Francken Abroad
Down under

Theorist vs. Engineer
Formation never ends

Board Quiz
Which position are you?

Francken Vrij

28.2 Formation


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Editorial
Already having formed our second edition of this year's sequence of Francken Vrij's, we're happy to present to you this gigantic edition being the biggest magazine I've seen in my almost two years of working on the magazine. But, don't you worry, the increase in length has in no shape or form decreased the quality of the content.

We've brought back the infamous Theory vs Engineer piece and we even went as far to resurrect our committee mascot Bob, and for the Francken Friday Lecture fans out there, there is a little preview of an upcoming lecture so make sure to read it!

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Chair's preface

By Ciska van Elsberg

Dear Francken members, our lovely association was formed almost 40 years ago and I am very excited about the upcoming lustrum. However, as we move to the Feringa Building changing to some of our traditions and ways is inevitable. Formation is the way that something is arranged or the development of something into a particular thing or shape. This is a concept that cannot only be applied to our dear association but also to our hearts.

During our years at the university and within the association, we have seen many sjaars and individuals grow and develop themselves. Committees and boards have formed, taken shape, and gained valuable insight from each other. We, as Francken members, are a tight-knit community. I firmly believe that the core of Francken is the collective will and motivation of its members to keep the association running and constantly evolving. Of course, we cannot forget Pluis and Truus, who are always there to watch over us.

By constantly evolving we may lose some traditions but we also gain new ones. This will hold true as well with our move to the Feringa Building. This doesn't mean that the core of Francken will change, as our dear member will make sure of that.

This picture is from the Hitchhiking weekend album!

News of the Association

By Hannelys Posthumus

A **lot has** happened since the last Francken Vrij came out. Since the first Francken Vrij of this edition, there was a lot of pressure, since it was the new year, there were new sjaars, and so on. But after the formation of the new academic year, we have gotten into the flow of student and study life together with a lot of fun Francken events! I have made a nice summary for you to give you some nostalgy or FOMO :).

Karting with Yer

The yearly karting with Yer was a great success again. And it turns out the editor-in-chief of the Francken Vrij committee is a great karter! Everyone played two heats of karting and he won both of them. Next to that Yer gave us a nice talk about their company.

FFL: Andrea Giuntoli

During this Francken Friday lecture professor Giuntoli gave an interactive talk about a topic that could be applied in a lot of fields; the art of choosing the right computer model. He explained that all models are simplifications and that it can be complicated to approximate the complex physics of nature.

Member's Weekend

The half-yearly member's weekend took place in the first few days of December, and the outside temperature was under zero degrees Celcius. Nonetheless, there was a summery vibe during this weekend. We swam in inflatable pools, played games and people wore outfits like it was July. It was a blast!

The greatest achievement of Francken members

Tour de Francken

The first few hours of the Tour de Francken were quite stressful. There were some technical difficulties and the equipment essential for the Tour had to be soldered onsite. At 20:30 everything was fixed again, and the chugging could start. We had to rush and there was a bonus round, so that's a recipe for disaster. Luckily everything worked out well!

Lab Tours

Third-year physics and applied physics students got to see the research that is being done at the Zernike Institute of Advanced Materials. In this way, they could get a picture of what they would be doing during their bachelor thesis project.

Christmas Dinner

Fraccie organized the Christmas dinner again this year. Well… it was not that much work for Fraccie, because it was a potluck dinner, meaning people brought their own food! Members put a lot of effort into making delicious meals, such as soup, casserole, or mac and cheese. But the person who put the most effort into their self-brought meal was Maikel, who brought a pack of pancakes from the supermarket.

Master Borrel

The last event of the year was the first Master Borrel. It had a very fitting theme, namely My Little Pony. Our master students came by for a cold one and a talk with their peers and the board of Francken. Hopefully, a second master borrel will be as great!

FFL: Luc Assink

On the 12th of January Luc Assink, from Ronnie Hoekstra's research group held a lecture called 'What a mess all that tin'. He gave us a talk about his research which concerns the usage of tin in making high-energy lasers.

Buixie Announcement Borrel

And we are going to… Sweden! On the Buixie announcement borrel, the Foreign excursion committee announced the country we are going to this April. In their amazing video (which I have watched like fifteen times) they made a silent movie transformed into an action scene, with a complicated plot. Lastly, it was the first time they showed their beautiful board picture!

Appreciation for Buixie's committee picture

Applied Physics Dinner

The Applied Physics committee organized the Applied Physics dinner successfully again this year. Fifty professors, students and PhD'ers got to enjoy a varied meal while enjoying some home-brewed beer (Gebouw 13). But most importantly the company was great and there was a lot of interaction between students and staff.

FFL: Marieke Reijmers

Let's talk about sex! This was a Francken Friday lecture like no other. Marieke Reijmers (Rosa's mom!) is a sexologist and she gave us an interactive talk about everything that has to do with sex and relationships. It was supposed to take one hour, but Marieke was so passionate about her work and people asked so many interesting questions, that it ended up taking over two hours!

Valentines Borrel

Love was in the air during the Valentine's Borrel organized by the Borrelcie. There were Francken couples present, but mostly singles who were ready to mingle. Friends and potential lovers showed their affection through writing (anonymous) letters. Maybe soon there will be even more Francken couples!

FFL: Patrick van der Wel

Patrick van der Wel is the head of the NMR spectroscopy research group and on the 18th of January, he gave a talk about his research. He focuses on its use to examine molecular-level structure and dynamics in bio-materials, nano-materials and biological samples.

Hitchhiking Weekend

This year 18 Francken members hitchhiked in pairs of two to Schwerin. I can tell you that a lot of pairs made it to the end; no less than two pairs! The rest had to be picked up by the committee, but in the end, they made it (with a little help) to the destination. There they could enjoy the city and drink some cold ones. Despite the lack of hitchhiking talent, the weekend was a blast!

Jam Session with Sirius A

Fraccie organized the jam session this year again with Sirius A's committee Event Horizon, and the musical talents of both associations fused to play some beautiful tones and sounds. But some spectators drank some free beers and enjoyed the talent of the members!

Half General Members Assembly

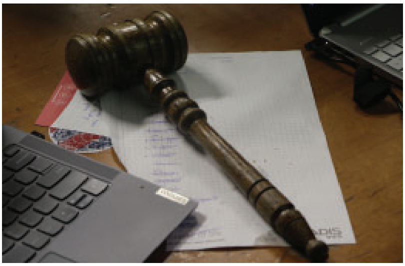
And it was time again for the three-yearly complaining event! ;). Members could give input and complain (;)) about the association. It took a long time before the meeting was finished, but some insightful information was discussed and hopefully, it will help the association a bit further.

FFL: Roberto Lo Conte

Roberto Lo Conte, one of the new professors at ZIAM this year, gave a Francken Friday lecture. His lecture focused on the design and investigation of topological quantum materials through different techniques: low-temperature spin-polarized scanning tunnelling microscopy(SP-STM) and spin-polarized low-energy electron microscopy(SPLEEM). Afterwards, he had a nice talk with the members, and eventually became a member himself and got a spot on the professor's mug wall!

Sjaarscie Dinner

There was little to complain about during the Sjaarscie dinner according to active members; the food was good, it was on time and the first years didn't act like first years. But now the question is: was it no success or a great success.



Inside view

By Antonija Grubisic-Cabo & Marcos H. D. Guimarães

Realm of Flatlands: How are 2D materials formed

Arguably, one of the most popular and exciting materials in the field of condensed matter physics are two-dimensional (2D) materials. In these materials, the spatial degrees of freedom of electrons are reduced compared to other materials we often encounter: the electrons are confined in a 2D plane. But how did this field emerge, and why are the "flatlands" so exciting to the millions of physicists around the world? In this piece, you can take a journey with us into the realm of these interesting "flat" systems. We will talk about the humble origins of this field, and delve into the formation of 2D materials, discussing each method a bit, as well as their pros and cons. Now, we should also mention that this is nowhere near an exhaustive list, it is just our personal selection of most relevant methods - or ones we like to use best. For the rest, you might have to take a course in Nanomaterials Synthesis and Engineering!

Low-techie-techie

When you think of atomically-thin materials deposited on substrates used in the high-tech industry, I bet you immediately think it involves equivalent high-tech machines. Perhaps those shiny aluminum vessels you see through the clean room windows on your way to the Francken room. Well… That's not how things started for the field of 2D materials. It actually involves a very low-tech method.

The first 2D material properly isolated was graphene, a single layer of graphite, made of carbon atoms arranged in a beautiful honeycomb lattice. This was done all the way back in 2004 and caught a lot of attention from researchers all over the world. But why? Well, it turns out that graphene shows all sorts of interesting properties [1]. For one, it is super strong. In fact, this one-atom-thick layer of carbon can actually hold an elephant (if you make it big enough to make the elephant stand on top of it). Graphene also conducts heat very efficiently, and transports electrons with very little scattering. This last fact is actually being used to define the kilogram through the quantum Hall effect [2]. Because of all this, the folks who isolated graphene for the first time - Andre Geim and Konstantin Novoselov - got the Nobel prize in Physics of 2010.

But how did they isolate graphene? What could have been so complicated that only in 2004 humanity was able to separate one single layer of graphite? And what kind of high-tech did they use for this? After all, graphite is being used by humans for (literally) millennia! Weirdly enough, the isolation of graphene only took a bit of graphite and a piece of a sticky-tape. This is known as the "scotch tape method" or mechanical exfoliation. In this technique, we glue a piece of tape on top of the bulk crystal and peel-off - or cleave - the top few layers of the crystal. It is relatively easy to cleave graphite because the graphene layers are stuck onto one another by weak van der Waals bonds. That's also why you can write with a pencil, the layers easily slide or detach from each other. After peeling off a part of the bulk graphite crystal, we then take another piece of tape and glue it to the first tape, cleaving the crystal once more. And then we do that some 10 or 20 times more. Finally, we take the last tape and put it on top of a substrate, usually a silicon piece, and take the tape away. If everything goes well, little pieces of graphene are then attached to the substrate.

