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ASTATINE

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# ATTENTIE

Periodical of S.A. Astatine



General relativity



Introducing the  
13th board



Shod vs barefoot  
running

UTChallenge:  
Eden 365



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We're back.

Back from a long sleepy summer. Due to some unexpected complications edition 11-4 has not reached her deadline. In order to put this unfortunate turn of events behind us however, we've put in extra love and attention into this completely fresh edition.

I especially like how the Eden 365 article turned out. It's a great look into the life of an entrepreneur, with a cool result but also with attention for the insecure sides of trying something new. Written in a light-hearted and fun style it's sure to be a nice read.

Next to freshly written articles there is also a fresh layout. We've attempted to retain the general idea behind it, but to make it look more clean by sticking to the same style throughout the whole magazine. The controversial cutting off of the category titles has also gone to make way for better readability.

I would also like to welcome our new editors, fresh off the press we've added buckets full of talent to our team. Have a great time reading this edition and see you around,

Editor in Chief,  
Jasper Gerritsen



## From the AT staff

At the start of this academic year we welcomed around 70 new 1st year students. After a couple of busy weeks I managed to talk to all of them, thanks to the very strict planning and students coming on time. Fresh(wo) men, I thank you all for that!

A few interesting facts caught my attention: this year we have 13 girls (which is not bad, but I would like to see more!). Two of them hold a black belt (judo, taekwondo) and one is playing rugby (so guys, do not mess with them). One guy plays ultimate frisbee and lots of students seem to be interested in swimming and water polo this year. Maybe we can start an AT water polo team? It is interesting to see how each new generation seems to have different hobbies and a different focus, is this pure chance? A couple of years ago we had many students who played different instruments; we could almost have a symphony orchestra even including a conductor!

At the end of September we had a bachelor's graduation ceremony. Besides the University of Delft (Mechanical Engineering, Aerospace Engineering) and the Erasmus University in Rotterdam (Management) some students continued their education in ETH of Zurich (Applied Physics, Micro and Nano systems), Imperial College in London (Applied Mathematics), University Carlos III in Barcelona (SET), Emlyon Business School in Écully (Management). Well

done, every graduate! I wish you all the best in your master!

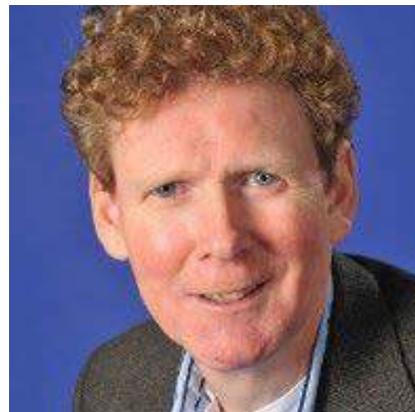
I also would like to take this opportunity to remind all the 2nd year and older students about some major changes in the OER (the education and examination regulations) such as the validity of module part results, the sequence of study units and the abolition of extra repairs for the 2nd year modules.

You can find a good overview of most important changes in the AT Newsletter from September. Also, how you should register for one or more parts of a module can be found in that newsletter or on the AT homepage under transitional rule.

In the beginning of February 2018 we will start with the master information sessions which might help you in your search for the right master's programme. When the results of the second quartile are known I will invite each 2nd year student for a progress meeting, also discussing your search for 'the best' master. For the students in their final year we will organize an information session about Bachelor assignments in coming December.

And to finish off: If you have any questions you are always welcome to drop by or to make an appointment through the online-planner: [tnw.planner.utwente.nl/](http://tnw.planner.utwente.nl/).

## Interview with Ben Betlem



*During the general assembly on the 14th of February 2017 it has been decided that Astatine will also represent the master students from Nanotechnology. A great reason for an interview with their programme director: Ben Betlem.*

### Could you introduce yourself please?

Yes! My name is Ben Betlem and I am the programme director for Chemical Engineering and Nanotechnology. That's my current function outside of being involved in educational committees, but next to that I also still teach courses in the field of process regulation and process dynamics. That is also my original field of expertise.

### So where did you grow up?

-laughs- I'll tell you something about the course of my life, that might be easier. I'll start at the beginning, and we'll do it in chronological order. I was born in Weert, that's in Limburg very close to Brabant, 26 kilometres from Eindhoven. There I had my pri-

mary education and then moved to Brabant. For the last few years of high school, my parents moved abroad and I went to seminary, which is an education to become a priest. But, I must say, barely anyone from my group actually became a priest.

Instead I went to study chemical engineering at the Technische Hogeschool Twente. At the time there were three very narrow set of established programmes: Mechanical/Electrical/Chemical engineering. A fourth one, physics, had just started. In 1969 physics and mathematics joined as well. All students did the same thing in their first year, sort of an AT-like education. There was a ton of math, mechanical and electrical engineering, of course, but also a surprising number of socially engaged courses. During 5.5 years, you had to do 11 societal courses. I must say, even back then students didn't like them. -laughter- Anyway, after that I went to Eindhoven. I spent four years studying process dynamics and process regulation in the physics department of the Technische Hogeschool. Next, I worked as an application engineer, creating software for regulation systems. Before my time, regulatory systems were completely analog, and I found myself right in the middle of the transition to digital systems. Mind you, those computers were very different from computers now. We worked with bits and recognizable memory.

After two years, I went to work for Hoogovens (TATA Steel), in the auto-

## Interview: Ben Betlem

mation of the rolling of metals. After that I was asked to come work here.

### You were really asked by the University?

Yes. There was a vacancy in the group, and back then there was an education for informatics within Chemical Technology. It wasn't unusual for people from the industry to be asked, and besides, I could speak from experience in the field. As a matter of fact, until the 1990's, every professor also had to have a background in the industry. Many of my professors came from Shell, for example. Now it's completely switched around; it's really a rarity if someone has worked in an industry.

### What were your activities here at the UT?

I became UAD by coincidence, because the last programme director of chemical engineering was also programme director for AT, physics, and nanotechnology. (The dean at the time thought you needed some kind of super-director with some coordinators beneath that. But it didn't really work, because that director had to attend all those exam and educational committees; it was just too much. The system only lasted for a year.) The super-director became overworked, and then his studies were all split up. Separate directors were appointed: Jaap Flokstra for AT and nanotechnology, the original director went to do physics and I went to do chemistry.

### Could you tell us something about the TOM model? You were quite involved in the development?

I was certainly involved, but only indirectly with AT. The idea of TOM is from some people near the Rector, who believed that education should be structured very differently, that projects should play a more central role in education, and that there should be thematic modules. The vision was developed centrally, and in a large meeting with all education directors present, the idea was publicized.

Let me mention that every education has given its own twist on the TOM, to make it work for each study. Within chemical technology, we really paved the way, making a blueprint together with the curriculum committee. The coarse layout was made definitive quickly; it was quite easy compared to physics and AT.

Anyway, students were very content about the implementation, which is why I have this decorative plate. We got it from Alembic for the successful implementation of TOM. It isn't just for me but also for the professors.

Well I must say the advantage of chemistry over AT is that it is easier to build a community with teacher mentors. Within AT we tried that too, but it quickly stopped working, because there are teachers from all different fields. For AT, two study advisors were appointed instead, Marijke and Dejana. And now I'd like to talk about nanotechnology for a bit, considering it

falls under Astatine now. It started as an education with very few students, sometimes 3 or 4 students in a year, which is really saddening. I got the assignment from the rector to make that at least 20 and I started to make a new program. We made a curriculum committee and put down something completely different from the old program, which was mostly loose courses. Now, we have three modules, like TOM. Then there is also a practical, partly in the clean room and partly in the group. Next to that we have an internship in the first year. Students can specialize in one of the three directions: one in soft matter and systems, one in molecular, and one for solid state physics. We are only in the second year of the new curriculum, but we really chose for a completely new setup.

