



**the materialist**

**Klein**

**Oktober 2023**

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# Editorial

von Aline Maillard

Hallo Grüezi!

Ein kleines bisschen Stress, ein kleines bisschen Chaos, und ein kleines bisschen überfordert. So sahen die letzten Wochen bei mir jeweils aus mit Vorstandsarbeit, Masterarbeit, Freiwilligenarbeit, Arbeit-Arbeit und ab und zu noch Freizeit. Deswegen dachte ich, wieso nicht gleich «klein» zum nächsten the materialist Thema machen? Es ist ja sogar noch passender, da in diesem Semester ein sehr kleiner Jahrgang an neuen Erstis gestartet ist. Wir haben auch in dieser Ausgabe wieder spannende Beiträge aus der Forschung, schöne Gedichte, knifflige Rätsel und unterhaltende Texte für euch. Was jedoch in dieser Ausgabe drin ist und nicht ganz perfekt zum Thema passt, ist die Prüfungsstatistik. Die ist nämlich Grund zur grossen Freude.

Nun hoffe ich, dass ihr eine kleine Lese-Pause einlegt und diese Ausgabe genießt.  
Viel Spass!

Eure Chefredakteurin  
Aline



# Terminkalender

## October

11.10. Ersti Stamm

## November

01.11. Oktoberfest Stamm

08.11. Materials Colloquium

22.11. Raclette Stamm

27.11. Einführungsvorlesungen von D-Matl Professoren

## December

06.12. Materials Colloquium

13.12. Glühwein Stamm

# Präsidial

von Aurél Gerber

Liebe Mitstudierende,

Vor kurzem durften wir wieder den Ersti-Tag planen, organisieren und die neuen Erstis in unseren Reihen willkommen heissen. Auch nach dem dritten Mal war es mir eine grosse Freude, den ersten Eindruck in unsere Gemeinschaft zu bieten. Ich hoffe von Herzen, dass ihr euch gut eingefunden habt. Darüber hinaus wird dieses Semester vorstandsintern von den an der Generalversammlung eingehend diskutierten Budgetangelegenheiten geprägt sein. Unser Ziel ist es, bis Ende des Semesters sicherzustellen, dass der SMW eine nachhaltige Entwicklung aufweist und finanziell auf sicheren Beinen steht. Mit den konkreten Plänen die wir im Vorstand ausgearbeitet haben, sind wir gespannt auf diese Zeit und freuen uns, die Situation anzugehen.

Mit Freuden,  
Aurél



# HoPo-Log

von Aaron Locher

Hallo zusammen,

Ein neues Semester, neue Erstis und neue Vorlesungen, alles neu? Nein nicht ganz, das kommende Semester bringt auch alte Routinen, Abläufe und eingeübte Schauspiele mit sich. Ein Wechselspiel zwischen Neuem Entdecken und Gewohntes einfacher Durchführen.

Für eine genaue Ausführung, was für mich als HoPo gewohnt ist, verweise ich gerne auf meinen Semesterbericht, welcher an der GV veröffentlicht wurde. Dort habe ich versucht, möglichst einfach die Vielfalt der ETH-Strukturen zu erläutern. Wenn du diese Ausgabe in den Händen hältst, wird schon ein FR, eine DK und eine UK stattgefunden haben, allesamt mit spannenden Themen gefüllt. Zum Teil werdet ihr in dieser Ausgabe mehr darüber erfahren, andere Themen brauchen noch mehr Zeit, um auszureifen. In einem PAKETH wird der akademische Kalender umgekrempelt, doch wird die Umsetzung erst für unsere Erstis in ihrem Master spürbar. Ein zeitlich näheres Projekt und für alle erlebbar ist die Phänomena 2025. Eine Wissensstadt, bei welcher unser Departement Fachpartner ist und der Schweiz die Materialwissenschaft näherbringt. Prof. Lucio Isa arbeitet nun daran, mit Studierenden Experimente für die Öffentlichkeit zu validieren, damit nicht schon nach 2 Wochen das Experiment unbrauchbar ist.