Mechanical exfoliation actually gives graphene flakes with the highest quality, and we still have not come up with a method as good as a humble scotch tape when it comes to getting high quality flakes. That's one of the reasons why it is heavily used in research labs to explore new physical phenomena. It is super easy and cheap, so every lab in the world can start working with graphene. Moreover, this same method, with exactly the same steps, can be applied to the whole family of layered van der Waals crystals to isolate their monolayers. These are crystals that, like graphite, are composed of layers attached to one another by van der Waals forces. And this is a huge family, with over 2000 different materials with vastly different physical properties. We can find excellent insulators (e.g. boron nitride), semiconductors (e.g. WSe_2), ferromagnets (e.g. $Cr_2Ge_2Te_6$), superconductors (e.g. $NbSe_2$)... The list goes on and on. This is why the field of 2D materials is now the largest community in solid-state physics. There's just so much to do!

If this method is so simple and cheap, and can create the best 2D materials, why isn't everyone using it, what's the catch? Well, mechanical exfoliation gives only very small crystals. We are talking about layers which are only a few micrometers in size often surrounded by thicker layers, making device fabrication quite difficult.

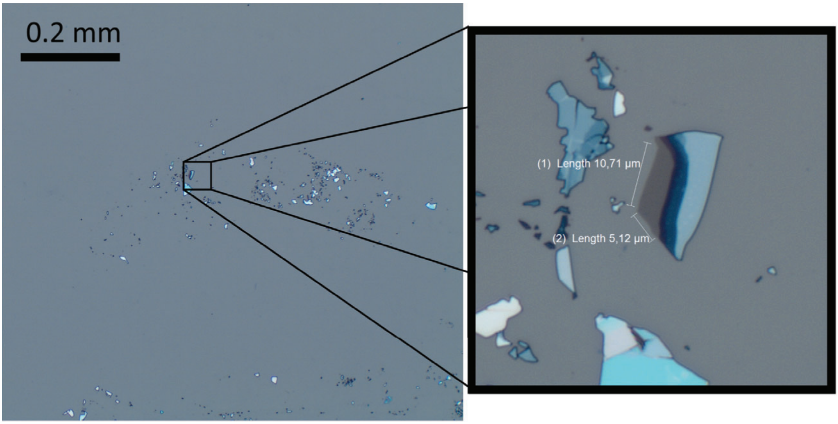


Fig. 1: A flake of WSe_2 obtained by mechanical exfoliation on a SiO_2 substrate seen by optical microscopy using a magnification of 5x (left) and 100x (right). The dimensions of the WSe_2 monolayer are indicated. (Credit: Teresa Lopez)

Romance is in the air - Gotta let them KISS. You can ask any of Marcos' students, looking for the tiny flakes obtained by mechanical exfoliation on the huge substrates is indeed like trying to find a needle in a haystack. The flakes are about 10 micrometers in size, and you have to look for them in areas of square centimeters! And to add insult to injury, the flakes are often semi-transparent. See Figure 1, for example. Some people find it actually quite relaxing, some sort of zen meditation while looking for pieces of crystals come and go. Marcos never really liked it and Antonija was never really that good at it…

Luckily, Antonija has developed a technique to save us all [3]. And weirdly enough, it involves a very flat, clean surface and a van der Waals crystal getting intimate.

You see, it turns out that van der Waals crystals have stronger affinity for interacting with other materials than among themselves, so if you bring them in close contact with clean gold, silver or germanium, they will make a stronger connection than the bonds existing between layers within the van der Waals crystal itself. And this is the basis of a new synthesis method that Antonija came up with, the **k**inetic **i**n-situ **s**ingle-layer **s**ynthesis (or KISS) method. To do the KISS method, all you need is a vacuum chamber, preferably one that has ultra-high vacuum. (You should know what UHV is if you read our piece for the previous Francken Vrij issue). You also need a few tools commonly found in a surface science lab: you need something to make a substrate clean (a heater of a kind, and maybe a sputter gun), and something that will allow you to remove dirt from van der Waals crystal (spoiler alert, sticky tape is great for this as well!). Once you have everything nice and clean, you simply bring a van der Waals crystal in contact with your clean substrate, and voila! You have a fairly large 2D flake - atomically-thin and on the order of a few hundred micrometers in size. If you want to know more about how the KISS method works, check out a piece that Antonija wrote last year for Francken Vrij that talks about sticky gold, or talk to Antonija and her students because that's one of the main synthesis methods in her group.

So, is this method something that everyone will use in their labs ASAP, or is there a catch for this one as well? Well, good news is that you can make many things sticky, not only gold that Antonija wrote about before, as long as you have a good vacuum (if you ask Antonija, she will tell you that's around 10^{-10} mbar, which is really low!). It turns out you can also make silver and germanium sticky as well - but we are still working on silicon wafers and need to test how sticky insulators are - which are the substrates we use to make 2D devices. We also need a good way to place flakes on a specific location, because at the moment, it is mostly a game of guessing. And lastly, the KISS method was originally made for surface science labs, so it might require a bit of engineering to make it suitable for other labs, or to send these samples to other groups. But this method is barely 1 year old, so there is still time to upgrade it from a fling to a long-term-relationship!

One layer is good, but five is better!
One of the main advantages of van der Waals materials is that we can place one material on top of the other without having to worry about strain caused by the differences in their lattice constants. This means that we can take a material - say, graphene - which has a relatively small lattice constant, and place it on top of WSe_2 without the graphene being all stretched out trying to match the atomic lattice of WSe_2. Because there is only a van der Waals interaction between the two materials, the layers remain fairly independent of each other. However, they are close enough that the wavefunction of the electrons of one material overlaps with the wavefunction of electrons of the other material. If you remember your quantum mechanics course, when this happens the two states can hybridize, giving rise to a total wavefunction which involves a superposition (i.e. has properties) of both systems. This can be used to induce magnetism in materials which are non-magnetic or to add spin-orbit coupling

to materials with light elements [4]. We can also encapsulate materials which are air sensitive, making a sort of sandwich - e.g. boron nitride (BN)/WSe_2/BN.

But how do we put one material on top of the other? We start with mechanical exfoliation and use a polymer to pick-up the different materials, making our sandwich layer-by-layer. In Marcos' lab we use a robot controlled by an Xbox controller to do this. Cedric Cordero has a piece on this issue of the Francken Vrij explaining the whole technique. You should check it out if you haven't done so!

"Ain't nobody got time for that!" - said a chemist, maybe

It's all fun and games, exfoliating 2D materials on small silicon pieces and trying to stack them. But unfortunately it's not really scalable, even with the KISS method. Who is going to be looking for flakes and selecting the locations where we can make transistors? Unfortunately paying students to do that is too expensive. So is training monkeys (or AI) to do this job. What we need is a way to deposit 2D materials on top of the whole substrate, with a single monolayer in thickness while still maintaining their excellent properties and high homogeneity. That's where chemistry comes in.

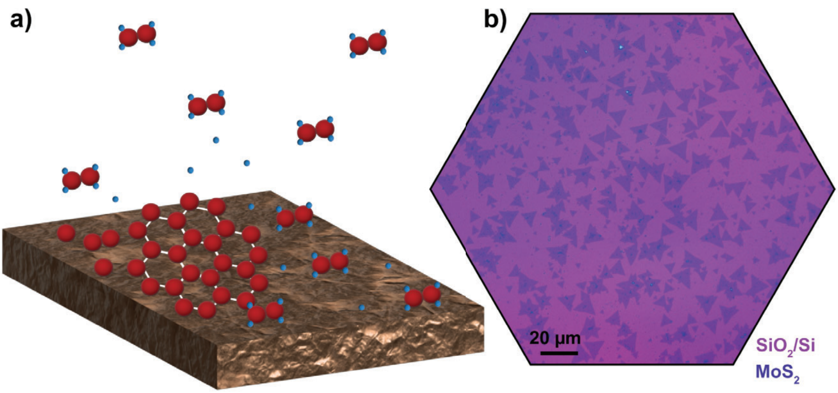


Fig. 2: Chemical vapor deposition (CVD) growth of 2D materials. a) A sketch of the CVD growth where ethylene (C_2H_4) is used as a precursor to grow graphene on a copper foil. b) Optical image of CVD grown monolayer islands of MoS_2 on SiO_2/Si (Credit: Giovanna Feraco). In this image you can see how MoS_2 starts growing in the shape of small, triangular islands. These islands later merge and create a full coverage monolayer.

The most commonly used technique to make 2D materials on top of large area substrates is a method called chemical vapor deposition, or CVD [5]. In this process, a substrate is put into a tube furnace and heated up to high temperatures, often around 1000 degrees Celsius. We then flow a gas (precursor) containing the elements which will compose our 2D material. Common precursors for graphene are methane (CH_4) and ethylene (C_2H_4), and the substrate of choice is usually copper. This is because copper acts as a catalyst, helping to break the methane molecule apart, depositing the carbon on the surface of copper and letting the hydrogen out. Copper has another advantage compared to other (catalytic) metals - it is cheap and abundant - all properties that are desirable when it comes to scaling up, and possibly making it on an industrial scale.

A similar CVD approach can be used for other 2D materials. For example, for 2D semiconductors such as MoS_2 one can use powders of MoO_3 and sulfur which sublimate and redeposit on a substrate, this time sapphire or silicon, and form MoS_2. That makes big monolayer crystals, sometimes with sizes up to millimeters. More importantly, as it can be used to deposit these 2D semiconductors on top of silicon, it makes it very easy to integrate 2D materials into the semiconductor industry we have today. But in order to do this, we need to achieve homogeneous monolayers with the sizes of the wafers used in the silicon industry, which are around 300 mm in diameter, or about the size of a vinyl record. To reach these sizes, a special type of CVD technique is used, a metal-organic CVD (MOCVD). In this CVD approach,you have to use more complicated precursors, metal-organic compounds, and more complicated furnaces which usually have different heating stages. It is more complex but worth it. Using MOCVD growth chambers and precursors like molybdenum hexacarbonyl (Mo(Co)6) and diethyl sulfide ((C_2H_5)2S) one can deposit a single layer of MoS2 layer on top of a Si/SiO_2 wafer with high homogeneity throughout the whole wafer [6]. This is now a commercial technique that is being implemented in many semiconductor manufacturing companies, such as TSMC and Samsung.