### So right now you succeeded in getting at least 20?

Yes, last year we had around 24, now there are about 20, it is fluctuating a bit. We have some students doing two degrees who are noted at a different education, and some internationals. The number of people transferring in from AT varies quite a lot; one year it's barely anyone and the next year it's a reasonable number. AT students go in all kinds of directions, and nowadays they tend to be more interested in engineering than in sciences such as nanotechnology. With my colleague Herbert I have tried to tune this a bit more, so AT students can flow into na-

notechnology more easily.

### Because that was the original idea, right? That AT would be the bachelor for nano?

Well, not really. There were different ideas about it. The group of teachers involved in creating AT was mostly comprised of the same people responsible for establishing nanotechnology. One example is Dave Blank. He wanted a study where future MESA+ers could get a broader base than just physics or chemistry. Miko Elwenspoek was also involved in both educations, he had similar ideas.

AT has become a bit broader in focus than nanotechnology, but both are oriented towards new technology and innovation. I like that the goal is to educate people who know a bit about every field, because they are needed in this technology and others. I told you about my background; I am process technologist in systems and regulation, and I was taught by electrical engineers and physicists. Later I went on to work with software implementation, so I do find that a broad orientation is very important. Myself, I'm much more oriented towards engineering than science, as you've probably noticed.

### You get a lot of insight with that way of thinking, right?

Yeah, you really start to see the parallels between different studies. AT was kind of born out of physics and chemistry. There was one year where we

### Interview: Ben Betlem

tried to let physics and chemistry have a shared first year. That was a very fun course; we tried to integrate the two and we showed that the math was the same for both fields of study, and that you could approach the systems in the same way. The course finally perished under TOM but it existed for a very long time.

Before AT there was actually first a different study, called Technische Wetenschappen for a short time. Herbert, Jeroen, and I gave this common first year some shape, and eventually that's where AT came from. There were only two students subscribed for this study and they didn't stay within AT. We got a license, though. It took some time before the name changed to Advanced Technology, but you might know the history better than me.

#### **I think thermodynamics is shared now.**

Yes, back then, thermodynamics, math and materials science were also shared, which was hard to digest for the physicists. However, later a lot more mechanical engineering and business got added to AT, and that really made a large change, I shouldn't hide that. It's not like AT is just a combination of chemistry and physics, that's absolutely not true.

I must say the UT is a unique place where that can happen. For example, in Delft and Groningen, chemical technology is in one building, but at the UT it's split among four buildings. We are very spread across the campus per

theme and specialization. Multidisciplinary ordering-- I find that fantastic, we only have that in Twente.

#### **What about your hobby's?**

I used to run a lot, I did that my whole life until I was halfway through my fifties and got a little too enthusiastic for my age. I do miss it a bit, and I do still walk. Last year I was very busy though, and until September I was also in the Faculty Council and that really meant that I didn't have much free time. Also, on Saturdays and Sundays, I work a lot and now I have the visitation for chemical technology, so it stays pretty busy.

#### **Who is your favorite scientist?**

Constantijn Huijgens, because he is so broad. Also, he's a Dutchman. Huijgens is scientist and technician, really very broad. Technology is sometimes underestimated by scientists, but it is very important because it opens up new possibilities for science. Huijgens is an excellent example of that.

Just yesterday, the Nobel Prize for chemistry was awarded to the cryogenic electron microscope, for its possibilities for mapping virus proteins. The virus causing a cold can now be mapped, and this is because of the technology, not only because of that scientist! Thanks to technology.

During our association's constitution drink of this academic year we have had the chance to congratulate our newest board, the 13th board of S.A. Astatine. Even though you've probably already met them in person I will provide a little refresher to you. In constitutional order we have Roelof Jan Velthuijs, Niels Adams, Daniël van Dijk, Famke Sprakel, Elise de Groote and Lennart Bouma.

As Pedel in Chief, together with my fellow old board colleague Cham Busstraan, I have had the honour to oversee the progress of this event. It has been a throat-killing yet rewarding experience to me, especially as member of the previous board of our association. It felt as if it were yesterday that we stood there, being congratulated by all our brother and sister associations. To see this pleasure in the eyes of my successors made me feel proud to have been part of it.

There's more to it than just the board being congratulated. It is an event for the entire association. And I'm not only talking about the free drinks,

which are of course great. I'm aiming at our Pedellen. The Pedellen, of whom many were freshmen, experienced one of the finer aspects of what being a student means to you. While they were pushing, while they were pulling and while they were shouting back at the guests, they experienced brotherhood. Standing there together as a team.

And this is so important. You have a common goal to defend what is dear to you, you work together and help each other in times of need. In my view this is what an association is all about, being together, sharing the best and the worst, but always looking back on it with a smile. Even though we struggled and lost the Pedel staff and most of our guestbook, we stood there together, and we smile back. We smile back together.

I want to wish the board and the association the best year they can imagine!

Op de hoogste!



# Introducing the board

## 13th Board - Chairman

Hey there, I'm Roelof Jan Velthuijs, I'm 20 years old and I will be the chairman of Astatine during the coming year. I'm from Groningen, which is an awesome city in the north. I'm half French as well, so you can come speak French to me if you want.

When I came here to Enschede I did not really know what would happen during my study period, but I quickly found out how much fun it is to go outside and do new stuff.

Having awesome people around you to hang out with is something I deem very important next to my study and I found such people at Astatine. Sometimes it is just to chill or go out in the city, but there are a lot of other activities to do like laser gaming or water skiing.

I have been a member of Euros, the rowing association, and have played some soccer. At the moment, I'm still looking into a new sport to do, but that's the awesome thing about studying; there is so much to discover. Next to that, I like watching movies with my house or having a drink with my friends.

I have done a few committees within Astatine, which can result in some amazing experiences. I found it so much fun that I decided to do a board year. It's awesome that I got this opportunity and I hope to learn a lot from it.

I'm really looking forward to the year and hope you will find your way around the university and Astatine! Swing by the Astatine room, see you all there!

Op de hoogste!

## 13th Board - Secretary

Beloved Astatine members, I am Niels Adams and I will be your secretary the coming year. Before my life started at the UT I lived in Steenwijk, which is close to Meppel in Overijssel, for most of my life.

Now that I am here in Enschede, I have picked up the new hobby of prom dancing, and kept my old hobby of playing trumpet at an orchestra, I have already been doing this for 15 years! The orchestra I nowadays play in is the university's very own orchestra SHOT. So as you might have guessed I really like the arts that connect to music.

Of course I am also active in Astatine, I did the ATtraxCie and the Kit-Cat. These things were very exciting to organize with all my fellow committee members. I am convinced the KitCat is the best committee in Astatine, because it taught me a lot of how the university works inter-

nally, and how to work with people. After all these cool experiences in Astatine, I came to the conclusion that I wanted to do even more for the association. This is why I decided to apply for the board as secretary. I chose for secretary, because it seemed the most fun for me and weirdly enough I like making minutes. Hopefully I can now do my part in making people have a amazing time in Astatine as I have (or more of course!), and help the students where needed. We are hopefully are going to make Astatine even better than it already is.

I hope you now know some more about me! Together with my fellow boardmembers we will do everything to make it an amazing year. If you want to go us to know more, drop by in the boardroom we will probably be there!

Op de hoogste!

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Roelof Jan Velthuijs

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Niels Adams

## 13th Board - Treasurer

Hello Astatine members!

