Introduction
Meet dr. Andrea Giuntoli

Finiteness and Beyond
A crossover with Idun's Lifeline

Association's News
Catch up with all activities

Francken Vrij

Exact

Volume	26.1
Theme	Exact
Colours	
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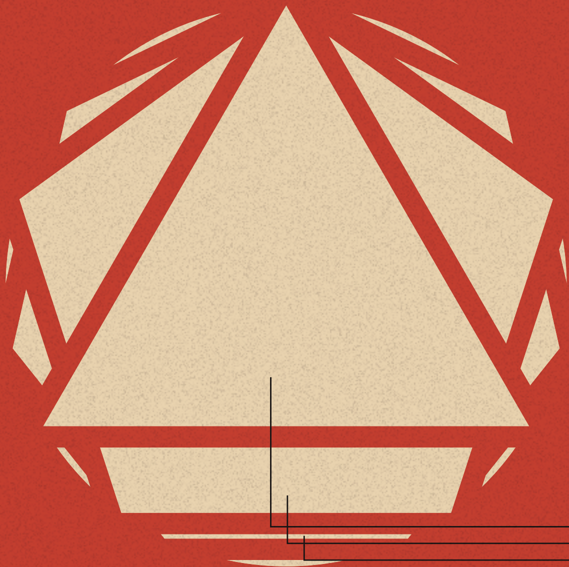
Francken Vrij
T.F.V. 'Professor Francken'



26.1 Exact

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Editorial
A **new year** a new Francken Vrij! The theme is *exact*. And I hear you thinking, 'exact?' Yes, exactly! Or wait no, just exact. Anyway, this year we're going to try a couple of new columns. This edition will feature a crossover with GLV Idun's *Lifeline*, the introduction of Dr. Giuntoli, and a summary the recipients of the last Nobel prize. However, lately Francken Abroad, and Life after Francken have looked a bit too similar. Therefore, Francken Abroad will only be reserved for members that are, or have recently been, on exchange. As you might understand, finding people who have recently travelled is a bit difficult, so suggestions are always welcome.

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Marit Bonne, Jelle Bor MSc, Dr. Ronniy Joseph, Dr. Giuntoli, Arjen Kramer, Bradley Spronk

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18 Puzzle

Arjen Kramer

For this edition Arjen has provided us with a nice logic puzzle. The goal is to place twelve pentomino arrangements in a 12x12 grid.

22 Nobel prize

Alexandra Meerovici

Every year the famous Nobel prize is awarded; the most prestigious price in physics. In this edition we explain the research for which the last Nobel prize was handed out.

21 Introducing

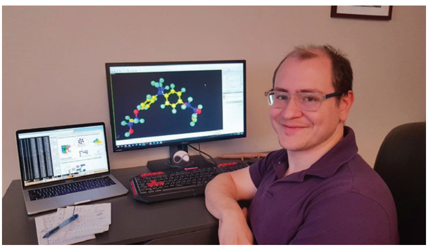
Dr. Giuntoli

The second new column of this edition! For this column we're approaching staff that is new to our faculty. This edition we've approached Dr. Giuntoli, who started a group within the micromechanics team, to tell us a bit about himself and his research.

28 Life after Francken

Dr. Ronniy Joseph

Some of the older members might still remember Ronniy Joseph. After graduating in 2012, Ronniy has seen quite a lot of the world. If you are interested in all the amazing places you can visit (while studying), then we suggest reading this piece! Perhaps you might get some inspiration for your next journey.



Chair's Preface

By Ian Soede

As of writing this I am sitting in the board room of Francken, trying to find a spark of inspiration to write this preface, while simultaneously feeling lucky that my utmost concentration is not being disturbed by the banging of fists on the wall shared with the Franckenroom (I have recently learned the very basics of jassen). Although we are not fully back open yet, I have been glad to find out that even after a long lockdown these traditions have not faded away. Some things, like the desire of a Franckenmember to hunt for a vierde man or the excellent taste in music of the all-time greats such as the Vengaboys and K3, will hopefully never change. Much has at some time been possible again, such as borrels, excursions or lectures from professors. But when everything will be completely back to the way things used to be,

i.e. having a drink in the members' room, no one knows exactly. One thing we all know for sure will happen, whether soon or late, is the arrival of the Francken Vrij on your doorstep or in your e-mail. This time with the theme 'Exact', to hopefully give you some certainty in still uncertain times. Hope to see you soon!

News of the Association

By Sjoukje de Jong

We started off our year nicely Covid-wise, as we were able to host some nice on site activities. Then, later on, when Covid cases started to rise, our possibilities got a bit smaller. After SLEF we unfortunately had to close our room but in the end we did have some nice activities over the last period!

Introduction week: AP Burgers and Pubquiz

During the AP burgers we were able to enjoy nice burgers at Papa Joe's, after which there might have been a nice afterparty. Two days later, the first years were able to test their knowledge during our Pubquiz at the Buckshot cafe. As they enjoyed the rounds and beautiful pictures in the slides, they were able to race for the most amazing prize, another round of beers!