So, what's the future of flatlands?

Two-dimensional materials really took the scientific community by storm the moment their unique nature was recognised. This recognition is the important part, because to be historically factual, graphene was "found" a long time ago, but people thought of it as just annoying dirt messing up with their perfectly clean metal surface, and tried very hard to get rid of it [7,8]… These days, 2D materials are something you want to keep, and you discard the metal! Oh, the irony! Since 2004 there has also been a lot of effort dedicated to creating optimal synthesis recipes. Methods to fabricate 2D materials these days are relatively easy and cheap, and the same growth technique can be applied to many members of the van der Waals materials family. This gives us access to many different physical properties and phenomena, allowing us to explore low-dimensional physics while also giving a huge boost to possible technological applications, such as new types of transistors, LEDs, or even new ways to clean our water. That is just the applications we have now, but many new properties are being discovered in 2D materials almost daily, and the list of possible applications is expanding all the time. It is flat-out fascinating all the opportunities that these materials give us - so come work with 2D materials, where the physics is flat but the beers are not!

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Francken meets & greets

'Age doesn't matter, unless you're a Frisian clove cheese':

An interview with honorary Jeff

Interview with Jeff de Hosson
by Charlotte Broekmeulen & Eline Mijnlieff

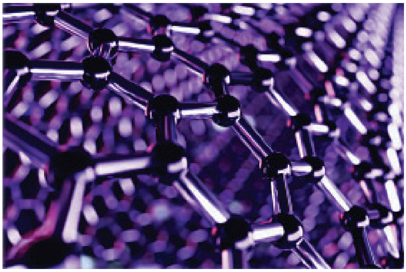
It has been (too) long since our beloved Honorary Member Jeff De Hosson has been able to tell us stories about Francken and inform us about the lastest developments in material science. So, it goes without saying that we were more than pleased when Jeff said yes to doing an interview for the Francken Vrij (and the Lustrum Book). During his career as an Applied Physics professor at our university, he has not only done wonderful things for our association, but has supervised 87 PhD-candidates, published over 1100 publications and has won an impressive amount of awards. He has also been an editor for 20 journals, so he probably should join the Francken Vrij. Despite all these activities, he was so kind to welcome us to his house in Marum to have discussions about physics and pet his dogs. We hope that you enjoy reading some of Jeff's interesting insights and his advice!

How would you describe yourself in three words?

That's not an easy one: 3 might be far too little for me! I would say dynamics, non-linearity and intrinsic humor belong all 3 to me and likewise I am very curiosity-driven with interests in inspiring and stimulating other fellows. I guess it boils down in three words 'dynamically' progressing in a 'non-linear' mode over 43 years in Groningen (second-order phase transformation-Ehrenfest) from student to a retired faculty, like the 3 words spanning my lifetime in a continuous mode: researcher-scholar-intellectual.

Why did you choose to pursue material science? What interested you the most?

From a research perspective I am intrigued by the question whether it is possible to predict, i.e. not only describe, structure-property relationships in materials, mainly metals and ceramics (nano-micro, macro- length and timescales). In addition to research itself, another interesting observation for me (when postdoc in the USA) was the impact that 'materials science & engineering' had on the great variety in professions and personal development of the materials science students, e.g. from a vacuum tube engineer to (quantum) computing. Thus, for the materials scientist, the fundamental concepts do not alter, however the changes of the context in which they are used, make it a very attractive world of challenges and opportunities for students as well. Equally important for Engineering Physics education, my subfield of materials science (electron microscopy) contributes substantially to instrumental developments. New instruments require new materials and new specialists, before provoking new science leading to new instruments, in what the colossal Hendrik Casimir (1909-2000) director of Philips Nat. Lab. used to call the 'science-technology spiral'. I have always considered the latter as an attractive element for the Engineering Physics curriculum in Groningen.



What are the most exciting developments in material science in the last couple of years, according to you?

The recent decade has seen emergence of a newly developed class of High Entropy Alloys (HEAs) or multicomponent materials that ideally comprise of equiatomic or near equiatomic proportions of four to five elements, giving rise to a single-phase solid solution . High-Entropy Ceramics/ Oxides are also under development for functional applications in energy related fields. The-concept of achieving a single- phase matrix, despite the absence of well-defined solvent, is based upon the precedence of entropic stabilization over enthalpy contributions of the expected intermetallic phase formations.

Novel design schemes involving hierarchical microstructures with simultaneous compositional fluctuation, grain size and defect topology gradients can be employed to promote multi- scale strengthening in new generation HEAs. I am working on this with ETH-Zurich (Indranil Basu, Jorg Loeffner) and Herman Fidder (South Africa, Cape Town & Stellenbosch).

What is your favorite research topic you've ever worked on?

It is fair to say that the overall heading of my research efforts spanning several decades has been concentrated on revealing and predicting structure-property relationships in crystalline and non-crystalline materials, including synthesis using high-power lasers and vapor-deposition. However, the actual linkage between the microstructure studied by microscopy on one hand and the physical property of a material on the other hand is almost elusive.

The reason is that various physical properties are determined by the collective and non-linear behavior of moving defects (over various length scales and time scales) rather than by the behavior of a single stationary defect. Therefore I decided to concentrate in Groningen on in-situ scanning - & transmission electron microscopy observations of the structure-property relationship. Over the years it was appreciated by our international peers that we did a great job working at the international forefront of in-situ microscopy. Our approach in structure-property-synthesis relationships not only confirms the fairly widely used driving argument 'seeing is believing' (after Antoni -van?- Leeuwenhoek) but rather goes a step further of what I call 'gaining sight after being blind', i.e. providing physical explanations and in-sights by turning microscopy from a 'peepshow' and show-box into a measuring tool for unravelling the relationships in a quantitative and systematic manner on dynamical phenomena in novel materials.

When or where do you find yourself the most inspired?

Difficult question: I get really inspired when I understood a basic question in +greater depth. But most inspirational events are due to unexpected and unforeseen eye-openers. I get still a kick by guessing that I might be the very first in the entire world to understand a difficult issue (which is unlikely but that is A for a kick experience as such). Formulating an intriguing question is not so trivial.

To give you a very simple down-to-earth example: Let's take the subject of 'energy transition' everyone is talking about, including politicians. I became convinced thinking a bit that 'energy' as such is not key but it is 'entropy' that matters when developing e.g. fusion, not energy. As a matter of course I will not be able to explain this in simple terms to politicians though. Being a freelance worker now myself, maybe I should offer Rob Jetten an extra crash-course (free of charge) on entropy vs energy. What do you think: would it be appropriate and successful ? Please note when I stated 'seeing is believing', for politicians it seems rather 'believing is already seeing'.

It looks like you have an immensely busy life, how do you relax and decompress after yet another busy week?
My theory about relaxing/decompressing is that you should avoid discontinuities, in particular first-order phase transitions and non-linearities in life, e.g. please note that Mother Nature appreciates only linear-elastic behavior (probably also some visco-elastic behavior) and avoids non-linear elasticity. Plasticity is unknown in nature as far as I can see.

Therefore when relaxing only accept a second-order phase transformation, i.e. discontinuous in second but continuous in first-derivatives of thermodynamics. So, after the busy week, relax smoothly and unwind slowly and please do not jump immediately into a plane to Ibiza! That may be quite harmful in fact. I am not knowledgeable about the precise statistics but I suspect many (most?) burn-outs appear immediately after your return from vacation on the various Ibiza's around the world.

What is your favourite spot in the house?
My study!

I've gathered, from your piece 'The undutchable Dutch T.F.V. 'Professor Francken' in the 7th lustrum book, that you did not necessarily like being, as you said, 'kicked out' of the university, into retirement. Understandable, considering how busy you kept all your life, but what do you like about being retired? How do you like to spend your days?

Basically I do not like being retired. It feels uncomfortable and to me an even an inhuman discrimination in a so-called free-western world. Actually I used to say -quoting my dear colleague Sir Peter Hirsch in Oxford-: I am on pension, not retired. In fact, regrettably I did not see any action among the universities in Holland against 'age discrimination': rather dull, lacking in sparkle, not 'leading', regressively and not progressively to lift the mandatory retirement rules, nothing like in US. Please note my one-liner: ….. age doesn't matter, unless you're a Frisian clove cheese.

A good thing though and definitely a pleasant relieve in my present so-called 'retirement' is the lack of terrible and pressing 'deadlines'. I spend my daily time on various things but mostly writing papers, started with writing a science book, reviewing, editing journals, organizing TEAMS/ZOOMS with colleagues abroad as Editor, reading and playing piano, and I am far less on international travel than I was used to!

What's next in material science?

I am sure Materials Informatics will play a predominant role from the perspective of how our understanding of structure-property relationships in materials science can be significantly enhanced by harnessing the tools of information science. Also synthesis of new materials will benefit from materials informatics. Given that Materials Informatics is highly interdisciplinary, covering mathematics, computer science, statistics to engineering and materials science, the exciting outcome will be determined by the resulting nexus of all these fields where new discoveries in materials science are achieved.

I know that already several software packages are available that strive to perform "automated machine learning" (AutoML) in materials science. My feeling is that so-called "Materials Connectomics" –i.e. connecting length scales - are rather old ideas in literature now and have to be replaced with more exciting and new "Materials Connectomics".

Also as regard impact to electron microscopy pattern recognition and machine learning will contribute in greater depth to structure-property relationships (machine learning algorithms in particular Bayesian optimization).

What is the best advice you've ever received?

Keep up the spirit!

Do you have any advice for our fellow aspiring physicists?

Prime: Enjoy your student life as an intellectual and talented sponge (non-linear and with a multi graded hierarchical structure). It is a unique period in your life: make use of it in an exhaustive manner and give a hundred percent in everything you do since time is irreversible (although you can still solve Maxwell equations for negative time).