My name is Daniël van Dijk and I am happy to tell you that I'll be the treasurer this coming year.

A bit about myself: I am 20 years old and lived in Meppel, Drenthe for most of my life which is not that interesting. Besides that I love playing all kinds of sports, but at the moment I mostly play football and go on the activities the amazing SportCo organises. I am a quite organised and reliable person who hates being late. In short, I'm a very exciting person.

During my time at the University of Twente I have greatly developed myself, which was made possible by the many things that can be done around here. Taking an active stance

within the association life greatly helps too. Joining the SportCo and helping organise our participation in the batavierenrace has been a great experience for me.

As this year's treasurer I will manage the money within Astatine. I applied for this function because it is a responsible task that I am happy to take on, I also happen to like numbers, which helps too :). I hope that, together with my board members, we can keep everybody happy and make it a fun year full of amazing activities.

Op de hoogstel!

## 13th Board - Educational Affairs

Hello everyone, allow me to introduce myself. I am Famke Sprakel, 19 years old and as of writing this, a second-year AT student. Next year I hope to fulfil the role of commissioner of educational affairs in the board of Astatine. Some of you might already know me from the committees I've been part of, or you have seen me as a student assistant. I had a lot of fun organizing the Faculty Kick-In last year and I hope to put the experience I gained here to good use during my board year.

I grew up in the lovely town called Huizen, near Hilversum. After having lived there during the first 17 years of my life, I decided it was time to go back to my parent's roots and move to Twente to study Advanced Technology at the University.

As an Advanced Technology student, free time is hard to find, yet I do a lot of fun activities outside the university. I play volleyball and I do fitness (a necessary evil). Besides these sport activities I also enjoy watching series and reading. But let's get back to my being the current candidate of educational affairs.

I always liked being active at Astatine, but the idea of wanting to be a board member didn't make its way into my head until well into the second year. I have quite some plans for the coming year and I'm looking forward to my board year as the commissioner of educational affairs. Hence, if you ever have any questions, suggestions or just want to talk about the study, don't hesitate to come talk to me.

Op de hoogstel!

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Daniël van Dijk

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Famke Sprakel

## 13th Board - External Affairs

Dear members of Astatine,  
My name is Elise de Groot and I am currently very happy in the role of External Affairs of Astatine. Before studying AT I lived my life in the city Emmen, the one and only place that has the best zoo in the Netherlands. I have been living in a very nice and active house on campus ever since I started studying here.

The time I spent here at the UT so far was wonderful and I am ready to seek even more amazing opportunities. I personally love to travel and try out new things. The student days are the best time to gain new experiences. I absolutely love to try out new and weird things or see what is possible when going to new places and meeting new people. I am always up for food that I have never tasted before and travelling new roads that I do not know. For those who know me well the fact that this curiosity goes well with getting lost is no surprise.

The main reason for eventually deciding to apply for the board was the happiness you feel around Astatine. Every time I walk on the 7th floor of the Horst there is always someone making me smile and I cannot wait to give back to this great community. Within Astatine I have found amazing chances to travel around. In my first and second year I have joined the BuCom and I also joined the study trip.

As the External Relations I would like to keep the great atmosphere and extend the different type of opportunities and experiences. Hopefully I can make sure that every time each of you go to the 7th floor you will get to smile. I am looking forward to next year and all the great stuff that is awaiting. Hopefully I can contribute to providing amazing opportunities for you as well!

Op de hoogste!

## 13th Board - Internal Affairs

Hello everyone,  
My name is Lennart Bouma and I am going to be taking care of the Internal Affairs of Astatine. I am 20 years old and I went to high school in Groningen.

I am an active person and do a lot of different things. Like organizing parties doing drinks at Euros and working for Pre-U. But it would be weird if I didn't mention Astatine because I am also a lot of the time present there.

Last year I was in the Bucom committee and the year before that in the Nicat. Both were super fun to organize and I had a great time. The Bucom this year was a great success and it will be one of the weeks that I will never forget in my life. Because this year was so much fun at Astatine I decided to apply for the 13th board.

Coming year I will be the internal relations of Astatine. Internal relations is a function that fits me really well because I like to talk to people and support them if they have crazy ideas. So during the year you probably are going to see me a lot since I will be around most of the time. If there is anything you want to ask me or have a nice idea or something totally different you can always come by.

Hope to see you next year!

Op de hoogste!

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Elise de Groot

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Lennart Bouma

## Shod vs barefoot running

As a novice runner I'm always interested to follow developments in the field of running technique, especially when it touches on my field of study a bit. Therefore on today's episode of "casual literature study" we'll have a look at the kinematics of running, specifically focusing on shod vs barefoot running and heel striking vs forefoot striking. Whether barefoot running prevents injuries has been a hot topic of speculation among lovers of pseudoscience and the like. I will try to illustrate the effects of barefoot vs shod running and form a very anti-climactic conclusion on this question of injury rates.

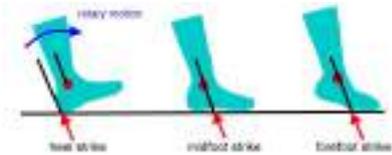


Figure 1: Three different foot strike patterns.

### Types of strikes

First off let's take a look at some common styles of landing the foot upon impact. Generally considered are three distinct ways of landing the foot, the most popular one being the heel strike. Here the foot lands first on the heel and then gradually rotates to leave the ground with only the toes touching. This is by far the most common way of running, employed by around 75% of shod runners.



Figure 2: The location of maximum pressure for the heel strike simply moves from the back of the foot towards the front.

Secondly there is the midfoot strike, used by around 20% of shod runners is the midfoot strike. This is a strike where the point of impact is just before the heel in the middle of the foot. The foot strikes the ground in a horizontal position, it is a middle ground between heel strike and forefoot strike.

Finally there is the forefoot strike, here the foot lands on the forefoot with its center of impact just ahead of the middle of the foot. The load is then transferred to the heel and finally to the toes as the foot is lifted off the ground again. This technique is very rarely used by shod runners, but is quite common in barefoot runners.



Figure 3: The location of maximum pressure for the forefoot strike moves from the middle to the back and finally to the front.

### Impact transients

From the force graphs in figures 4 and 5 below it becomes clear that the heel strike has an extra peak upon impact, whereas for the forefoot strike this is absent. The steep rise in the first peak suggests it might be important for predicting injury, but more details on this will follow later. An impact of more than twice your bodyweight within 50 milliseconds is not going to be as easily absorbed as the more gradual one shown in the forefoot strike graph on the right.

So from glancing at these graphs we see that forefoot striking is one way to get rid of this intense impact, but there is another thing you could try. Wearing shoes seems to work quite

alright too. Running shoes generally make the heel strike less uncomfortable. The impact is spread out over a larger amount of time as well as a larger area of the foot.

Typically the idea behind barefoot running is that it will naturally change your foot strike pattern towards a forefoot strike and prevent that steep peak upon first impact. At first sight it seems this is a more natural way of running and might prevent injuries, but this is really not so obvious. In fact we can not even confirm this first assumption, higher impact force on your legs might actually reduce your risk of injuring them!

This remains unclear until a large prospective study is done. There is actually already a candidate study for this: in 2016 Altman and Davis compared 200 experienced runners and found no statistical difference in injury rate between shod and barefoot runners. However the barefoot runners ran 24 km/week while the shod runners did 41 km/week. So, yes the type of injuries is most likely different between running types, but barefoot running is not a miracle for preventing injuries and for the injury rate we need larger and better studies still.