Francken Friday Lecture

Elisabetta Chicca was able to give us an interesting talk titled 'Exploiting te gamporal dynamics in neuromorphic sensing'. This Francken Friday lecture was one of the few activities that was able to be held in the Franckenroom. It was a very interesting talk and afterwards we even got to see Jeff de Hosson's old office as this is Elisabetta's office now.

Intro weekend

Instead of a Pienterkamp this year an Intro weekend was held to introduce our Sjaarzen to the student life and study associations. On the first day there was a tour through Groningen where all the groups had to guess where certain pictures were taken and recreate them. On the evening a pubquiz was held at the ACLO sportsbar. The second day some fun sports were played at the Kardinge beach, including Vlaby. Then, a delicious BBQ was served and we were able to enjoy some drinks. The day after there was a Crazy 88 followed by pizza's at Stadspark. In the end I think the INTRO committee was very successful in introducing our Sjaarzen!

ZIAM

The ZIAM lab tour for first years was a big success. In small groups we got to see lots of labs with some interesting talks. It was very interesting to see what goes down in the beautiful building of Nijenborgh, of which I was not very aware before. The

different research groups did a great job explaining their research to first-years students, which is not always easy. After the tour was done we got to enjoy some pizza close off the tour.

Francken auction

In order to clean up the board room and Franckenroom a little bit, the board decided to auction off some ~~garbage~~ hidden treasures. At some point, when the treasurers had all been all auctioned off, the great idea to auction of anytimers on basically everyone that was present emerged. I don't know whether I should be proud of this but it brought up about the same amount of money as was raised from auctioning the treasures.

Committee running dinner

After last year's success, this year there was another committee running dinner. In small groups you were able to travel along the different committees to get another course of the meal. Fraccie & Filmcie, Sympcie, Sjaarcie & Buixcie and Wiecksie & Borrelcie showed us their cooking skills. Almost every committee was able to recruit some new members which is off course very good news.

September BBQ

At Stadspark we were able to enjoy some very good meat and games. Loads of people were able to enjoy the fun and get to know the association a bit better.

Members weekend

This members weekend was held at De Hullen in Roden.

SLEF

After our exam week, 27 mooie gekken were able to escape the Dutch lockdown by going to Switzerland and Italy for eleven days. We visited some very interesting universities and research institutes in Zürich, Geneva, Turin and Milan. We also got to know each other a little bit better when visiting the nuclear powerplant in Gösgen. When not wearing a suit we were also able to experience some cultural highlights such as the Rheinfall close to Zürich, the Leonardo da Vinci museum of Science and Technology and a football match between Inter Milano and Napoli. It was a great foreign excursion!

I-GMA

After almost two months into the year it was time to have the intermediate general members assembly. Locatied at Het Paleis there was a very large room that was filled by the current and past boards, as well as the Franckenmembers of course. As a lot of people were coughing a bit, I had lots of fun listening to the recordings. A lot of nice motions were also written to the board, most fun being the Chubby Bunny challenge.

3, 22/7, 3.141592-65358979323846 or π

By Jelle Bor

Although π is not a physical constant, it appears very often in equations describing fundamental principles of the universe, because of its relationship to the circle and to spherical coordinate systems. For example, Heisenberg's uncertainty principle, which shows that the uncertainty in the measurement of a particle's position (Δx) and momentum (Δp) cannot both be arbitrarily small at the same time (where h is the Planck's constant):

$$\Delta x \Delta p \geq \frac{h}{4\pi}$$

Another, more specific example, is due to the fact that π is approximately equal to 3. This results in the relatively long lifetime of ortho-positronium (an electron and its anti-particle, a positron, bound together into an exotic atomin the triplet state, i.e. with parallel spins: $S = 1$, $M_s = 1, 0, -1$) with respect to para-positronium (antiparallel spins, singlet state: $S = 0$, $M_s = 0$). This system is unstable anyway: depending on the relative spin states, the two particles annihilate eachother to predominantly produce three or two gamma-rays, respectively. The inverse lifetime (τ) of ortho-positronium to lowest order in the fine-structure constant (α) is namely:

$$\frac{1}{\tau}\alpha(\pi^2 - 9)\alpha^6$$

There are many more examples of the importance of in physics and of course in other disciplines. Although we know this number now-a-days to many digits, even so much it's not of practical physical use anymore, we do not know this very important number exact. π comes from the first letter of the Greek word perimetros (meaning circumference) and is commonly defined as the ratio of a circle's circumference to its diameter: C/d. However, this definition implicitly makes use of flat (Euclidean) geometry, although the notion of a circle can be extended to curved geometry. Then the circumference is the arc length around the perimeter of the circle.

For example, one can define π by the arc length of the top half of the unit circle in Cartesian coordinates by the integral:

$$\pi = \int_{-1}^{1} \frac{dx}{\sqrt{1-x^2}}$$

However, integration or geometry are not always used as the analytical definition of π. For example: π is twice the smallest positive number at which the cosine function equals 0 and the cosine can be defined independently of geometry as a power series, or as the solution of a differential equation. Similarly, π can be defined using the complex exponential, exp z, of a complex variable z: the set of complex numbers at which exp z = 1 can be written as z = 2πki (with k = ...,-2,-1,0,1,...) and there is a unique positive real number π satisfying this.

