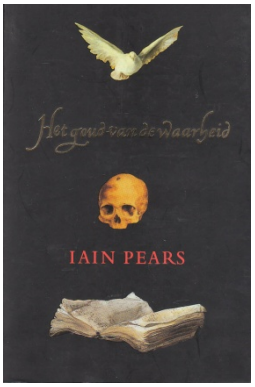
It is clear that Ono is a strong admirer of Ramanujan. The message of his book is that no matter how depressed you are, there is always something or somebody coming to your rescue. If you think your research is hopelessly stuck, there may come a sudden moment when you least expect it, that you see the light and the puzzle falls into place.

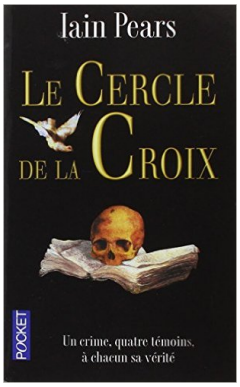
Even though Hardy had chosen his mathematics to be the least applicable and therefore the least harmful (thinking of military applications), it turned out that the prime numbers became the key element in modern cryptography that is used by anybody using a digital password, which is almost everybody. Ono also links to the applications of Ramanujan's formulas in string theory which is trying to understand the basic building block of our universe.

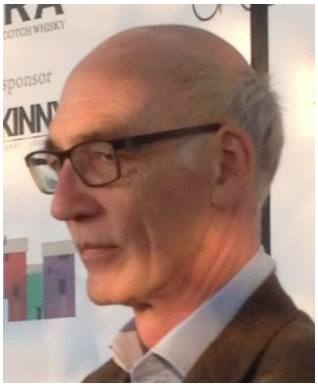
Adhemar Bultheel

Iain Pears *The instance of a fingerpost*, Jonathan Cape, 692 pages, 1997 ISBN: 0-224-04466-4
Iain Pears *Arcadia*, Knopf, 528 pages, 2016 ISBN: 978-1101946824
Blake Crouch *Dark matter*, Crown, 342 pages, 2016 ISBN: 978-1101904220








Iain Pears 2015

The first book is rather old, but the reason why I want to review it here is that one of the main characters in this historical thriller is the mathematician John Wallis (1616-1703).

John Wallis was the most important mathematician in England of his time and prepared the path for Newton. In fact he initially engaged in medicine and studied the then recently discovered idea of blood circulation in animal and human bodies and the first experimental blood transfusions. As a mathematician he is best known for his infinite product defining $\pi/2$ as $\prod_{n=1}^{\infty}(\frac{2n}{2n-1}\frac{2n}{2n+1})$. According to Wikipedia, he also introduced the symbol ∞ and was the first to use the term continued fraction. He lived in a turbulent period of the English Civil War in which Royalists fought Parliamentarians. King Charles I was sentenced to death in 1648 and a military dictator Cromwell became the leader of the Protectorate. After Cromwell's death in 1658, the monarchy was reinstalled and Charles II returned from exile in 1660.

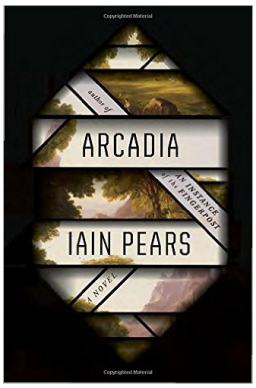
Wallis was very helpful to the Parlementarians as a cryptographer by deciphering the secret messages of the Royalists. He spent some time in Queen's College Cambridge but returned to London after his marriage. There he had weekly meetings with several scientists among which Robert Boyle, John Wilkins, and Christopher Wren. This group became later the Royal Society. For his loyalty to Cromwell he got the Savilian Chair in Oxford, which he held for 50 years until his death. Later he also became keeper of the University archives.

Pears structured the book in the form of 4 (fictitious) contradictory memoirs written a long time after the facts that must have happened just before Charles II was reinstalled. The first narrator Marco da Cola, is an invented Venetian catholic dandy traveling for his father's business. For shortage of money, he wants to work with the physicist Robert Boyle (1727-1691) who assigns the physician Richard Lower (1631-1691), as his supervisor. Cola becomes a self declared physician and administers a blood transfusion on the mother of Sarah Blundy. The credits for the success of this experiment were taken by Lower, which is indeed what he became famous for. During Cola's stay in Oxford the astronomer Robert Grove is murdered, and this triggers the whodunit aspect of the novel. The second memoir is by Jack Prestcott who is the son of a Royalist traitor trying to clear his father's reputation. At some point he takes advantage of Sarah Blundy and is convinced that she, as a witch, has put a spell on him. Sarah was working for Grove and she is eventually accused of the murder on false grounds, sentenced and hanged. John Wallis writes his own version of the facts after reading the memoir by Cola. In fact, fully involved in the turbulent politics, he is obsessed by conspiracies and spying, and is convinced that Cola came to England to murder the king, or the Lord Chancellor, and he is convinced that he has already murdered two other persons. One of them is his young servant for whom he has more than usual affectionate feelings. The last narrator is Anthony Wood (1632-1695), an historian in Oxford. He falls in love with Sarah, and he is after the archives that are guarded by Wallis. He is the one who brings in his account the truth of what actually happened and who the true murderer is with several unexpected story twists at the end.