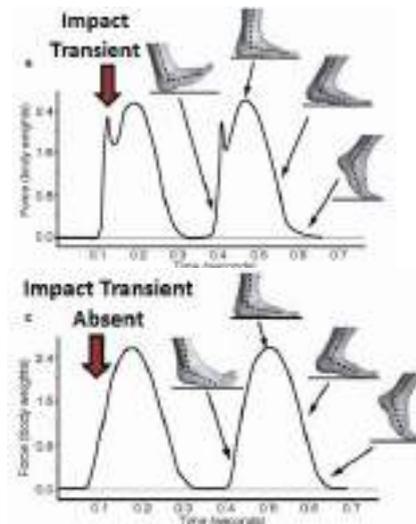


Figure 4 and 5: Force as function of time for barefoot running for heel strike and forefoot strike respectively. [Lieberman DE, Venkadesan M, Werbel WA, et al. 2010]

## Tiny Astatine News

### Kick-in

The kick-in this year was as it was last year. A total blast. The first years were awesome, the parents were late or absent and there was a lot of beer. It set the bar for the remainder of their year very high already, making the upcoming kick-in of 2018 a promising prospect.



### Cooking workshop

The cooking workshop was a brand-new activity, organized by the IMCo and the EduCo, to bring teachers and students together and have some fun. We went to De Kookklas, where they had many small kitchens. We got a workshop in making Biryani masala and Prapu, two South-Asian dishes. Everyone tried their best to make the best dish and together we had a feast afterwards. Off to the next cooking workshop!

### Thales excursion

On the 16th of September, Astatine went to Thales in Hengelo for an excursion. During this excursion, participants got an impression of how it is to work for Thales. A presentation was given about the control system on navy ships. It was a great excursion, but that is not all. Afterwards, we heard that Astatine was the association with the most student participants. This meant we won 2.500 euros to use in future events. Sweet!



### General assembly

The 34th general assembly took place on the 7th of September. During the general assembly, it was decided to change the name of our association. No more S.V.A.T Astatine but S.A. Astatine from now on. Furthermore, the 12th board laid down their hard work as they were sworn out and the 13th board was swung in. This all was celebrated by some (or maybe a lot) drinks in the Vestingbar.

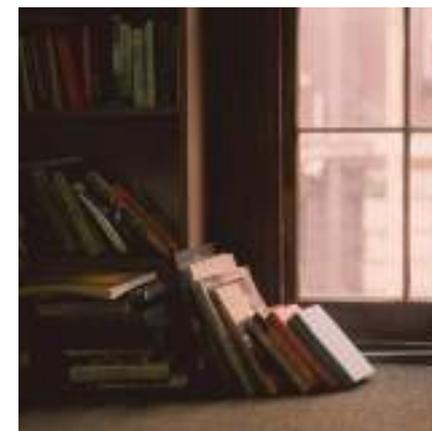


### Study trip students return

Every two years the SSA (Stichting Studiereis Astatine) organises a trip mainly visiting companies and universities. The traveling is funded mainly through case studies carried out by the participants. After making their way through the land of the free they went on to check out the technology in Canada. They didn't forget the most important part of traveling though: coming home, so if you run into any of them make sure to ask them about their experience!

### Astatine Book Club

The Astatine Book Club is a member's initiative project involving reading and discussing books around a central theme. The inaugural meeting was on the 18th of October, and the first chosen theme was science-fiction. Potential new members are still encouraged to join (especially first years).





## AT Afterlife

11 February 2016 late evening, while scrolling through my Facebook feed, I found a friend's post saying that the website of Physics review letter had crashed. This piqued my curiosity: something big must have happened in physics. A google search revealed the news of LIGO-Virgo's first detection of gravitational waves. Hearing this news cleared up a small personal mystery. I was supposed to visit NIKHEF the very same day to assist in a workshop on interferometers. However, a week before, Prof. Bob van Eijk at UT, who appointed me for the task, told me that the workshop was cancelled. Being asked about the reason he replied, 'It's confidential, but stay tuned!' Just having a story about yourself related to one of the biggest historic events in the history of Physics was exciting. Fast forward one year, and I was sitting in front of Prof. Jo van de Brand, (currently spokesperson of Virgo) for a job interview. And now, I am a part of this historic research.

When I was about to graduate from AT, I barely knew what I would be doing after graduating. In the rush of academic adrenaline, I finished my bachelor seven months too early without a real plan about the effective utilization of the time I saved. Looking for a job is the customary option taken by a graduate, so I did the same. But the biggest question was, who is going to give me a job

with just a Bachelor degree, in AT of all things where we are the Jack of all trades but Master of none. I spammed every contact of mine who can be a potential employer and Prof. Bob's reference got me the job interview. The first question in the interview was, 'Do you know how our interferometer works?' even though I did know, but even if I didn't, who cares? I was trained by PBL, so if I didn't know then, I would figure it out by the subsequent evening. It didn't take long to realise that I would be moving out of Enschede, probably forever. I never expected I would ever mind moving out from Enschede to Amsterdam, but what can be more surprising than your emotions?

Luckily, the work turned out to be more fun than I expected. I have been assigned to an R&D project and am working on it on my own. This comes with huge independence and responsibility. The gravitational wave detectors are essentially 4 Km long interferometers. As you might expect, the laser beams must be perfectly aligned up to sub nano-radian precision. For the past twenty years, we have been using a technique based on four segment (Quadrant) photodiodes for alignment sensing. I am assigned to explore a better alternative to this, if any exists. Taking up the responsibility of such a project is always a gamble. Successful completion of the same can bring

you a lot of fame, while you will not be recognized at all if you can't finish it. Either way, it's fun and a great learning experience therefore I picked it up. Working at NIKHEF gave me the excellent work culture of this scientific world. Irrespective of their age, gender, nationality and culture, everyone here works with an equal passion. It's beautiful!

In the beginning, not having friends and a social circle in Amsterdam made me spend a lot of weekends in Enschede. I tried getting adjusted to the city, it didn't work. It was only when I stopped trying that I started enjoying myself, and my love for this city started evolving. It's different to live in a big city, and it can be very harsh on you sometimes. I had to suffer a month of homelessness, but guess what, soon my living arrangements became fancy. I lived on a boat right in the centre of the Amsterdam during the month of my homelessness. Sitting on the deck with a glass of wine made all tourists jealous of my lifestyle (just bragging!). It's difficult to find friends

in a big city, specifically when you are not a student or a part of a University. But soon I realized it had a different thing to offer. I started befriending tourists while attending and volunteering in some creative events happening around the city. It's not the same, but it was nice nevertheless. For the past few months, I made several friends scattered across the globe and I'm loving it. I have two more months to enjoy this city before I would move out and start my Masters. Meanwhile, I am trying hard to finish my project up to some conclusive stage and to find a good balance of professional and personal life. Normally you get to explore this when you start working after your Masters. But thanks to my layover period, I can access these experiences already. I am aiming to spend my life in research and academics. Therefore, it's great that even before starting my Masters I already have an idea how it would look like in future.

So far, I can only say: It's just a beginning, there is a long way to go.



# General relativity

*The strange features of Einsteinian Gravity*

# Physics

## General relativity

Everyone understands the ideas behind Newtonian Gravity and the famous inverse square law behind it, predicting the attraction between celestial bodies. Okay, you are right, not everyone. But flat-earthers ignored, have you ever wondered about General Relativity and how Einstein revolutionised our understanding of gravity beyond Newton's theory? A quick google search may have gotten you deep into the tedious realm of tensor maths already. However, mathematics is also a language, so it should be possible to translate general relativity into a more intuitive one, even if it's just the fundamentals. I will try to do just that, showing you the weirdness of one aspect belonging to this well confirmed theory. Let us get to it!