Next: please study carefully my 10 commandments in the 7th Lustrum Book of Francken, in particular #3 & #10 'Concentrate on new concepts, not details' and 'Realize that the closer your experiments match your theoretical predictions and vice versa, the further away you are from the Nobel Prize.'

Next to next: A couple of advices from Nobel Laureates whom I met in person in the past:

- if you obtain rather unexpected experimental results, do not throw it away even when the rest of the world disapproves your results' (Dan Shechtman, 2011);
- 'please do not stick to the same research topic and be eager to explore other opportunities of your own'(Sir Andre Geim, 2010).

Member's input

By Matias Santacruz

I initially joined Francken because it was the only study association of "Applied" Physics, however, I did not have a clear idea of what my role, if any, I would have in the association. Through friends, and out of sheer curiosity, I found myself in four very distinct committees in my first year, however, there was one I especially enjoyed, the Sympcie. I had been told it was a 'serious' committee, and as a first year I was scared, but I joined anyway. Luckily, I soon found myself surrounded by a supportive group of people which I got to meet a few times a week for an hour, for many weeks. The progress was initially slow and frustrating at times, and as the Chirstmas block came to an end, I considered quitting. However, we had emails to respond, websites to design, money to gather, and I realized that for the first time people were relying on me for something quite important, a long-term project that would forever be a part of Francken. Something clicked at that time for all the committee members, and suddenly we had speakers, a venue, and even a logo to make it official.

On the day of the symposium, I arrived early to help set up and found out we didn't have a long enough cable, so essentially, nobody could present. So, while the rest of the committee started welcoming the speakers and guests, I raced off to Media Markt to fetch the cable in what I am pretty sure was some record time. The symposium was a small, much needed dose of reality for the association after the COVID-19 pandemic.

I learned a lot from my first symposium, perhaps most importantly, that procrastination fears motivation. What I mean is that in those instances where you keep putting a task to the side either because you believe it is too big to accomplish, or you don't believe you can do it, thinking about what it would mean to accomplish it is incredibly helpful. Francken has given me this opportunity time and time again, allowing me to do things I never would have done otherwise which, for either personal or professional reasons, have made me a better person.

I should also point out, that it was a lot of fun, which is why I decided to stay in the Sympcie the following year.

With some experience under my belt, and yet another great team, a second sympoisum was (majorly) successfull. Having been through the process, I was able to place myself in roles where my strengths contributed to the success of the group even more than before. Not only, but I even developed new skills and met some amazing people. So don't let the fear of a "serious" committee scare you, and join the Sympcie.

Theorist vs Engineer

By Caspar van der Wal

Formation never ends

Formation: this may refer to how a material system gets into some state, but also to the education and intellectual growth of a human being. It is mainly this second case that inspired me for this column. When then considering the formation of science students, I first like to get off my chest that I oppose to the positioning of Theorist vs Engineer (the title of this column series). This framing is maybe still coming from a conceptual mishap that sneaked into the wording used by some circles at least some 20 years ago. It was (or maybe still is) widespread for a while, not only among students, but also in the presentations on study options for high-school students by our Faculty. Groningen is the only university in our country where we have both a study program in Physics and Applied Physics (and for the latter Engineering Physics could be a better name). Then, in discussions, one runs into the need to sometimes really clarify what study you talk about. Whether you mean Applied Physics, or the other one. And for the other one, the wording Theoretical Physics would then be used on occasion (if you still do that: STOP!).

However, in particular for high-school students and starting bachelor students in these programs, this wording is harmful, as it strongly misrepresents the character and beauty of how you can work in Physics and Engineering. I refer here to the fact that some of the most creative and important pieces of work in what is really Applied/ Engineering Physics, is work that is 100%

a theoretical. Work that is done with only pen and paper, and running code on a computer. Incoming students that like working in this manner, should thus not get the idea that there is no place for them in Applied/ Engineering Physics.

Conversely, we meet very smart and creative students whose talents come out best when using their hands and building stuff, when they try and explore things by experimenting (and who love to do exactly this). These students must know from the start that they can work in the part of Physics that covers fundamental research. Here, tinkering and experimental work is just as crucial as purely theoretical work for discovering new insights. Also here, their unique contribution can make the difference.

So, what is then a good name for the not-Applied-Physics study program? The perfect wording seems hard to find. Maybe we should call that study program Research Physics, but you could indeed oppose that much of the work in Applied Physics is also research. However, with Research Physics vs Applied Physics you at least get a feel what dot on the horizon you get will educated for. And I propose this after considering some ten other options that have more serious flaws.

It should also be noted that once its participants get well beyond the bachelor phase, this whole question on characterizing your work either as Research Physics or Applied Physics just vanishes. To be clear, it is really true that the set of skills, and the focus and mindset, are really different for a good training in Research Physics or Applied Physics. However, once you are well beyond this training (either in academia, in industry, or any other part of society that can use a physicist), you get the best work done by not worrying about the distinction, and to take a style of work that best matches the task at hand. You as an individual, by continuous learning, by setting up mixed teams, or via collaborations, should feel free to diffuse across this artificial border between the core areas Research Physics and Applied Physics. Formation never ends.

In my research group (Physics of Nanodevices and Quantum Devices), our work is all the time some poorly defined mix of Research Physics and Applied Physics. In fact, in these research fields, it is exactly this poorly defined focus that brings the most creative and innovative contributions. As an example, let's take in mind our recent work on semiconductor device-structures made of silicon carbide. For what we want to do, this material is just a transparent crystal (high-bandgap semiconductor), and the real function comes from the electron spin and optical transitions of a few impurity atoms in these crystals. This could lead to devices for quantum-optical communicating over large distances, with as unique new feature that eavesdropping is then really impossible.

In part, this work will have an engineering character already from the fact that this whole research field Quantum Technology clearly has the scenario in mind that one day some of its findings will find widespread application in society. However, while trying to really build and test some ways that seem a good design at first, you just run into so many questions. With material A it seems to work, but it can only work with the optical wavelength of 637 nm. So, is there a material B, C, or D, for which it can work just as good, but with the optical wavelength in a telecom band (roughly from 1300 to 1560 nm)? And then, by just trying, we find that material B indeed works. Not only good enough, but even 100 times better than we can explain by the best theoretical understanding.

So, then we want to know why. Why does it work so much better than expected? And we explore this deeper than what would make sense if it were only and engineering project in industry, because we really want to know what physical principles are missing in our understanding (and as a side note: realizing new experiments for this fundamental work requires some hardcore engineering on the actual measurement setup). But then, while the fundamental insight comes forward, you happen to recognize in some unexpected features that they are a great new tool for a quantum-engineering effort that seems stuck on a rather unrelated problem. In turn, to really demonstrate that this can work, your expertise is really needed, so you deeply participate in designing and optimizing the engineering cycle, and testing of its actual functioning. So, you tell me: are we researchers or engineers?

Driving through Australia on purely solar energy

By Ian Soede

No, my absence at Francken has not been because of a 'postboard depression' nor is it because of an abstinence of alcohol. For the past 1.5 years I have been building a solar car and racing with it through the continent of Australia. It has truly been the most wicked experience of my life and I'd love to share some stories in this edition of Francken Abroad.

You may not ignore air resistance

For those of you unaware, I participated in the Bridgestone World Solar Challenge. In this challenge you try to be the quickest to drive from Darwin to Adelaide, that is a little more than driving from Groningen to Istanbul, with a vehicle powered by purely solar energy. It is an endurance race which means that you build a car that is optimised for turning solar energy into motion. You want to get as much energy in as possible, and lose as little as possible to other sources.

My involvement at the start of the project was mostly in the design process, creating a car shape that has the lowest possible drag considering challenge regulations. Since at 80 km/h, air resistance is roughly 80% of the total loss of the car, every little bit matters. We went through hundreds of designs, to arrive at a model optimised to the 10th of a Newton and with less drag than a crate of beer would have at the same velocity.

After designing the car, it is onto manufacturing, which for an 'Applied' Physicist is quite a challenge. Suddenly, you have to consider real world constraints: a zero tolerance design will not work, structures will break if you design them on the limit, and however much you try, your product will never be as perfect as your design. Spherical cows do not exist in the real world. But however much you optimise, and however well you try to manufacture, there is always the possibility other solar teams outsmarted you. That competition is both really intimidating but also exciting and driving. A competitive person might begin to understand why one would be crazy enough to dedicate 1.5 years of voluntary full time work weeks to this project. Of course getting the opportunity to go to Australia helps a lot in that decision.

'How you going mate?'

Even though Australia is on the other side of the world, culture wise it is more familiar to me than Turkey would be. They speak a language I speak, they wear clothes I would buy myself, and have food my tastebuds recognize. Even though the country is familiar in some way, there are subtle differences. The people are incredibly friendly and outgoing. The way they approach strangers is very different from the Dutch, to whom it is almost a bother to even chat with a stranger. On a few occasions when doing groceries I was approached with a friendly 'How you going mate?', which I quickly learned to answer with 'Good, you?' instead of an elaborate explanation of how I am doing. They would then follow up with 'I've seen you guys all over town, where are you from?'. It's a simple interaction, but I appreciated that they followed their curiosity and asked a question, instead of just minding their own business.

Every Australian, whether at the park we were staying in, at the workshop, or in the middle of the Outback was of incredible help. I would go as far to say that without their generosity it would not have been possible to have the car ready on time for the competition. The most crucial moment was probably when our car was stuck in customs. Australia is incredibly strict

regarding biosecurity with its import. They have a really sensitive ecosystem because they are so isolated from the rest of the world. When our car arrived in the country, the customs officer found a little spider in the corner of the door. Immediately the spider was taken away, the transporting case of the car was closed shut and filled with fumes to kill other potential vermin. The spider was inspected and turned out to be from outside of Australia, this delayed the process of getting the car to our workshop incredibly. Luckily, the owner of the workshop knew a guy who has connections at customs. After a quick call, we were able to get our car the following days. A bureaucratic process that could have taken weeks, took days because of a simple favour. I could name a bunch more moments when complete strangers were willing to do us a favour. Australians are truly awesome.