The reason we do not know the number π exactly is that we cannot write it as the ratio of two integers as it is an irrational number: it has an infinite number of digits in its decimal representation and it does not settle into an infinitely repeating pattern of digits. There are several proofs for this which rely on the reductio ad absurdum technique, i.e. by showing that the opposite scenario would lead to absurdity or contradiction. Since the invention of computers and using iterative algorithms, a large number of digits of π have been available (Figure 1). The digits of π have no apparent pattern and have passed tests for statistical randomness, including tests for normality: a number of infinite length is called normal when all possible sequences of digits (of any given length) appear equally often. However, it is not proven that π is normal. Any random sequence of digits contains an arbitrarily long subsequences that appear non-random by the infinite monkey theorem.

This theorem states that a monkey hitting keys at random on a typewriter keyboard for an infinite amount of time will almost surely type any given text (f.e. writing Hamlet in Figure 2). Thus, because the sequence of π's digits passes statistical tests for randomness, it contains some sequences of digits that may appear non-random, such as a sequence of six consecutive 9s that begins at the 762nd decimal place of the decimal representation. This is also called the "Feynman point", after Richard Feynman, although no connection to Feynman is known. In addition to being irrational, π is also a transcendental number, which means that it is not the solution of any polynomial equation with rational coefficients. This has

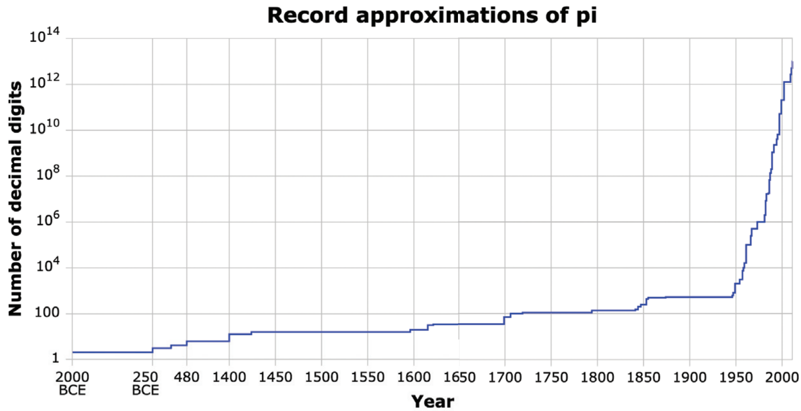


Figure 1: As mathematicians discovered new algorithms, and computers became available, the number of known decimal digits of π increased dramatically.

two important consequences. Firstly, π cannot be expressed using any finite combination of rational numbers and square roots or n-th roots. Secondly, it is not possible to "square the circle", i.e. it is impossible to construct, using compass and straightedge alone, a square whose area is exactly equal to the area of a given circle.

On the other hand, every irrational number, including π, can be represented by an infinite series of nested fractions, called a continued fraction. Truncating the continued fraction at any point yields a better approximation for π: the first four of these are 3, 22/7, 333/106, and 355/113. These numbers are among the best-known and most widely used historical approximations of the constant. Each approximation generated in this way is closer to π. Because π is known to be transcendental, it cannot have a periodic continued fraction. However, mathematicians have discovered several generalized continued fractions, such as:

$$\pi = \cfrac{4}{1 + \cfrac{1^2}{3 + \cfrac{2^2}{5 + \cfrac{3^2}{7 + \cfrac{4^2}{9 + \ldots}}}}}$$

Before Christ people were already using π. Based on the measurements of the Great Pyramid of Giza, some Egyptologists have claimed that the ancient Egyptians used an approximation of π as 22/7 from as early as the Old Kingdom (2700–2200 BC). However, this claim has been met with a lot of skepticism. The earliest written approximations of π are found in Babylon and also in Egypt, both within one per cent of the true value. In Babylon, a clay tablet dated 1900–1600 BC has a geometrical statement that, by implication, treats π as 25/8 ≈ 3.125. In Egypt, the Rhind Papyrus, dated around 1650 BC but copied from a document dated to 1850 BC, has a formula for the area of a circle that treats π as 16/93.16. Astronomical calculations in the Shatapatha Brahmana (ca. 4th century BC) use a fractional approximation of π 339/1083.135. Other Indian sources around 150 BC treat π as √10 ≈ 3.1622.A great improvement was done by Chinese mathematics, to an accuracy of seven decimal places. After this, no further progress was made until the late medieval period. Nowadays we know much more digits of π and people are still searching for more. Is it important to keep typing on that typewriter? Exactly.

Figure 1: Cartoon about the infinite monkey theorem

To finiteness and beyond

By Marit Bonne

This article is a crossover between the Francken Vrij and the LifeLine from G.L.V. Idun, of which one of the editors wrote this piece about the inexactness of science.