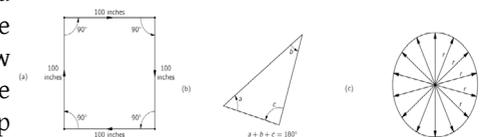
Does earth accelerate upwards, or do we fall downwards? Probably not a question you ever asked yourself. This is not an attempt to justify flat-earth society claims, but a result of General Relativity!

Let's recap on the well-known scene of 18th Century England: Newton is sitting under a tree, all the time being pushed up by the Earth accelerating upwards below him, until suddenly an apple's stem cannot hold it to the accelerating tree anymore and loses contact. The apple now stays at a constant velocity, while Newton's head quickly catches up to bump into it... at least that is how

Einstein might have described it. But how can one think that earth accelerates upwards? It is round, so it would have to accelerate into all directions simultaneously, right? In order to explain, I will introduce two concepts from General Relativity: Curved space-time and the principle of equivalence. Do not worry, we will not look at that mathematical monster hiding in the depths of this theory, which even took Einstein and a fellow mathematician a good four years to master [1].

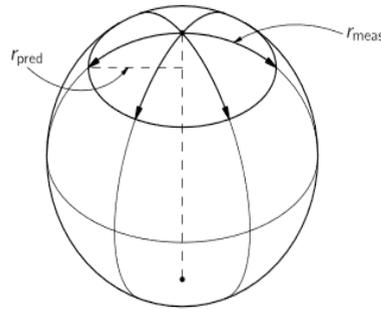
How to imagine four dimensional space-time? Going deeper, how to imagine it curved? We will use an analogy in two dimensions, be it to comfort our sphere-doubting friends.

Take a sheet of paper and draw a few shapes on it. Squares, triangles and circles all obey a certain set of rules: the square is a closed shape, the triangle's angles sum up to  $180^\circ$  and the circumference of a circle is  $2\pi r$ . [2] These rules stem from what is called Euclidean Geometry, which works well as long as everything is flat. However, we will now bend our surfaces to see what space-time is doing and go into Riemannian Geometry.

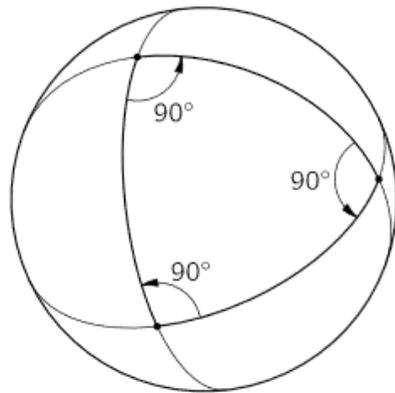


## General relativity

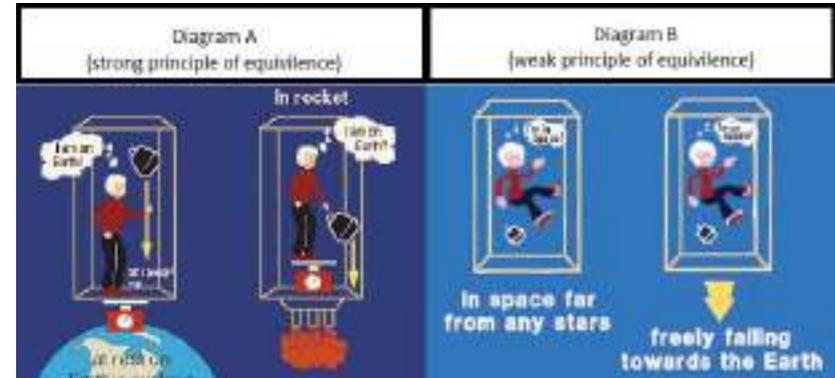
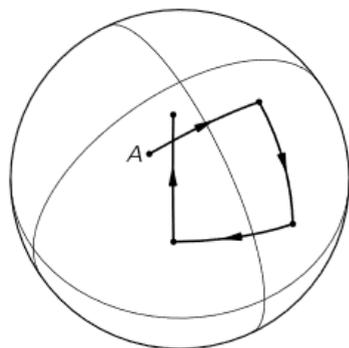
Let's take a three dimensional object, e.g. a ball, and draw the mentioned shapes on its surface: This surface is clearly not flat, so the shapes on it do not obey the Euclidean Geometry of a two-dimensional object. The square is not closed anymore, the circles radius is bigger than we expect from walking around its circumference and triangles with 3 right angles are possible. [2]



We can now take a look at curved space-time! Bodies curve space-time stronger, the more mass they have (For the first-years: Proof by intimidation will be introduced in Module 04). This leads to heavy bodies having a bigger radius than they should have, analogous to the way shown in Figure 2. Only with a 3 dimensional earth on curved 4 dimensional space-time, instead of a 2D circle on a curved 3 dimensional ball. That amounts to half a kilometre for the sun, and a whopping 1.5 millimetres for the earth [2].



Not a lot, for sure, but how does this justify earth's accelerating "upwards"? As promised, I am going to introduce one last axiom of general relativity: The principle of equivalence. It states that a person in a rocket accelerating with 1 G in free space cannot tell if said rocket is in free space or if it stands still on earth without looking out of the window. The accelerating frame of reference and the gravitational frame of reference are equivalent!



So, can we say that "falling objects" are actually the ones not accelerating? What about the fact that objects with constant velocity should not accelerate with respect to each other? Here, the bending of space-time comes back into play: the "falling" apple has a straight path in space-time. So, it is not speeding up with respect to other falling objects and objects moving constantly in free space!

I was sceptical of this too, at first... What about an orange falling in Australia? It clearly moves in the opposite direction of the one triggering Newton's greatest success, does it not?

But with this way of thinking we make a mistake: We cannot span a three-dimensional reference frame over the entirety of earth, and compare apples to oranges, without losing consistency. Looking at our small patch of grass, on which Newton's head bumps into the apple, is

all there is to do without making mistakes with our choice of reference systems. Space-time is bent all around our planet, and it is this four-dimensional entity in which the apples are at constant speed, while we, standing still on earth, follow curved lines of accelerating objects through it.

General relativity does not just throw our conventions over board because it is able to. Like the discovery of Earth's curvature, it shows us that we cannot always trust our senses and that there is more to reality than we think at a first glance.

[1] *Lost in the Tensors: Einstein's Struggles with Covariance Principles, 1912-1916*; John Earman, Clark Glymour; 1978; DOI:10.1016/0039-3681(78)90008-0

[2] *The Feynman lectures on physics*; Richard P. Feynman, Robert B. Leighton, and Matthew Sands, Addison-Wesley, Volume I, II (1964); Volume III (1965); R.B. Bird; DOI: 10.1002/aic.690100602

## Nicat

A lot of study associations have two introduction days where they go to a location with all the new first years. In these days a lot of fun activities are done and the first years have a good opportunity to get to know each other. Our association doesn't have that and we stay on the university on those days. But we have something better, we have the NICAT.

The NICAT is a committee that organizes an awesome weekend for all the first years. This year we went to a farm somewhere near Ootmarsum. As usual everyone went on the bike which was a long trip. It was really rainy and everybody arrived completely soaked. But this didn't ruin the fun, after changing clothes the evening program started which included a fun pubquiz, a lot of socializing and playing games. The evening took long and because of that the next morning was a bit quieter. Luckily after breakfast people were fully awake again and the program could continue. Unfortunately it rained too hard for the outdoor activities. But it was a nice day and in the evening the traditional cantus took place. For the cantus not only first years join but also a lot of higher years traveled to be at this event. For them a separate location on the same farm was hired so that they all had a place to sleep after the cantus.