Dazu kommt die Optimierung der Zusammenarbeit mit dem Departement und den Semestersprechern, damit Änderungen einfacher und schneller implementiert werden können. Somit können wir den Studiengang von Jahr zu Jahr verbessern und dies aktiv vorantreiben. Dabei geht dieser Bereich auch in meine Entdeckungen über. Alte Verbindungen wieder aufleben zu lassen und herauszufinden, was sich alles mit den bestehenden Mitteln machen lässt. Ich bin gespannt, was wir dieses und nächstes Semester auf die Beine stellen können.

Obwohl wir verhältnismässig klein sind, können wir grossartige Momente kreieren.

Euer HoPo, Aaron

# Vorstandsvorstellung

## Neumitglieder

Felix Wegmüller

Quästur



**Funktion:**

Quästur

**In welchem Semester studierst du?**

5. Semester

**Was würdest du dir vom SMW wünschen?**

Financial Freedom

**Was ist dein Lieblingsmaterial?**

Halbleiter

**Über welche Kleinigkeit regst du dich manchmal auf?**

Sachen, die rum liegen?

**Marguerite Babusiaux**

**Ersti Beisitz**



**Funktion:**

Ersti-Beisitz

**In welchem Semester studierst du?**

1. Semester

**Was würdest du dir vom SMW wünschen?**

Ganz viele Events (wie die Stämme), damit sich alle integrieren können und wohlfühlen.

**Was ist dein Lieblingsmaterial?**

Nanomaterialien

**Was gönnst du dir jeweils als «kleine» Belohnung?**

Eine (oder manchmal wohl auch mehrere) Folgen meiner aktuellen Lieblingsserie.



# “Einmal SMW GV mit Alles, bitte! - Mit Scharf!”

von Michael Imhof

Die Verwunderung war gross, als ich im Mail zur SMW-GV am 21. September las, dass es statt der traditionellen Pizza einen Döner geben soll. Da ich gratis Essen gegenüber jedoch nie abgeneigt bin, und darüber hinaus neugierig war, wie unsere Kultis unsere individuellen Bestellungen zu handhaben gedachten, meldete ich mich natürlich wie jedes Semester an.

Die GV startete mit der Begrüssung durch unseren Präsidenten Aurél Gerber. Schon bei der Annahme der Traktanden dämmerte es uns, dass etwas nicht ganz im Reinen war, denn eine Gruppe von Studierenden (die offensichtlich mehr wussten als meine Wenigkeit und meine Sitznachbarn) stimmte dagegen und äusserte den Wunsch, die Besprechung der Probleme des SMW vorzuziehen. Da es jedoch keinen offiziellen Antrag zur Änderung der Traktanden gab, wurden die vorgeschlagenen Traktanden dennoch mit einer Mehrheit angenommen, und wir Unwissenden wurden bis fast ganz zum Schluss auf die Folter gespannt, was es mit dem Ganzen auf sich hat.

Da unser Budget seit der letzten Reglements-Änderung über ein ganzes Jahr läuft, gab es an dieser GV keine Erfolgsrechnung zu besprechen. Quästorin Lara Wagner stellte daher nur das Budget für 2024 vor, welches ohne grosse Diskussionen oder Fragen angenommen wurde.

Wie üblich standen die Vorstandsmitglieder dann der Reihe nach auf und erzählten uns von ihrer Arbeit im vergangenen Semester. Da Lara von ihren Pflichten als Quästorin zurücktritt, wählten wir einen neuen Quästor. Als Kandidat stellte sich Felix Wegmüller zur Verfügung, welcher sich nach eigener Aussage der finanziellen Schwierigkeiten des SMW bewusst sei (im Gegensatz zu vielen Anwesenden). Aurél kandidierte erneut als Präsident, für seine mittlerweile sechste Semester-Amtszeit. Auf die Frage, warum er denn noch ein Semester bleiben wolle, antwortete er, dass er uns keinen Scherbenhaufen zurücklassen wolle und die bestehenden Probleme gerne lösen möchte, ehe er das Zepter übergibt.