Though I would like to tell much more about the country during this period, it was incredibly busy and we stayed in mostly one location. My best stories are from during and after the challenge.

Shovelling kangaroos and losing minutes

The challenge itself is incredibly thrilling, at times. You have to realise that the majority of the day is spent on driving on a straight road. You don't see many other cars, wildlife or anything else. And if you are doing a great job (or really bad one), you won't see many other solar teams either. But the moments that count towards potentially winning or losing the challenge, are the most nerve wracking ones because every second matters.

During the challenge, I was located in the scout vehicle, this is the car that drives ahead of the solar car to take care of a few things: make sure that the car smoothly enters the control stops, find a camping spot at the end of the day, and make sure the road is clear for the car to drive over. Every task is more challenging than you might think, with unexpected challenges. Particularly the last point I mentioned, because in Australia, kangaroos are everywhere. You see them in fields, bushy areas, in groups, alone, or dead on the road. They are not the brightest animals and sadly easily get hit by cars and trucks. But unlike a regular car, a solar car cannot drive over a carcass. Maybe you are getting it already, the scout vehicle was responsible for removing all kangaroos we encountered on the road to smoothen our drive. This means stopping by the road, getting a shovel and gloves from the car, and scooping every part off the road. But the clock is ticking, you must stay ahead of the solar car, and not bring yourself in danger on the road. With disgust, and admittedly also pride, I'd like to share that I have scooped 12 kangaroos and 1 emu during the challenge. These efforts, I tell myself, surely were crucial to allow us to finish the race.

With your team you spend 1.5 years building up to 5 days, so the pressure is immense, and even though you want everything to go perfect, it can go wrong. And so it did for us on a few occasions at the control stops. Control stops are set points along the race where it's mandatory to stay with the solar car for half an hour. The trick to these stops is to get the car in as quickly as possible, get the driver out as quickly as possible, and put the solar deck on the right angle to catch every ray of sun, you guessed it, as quickly as possible. With all this pressure to save every second, we forgot to calm down and follow procedure. The result was that instead of saving seconds, we lost minutes. By having the driver rush out of the car, the car was not put in the so-called 'charging mode' and therefore consumed unnecessary energy. Along with that the solar deck was not at the optimal angle, missing hundreds of Watts. Even though the challenge did not go perfect, we managed to end up in 6th place, arriving approximately 6 hours after the first and finishing approximately 6 hours before the team before us. I consider ourselves the worst of the best, not too shabby of a performance if I say so myself.

On the road with the Mystery Machine

After the challenge was over, and the car had been packed, I went on to discover the country for a few weeks with two good friends of mine from the team. We rented a van, got some groceries, went on the road and decided to see as much wildlife as possible. We travelled from Adelaide to the Flinders ranges up North, down to Yorke Peninsula nearby, crossed through the southern territory to Melbourne to make our way to Tasmania. Here we spent roughly two weeks discovering the beautiful island (still with an area about twice that of the Netherlands). The nature is truly beautiful and the Tasmans are proud of it, a third of the land is protected. We saw parrots, echidnas, wallabies, wombats, kookaburras, little penguins and even Neil the Seal, an elephant seal that went viral on the internet for being quite obtrusive in the village it decided to use as a napping spot. All of these animals were located in the most varied of lands; planes, mountains, lakes, seas, cliffs, beaches, the island is incredibly diverse and impossible to truly appreciate with the time that we had. Australia and Tasmania are the ultimate dream destinations for an outdoorsy person. The country is truly beautiful and I really wish I get a chance to go back, to see even more.

I have only been able to share a few stories of what I experienced the last 1.5 years. It has been a truly wonderful experience, one I highly recommend to anyone who is willing to take the opportunity. But for me that experience is over, so instead of full time messing about it is onto full time studying. If you are curious, I'd love to tell you more about my experiences. I'll be in the Franckenroom, so do not fret to ask. If you still recognize my face that is.

The Art of Stack, Twist and Shout in Two-Dimensional *Boterham* Devices

By Cédric Cordero Silis

I have a picture of my infancy, I see myself seated in front of a Compaq desktop, probably from the early 1990s. Of course, I do not remember the exact specifications but, a quick Google search reveals that the number of transistors in their microprocessors was around 3-4 million. This sounds like quite a large number considering the boards had around 20x20 mm2 in area, especially when 20 years before that, we managed a few thousand transistors in a similar space. The technological leap is quite remarkable. Nowadays the field has evolved even further. Our phones easily host 10 BILLION transistors, while high-end microprocessors have hundreds of billions! Imagine the Francken room on a Friday evening but with nearly a million times more people!

But why do we care so much about transistors? Why is a technology dating 50 years still so crucial? Simply put, the number of transistors is related to the complexity of a problem that a computer can solve. The more you have, the faster your calculations are, the smaller they are, the more compact your device can be. Over the years we have managed to rebuild a computer that used a whole room, into a small phone with exponentially greater computing power in our hands.

But how small can we go? In 1965 Gordon Moore published a brief article in which he predicted (by extrapolating from Douglas Engelbart's studies on the downscaling of integrated circuits) that every couple of years, the efficiency of a device would double. The famous Moore's Law was born.

Unfortunately, with every couple of years, the complexity of the questions we want to solve has also increased exponentially.

So what is the problem? We should then just keep making things smaller and that's it, right? Well, there is a limit. Heat dissipation and quantum restrictions have led physicists and engineers to propose and investigate new materials and physical mechanisms to tackle this problem. The discovery of new materials and device fabrication methods devices has kept the increase in computational efficiency, nonetheless, we will eventually reach a top performance with these conventional technologies. Thus, the quest is to recreate transistor logic in more efficient ways, enhancing computational performance.

One of the pathways that research has taken is the production of novel devices that involve complex solid-state physics theory and, from time to time, extensive lab work. In this context, two-dimensional (2D) materials are an excellent platform in which the interplay between light, magnetism and spin dynamics can be probed.

But what makes 2D materials so interesting?

In 2004, the Nobel Prize in Physics was awarded to Andre Geim and Konstantin Novoselov for the successful exfoliation of graphene (a single-atom thick layer of carbon), by separating it from the bulk graphite using scotch tape. We call this "high-tech" method (mechanical) exfoliation. From there, the idea of combining several materials in a sort of sandwich arose.

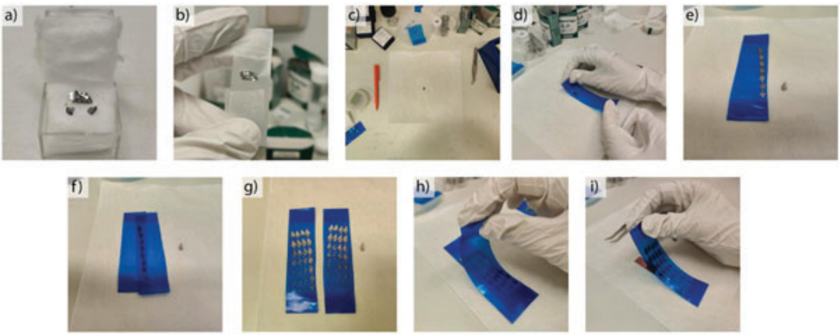


Figure 1: General exfoliation process. a) Starting from the bulk crystal, b-c) removing a thinner layer from it using regular scotch tape. d-h) Using the "fancy" tape (called Nitto tape) the exfoliation process is started to thin down the crystal to few/mono-layer. j) Final transfer to a silicon/silicon oxide wafer. Figure from Dr. Jan Hidding, former member of the Optospintronics of Quantum Materials group.

Graphene, just like a slice of cheese, can be combined with other materials with different properties, magnetic materials (the ham), semiconducting materials (the tomatoes) and even encapsulate it in hexagonal boron nitride (hBN - our top and bottom breads) to enhance its transport properties and protect graphene (or other material) from the environment while still allowing us to probe it both electrically and optically. From typical metals, insulators and semiconductors to the more exotic magnetic, superconductor, topological and combinations of these, we can decide what to choose and then tailor materials for specific applications.

The idea is simple, make the best sandwich possible for a specific occasion. In particular, my PhD project deals with the concept of topology. Before making our sandwich, let me explain what I mean by topology.

Maybe you have heard about the mathematical joke regarding a doughnut and a mug being 'topologically' equivalent, or a pretzel being completely different. It seems that this way of categorizing objects is all related to the fact that they have a different number of holes. Well, the physicists borrowed this concept from fundamental mathematics and used it to define a type of material that manifests a dual nature. For example, consider a piece of paper, this material is usually an insulator but imagine it can conduct electricity only in the edge of the paper without dissipation of energy, meaning, without producing heat. If we cut the paper in half we keep the same property, transport in the edge and an insulating bulk. This duality is counterintuitive, we usually have conducting materials, like metals, non-conducting materials, insulators, or materials that require certain electrical input to be able to conduct electricity - these are called semiconductors. The fact that we can form this protected non-dissipative conductive edge in an otherwise insulating bulk makes these systems so interesting.

In my research, just like with a piece of paper or a single slice of cheese, I study 2D materials and their coupling (a slice of cheese plus a slice of ham plus some lettuce for example). I stack them into heterostructures, forming heterostructures (the whole sandwich) where this topological protection can be induced by applying an electric field.

So where do we begin? Which ingredients will form our sandwich? It all starts with a single bulk crystal of a semiconducting transition metal dichalcogenide (TMD), which is a few millimeters in size. I grab some "fancy" scotch tape to remove layers from it (remember the mechanical exfoliation?) until I get monolayer flakes. This material, comprised of a transition metal atom M and a couple of chalcogen atoms X is quite interesting as its band structure - responsible for its optoelectronic properties - evolves from indirect to direct band gap upon reaching a single layer thickness

When you have a monolayer, and you optically excite it above bandgap, the relaxation to the ground state will be accompanied by the emission of photons - this process is called photoluminescence or PL for short. We illuminate the sample and with a special camera, we detect the PL, proving it is indeed a monolayer. I do this for 2 materials: tungsten diselenide and molybdenum ditelluride (WSe_2 and $MoTe_2$).