Besides the fact that John Wallis and Anthony Wood actually existed, just as many other characters that are mentioned in this novel, the whole intrigue is fantasy and although the political and scientific climate of that period are rather accurate, the psychology of the persons is for the sake of the story and is probably not corresponding to reality. There are a few pages on the elementary crypto systems of those

days, but there are for the rest no mathematics. When Prestcott visits Samuel Morland (1625-1695), a diplomat, spy, and mathematician, he is introduced to his collection of calculating machines, "the finest in the world, not alas unique as some little Frenchman has one, but ... his doesn't work as very well. Not like mine." Morland says and hereby refers to the Pascaline of Blaise Pascal.

The book is also available in Dutch (*Het goud van de waarheid*, Anthos, 1999) or in French (*Le cercle de la croix*, Pocket, 1999).



Iain Pears has written several bestsellers and is known for experimenting with the the structure of his novels. In his latest novel *Arcadia* he tilts the experiment over the top in my opinion. The book appears in printed form but is also available as an app for iPhone and iPad. There are many different stories that are intertwining and the app allows to choose whichever line you want to follow. Not only is the story complex because of the different story lines and the many characters, but Pears also succeeds to cook up a mixture of a fairy tale, a science fiction story, a spy novel, and many other genres. You will recognize elements from Alice in Wonderland, the Wizard of Oz, Lord of the Rings, Narnia, James Bond, etc., and it is all caused by a maverick mathematician from the future: Angela Meerson. She is working on parallel universes and when she is afraid that the project will be cancelled, she uses it to travel to a parallel universe which turns out to be also a time travel. Her disappearance consumes so much energy that there is a worldwide electricity breakdown. Since she is the only one who is able to operate the machine, it takes several years for other scientists to make the machine operational again. She arrives in the second World War period of the 20th century and has a love affair with a British spy Henry Lytten. She knows the future and is also super intelligent, which helps her to survive easily. She is able to reproduce her machine and hides it in the basement of Lytten in the form of a pergola. Many years later Lytten is retired and is joining a club of storytellers who meet in the weekend to go through their stories in progress. They create a fantasy world called Anterworld in the style of Narnia or Middle-Earth. By way of experiment, this is used by Angela to create a static parallel universe to which her machine gives access. It should however be kept isolated, because interference from outside would start up dynamics and evolution, and this could possible alter the present, which would be disastrous. Rosie, is a young girl who is looking after Lytten's cat when he is absent, by accident enters the pergola and arrives in this Anterworld where she lives many adventures. People in that world resemble people from the 21st century and also people from the future interfere when they are looking for Angela to bring her back to the future and punished her.

Thus the origin of all this is a mathematical genus in the person of Angela Meerson, but I do not think that this comes anywhere near the mathematics that govern the quantum physics and that suggests the possibility of parallel universes, let alone this to be equivalent to time travel.

Parallel universes are also the main subject of the book *Dark Matter* by Blake Crough. Here the idea stays closer to a naive version of Hugh Everett's multiverse interpretation of quantum mechanics. Schrödinger's cat is in an undecidable quantum state of being alive or death, but the moment we observe it, the state will collapse to one of those, but the hypothesis is that the other possibility also exist in a parallel world. Each time a decision is made and one chooses for one option, the other possibility will happen in a parallel universe, which creates an infinity of possible parallel universes.


Blake Crouch

In this novel a bright student makes his girl friend pregnant and there are two possibilities: either he chooses to become a family man, or he chooses for an abortion to continue his scientific career. The science person is so brilliant that he succeeds in transferring himself to a parallel universe. He however misses a family life and decided to change places with his family-life-alternative. From that point on we follow the family man who is desperately trying to return to his wife. His attempts lead to many adventures in all kinds of weird universes. In the end he succeeds to regain his wife and kid, but in all his attempts he has made many decisions and so he is confronted with many copies of himself who are all claiming to be the one and only husband.

A. Bultheel

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JOURNEE ORGANISEE AVEC LE SOUTIEN DE L'EDT MATH

Services d'Analyse Mathématique et de Probabilités et Statistique

10h15 **Isabelle Chalendar**
(Université Paris-Est Marne-la-Vallée)
Problème du sous-espace invariant et le rôle particulier des opérateurs de composition

13h45 **Quentin Menet (Université d'Artois)**
Introduction au chaos

JEUDI 16 NOVEMBRE 2017
Le Pentagone – Salle 0A07/rez-de-chaussée
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Invitation cordiale à tous

Résumés

Isabelle Chalendar : *Problème du sous-espace invariant et le rôle particulier des opérateurs de composition*

Un des problèmes les plus célèbres en théorie des opérateurs et à ce jour encore est le problème du sous-espace invariant (PSI) que l'on peut formuler ainsi :

Soit T une application linéaire et continue sur un espace de Hilbert H (complexe et séparable), existe-t-il toujours un sous-espace vectoriel fermé non trivial M de H tel que T(M) soit inclus dans M ?

Nous verrons quelques résultats remarquables liés à ce problème et nous verrons des exemples d'opérateurs dit de composition, très simples, dont l'étude est équivalente à la résolution du PSI.

Quentin Menet : *Introduction au chaos*

Les systèmes dynamiques sont des objets mathématiques renfermant une grande richesse. Plusieurs problèmes célèbres tels que le problème des sous-espaces invariants ou la conjecture de Syracuse reposent sur de tels systèmes.

Le but de cet exposé sera de mettre en avant la notion de chaos à travers l'étude de différents systèmes dynamiques et de montrer que le chaos linéaire existe bel et bien !