Bevor wir dazu übergingen, Felix und Aurél in ihre Ämter zu wählen, war es schon Zeit für unsere Verpflegung. Denn statt wie gewohnt am Schluss der GV zum Pizza-Essen überzugehen, wurden die Döner schon relativ früh

geliefert, um die Anwesenden bei Laune zu halten (auch wenn es streng genommen Dürüms waren, wenn mich mein kulinarisches Wissen nicht täuscht). Danach gingen wir zur Wahl von Felix und Aurél über, welche mit einer klaren Mehrheit, aber auch vielen Enthaltungen gewählt wurden (an Felix lag's eher nicht).

Weitere Änderungen im Vorstand waren der Rücktritt von Yannick Gachnang als Kulti, welcher durch den bisherigen Ersti-Beisitz Fabian Kleiner abgelöst wurde, und die Neubesetzung des Ersti-Beisitzes. Für letzteren gab es zwei Kandidaturen, Marguerite Babusiaux und Elias Hinder. Beide waren interessiert an dem Posten, da sie gerne einen Einblick in den SMW-Vorstand erhalten möchten, um sich allenfalls später mehr einzubringen. Da wir im SMW kein Talent (und schon gar keine Freiwilligen) verschwenden möchten, wurde versucht, einen Kompromiss zu erzielen um beiden eine Aufgabe im Vorstand oder in Vorstands-Nähe zuzuteilen. Dafür fand sich leider keine Lösung, so dass die beiden gebeten wurden, kurz nach draussen zu gehen damit wir wählen konnten. Marguerite kehrte daraufhin als Ersti-Beisitz in den Saal zurück, aber ich kann mir gut vorstellen, dass Elias bei einer zukünftigen GV der Sprung in den Vorstand doch noch glücken wird.

Die Bestätigung der Kommissionen verlief ebenfalls glatt. Die LMW+ wurden von Linard Ráz präsentiert, FS4S und the materialist von Aline Maillard, und die Kulturkommission von David Stahel. Da sich alle diese Kommissionen schon etabliert haben, wurden sie ohne Diskussionen bestätigt und können ihre Tätigkeiten wie gewohnt fortsetzen.

Zu guter Letzt kamen wir dann zu den Varia, und endlich erfuhren dann alle Anwesenden, woher diese Spannung kam, die uns schon zu Beginn aufgefallen war. Nachdem wir bereits im letzten Semester aufgrund eines Missverständnisses mit dem VSETH einen grossen finanziellen Verlust am PVK erlitten hatten, hatte sich die finanzielle Situation des SMW weiter verschlechtert. Ein Missverständnis zwischen dem Vorstand und dem Skiweekend-OK hatte dazu geführt, dass viel mehr Geld ausgegeben wurde als budgetiert, und beim letzten PVK waren die Einnahmen geringer als erwartet. Als Konsequenz dieser Geschehnisse, deren volles Ausmass dem Vorstand seit diesem Sommer bekannt ist, ist die SMW-Kasse daher so gut wie leer, und es besteht kein Spielraum für weitere Fehler mehr! Als Reaktion darauf hat der Vorstand einige Massnahmen beschlossen. Das Ziel ist nun, weitere solche Zwischenfälle zu verhindern, sowie den finanziellen «Puffer»

durch verschiedene Sparmassnahmen und zusätzliche Geldquellen wieder aufzubauen. – Möglichst ohne, dass die Studierenden davon durch höhere Kosten oder weniger Dienstleistungen betroffen sein sollen.

Die Situation wurde noch rege diskutiert, mit zahlreichen Anregungen, wie man ggf. noch mehr sparen oder einnehmen könnte und diversen besorgten Fragen, inwiefern wir vielleicht doch betroffen sein könnten. Obwohl der Vorstand zwar einräumen musste, dass es noch nicht sicher ist, ob es nächstes Jahr ein Skiweekend oder einen PVK geben wird, schienen sie hingegen ziemlich zuversichtlich, dass der restliche SMW-Betrieb wie gewohnt weitergehen kann. Daher waren wir am Ende alle relativ zufrieden mit der Diskussion, und Aurél bedankte sich für die zahlreichen guten Inputs. Y Vi Thach nutzte die Gelegenheit, um im Namen aller dem Vorstand und allen anderen zu danken, die für den SMW tätig sind und dabei (im Allgemeinen) gute Arbeit leisten.