The cantus was a great success. Everyone sang their songs with full commitment and a lot of strange ways to drink were introduced. After the cantus the mood was very good and the evening continued while listening to some party songs from the music installation that was way too big for such a location. But first some cleaning up had to be done since a cantus can get messy.

The next morning was the last breakfast. Everything had to be cleaned and everybody had to pack their stuff. Around 13:00 the trip back to the campus started. Everything went smooth except for one broken bike but that could easily be solved. I am looking back on a very awesome weekend and I think I speak for most of the participants.

Thank you NICAT!



## How to write a bad text

*When trying to find out the optimal way of doing something it is often difficult to describe, because there is such a wide variety of complex solutions. However, outlining the opposite, the absolute worst course of action is usually more straightforward, glaringly obvious even. Because of its simplicity, the bad can be quite insightful to show the flaws in your current version of good. So to learn how to get our point across, let's ask ourselves: how to write a bad text?*

### Do not provide context

To make sure your knowledge does not reach the reader you must first make sure not to give any background information. Any mention of history or common practices in the topic of writing might give them clues as to what the hell you're on about, so stay far away from that.

### Do not keep your reader in mind

When you want to write the worst words in history, you must think of yourself, and only yourself. Draw up a wall between you and the reader, for they are not deserving of your precious advice, in fact they are your enemy. Assume the audience already knows everything you know, so in fact there is not even a reason to write in the first place. Might as well leave the page blank in that case, but you write something anyway, just to mess with them.

### Zoom in on details

Your reader wants to know the general idea you're putting forward, so to divert their attention you will have to shift the emphasis to the unimportant parts. Does your topic have obscurities nobody cares about? Write about that! Use the redundant information to save yourself from having to write anything of actual substance.

### Be especially vague

One of the most common mistakes for aspiring authors of appalling arguments is to be direct. Of course you could just say what you mean, but that would be showing weakness. Why be so straightforward when you could lead your reader astray by drifting off about related areas of interest, by the way now that I mention it, another important way of being vague is using very long sentences which just won't end and also using a lot of commas is helpful especially in, the wrong places to give that poor reader a sense of confusion oh man does this editor have no shame, even referencing himself in the third person or a lack of commas also works to really help beat out that pesky sentence structure.

### Do not write a conclusion

## UTChallenge: Eden 365

When asked what I do, I usually avoid sugarcoating it: “I make systems that throw small amounts of salt water at plants every now and then, subject them to pink light, and try to control every aspect of their lives while telling myself that I’m doing it for the future survival of the human species.” That is being a control freak on a whole new level. I hereby present to you a real-time case study of a guy with no extraordinary qualities, bar discipline and

a thick-layered bubble of disillusionment wrapped around him at all times, ending up taking a break from his studies and hoping to pursue the life of an entrepreneur without a real solid understanding about anything in life. With that said, I do think some things are worth mentioning about my experiences while working on a project full time, especially ones that relate to “expectations vs reality”, and my role in the project as someone coming from a broad study.

*System module (left) and dashboard design (below)*

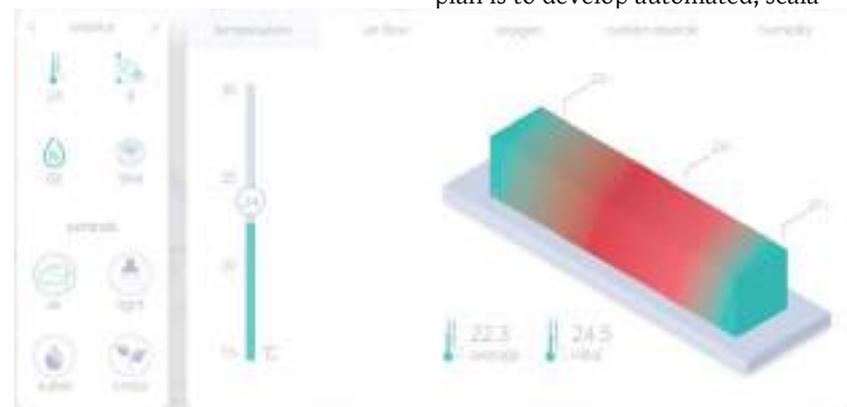
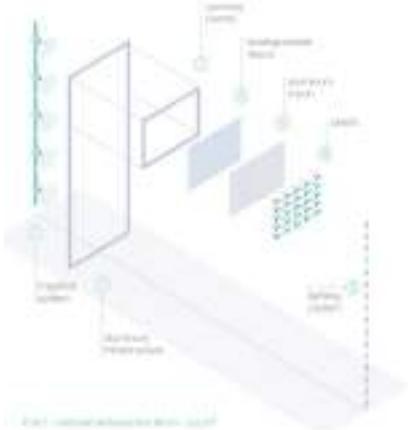
Cutout from a rollup banner we made to explain to the general public how our system works – one module of a total of 36 to be placed in the container

If the initial rough explanation of what I do was not clear enough, then let me try again. Eden 365’s plan is to develop automated, scala-

ble, vertical urban farming systems using an irrigation method called aeroponics, which was developed by NASA in the 70’s to investigate its potential use in zero g environments and for space colonization. Contrary to hydroponics, which is growing plants with their root systems suspended in an oxygenated aqueous nutrient solution, aeroponics grows plants with their root systems suspended in air and misted with a very fine mist (particle size 10 – 50µ m) of the same nutrient solution. This method decreases the amount of water and nutrients used per plant, increases the rhizosphere exposure to an oxygen rich environment which results in a 10-15% increase in the rate of growth compared to hydroponics, and helps preventing pathogen formation. It’s basically hydroponics on steroids. In addition, it also increases the predictability of the pH and electrical conductivity (EC) values of the solutions used on plants. This is significant, because the different nutrient salt ion absorption levels (12 salts that include all the elements the plant needs) vary both in time and plant development stage. This means that a preprepared solution in a hydroponic setup would change the N:P:K:Mg:Fe:etc. ratio to a sub-optimal level, and it’s inconvenient to compensate for the lack of individual elements by dosing in the specific amount needed to restore the balance, leaving room for error.

An aeroponic system tackles this with a different approach: constantly spray the same, premixed solution on the plants so that the plant always has enough of everything, but doesn’t go into a nutrient lockout. This can be a result of overexposure to certain elements (as well as overly high/low pH levels) and, as the word suggests, lock any further nutrient uptake until the plant senses that it can go about its normal activities again. There is, of course, a Goldilocks range, which can be achieved with a lot of fine-tuning of the system and absorbing a lot of research on which recipes are based.

Through a series of events involving my participation in the events organized by the student entrepreneur association Hardstart, I met my current partner Marius, who was the president of the Dutch Student Investment Fund at the time. His skillset includes excellent business and marketing skills and graphic design. After becoming interested in my idea, it didn’t take long before he found someone interested in hearing our pitch. In January we pitched to one of the CEOs of the startup accelerator Spinnerij Oosterveld. With nearly 6 pitches over the course of 5 months, we managed to bring the board of investors on board with our idea. The “fake it till you make it” mantra worked for us like a charm, and it is not as uncommon as one would expect.



## UTChallenge: Eden 365

By that time Marius had gotten Christiaan, the third Eden 365 team member, interested as well. He is an excellent programmer and an industrial designer. These 5 months felt like an eternity, as nothing conclusive was coming out of the deal. In March, Marius dumped 300 euros into buying tools and materials for building a small scale prototype. Equipped with one PVC pipe, some cheap sprinkler nozzles from Karwei, a 10 bar espresso machine pump bought from a spare parts shop online, a lot of duct tape, hot glue, “borrowed” plastic tubes from the Design Lab, and 1L of some random tomato fertilizer that smelled like Ketjap and looked like the darkest petroleum ever seen. This is what the result looked like:

Give me one good reason why this totally 100% legit setup would not work #ISOstandards.