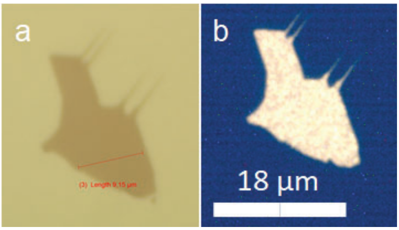


Figure 2: Monolayer TMD and photoluminescence. a) Optical image of a monolayer TMD and b) produced photoluminescence

The twist and stack

These are my cheese and ham, the key ingredients of my sandwich. These materials have a hexagonal symmetry and, when stacked in a specific orientation, can develop the topological phase we are looking for. I then go to our x-box controlled (yes, the video game console) transfer stage inside a glovebox in a nitrogen gas environment. Here I can pick up each layer and rotate one with respect to the other to align the crystals in a specific orientation. The metallic atom of one layer on top of the chalcogen of the other layer - this is known as AB-stacking - forms a periodic super-lattice known as a moiré pattern (or lattice). It has been found that a topological phase with quantised resistance can be achieved by controlling the electric field and charge carrier density inside this system. So, by encapsulating our bilayer in an insulating material, namely hBN, (the bread), we can protect it both from external impurities, while still being able to probe it by optical means. Finally, the electric field control is performed by also exfoliating and stacking several layers of graphene on top and bottom of our sandwich.

Now our system is ready, we just need to fabricate electrical contacts to it, this is the last dressing in our recipe, but very important! We do this in the clean room near the Francken room. I'm one of those guys in the funny suits - funnily enough, they are called bunny suits!

To "taste" (measure) our sandwich, we go to the laser lab of the Optospintronics of Quantum Materials group. There, we load our nanodevice in a cryostat where we can cool down to liquid nitrogen (77 K) or helium (4.2 K) temperatures, and apply the necessary electric fields to induce the topological state. In our labs, we can scan our device spatially and resolve its optical signatures in the visible and near-infrared spectra. Study the spin/valley dependent response, characteristic of the TMD-based systems, and even apply magnetic fields to further characterize the topological phase, this is, accessing a quantum anomalous Hall phase.

In summary, we meticulously craft and study these "sandwiches" made of 2D materials, controlling their ingredients, the twist angle between the layers, and the electric fields within them. We perform transport and optical characterization to understand the charge and spin dynamics in a quantum topological phase, looking for edge transport and the effect over the device's optical response. Yet, there's much to uncover regarding the main mechanisms governing quantum states of matter for potential (opto)electronic applications.

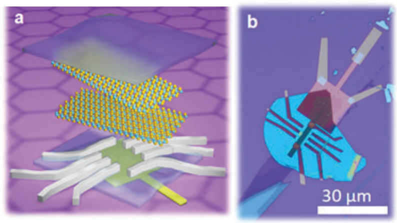


Figure 3: Example of a digital and experimental nano sandwich. a) From top to bottom: hBN (the transparent bread) is used to protect the TMDs (cheese and ham), which are contacted with platinum contacts for electrical measurements. Finally, on the bottom a local gold gate to apply an electric field. b) Final heterostructure including a top graphene gate.

So, if you're intrigued by topological "sandwich" recipes and the exciting research in this field, feel free to ask me when I'm passing by the Francken room on my way to/from the clean room (the kitchen).

Note from the editor

On the 26th of April we will have the honor to get to dive even deeper into this topic during the Francken Vrijday (get the joke?) lecture on that day. Cordero Silis will explore these so-called sandwiches further and attendees will get the chance to ask questions and discuss this topic. The Francken Vrij committee hopes to see lots of you there!

Puzzle

By Omar Gutierrez Laafou

The puzzle of this edition revisits the concept of a popular riddle. I still remember how much time a younger me used to spend staring at an empty grid with no clue how to progress. However, this crossword contains more than meets the eye. The true answer is a "Sneak Peak" to the theme of edition 28.3 of the Francken Vrij. Find the hidden word to claim the prize for yourself and become the first to learn the theme!

Across

1: Material formed through the combination of molecules to create a larger chain.

3: Opposite of a law of physics that dictates order in the Francken room. The tendency of a system to evolve towards increasing order.

5: Object that can attract or repel others using a fundamental force.

7: Small units that are combined to represent images on a screen.

9: Adjective. How students feel before facing a final exam.

Down

2: Three-dimensional geometrical shape that exhibits a continuous curve around a central axis.

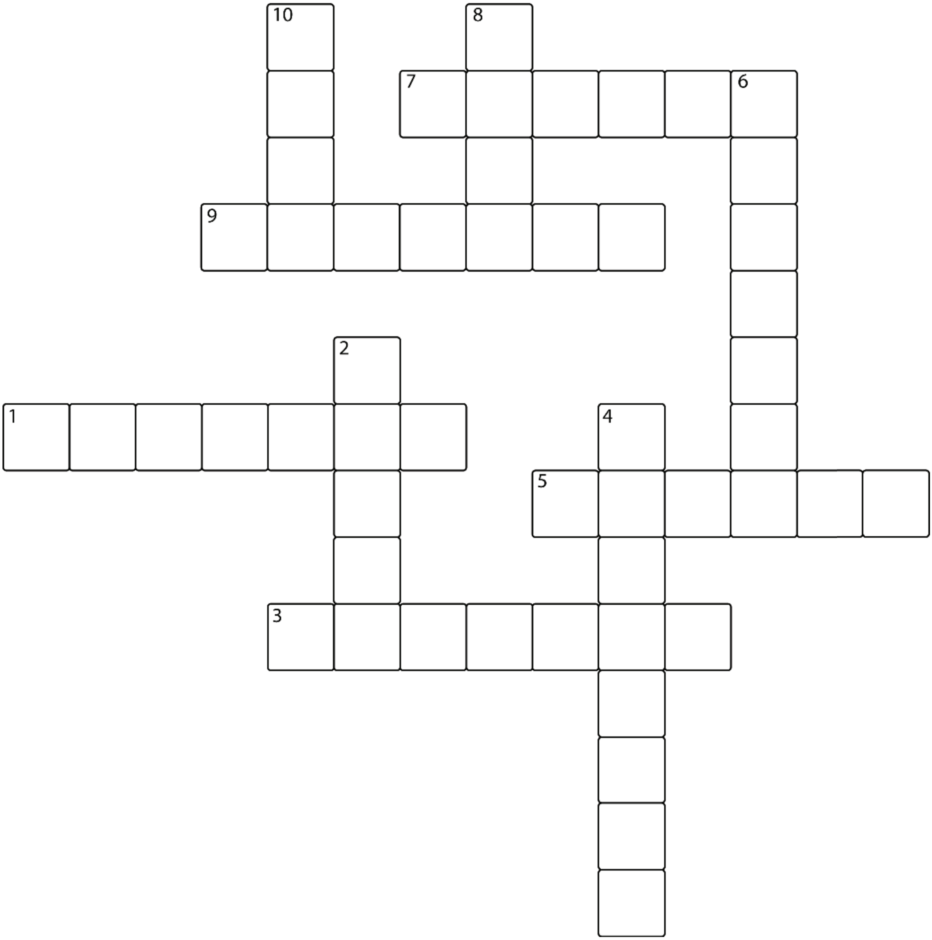
4: Typical soup from southern Spain made of tomato and consumed cold.

6: Element that can be used to produce glass or an electronic device.

8: SI unit used to form a Newton 1 N. It follows from Newton's second law.

10: Celestial body that causes tidal forces on our planet.

Final clue - Related to the Big Bang.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Comic

By Tetania Ovramenko

Collage

By Charlotte Broekmeulen

If you have ever been at a Francken event, chances are that I have pointed a camera at you and/or have blinded you with the flash. (And I will certainly never apologise!)

The collage is made up of photos made as far back as 2020 using disposable cameras. The cameras may have been disposable, but the memories captured certainly were not. Moving from the South of the Netherlands to the North meant knowing absolutely no one, having to make friends and open up to people. As you can probably tell from the collage, I have managed to make some friends over the years, mostly at Francken. My mentor, Hester, and the rest of board 'Charm' charmed me into joining all the Francken events in my first year together with my little girl squad. Most of us ended up doing a board year at Francken, and will probably always stay tied to this wonderful community.


WEG TOT DE WETENSCHAP
Verlengde

Life after Francken

By Sjoukje de Jong

When I was still in highschool, I did not plan on studying Applied Physics, or studying in Groningen. But as some of you might know, this is what I ended up doing for four years. I started my studies in Groningen in 2019 and experienced about half a year of studying without lockdowns before covid came. Being quite bored with just studying during a lockdown, and also the fact that it is not my dream to excel in Applied Physics, I decided to take a break from studying by doing a board year at T.F.V. 'Professor Francken'!

In 2021, I became the Secretary and Vice-chair of my board 'Half-life'. I had a great time with my fellow board members, even though there were still some covid restrictions during our year. We ended up going to Switzerland, Italy and France with SLEF and Buixie, and most of us also managed to pass some courses during a very busy board year. After my board year, it was time for me to finish my bachelor and chase my dream job, to become a commercial pilot. Since I was sixteen I have flown in gliders

as a hobby and it has been my dream job for an even longer time to become a pilot. Sadly, my first attempt to get through the selection procedure of my preferred flight school was not successful. For some reason I thought it would be a good idea to do Applied Physics, so that's how I ended up at Francken. Last year during my final year of my bachelor I started with my second attempt for the selection at the KLM Flight Academy. With a resume that had tripled in size and some extra life experience I went into the selection with confidence, and managed to get accepted!

The first three selection rounds I did during my bachelor thesis, which looking back was quite nice. I was very flexible and could quite easily get a day off in order to prepare or go to the selection rounds. Even though this flexibility was nice, I have never experienced so much stress in my life, as I was not sure what I would do if I would not get in. Two days before my final bachelor thesis presentation I got the news that I was invited to the last round, which they call the 'COVA'. This translates to 'committee of acceptance', and basically consists of four people from KLM that have different important roles within KLM that will decide whether they want me or not.