Als nächsten Punkt bei den Varia stellte Horacio Keller das Konzept für die Designkommission vor, welches er im Auftrag der letzten GV erstellt hatte. Deren Aufgabe soll es zukünftig sein, Designs für den SMW zu erstellen. Diese Kommission wird von Zoe Grämiger aufgebaut und beaufsichtigt werden. Basierend auf diesem Konzept wurde beschlossen, die Designkommission ins Leben zu rufen.

Zu guter Letzt wurden noch die Vorstandsgeschenke vergeben. Y Vi (OIV vor Julian), Lara, und Yannick wurden für ihr Engagement für den SMW gewürdigt und erhielten ihren Interessen angepasste Geschenke.

Damit endete die GV, da wir den gemütlichen Teil schon vorgezogen hatten, und mit Auréls Verabschiedung schwand auch die letzte Hoffnung, dass es zum Abschluss noch ein Bier geben könnte. – So viel dazu, dass wir Studierende vom neuen Sparkurs nicht betroffen sein würden! – Alles in allem war es aber dennoch eine gute GV.

# Ersti Tag

von Aline Maillard

Der diesjährige Ersti-Tag des SMWs fand in kleinem Rahmen statt. Nicht etwa, weil wir uns dazu entschlossen haben, weniger Programm anzubieten, sondern weil wir dieses Jahr nur sehr wenige Erstis begrüßen konnten. Es ging sogar so weit, dass wir fast gleich viele Helfer und Helferinnen hatten, wie neueintretende Studierende. Das hat jedoch nichts am entstandenen Chaos geändert. So wurden Würste und Brote zu Hause vergessen, es gab am Morgen noch eine Notfall-Einkauf-Aktion und es wurden sogar am Ersti-Tag selbst noch Helfer organisiert! Und die Unterstützung dieses Jahr war gross; viele Helfende haben noch Snacks, Salate, Brote oder Desserts fürs gemeinsame Mittagessen mitgebracht!

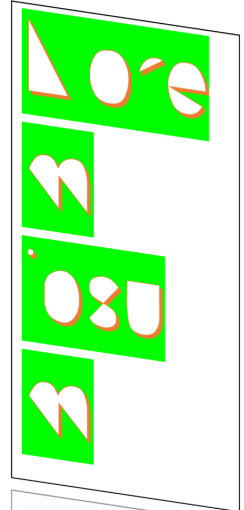
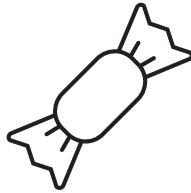
Aber auch wenn hinter den Kulissen am Anfang ein kleines «Rumgewusel» stattfand, so schien am Ende doch alles und trotz Regen rund gelaufen zu sein!

Und nun habt ihr die Möglichkeit, die künstlerischen Talente (unter intensivem Zeitdruck, versteht sich) unserer Erstis zu begutachten. Am the materialist-Posten mussten sie sich nämlich in Gruppen einen Team-Namen ausdenken und diesen gestalten.

GRUPPE 4



Holy Trinity



PDP

Aka.

Pizza-Döner-Pasta

*Wild Alligators*

# Soccer Cup 2023

von Aline Maillard

This is a great example of how information can get lost. It was May 20th when I randomly received a forwarded message of this group picture via WhatsApp, with the comment «From Soccer Cup». Given that the picture seemingly was taken on a large soccer field, I believed the subscription without giving it another thought and presumed it was meant for a the materialist article. But that's where I went wrong. I didn't write myself a tiny note somewhere along the lines of «inquire who is going to write about the soccer cup» or «find out who took the picture».