Science cannot be exact. Can it? A strong, bit controversial, point of view that somehow makes sense when you think about it. To dive into this topic, I turn to a specialist: a marvelous German thinker that seemed to have the universe and everything in it figured out.

It was Nicholas da Cusa that wrote several doctrines in the Middle Ages, with topics ranging from metaphysics to the human mind. In one of these doctrines – the 'Docta ignorantia', which literally translates to 'learned ignorance' – he discusses that humans are structurally incapable of knowing the whole truth. Humans, da Cusa says, tend to think by building relationships between things: we think in quantity, quality, and opposites. This doesn't nearly come close to the truth, as the truth is described as the infinite coincidence of opposites, which da Cusa later links to religion, and describes this as God1.

Nicholas da Cusa thought that the universe was infinite and expanding. Therefore, the finite mind of humans could never comprehend to understand such a thing. He coupled a thought experiment to this belief, using circles and polygons. Imagine a circle, a shape that has infinite sides, as the universe (or the whole truth as mentioned in the last paragraph). Inside, humans live, humans think, and humans exist. Our mind is characterized by the polygon. Let's say that the mind of a newborn child has yet to be developed: we make this the simplest of polygons, a triangle. There is a lot of leftover space between the finite sides of the triangle and the circle, which means that the child has a long way to go to discover the whole truth. As humans, our societies, and technologies, grow and grow, our mind grows with us: we become a polygon with more sides, that are still finite. No matter how much we increase the finite sides of our polygon, we can only come near the circle, near the whole truth, but never reach it. Da Cusa's main message is that we should not fear this conjectural nature of our mind, but instead use it to our advantage. Or, in other words, 'the limits of science need to be passed by means of speculation.' Despite the blunt undertone of this article saying that science cannot be exact, I think humans are more than capable of passing the limits our science has. Our current technologies, theories, and estimates are considered highly accurate and refined, which ultimately results in us increasing our polygon sides and getting closer to that circle. Let's be aware of our conjectural mind and embrace it, rather than be discouraged by it. Let's try to find our infinity and reach beyond it.

Note: Nicholas da Cusa was a man of religion and this clearly shines through his work. However, he also uses mathematics and astronomy to explain his train of thought. Consequently, his philosophical ideas were mostly accepted by the Church, even those of extraterrestrial life, which was considered taboo in most churches.