This time the timing was less fortunate, as I had planned a holiday with my friends which coincided with this COVA. I ended up rescheduling my flight in order to leave the holiday early and attend the COVA. The pilots of this flight were really nice, as they let me sit in the cockpit on my way back to Schiphol. About two weeks later I was on a gliding camp. This is where you go camping and gliding at an airfield for a few weeks. At this camp I got the news that I got accepted to the KLM Flight Academy!

I started in Eelde in September 2023 and have been here for half a year already. At school we have groups of 15 people that you will have all your classes with. My group has 6(!) women in it which I am very grateful for. Living on the campus feels like living in a village, everyone knows each other which is sometimes nice, and sometimes a bit less nice. There is also a bar on campus of the student association, which is a very nice place to relax after a long day of studying. It is a completely different vibe than Francken, but a good vibe nonetheless.

In the week that I am writing this I have just flown my first solo! Off course it is not my first first solo, as I already fly solo when flying in gliders, but it is a milestone nevertheless. Here at school there are some traditions associated with the first solo, including the instructor cutting off your tie. Your classmates will carry you to the designated pond and throw you in. For guys they will also be shaved bald, but since this is more drastic for women than for men, women get to dye their hair a funky colour. Mine was meant to be blue but it is more green now.

At the time that you are reading this I will hopefully have passed my theoretical exams which are coming up next week for me now. And in about two years I hope to be flying for KLM as a second officer on the intercontinental flights :)!

Do you want to be a SYMP?

It's time for our annual symposium related to Applied Physics. This year the topic is **Illuminating the Future!!!** So we will learn about photovoltaics. The symposium is an all-day event, where there are going to be speakers from research groups and companies in the field. The speakers will explain the topic and its possible uses and advances in the near future.

The symposium will take place on the 21st of May at the Flonk Hotel from 9:00 - 17:00 and it costs 10€, but if you are a Francken member the price is reduced to 7.50€. This price includes coffee, other drinks and a lunch. Also, if you are a master student you can get 2 colloquium points!

Come join to learn more about photovoltaics and enjoy a day of learning with free lunch!!

You can sign up by scanning this QR:

ILLUMINATING THE FUTURE
FRANCKEN SYMPOSIUM
PHOTOVOLTAICS
2024

How profitable is Francken?

By Rosa de Graaff and Siem Kuijpers

Do you remember the first time you stepped inside the Franckenroom? Did people shove a sign-up form under your face and begged you to become a member? Often I see people convince first year students with arguments like: it is fun, many social events, but also a lot of useful study events. Also, a very important and often said argument, "if you sign up now for only €5 euros you can drink unlimited coffee for free, already worth your money!". And, on top of that, there are a lot of events where the association pays for free food and drinks, so it seems like a good deal. But as current and old treasurer, it got us wondering. We like to see concise numbers to this good deal, how much profit can you actually make? To answer that question, we sat together and went over the financial statement of the year 2022-2023 together with the year planning.

In order to make it more personal, we decided to consider three types of Francken members. There is the group that goes to every single event (category A), the ones that only go to half of the events (category B) and the ones that only go to the free events (category C). If you are not really sure in which category you belong, below is a short description of each personality per category. Note that for category B we have taken half of the events, the chosen events were based on the highest number of participants.

Category A

You have Francken in your heart and in your soul, the reason why you simply can not miss out on any of the events. During the day you will visit company excursions and borrel lectures to already orientate on your future career. But aren't you rushing it too fast now? After all, you are also going to every borrel and event from the committees itself, often accompanied with some refreshing beers… Hopefully for you, you know the consequences of alcohol and are capable of balancing this with your study life (lecture, exams, homework, etc). Or you don't care about any of that and you are fine with becoming meubilair someday, the ones that take a couple more years of "studying". It doesn't matter for you, whether you have to pay for it or not, you go because you know it will be worth your time and money anyways!

Category B

This is probably the most relatable category. As much as you want to go to every event, you probably don't have the time for it. This could be due to the fact that you know you are missing a backbone, so going to an event means staying at the event which is not always feasible due to your study. Or you just have more in your life than Francken, good for you. Or you are just boring, I don't know. Money is not the issue here, because if you like the event and have the time for it, you don't mind paying for it as well. In any case, you go to some events when you feel like it, but you are not always there.

Category C

Student life is hitting hard on you. You like going to events, but as soon as you see a participant fee you back off. Paying for something? Hell no, not in this economy, as a student you already pay enough… The only fee you pay to the association is probably just the €5 contribution fee, have you already saved enough for that? It is not a bad choice, after all, there are enough events for free anyways… But kind of selfish, no? If you love Francken you would not mind contributing to it as well… Oh well, maybe you show your gratitude in a different form, like joining a committee for example.

Now that you know to which category you belong, let's dive into the results! If you sum all the profits for each category (see table) you get that our diehard Francken member (Category A) makes a total profit of: €467.54, where our average member (Category B) makes a total profit of: €291.25 and lastly the greedy member (Category C) makes a total profit of: €287.28. Now you get a grasp of where all the money flows to in the association, ofcourses it flows back to you, the members.

On the next page you can see which events we have summed up and we show a simplified overview of how we have made the calculations.

	Number of events	Average costs per person per event	Average entree fee per person per event	Profit Cat A per person	Profit Cat B per person*	Profit Cat C per person	*Cat B goes to how many events?
Active members activity	1	€66.14	€0.00	€66.14	€66.14	€66.14	1
Barbeques	2	€12.08	€4.98	€14.21	€7.11	€0.00	1
Beach party	1	€14.84	€0.00	€14.84	€0.00	€14.84	0
Borrelcie free events	5	€2.79	€0.00	€13.95	€5.58	€13.95	2
Borrelcie paid events	1	€4.98	€3.00	€1.98	€1.98	€0.00	1
Committee running dinner	1	€3.23	€0.00	€3.23	€0.00	€3.23	0
Company activities	2	€32.43	€11.28	€42.30	€42.30	€0.00	2
Company excursions	6	€4.61	€0.00	€27.66	€13.83	€27.66	3
Company lectures	5	€8.18	€0.00	€40.92	€24.55	€40.92	3
Company workshops	3	€5.67	€0.00	€17.00	€5.67	€17.00	1
Dies party	1	€3.84	€0.00	€3.84	€3.84	€3.84	1
Fraccie free events	7	€2.36	€0.00	€16.55	€9.46	€16.55	4
Fraccie paid events	1	€8.95	€4.74	€4.21	€0.00	€0.00	0
Francken firday Lecture	8	€2.85	€0.00	€22.76	€11.38	€22.76	4
Gala	5	€1.45	€0.00	€7.26	€4.35	€7.26	3
GMAs	1	€39.14	€23.50	€15.64	€15.64	€0.00	1
Intercie free events	4	€4.61	€0.00	€18.42	€9.21	€18.42	2
Intercie Hitchhiking weekend	3	€1.28	€0.00	€3.84	€2.56	€3.84	2
Intro activities	1	€85.50	€61.00	€24.50	€0.00	€0.00	0
Karakter borrel	4	€5.73	€0.00	€22.92	€11.46	€22.92	2
Members weekends	2	€63.07	€41.84	€42.45	€21.23	€0.00	1
Sjaarscie	1	€5.96	€5.00	€0.96	€0.96	€0.00	1
Symposium	1	€7.95	€0.00	€7.95	€0.00	€7.95	0
Workshops	1	€41.49	€7.50	€33.99	€33.99	€0.00	1

Extra areas of profit

Some extra possible profits we did not take into account such as coffee: this one is hard to estimate, because not everyone drinks coffee and also not the same amount. Also, as opposed to what do we calculate this profit? If we compare it to the coffee price from the cheapest coffee machine in the university (€0.40), an average of 3 cups per day, an academic year of 36 weeks, is €216.00 saved! But we can also compare it to how much the association pays for the coffee. From our fancy coffee machine we are able to see how many coffees were drunk in the past year which totaled up to 3164. However note that the lease of the coffee machine only started at the end of Christian's year. In the current year as of writing this 9564 cups of coffee had already been drunk from our coffee machine. For both the last and the current year so far a total of €4509.29 has been paid for the combined costs of the coffee and the coffee machine, so that is about €0.35 a cup.

Notebooks: Francken provides also free notebooks. We estimate the profit by comparing it to the cheapest notebooks we could find (~0.65 at the HEMA). If you take a different notebook per course, you would need at least 12 notebooks per year.

By taking this for free from francken you saved €7,80 per year. Not impressed? Then take more notes during your courses to save even more.

Free from the canteen: not that this adds up that much, but just saying there are also free sauces, tea bags and salt and pepper in the Francken room… Estimated amount saved: maybe €2? Depending on how British you are you might even save more on the tea, innit?

As a nice footnote, we also like to mention that Francken often makes deals with external parties and thus increases your profit even more. For instance, take the karakterborrels. We make a deal with a pub, say €2,00 per beer while you would normally pay at least €3,00. We have only considered the €2,00 profit, so not your actual profit here. Another example is the lunch and other profits one could take into account when going on an excursion to a company when those are provided by the visited company. At last, we have also left out some Francken events (mainly those organised with other associations).

Become board!

Did you know that when you are a board member you don't have to pay for any of the events?! That means that by going to all

events as a board member, you profit an additional €221! On top of that you can go to more profitable events like constiborrels, alumni days, etc. If you aren't already convinced, you also get paid for it, on average €10000 divided over the whole board! So if you want to maximize your profit as a Francken member, apply for a boardyear!

Buixie

In this overview we have not included our yearly outland excursion. This has multiple reasons: the budget fluctuates a lot per year, only a limited number of participants can sign up, but more importantly, the finances of these trips don't come from Francken, as the Buixie is their own foundation. But as this big trip also comes with big financial advantages and only Francken members can sign up, we still give a quick estimation of the profit of joining the trip. As a guideline we use the Buixie trip to England & Scotland, but note that the costs vary year to year.