Now I'm sitting here, finishing up the plan for the layout of our October issue and randomly remembering this picture. So, enjoy a picture of happy materials scientists on a soccer field with no caption and no proper photographer credit (though it's very likely that the image was taken by another materials science affiliated person and given that our department is rather small with 546 people in total, it limits the pool of possible owners from infinity to quite a bit). I would tell you a bit about the soccer cup, but I wasn't there. So... Let's try anyways. It was a day, there were students and a football involved, there's a high chance that the people there had fun, probably some screaming and cheering, and very likely some running and likely some sweating.



# Buzzing Little Friends

by Evamaria Fuchs

I was sitting on the couch, thinking about what on Earth I should write about the topic “klein / small”. Or better, I tried to think, but was interrupted every few seconds by a fly trying to bite me (Yes, biting flies exist and we have them here in Aargau, it’s not fun). After countless attempts to get some peace and quiet I gave up raking my mind for a somewhat sophisticated topic for an article and decided to write about the little beasts constantly circling me instead. So here I am, telling you about insects. To change things up a bit, I figured I might as well try to present them in a better light for once. Maybe I will even get some of you to like them in the end. What we know better, we like better. I will let them present themselves in a “Freundebuch” kind of way, like we all used to do back in elementary school.

*My Name:* Musca Domestica

*My friends call me:* Housefly / Stubenfliege / GoAway

*My eye color is:* red

*I like to eat:* Everything, actually. But I have a very strong sweet tooth, so strong that I can even taste sugar with my feet.

*A cool fact about me:* I always land headfirst, so if I want to sit on your living room ceiling, I have to do a little half-somersault first.



source image: <https://www.news.uzh.ch/de/articles/2017/Geschlechtsbestimmung-Stubenfliege.html>

*My Name:* Calliphora vicina

*My friends call me:* Blue bottle fly /  
Schmeissfliege / GetOffMyFood

*My eye color is:* reddish-brown

*I like to eat:* Nectar and pollen from  
the flowers that the bees don't like.  
They say they stink. My kids like de-  
caying proteins.

*A cool fact about me:* My body looks amazing in the sun, it has a nice blue shimmer to it. Also, my kids are often lending their expertise in food matters to the police during murder investigations. They help making our society a safe place for everyone, I am so proud of them!

*My Name:* Sarcophaga carnaria

*My friends call me:* Common flesh fly  
/ Graue Fleischfliege / Ugh

*My eye color is:* brownish-red

*I like to eat:* Everyone thinks I eat  
meat, but actually I like flowers much  
more

*A cool fact about me:* I am viviparous, that means I don't lay eggs but give birth to my babies in their larvae-form. They grow up together with earth-worms, they help them loose weight very efficiently. I heard this is also called parasites, but I don't like the negative connotation here.



source image: [https://arthropodafotos.de/dbsp.php?lang=deu&sc=1&ta=t\\_38\\_dipt\\_bra\\_call&sci=Calliphora&scisp=vicina](https://arthropodafotos.de/dbsp.php?lang=deu&sc=1&ta=t_38_dipt_bra_call&sci=Calliphora&scisp=vicina)



source image: <https://www.insects.ch/art/sarcophaga-carnaria>



*My Name:* Drosophila melanogaster  
*My friends call me:* Fruit fly / Fruchtfliege / AhhSomethingJustFlewIntoMyNose

*My eye color is:* Also red, but with a warm golden tint when the sun hits them at just the right angle

*I like to eat:* I was into fermented stuff way before Kombucha was cool



source image: <https://www.wissenschaft.de/gesundheits-medizin/eine-fliege-fuer-die-forschung/>

*A cool fact about me:* I'm very well studied, you should see my Wikipedia page (side note from the author: it was a lot to scan through in search for a fun fact). The Drosophila Research Conference is an annual international event where within five days, my fans hold more than 1000 presentations just about me. I'm important, you know.

*My Name:* Stomoxys calcitrans

*My friends call me:* Barn fly or power mower fly / Wadenbeisser / OoouchYouLittleAhh

*My eye color is:* crimson scarlet



source image: [https://commons.wikimedia.org/wiki/File:Gemeine\\_Stechfliege\\_Stomoxys\\_calcitrans\\_0579.jpg](https://commons.wikimedia.org/wiki/File:Gemeine_Stechfliege_Stomoxys_calcitrans_0579.jpg)

*I like to eat:* I love blood, the warmer and fresher the better. I have a special little stinger to get it.