This did give us a feeling of immortality though. Being able to sell an idea with a DIY masterpiece like this standing behind your back induces a kind of a self-sustaining cycle of motivation and confidence, and a desire to make this thing happen by any means possible, regardless of how long it takes. This was module 7 by the way, so while my course-mates were delving into the epic world of electromagnetism taught by the famous squiggly line creator Prof. Feynman, I was duct taping and hotgluing misting nozzles to a PVC pipe, wrapping control electronics in an IKEA ziplock bag and putting it next to a high pressure pump, and stripping AH-bought parsley from the soil it was peacefully growing in.



The first summer months passed without much progress due to budget restrictions, but it did give us time to redesign everything and include 3D printed parts.

The transition from store-bought parts to designing and 3D printing better fitting ones improved the design dramatically. However, the moment you realize that the only limitations are your ingenuity, imagination and 3D design skills, first a feeling of emancipation hits, then a rapid curling up in a fetal position upon realizing that you're now responsible for every shape and dimension of the parts you design. At this moment you realize how personal this aspect of your job can be – you're showing off the combined results of your imagination, modelling skills and understanding of the materials and physics of the problems you're trying to solve. The trick is to realize that anyone who sees the product and shrugs off the design as poorly structured and full of flaws is an asset you can make use of, to learn from, not an enemy or someone you should hide from. Confronting one's incompetence is

dreadful, but once acknowledged and dealt with, it kickstarts growth more than anything.

We spent the month of August exercising the freedom that 3D printing brings, and slowly started the assembly of one third of the full container system that we had promised to have ready by the 28th September – the official opening of the Spinnerij Oosterveld. For the growing medium we had chosen burlap, as it is cheap and compostable. Little did we know that burlap is prone to mold if over-moistened and improperly ventilated. Who would have thought, right?

What we ended up having was a semi functional, loud, half-naked system placed in the middle of the 12m container, with the stench of square meters of oversoaked and moldy burlap penetrating everyone's nostrils at a 100m radius. We did not take many pictures because we were not necessarily proud of how it looked, even though we managed to get everything we wanted to work properly, and even had designed an app with a dashboard that we could use to turn everything on



# Nostalgia

## UTChallenge: Eden 365

and off wirelessly at the push of a button. It worked, but it was bare bones and not very impressive from an aesthetic perspective (tip: make things pretty, not only functional):



The final thing in the container is a combination of the following modules: a skeleton frame with plastic clamps attached on the vertical bars to attach the panels; the panels themselves (64x50cm); the irrigation mechanism: fine mist nozzles + high pressure pump + 3D printer-like automated sliding mechanism to irrigate everything with only one tube

Despite the looks/smell of the system, we managed to pull off several successful presentations, even landing ourselves a gig at the HORECAVA trade show, where we will be showcasing a custom-made setup

for the event. Not a bad end to what initially seemed to be a total disaster. This also made us realize the need for visual aids to paint a better picture of what is being built. It can feel redundant and counterproductive to do it. But if someone comes and asks what you are up to before you have finished the product, you will have pretty much nothing to show and you will end up trying to explain everything with hand gestures, some 3D prints of separate parts, and a semi-built setup that looks less impressive than a kid's drawing.

Doing this is definitely a different kind of learning, as it does not feel like the quantifiable learning process I have been used to while in school. However, I have learnt to appreciate it for what it is, and what it really takes to be in charge of every single aspect of a product, from conceptualizing to selling. You can not get anywhere with just an awesome idea and some cash. A team must have a good distribution of the different team roles we have heard about. Persuasion and presentation skills come a long way. Many, many small things contribute to the success of a project, and I have loved every second of the experience, and will cherish the knowledge I have accumulated over this short period of time for years to come.

## Bucom 2017

*Each year the BuCom takes a trip to a region somewhat near, within reach by bus or ship, with cool tech and bargain beer.*

*This year our harrowed destination took us 'cross the Channel wide. We made a circumnavigation of Scotland and England's border side.*

*Onboard the barge across the sea the views were mighty fine. This balanced the calamity of expensive food and wine.*

*And, then, after a meal, right on to Edinburgh did we go. Don't end it "burg". That's simply wrong. The locals say it "bro."*



*Monday morn we left by bus and to Ijmuiden rode. There Tata steel invited us to tour their grand abode.*

*Within its walls in a dusty hall huge sheets of steel are pressed. 11'th in the world, it's small. But the quality is best.*

*At Amazon, we saw their hub Of tech and innovation. This snappy office and social club was our first Scottish destination.*

*The University of Edinburgh was worldwide renowned. They taught us how the people stow their energy world-round.*



## Bucom 2017

## Magic

*The city was a stunning one  
with towers and old sites.  
Although our time was quickly done  
we could have stayed an extra night.*

*With Erik as our driver,  
we drove to Glasgow next.  
The man is a survivor  
of every single escalatie mix.*

*Manchester was in mourning;  
there'd been a shooting days before.  
There were flowers and wreaths adorning  
the square. You couldn't see the floor.*

*Bede Gaming writes the code  
for betting games, online.  
We spoke about their moral code,  
then drove to Newcastle Upon Tine.*



*Glasgow has a lot of spunk.  
The history there is real.  
For breakfast, still a little drunk,  
we had a truly Scottish meal.*

*Cashmaster counts coins and such  
in an efficient weigh .  
The effort they put in was much.  
Their cookies made our day.*

*Then, to the District of the Lake,  
with its inspiring view  
of mountains, sheep and (duh) the lake,  
and lots of tourists too.*

*This city is notorious  
for its Geordie Shores!  
The party scene was glorious,  
and the women really looked like whores.*

*And, then, on the sixth night,  
once more, we watched the ocean foam.  
And come the seventh morning's light  
we found ourselves back home.*

*Thank you, Erik, thank you, friends.  
It really was a ball.  
This BuCom was the best one yet!  
We thank you, one and all.*

Some time ago, two huge magic-based movies entered the cinemas: *Fantastic Beasts and Where to Find Them*, and *Dr. Strange*. *Fantastic Beasts* is of course a sequel to the legendary *Harry Potter* franchise, and *Dr. Strange* is one of the last *Marvel* movie to have appeared on screen.

Magic has been a part of fantasy for as long as we can remember. Since it speaks to our imagination so powerfully, it will probably remain a substantial influence in the genre. Before we got the chance to portray magic to its full extent with the technology of today, it appeared in the works of writers such as Tolkien and George R. R. Martin. A lot of the time, magic is mentioned in the same way it looks to those unfamiliar with it; as a strange and inexplicable force.

However, there are writers out there who take a more in-depth approach to magic, describing it as something that can be treated the same way as physics or chemistry. Those writers see magic as something that has its own laws, its own well-defined restrictions, its own particular set of rules and boundaries. Today, I would like to write something about one of these magics, as we are physicists after all. I am talking about the magical means of Patrick Rothfuss, in his trilogy 'the Kingkiller Chronicles'.

Patrick Rothfuss is a particularly slow writer. It took 7 years for each of the first two books of the *Kingkiller Chronicles* to be finished, and it has been six years already since he finished the second book of the series. This means, however, that his books are marvellously in-depth and his world building, creation of imaginary cultures, habits and rituals are incredible. The dedicated fan base of Rothfuss's franchise continues to wait eagerly for the conclusion of the trilogy.