The trip lasted 9 days together with 32 paying participants. The trip included three modes of transport, coach, ferry and metro, costing €5732.45 (€179.14 pp). During the trip, two times there was traveled during the night, so only for six nights of overstay is paid in total €6071,88 (€189.75 pp). Participants had to pay for breakfast, lunch and dinner themselves, with an exception of the second to last day where there was paid for a group dinner. This costed €1247.55 in total, so €38.99 each. On top of that there were various paid excursions: science museum, Oxford University, JET (company) and other public transportation in total costing €3123.31 (€97.60 pp). At last there were also 2 borrels held in Groningen, the participants and reunion borrel in total costing €470,00 (€14.69 pp). Add this all together we come down on €520,17 paid for you directly as a rough estimate (maybe you also got free coffee, lunch or goodie bags while visiting companies, but this was not seen on the budget). All this, while paying only €350, so €170,17 profit guaranteed! And ofcourse a overall nice experience and vacation feeling.

Some remarks

For the estimations, the final result/budget of Christian's year is used. So it is worth noting that this year (the financial year of Siem), the budget is different, but it should still give a reasonable representation of what you can expect in an average Francken year.

If you are interested in the specific details and calculations, email to franckenvrij@gmail.com to receive the excel sheet! With this you could also make a more personalized calculation of your own!

Bob's Adventures

By Malo Blömker

After months of being locked up in Filippo's dungeon, Bob finally made a run for it and escaped his captivity. Longing to make up for the lack of sunlight, he crawled into a fellow Franken member's suitcase and became a stowaway.

After a few hours of flight, Bob touched down on the beautiful Greek island of Crete. There he popped out of the suitcase and revealed himself. A road trip across the island brought us to Chania where Bob would spend the next week enjoying life.
First up was of course a trip to the beach. There we had to scrub out the gunk that accumulated in his fur over the last few months of hostage. The 25 degrees Celsius

The following days saw a handful of trips across the island. Historic landmarks and hiking were on the agenda. The mountainous landscape of Crete was just as spectacular as unexpected to Bob.

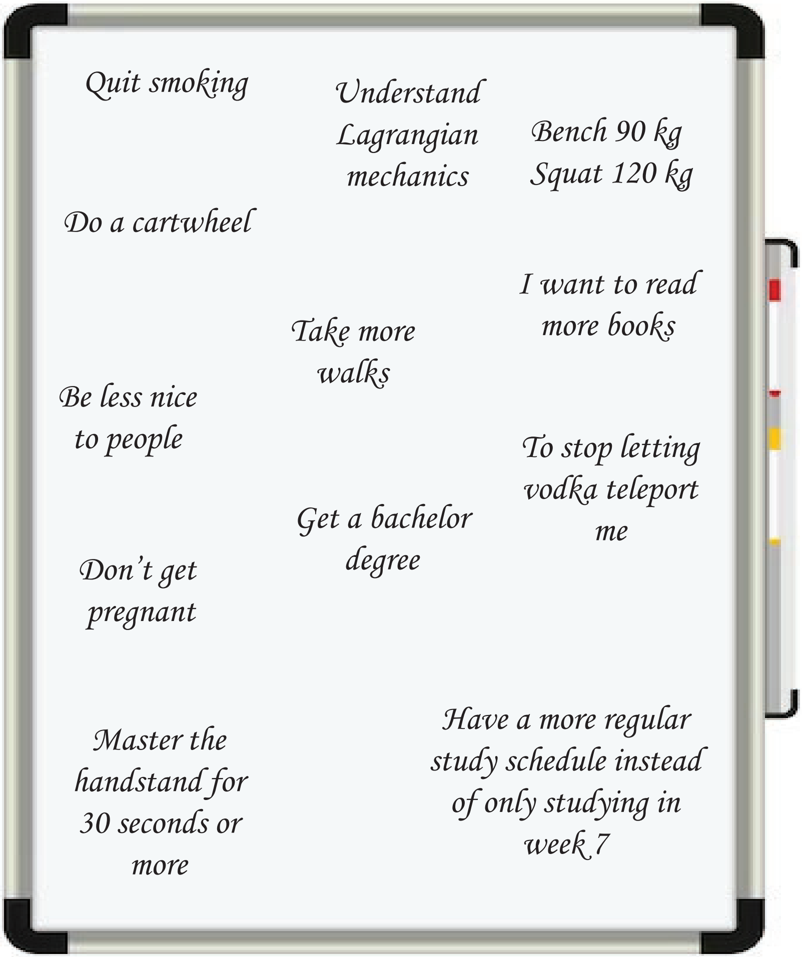
But before he knew it, the week came to a close. So there in the dusk of the final evening, bob sat down and thought to himself:

“Here I sit in the old Venetian harbour,
a junction of tale and wonder

Here I sit, looking at the people walking by,
as i reminisce and ponder”

New year's resolutions

By Francken members



Which board function are you? ~ *do the quiz!*

By Eline Mijnlieff & Charlotte Broekmeulen
with the creative help of Liz Titz

DISCLAIMER:
Please be aware that this quiz is intended purely for entertainment purposes. The questions and answers are formed entirely based on the creative interpretation of observations and behavioral analyses. This quiz does not claim to have any scientific accuracy, reliability or profound insights into your personality and should therefore not be taken seriously.

How would you spend your time in the boardroom?

a. sleep
b. be productive
c. scream at intruders
d. solo karaoke sessions
e. rizz men up
f. learn

What is your drink of choice?

a. red wine
b. liters
c. any cheap alcohol
d. too much wine
e. everything
f. ketel

How would you spend your friday night?

a. being Ian
b. making presentations about random topics
c. drink
d. cry in the boardroom
e. do chugs with your predecessors
f. playing klaverjas

What would you go to jail for?

a. to visit your board
b. for misspelling
c. for tax fraud
d. for killing your ex
e. for lying on your resume
f. for harassing people by playing the guitar

What is your type?

a. sporty people
b. you in a different font
c. interns
d. treasurers
e. everyone
f. FMF board

Someone breaks a mug in the room, what would you do?

a. tell them to clean up their shit
b. not realize
c. break another one
d. not give a shit, unless you have to close
e. why would I be in the room?
f. help clean up

Would you be a member of FMF?

a. yes, to 'befriend' their board
b. what is FMF?
c. yes, for giving financial advise
d. yes, to be a double agent
e. no, ew
f. yes, to go to board-game-nights

It's exam week, where can we find you?

a. at the table in the room, if you try to approach me I'll deathstare you
b. playing klaverjas
c. pretend to study, get a beer at 4 sharp
d. dilly dallying
e. undisclosed location
f. playing jas in the study room

What is your favorite snack to streep?

a. I don't snack
b. free fruit
c. beer
d. NOOOODLESSS
e. spring rolls, I forgot my lunch
f. chocolate bars

What is your favorite form of transport?

a. a bike, but it always gets stolen
b. skating
c. a bike without brakes
d. bus, I refuse to bike in this weather
e. running/a sponsored limousine
f. a van

Turn the page and check your results!

Most of your answers are:

a. Oh dear! You have the vibes of a chair. Good luck keeping your lovely (=crazy) boardmembers under control!

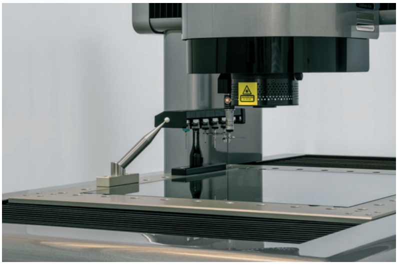
b. Bada-bing, bada-boom! You are a secretary. You're going to be emailing a lot, so you better step up your email sign-off game!

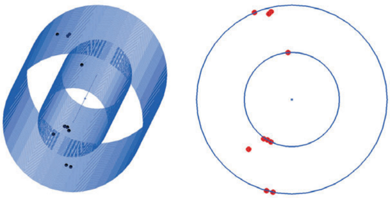
c. Goodness gracious, great balls of fire! You are a treasurer, you know what that means...

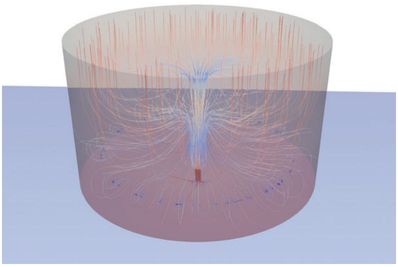
d. Yabba dabba doo! You have the vibes of an intern, be prepared to have at least 20 mental breadowns this year!

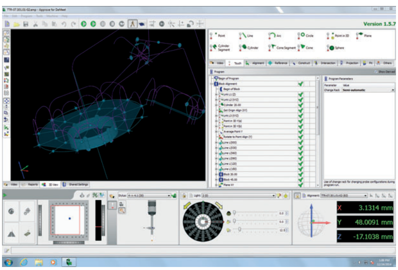
e. Mamma mia! You have the vibes of an extern, get ready to chug chug chuggg Oh and by the way, did you sign your contract with ASML already?

f. Bibbity bobbity boo, your an edu! as an education you learn a lot, so you might want to take a trip to the boardroom and tell your fellow boardmembers all that you learned.









Schut Geometrical Metrology (Schut Geometrische Meettechniek bv) is an international organization, founded in 1949, specialized in the development, production, sales and service of precision measuring instruments and systems. Our 3D CNC coordinate measuring machines DeMeet are completely developed in Groningen. This entails mechanics, electronics and software.

We offer positions for careers, internships or graduation projects involving a wide variety of technical subjects. Previous projects include topics such as adaptive tessellation using Bézier patches, fit algorithms for geometrical shapes from point clouds, optical lens system design, computational fluid dynamic analysis for air bearing designs and Monte Carlo raytracing.

For various departments we are looking for new colleagues. This includes Software (C++), Mechanical and Electronics developers and engineers or technical sales and support engineers. We are in particular interested in any person who completed at least two parts of the courses "Programming in C/C++" at the R.U.G.

You are very welcome to contact us for an orientating discussion, for an open job application or for a possible internship or graduation project. We are always happy to come into contact with motivated and talented students.

For more information go to www.Schut.com and Jobs.Schut.com, or send an e-mail to Jobs@Schut.com.

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