*A cool fact about me:* To lay eggs, my abdomen needs to be filled with blood completely, so please can I have some of yours? Not all of us carry parasites and bacteria, just some, don't worry.

# Tiny

by Anna Huber

Thousands of tiny grains of sand  
They get under your nails and roll around like eyeballs  
Then they split open – fish eggs come to mind  
Goosey translucent with putrid smell  
You could catch a waft from a mile off  
They make your eyes go green  
A dark murky green you'd find in a swamp  
Where the alligators live and you can't quite define what you're stepping on  
Watch them rolling  
Rolling rolling rolling  
It can drive you insane  
They're all watching you  
It's a show!  
Don't cry honeybunch, we're only judging :)  
You want to scream, you want to run away  
The galling stench makes you want to throw up  
Don't gag or they'll laugh  
And when they laugh it makes your skin crawl  
It's a slow tinkering that sets your teeth on edge

Beware don't let go  
Count them oozing  
Once they've burst you'll die  
Hahaha and no, you can't claw your eyes out  
This is your hell  
You created it  
You have to live in it  
You have to survive it  
– or not, ultimately up to you  
But if you don't, we'll mock you  
We can tear open your skin with our fingernails  
We can nibble at your earlobes  
Those ruby pearls are just too beautiful  
They must be set free  
They must be drunk down like elixir  
Don't let the tiny goblets get to you  
Once you see them, you can't ever un-see them  
They'll get their hooks in you and drive you to insanity  
We're all mad here!

# Flies Will Pass The Time To Fly

von Leonor Thorp

Give me a sec.

The seconds collect.

I gaze at them as though they are pacing.

They return to a tempo. Every decision to lean back will one day cost me.

Foolishly believing I can reclaim them.

Aren't they my memories after all?

A fly's wings flap, a finger that points at everyone, and anyone could be  
next.

"Take me back!", little pleas coming from the shutter itself.

It takes them with it.

If we refuse to follow, it'll just drag us along.

I wait for the day I'll be but a second away from witnessing a mighty dragon.

They say, they left but their bones.

Lift off in T-minus 3.

To the world it will feel like mere seconds, when Ben snuffs out a whole  
time zone.

Until our bones find a space next to their bones.

Struggling now, the second hand sticks to the pearly white slate.

Midnight.

Moon's plate will shiver.

Waning as we whither.

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# Quantum Interpretations Explained using cows and milk

von Stefan Schären

## *Preamble I*

I have a surprisingly vivid childhood memory from my grandparents' farm: Of a colourful wooden plate hung above the table in the living room, right in between the clock and the big cowbells. It showed several satirical panels, called "You have two cows" – where several political / economic ideologies were explained by using an analogy of *having two cows*. Given my age then, I did not really understand the content. Nonetheless, I liked to look at the painted farmer and animals. Inspired by this memory, I shall use the analogy of "owning a cattle" to exemplify the different quantum interpretations (note: Originally, I planned on using cats, but that analogy has been overused to the point of being most definitely dead by now).

## *Preamble II*

I know the term *cattle* is plurale tantum. Nonetheless, I will use it in the singular form here – in the sense of having "one cattle". So, one cattle is essentially an animal that is / could be both a cow and a bull (I am sorry for English grammar purists – but hey, you could just add this evidently missing word to your needlessly large vocabulary).

## *The milking problem*

If things get small, they get weird. Mind you, not weird enough that mathematicians or theoretical physicists are confused; just weird enough that everyone else is. See, the problem is the following: Very small objects can be completely described using a mathematical wavefunction. All observable properties, be it speed, position, spin or whatnot, can be derived from that wavefunction. But paradoxically, the wavefunction itself can *not* be directly observed. For example, the wavefunction of a cattle could dictate that the animal has both characteristics of a cow *and* a bull. But when you measure the cattle (henceforth called "trying to milk it"), you will find *either* a whole

cow or a whole bull – nothing in-between. The mathematics adds up. Still, some confusion arises since no one knows what *actually* happens when you milk your animal. This is the so-called measurement problem. And finding the two answers to “what happens when you milk your cattle?” and “what is a cattle, anyway?” forms the heart of quantum interpretations.