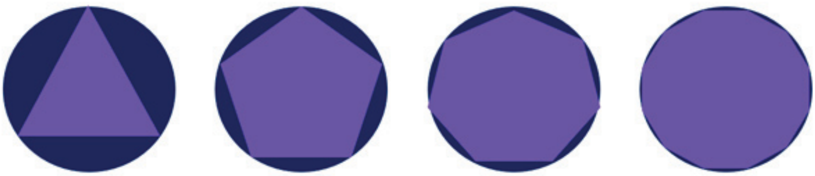


Figure 1: polygon in a circle; a metaphor

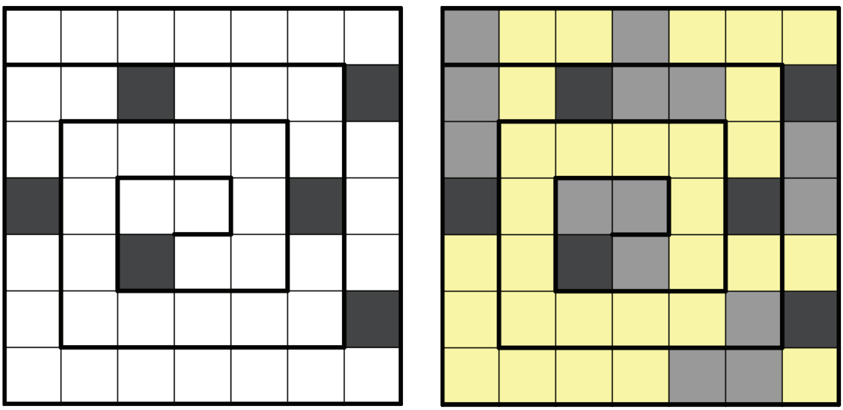
Comic

By Bradley Spronk

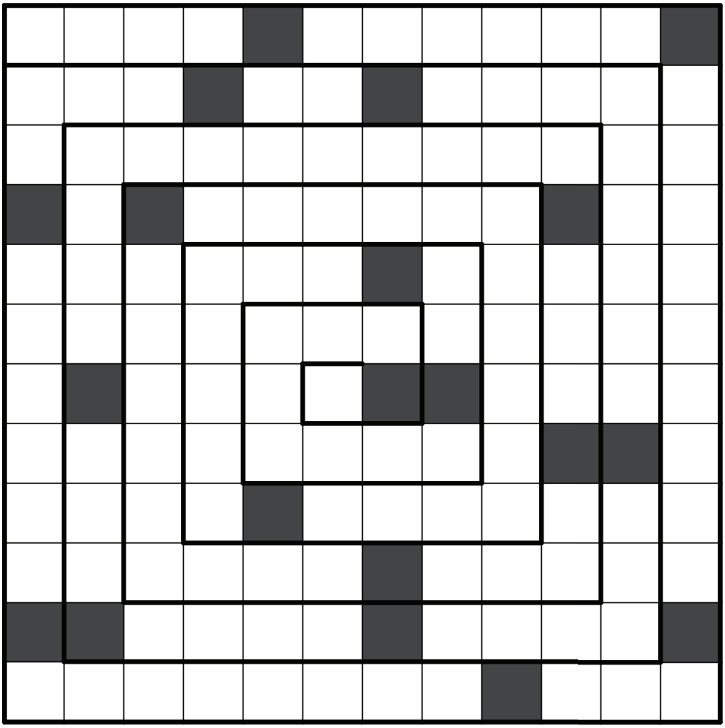
Puzzle

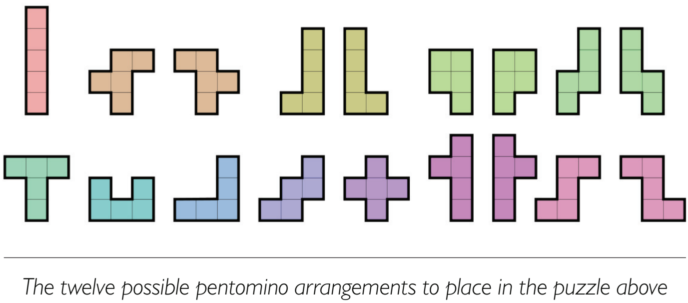
By Arjen Kramer

The theme **'exact'** is a natural fit for logic puzzles, as they have exactly one solution which (if designed well) can be found by using exact logic. For this puzzle I've gone a step further, as even the clues are given using exact rules. In this grid, some cells must be shaded, and following the spiral towards the center, exactly every third shaded cell has already been shaded for you. These shaded cells must form each of the twelve pentominoes exactly once, where rotations and reflections of a pentomino are considered the same. These pentominoes are not allowed to touch each other, not even diagonally. For illustration, I've added a smaller puzzle which has the same ruleset, but with the five tetrominoes instead.



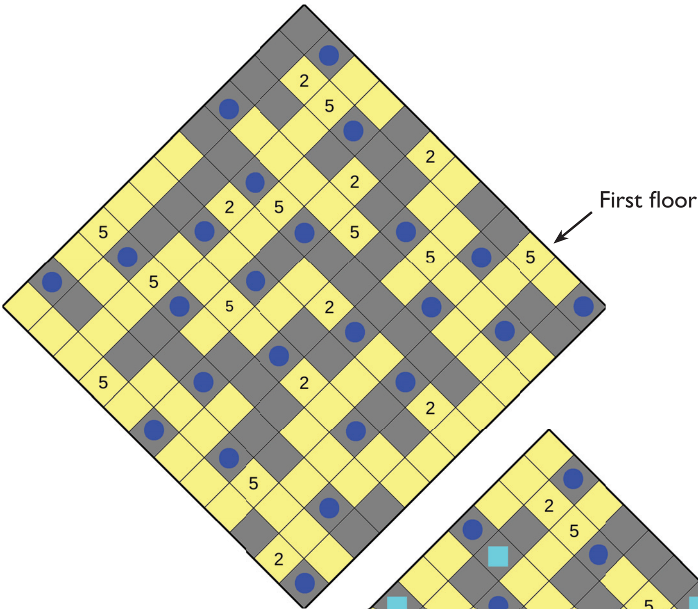
An example puzzle, that uses tetrominoes instead of pentominoes, with the solution





The twelve possible pentomino arrangements to place in the puzzle above

The solutions to last edition's puzzle:



Introducing Dr. Andrea Giuntoli

By Dr. Giuntoli

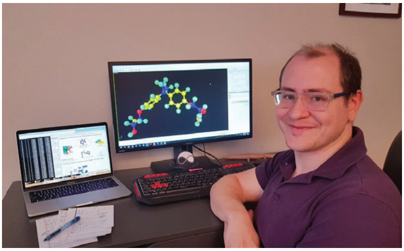
Over the last couple of years a lot of new staff members have joined our part of the faculty. Therefore, the Francken Vrij wanted to try a new column in which we interview one new person per edition. For this edition we approached Dr. Andrea Giuntoli, who started a new group within the micromechanics team, but you can read all about it yourself:

1. Could you tell us a bit about yourself?
I'm very excited to say that I am a new assistant professor in the Zernike Institute! I landed here after doing all my studies up to the PhD in Italy, my home country, and two postdocs in the US. Becoming a university professor has always been my goal, so I now feel extremely rewarded and I plan to stick around for a long time! I'm still fairly young and highly energetic. As one of my core values, I strive to interact with people around me in a way that empowers them and make

them feel valued. I'm sure that this job will give me many opportunities in my relations with students and colleagues. Personally and professionally speaking, I don't feel anywhere close to be "arrived", and there is so much more I want to learn. Knowledge is a life-long journey, and one that is best when shared. I'm sure that I will find many traveling companions on this new path.