Rothfuss presents two forms of magic in his books. One of them is called 'Naming', which is the art of seeing the ancient inherent name of an element that grants power over it, and using it to control the element. The most simple names of things such as stone and water are already infinitely complex, let alone the ever changing name of the wind and the name of fire. Even man and the fae have their own inherent names, which grant power and control over them, but since a living thing is much more difficult to understand than any other physical element, merely a few living arcanists can ever hope to achieve naming a living being. All of these deep names can only be seen by your 'sleeping mind'; a part of your mind that needs to be awoken before it sees these names. This kind of magic is rather less realistic than the one I will present a little

## Magic

further on. Only in a metaphorical sense, 'full knowledge of what an element comprises of shows what it is capable of', is the art of Naming understandable.

The second kind of magic is called 'sympathy'. Sympathy is a way of transferring energy from one point or region to another via a so called 'sympathetic link'. All kinds of energy can be transferred with this link, such as heat, kinetic and vibrational energy, et cetera. The first example that is mentioned in the book to explain sympathy is the sympathetic binding of 'parallel motion'. With sympathy come three laws. When you bind two iron drabs (a coin used in the chronicles) with the binding of parallel motion, and lift one of the two, the second will be lifted 'magically' parallel to the first. If you hold up the first drab, it feels like you're lifting both, because of the first law, 'conservation of energy', energy cannot be created or destroyed.

So, in theory, it feels like you are lifting two drabs. Practically however, it feels like you are lifting three drabs. This is because of the second law, the law of Correspondence, 'similarity enhances sympathy'. This means that the more similar two objects are, the better the sympathetic link is between the two. However, since no two objects are really the same, no link is perfect, and some energy is always lost.

The third law is the law of Consanguinity: 'part of a thing can represent the whole of a thing'. This means that a link between something that has been part of a bigger whole, and that bigger whole, automatically makes a reasonable link. Say you would link a hair of a person to the person itself, and you would burn the hair, about a third of the heat would transfer.

## Cheerful Chef: Burger buns

*Brace yourselves for winter is almost upon us. As it can be cold outside, it is important to stay warm, near a heat source. It is almost time to get that mid-winter bbq going and grill some burgers. To make sure vegetarians and vegans are also catered too, here are some recipes for vegan hamburger buns and patties.*

### Vegan patties, 6 patties:

- 1 large can chickpeas (leaked about 450 grams)
- 1 can corn
- 3 tablespoons flour

Put the drained chickpeas and corn in a food processor or mash them until it's fine, but still has a bit of crunch to it.

Stir in the flour and season with salt and pepper and other spices to taste. I used a ras el hanout mixture, this already has salt in it, to give it a Middle-Eastern taste.

Form 6 patties and put it on some baking paper. Let the patties rest in the fridge for about half an hour.

Take out the patties and cook them in a hot pan for about 5 minutes on

each side, only flip them once otherwise they might break.

### Soft bread buns, 10 buns:

- 450 grams flour
- 100 grams apple sauce
- 45 grams olive oil
- 1 teaspoon salt
- 2 teaspoons sugar
- 1 package dry yeast

Mix the yeast with 100ml lukewarm water and the sugar and put it to the side.

Mix the other ingredients, when the yeast mixture is foamy pour it in and combine until you can form a ball of dough.

Cover the dough with olive oil, this way the dough won't stick when it proves. Let the dough prove until double in size.

Divide the dough in 10 and form balls. Put the balls in an oven tray, cover and prove for half an hour.

Bake the buns in a preheated oven of 200 degrees Celsius for about 15 minutes.

I also made some meat burgers, since I was going for a Middle-Eastern vibe we topped the burgers with hummus, cucumber, rocket salad and some baked mushrooms with onions. On the side we had some roasted potatoes which I also spiced with ras el hanout.



## Cryptic crossword

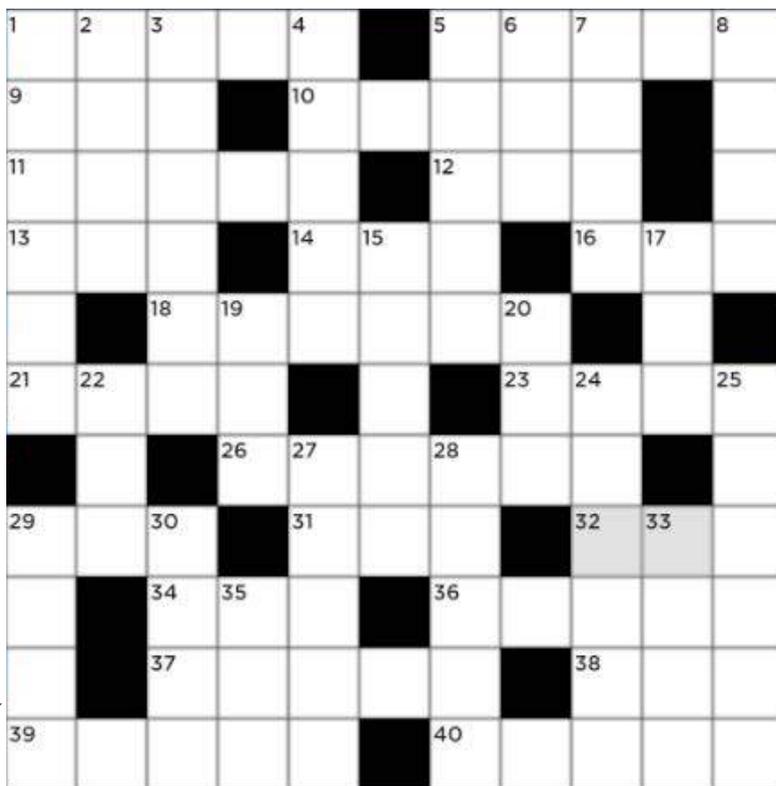
Send your solution to this cryptic crossword to [attencie@astatine.utwente.nl](mailto:attencie@astatine.utwente.nl) to win a 10 euro cinema coupon!

### Across

1. Talks about headwear (5)
5. Raid carried out by old medium (5)
9. Actor in shambles (3)
10. Cite problem with wife more than once (5)
11. Compensate by sending a note (5)
12. Speaking about food (3)
13. For each experience has it (3)
14. Copy of paper (3)
16. Rushed out of France (3)
18. Focusing on best dynasty (6)
21. Students take turn during interval (4)
23. Stan running from insects (4)
26. Friendly, getting the French to waken (6)
29. Woman gets answer through (3)
31. Animal gives party energy (3)
32. Singing with spirit (3)
34. Father left friend (3)
36. A step taken quickly (5)
37. Small spring to grow (5)

### Down

1. Fellow joins the spanish church (6)
2. Loathe terrible heat (4)
3. A lesson is corrupt (6)
4. Second squad has old power (5)
5. Get ready to tear directions (5)
6. Faced with expert (3)
7. It's expensive, darling (4)
8. Old soldiers get a sign (4)



38. Draw digit, say (3)
39. Woman finds the queen transparent. (5)
40. Youngsters seen playing behind junction (5)
15. Quiet instrument (5)
17. Captain has fitting (3)
19. Kind of milkman (3)
20. Youngster doesn't finish party (3)
22. Pruning around college (3)
24. Cancel directions to entrance (6)
25. Small wines generate sources of strenght (6)
27. Relied on working without eastern loafer (5)
28. Traded first diamonds terribly late (5)
29. Vast form of barrels (4)
30. Collapsed around part of church (4)
33. Picture one prisoner (4)
35. Wonder in drawer (3)