### *The Copenhagen Interpretation*

You own a cattle. When you milk it, it decides to become a cow.

### *The Many Worlds Interpretation*

You own the platonic idea of cattle-ism in your barn. When your awareness tries to milk it, it exclusively experiences the cow related parts of the idea. Unbeknownst to you, the cow is also a burger.

### *Pilot Wave Theory*

You own either a cow or a bull. Sometimes, a self-employed surgeon sneaks into your barn and performs a gender transformative operation on your animal. They never told you their schedule, so you can only guess whether you get milk or not.

### *Relational Quantum Mechanics*

You own a cattle. A can of milk indicates that you must have interacted with an animal and that it must have been a cow. If you were to drink the milk, both you and your cow would vanish from existence.

### *Consistent History*

You own a cattle. You milk it. Sherlock Holmes comes along and gives you a bizarrely long explanation of every scenario that could happen in a barn. He finishes by saying “since you have milk, we can deduce that the cattle most definitely is a cow” and leaves. You thought you already knew that; now you are confused.

### *QBism*

You own a cattle. A gambling addict shows up and asks how much you are willing to bet on whether or not it is a cow. You do not take the bet – disappointed, the gambling addict proclaims that cattle are not real anyway.

### *Transactional Interpretation*

You own a cattle. You decide you want to drink milk, while somewhere in the future, a glass of milk decides it wants to go back into an udder. You make a deal: You will go forward in time, milk a cow and enjoy a glass of milk – the glass of milk will go backwards in time, being spewed out by you before creeping back into the cow, transforming it into a cattle. Everyone got what they wanted.

### *Ensemble Interpretation*

You own a cow. You milk it, since it is a cow. It is surely nice to own a cow. Happy, you leave the barn. The next day you return and find a bull. You shrug your shoulders – you do not mind owning a bull either. Everyone else keeps telling you that you actually own a cattle. But you have never seen said cattle, so why would you care?

### *Quantum Darwinism*

You own a cattle. When you milk it, it briefly becomes a bull *and* a cow. But given that you milk it, the bull does not really make sense in this reality and dies. A scholar then tells you that this is a really smart analogy to the classical evolution algorithm: It applies the concepts of reproduction (the cattle becomes two things), selection (one of the things vanish) and variation (ok, he forgot that) to quantum mechanics. You ask him whether that analogy really makes sense since variation is kind of the most important point in evolution. Instead of answering directly, he loses himself in an avalanche of complicated jargon and vague thought-experiments.



### *Superdeterminism*

You have a cattle. You must voluntarily milk it and the cattle has to become a cow. Everything is all the time, always. The universe is a static, defined thing and your consciousness is nothing but a miniscule subsystem in the entirety; a thing that is complex enough to simulate free will and perceive the passage of time, but too limited to understand that all is just one constant. The future is as immutable as is the past; you are but a brief flicker in the eternalistic monolith of reality. Nothing must make sense, nothing matters.

### *Dirac's approach*

You like milk.

internships, full time positions  
for bright materials scientists



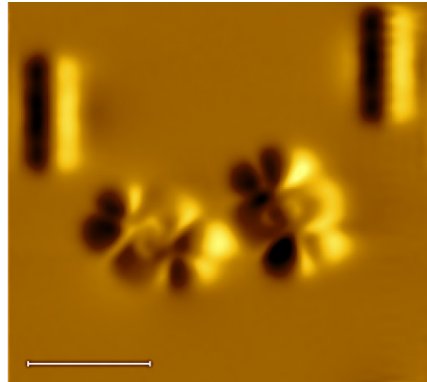
where fiction meets reality

# Probing Quantum Spins with a Scanning Tunneling Microscope

by Aishwarya Vishwakarma

In the world of science, there's a saying: "Small is beautiful, small is plain, small is easy, small is complicated. Small is relative!"