2. What was your research about during your PhD?

Using computer simulations, I studied the role of molecular relaxations in the dynamics and mechanical properties of glass-forming liquids, a fascinating and open problem in soft matter physics.



3. Can you tell us a bit more about your current research area? What does your group want to achieve?

I now work more directly on the prediction of the macroscopic properties of polymer materials from their nanoscale features like topology and functionalization. There is currently a big gap between the controlled conditions of most theoretical studies and the complex environment in which new applications are developed. By pushing the boundaries of current computations, I plan to bridge this gap and promote a stronger communication between fundamental soft matter physics and applied material science.

4. We have read that you have a background in theoretical physics, how did you end up in your current field? Can you tell us something about your journey?

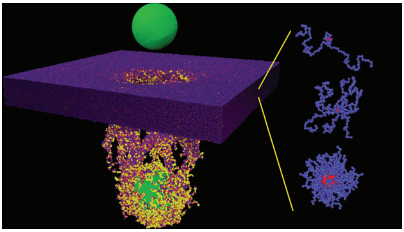
As many theoretical physicists, my initial driving force was a strong desire to understand the laws of nature. By the end of my studies I craved for a multidisciplinary environment where I could keep learning from people with different backgrounds, and I started working in the field of soft matter. My PhD was very theoretical, but after two postdocs in a Material Science Laboratory (at NIST, Maryland) and in a Civil Engineering department (at Northwestern University, Illinois) I now have much broader perspective and many interests.

5. What was the most important publication you have worked on?

I'm very proud of my latest publication, showing how the shape of star polymers and their picosecond vibrational properties can predict the energy absorption of thin films under ballistic impact. It's not my most important work, but it's the one that best shows the link between fundamental soft matter and material science applications that I am pursuing.

6. You have traveled quite a bit, what do you think about the Netherlands so far?

I immediately felt very welcomed here. At the academic level, the impression is that the whole country feels part of a single, large community. This aspect is extremely important and not often found elsewhere, in my experience.



7. Will you be lecturing a course at the Rug?
Yes, and I am looking forward to that! Starting next year, but I have not decided yet what I will teach, so stay tuned!

8. Do you have a favorite free time activity?
Martial Arts are a big part of my life. Then (video)games and many other nerd activities are also a good way for me to relax and socialize. I would say more, but it's a very long list in both areas so I'll gloss over the details!

9. As a student, what course did you like the least?
Laboratories. They were always very frustrating for me. Probably because I lacked the necessary patience to perform experiments.

10. And which course did you enjoy the most?
My first and eternal love will always be classical mechanics. It's incredible how much you can learn and discover simply using F=ma.

11. Is there any book you can recommend us?
If I'm forced to pick one, it has to be the Hitchhiker's Guide to the Galaxy. It is the one book that never leaves my side. And it contains a ton of useful information, such as the many uses of a towel.

12. If you wouldn't have had an academic career, what else would you have considered.
A tough one. I always felt like an eternal student, and I decided to be a scientist around the age of 12. I later learned that the only thing I like more than learning is teaching. The academic career seemed an obvious choice. But I also have a fascination for psychology and human interactions, so I might have chosen a psychologist or counselor career if science was off the table.

13. Favorite beverage?
Nothing feels as good as water when you are thirsty. Old Tuscanian wisdom, and I stand by it.

14. Do you have anything else to say/ask?
Thanks for this interview and for the warm welcome! I'm looking forward to my time in Groningen and I hope to meet many of you around!

The 2021 Nobel prize

By: Alexandra Meerovici

The Nobel prize in physics in 2021 was awarded "for groundbreaking contributions to our understanding of complex systems". It was awarded to 3 different people. Syukuro Manabe and Klaus Hasselmann won it "for the physical modelling of Earth's climate, quantifying variability and reliability predicting global warming. On the other hand, Giorgio Parisi won it "for the discovery of the interplay of disorder and fluctuations in the physical systems from atomic to planetary scales".

Complex systems are defined as being random and disordered time-dependent interactions. They are often characterized by rich, non-trivial and unexpected behavior. They manifest in several areas such as physics, biology, ecology, economics and the humanities. It is in our human nature to understand and characterize the world, giving the understanding of complex systems great importance.

One of the most important and relevant complex systems is Earth climate. Throughout the last decades we have been warned of its dangers if left uncontrolled. Droughts, heat waves, changes in precipitation patterns and natural disasters are no longer speculation, and scientific data supports this. Syukuro Manabe first demonstrated this by proving that higher levels of carbon dioxide in the atmosphere raised the earth's temperature. Furthermore, he created the first model of the earths climate in the 60s and investigated the relation between the vertical transport of masses of air and radiation balance. All of this created the basis for our current climate models.

Using Manabe's model, Klaus Hasselmann further contributed to the field by finding a relationship between weather and climate. This allows climate to be modelled despite weather being so tumultuous and unpredictable. He also created techniques to find the different ways that human activity and natural phenomena influence earth's climate. These techniques helped to prove that global warming is caused by human activity, mainly because of increased emissions of CO_2.

The final Nobel prize winner, Giorgio Parisi, found previously unknown sequences in disordered complex materials. This revolutionized the field of complex systems as this helps in comprehending and characterizing different materials and events. His discovery is specifically important because it helps to describe complex systems outside of physics as well.

This year's Nobel prize recognizes that the field of complex systems is a rising field with promising developments. It shows that in a world like ours, knowledge on climate change is based on strong scientific facts and discoveries. This is an important battle for humankind not only fought by politicians but also led and supported by science itself, making this award a well-deserved recognition.

References

1. The Nobel Prize in Physics 2021. NobelPrize.org. Nobel Prize Outreach AB 2022. Thu. 6 Jan 2022. <https://www.nobelprize.org/prizes/physics/2021/summary/>

Physics Nobel prize winners of 2021, from left to right: Klaus Hasselmann (photo by Bernhard Ludewig), Syukuro Manabe (photo by Risdon Photography) and Giorgio Parisi (photo by Laura Sbarbori) [1]

ASML Advertorial

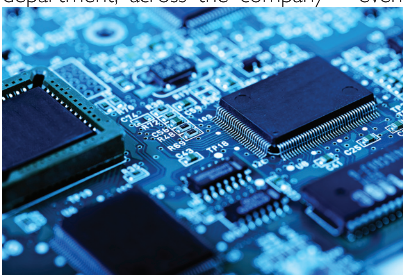
Meet Pieter Smorenberg, a 2017 Delft University of Technology graduate who recently found himself back at university, this time explaining to students how technologically fascinating his job is. Originally from Amsterdam, Pieter couldn't have guessed that he would find so many technical and social opportunities in Veldhoven at ASML, the fast-growing tech giant.

Pieter studied precision and microsystem engineering, and now works as an applications engineer in customer support at ASML. He also spends some of his time as one of over 400 'ASML Ambassadors', giving guest lectures at his alma mater university or promoting STEM among school-aged children in the region.

"The more I tell people about working here, the more things I realize I appreciate about the company," he says. "A lot of people don't realize just how big ASML is in the semiconductor industry. You realize it when you visit the campus in Veldhoven. You see the big tower, the cleanrooms, the huge gardens and parking lots; it's impressive. And then at the complete other end of the scale, almost all of the metrics we work with here are practically at an atom level – no other company is producing such advanced chip-making equipment." ASML is the world's leading provider of semiconductor lithography equipment, in an industry worth $438 billion. All of the world's top chipmakers are our customers, including Samsung, Intel, and TSMC.

Pieter has certainly found more than he expected in Eindhoven. "Coming from Amsterdam and Delft, I was a bit uncomfortable about moving to Eindhoven, but there's a lot going on that you only discover after you get here. It's not a 'small city'. It's a melting pot – people come from all over the world to live here."

Pieter has also found more than a career at ASML. "There's so much going on in our company, technically as well as socially. We have annual technology conferences where you can learn about what's going on in your department, across the company – even



across the world. This is really unique to ASML. You can develop your network and learn a lot about what other people are working on. It inspires, and you'll get ideas for yourself. I'm like a kid in a candy store at these conferences."

Celebrating our technology isn't the only way we have fun at ASML. "I sometimes go for drinks with the 'Young ASML' group for young ASML professionals," Pieter says. "You get to meet colleagues from all kinds of different departments. It's a really open-minded atmosphere, because everybody is there for the same reason: to share a good evening with each other." The ASML campuses are like small cities – more than 12,000 people work just at the Veldhoven campus alone. Young, old, male, female, LGBTI+, living abroad, you name it – it's easy to feel at home at ASML.

As a customer support engineer, Pieter also gets to travel a lot, listening to ASML's customers and helping them to achieve their technology roadmaps. During his travels he experiences other cultures first-hand. "You learn a lot – socially and culturally as well as technically. It's been an eye-opener for me. We're diverse, in terms of education, background, and nationality, but we're all working together as one team because we all have the same goal: make this incredibly complicated technology a reality."

Are you interested to learn more about ASML? Visit www.asml.com/students for more information about our events, internships and scholarship program.

Life after Francken

By Dr. Ronniy Joseph

Science is a global endeavour. The best thing about studying science that is that it opens the world for you, but you may have to spend a bit of effort opening doors. Just like you I was mesmerised by the inner workings of the world, in particular the Universe, but I also fell in love with a career that could take me around that same world. That also meant my life at Francken was 'kort maar krachtig'.

After finishing most of my undergraduate in Astronomy in 2012 I decided to do something else for a bit. After filling in stacks of paperwork, I went on exchange to Uppsala in Sweden to complete the rest of my degree by playing around with particle accelerators, and small-scale nuclear fusion experiments. Being there was also a great excuse to do touristy things with the many exchange students I met, like going up to the arctic circle, and seeing the Northern Lights. However, there is also something very special about life in Sweden with its own set of traditions, like building a Styrofoam boat to ride river after it thaws in spring, being hired as male choir to deliver serenades across the city, or to jump into a freezing lake after a sauna.

Figure 1: Looking forward to the next set of cold water rapids after barely making it through the previous one.

Figure 2: Although desperate for a cool down, this is not the best place. It's called Shark Bay for a reason.

After completing that exchange, I decided that accelerators were cool but not as cool as some of the accelerators in outer space, i.e. supernovae. Unfortunately, I decided that **after** the enrolment deadline at McGill University in Montréal. That was a slight setback to my plan to travel the world. Instead of returning to Groningen, I decided to do a master's in Astronomy in Leiden. Leiden's student culture was so different from Groningen, with a much stronger focus on student's societies. Everyone was a member of something next to being a member of their study association! I decided to join SSR Leiden, and I made some of my best friends there through committees and board memberships, but nevertheless I wasn't done travelling yet.

Although I knew I wanted to do a PhD, I didn't want to start one immediately after finishing my master's in 2015. I wanted to travel for a good few months, but like any recent graduate I was also cash-starved. It so happened that the Computer Science department was in dire need of someone familiar with the Faculty of Science and willing to fill in as a study coordinator and advisor. As soon as I got the e-mail I loaded my CV to the cloud and casually dropped by the departments' business manager. I got lucky and walked out the door with an exploded inbox, and a hundred things to do. I started at the most hectic time. August, the time when one cohort finishes their degree, and a whole new cohort is about to walk in the door. This meant I had a lot

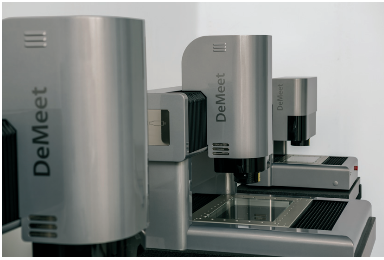
Figure 3: One of many stops along a 3 month trip along the Great Barrier Reef

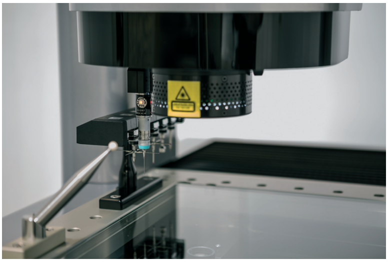
of chaos management to do, and it turns out I like solving problems, not just deep problems about the origin of the first stars in the Universe.

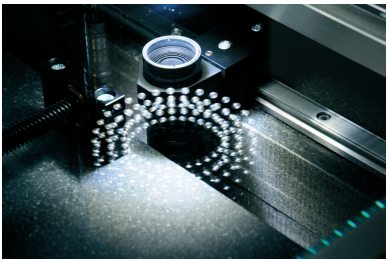
By the time everything calmed down, I was preparing to hand over my job in an orderly fashion and pack my backpack. After e-mailing and talking to about 30 research groups around the world I choose a PhD position in Perth, Australia. Instead of flying directly to Australia, I decided to take the long way round. I started in the Himalaya's in Nepal and from there would take six months to travel to Australia. Along the way I stopped in amazing places across Southeast Asia, and finding some of the best dumplings in the middle of the night. During my 3.5 years in Perth I researched radio telescopes that look for the first stars in the Universe. I worked with the Australian counterpart of the LOFAR telescope, the Murchison Widefield Array (MWA), which is located at the exact location where the largest radio telescope in the world will be built: the Square Kilometre Array (SKA). The west coast of Australia is an amazing place for radio astronomy because it's devoid of people, and therefore electronics that emit radio signals. Perth is after all one of the most isolated cities in the world. It also means there are so many places you can travel to. From the coral reefs and majestic whale sharks in the North, to the endless wineries in the south. But most of all, you can easily see the centre of the Milky Way with your own eyes. Australia's night sky doesn't suffer much from light population. This turns every camping adventure into a little trip into outer space. The number of visible stars gives you the feeling you can touch the universe itself.

After my PhD, I decided that I needed a break from Astronomy (the story of my life) and so I ended up working for an Australian government agency. Hired as a Data Strategy Analyst I helped the federal government make better use of the data it collects from hospitals, doctors, and welfare organisation around the country. The goal of my agency was to use that data and evaluate the health and welfare of Australians, particularly in marginalised populations . Australia is a country that (like many others) is still coming to terms with its history of colonisation. The Aboriginal people of Australia are still suffering from the long-term impacts of colonisation. It was therefore an amazing opportunity to put my brain to good use and contribute to something that would make the world a slightly better place.

As I reached the 5th year of my time in Australia, I was getting eager to continue travel onwards. Anticipating my travel bug, I applied to a postdoc with an awesome professor I met during my PhD. I spent a lot of effort during my PhD to spin up a collaborative project, an excuse to visit the research group so I could leave a good impression. I got lucky, because I am writing this from my office at McGill University in Montréal, Canada. Eight years later than planned, but here we are, nevertheless. Will I stay in research who knows? All I know is there are amazing opportunities that can take you around the world, and you just need to find them.







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