And indeed, when we think about the smallest entities in the universe, like atoms and molecules, it's hard not to be awed by the sheer complexity hidden within their minuscule structures. But what if we could not only observe these tiny building blocks but also control them, like puppeteers manipulating marionettes?



The image shows organic pentacene molecules on MgO/Ag (100). Scalebar: 2 nm.

The concept of wielding such power is tantalizing, and it forms the heart of our exploration: the attempt to probe atomic-scale species and fathom their underlying science.

Within these microscopic realms, electrons take center stage. Their charge property has long been harnessed in the form of electricity, powering our modern electronics. However, there's another attribute of electrons that has recently ignited the scientific imagination: their spin. This property is now under intense scrutiny as researchers aim to propel the field of spintronics into the future. Yet, the true frontier lies in controlling individual spins, providing us the ability to use them as quantum qubits.

But how do you go about controlling something as elusive as an electron's spin? Even before that, how can you visualize these spins? Enter the scanning tunneling microscope (STM), a remarkable invention that owes its existence to the brilliance of Gerd Binnig and Heinrich Rohrer in 1981. This tool has become indispensable for surface scientists, enabling them to capture

atomic-scale structures with astonishing spatial precision. However, human curiosity knows no bounds, and in our relentless quest to understand nature, we have upgraded the traditional STM. Think of it as upgrading the software on your smartphone. Our enhanced STM not only observes atomic and molecular orbitals but also deciphers the intricate world of spin structures, adding energy resolution to the setup. Researchers are now actively working to push the boundaries further by achieving temporal resolution.

So, what new revelations do these technological enhancements offer in our pursuit of fundamental scientific understanding? To provide insight, let's delve into the activities of our laboratory. We employ a specialized setup known as EPR-STM, which belongs to a select few groups worldwide capable of conducting such experiments. EPR-STM marries the exquisite energy resolution of Electron Paramagnetic Resonance (EPR) with the atomic spatial resolution of STM. This unique combination enables us to detect single spins and exert coherent control over them, transforming them into quantum qubits.

Imagine a single spin occupying a specific energy state, its degeneracy lifted by an external magnetic field, causing it to split into spin-up and spin-down states. Operating the setup at a liquid helium temperature, 4.5 K, we create an imbalance between these states and apply a time-dependent radiofrequency antenna, inducing transitions between them. The strength of this transition depends on the antenna's power input, known as the Rabi rate. However, these excited spins cannot linger indefinitely; they eventually relax into their ground state, a process influenced by the chemical environment and the spin's interactions. This intrinsic property of spin, residing in its magnetic orbital host, can be modulated by manipulating the environment, achieved by depositing a decoupling layer to shield against spin relaxation. This technique allows us to unveil the fundamental behavior of spins, once relegated to theoretical models in the past. Now, we can visualize the quantum operators at play.

To conduct these experiments, we prepare a spin-sensitive probe, an STM tip, designed for detecting spin sensitivity in atoms and molecules. In essence, if you wish to converse with a native speaker familiar with only one

language, it's most effective to communicate in that language. Similarly, to communicate with a spin, you need a spin-sensitive tool like an STM.

Another remarkable feature of STM is its ability to manipulate spin structures laterally and vertically. This enables the assembly of spin structures in various configurations, allowing us to study their interactions and communication – the realm of spin-spin interaction. These interactions, measured in nanoelectronvolts (neV), a billionth of an electronvolt, can not only be probed but also finely tuned by controlling the spin structures. By sending pulses of excitation and altering their shape, we pave the way for using them as quantum qubits on surface structures.

What sets EPR-STM apart from traditional EPR is its unique sensitivity to the state of a single spin. While traditional techniques measure many spins and derive average properties, our approach enables us to gather data on individual spins. This level of precision is unprecedented and opens doors to a deeper understanding of the quantum world.

In conclusion, the world of the small is indeed intricate and requires meticulously designed experiments to reveal its secrets. With the scanning tunneling microscope and EPR-STM, we are unlocking the mysteries of quantum spins, providing a glimpse into the mesmerizing world of quantum mechanics at the atomic and molecular scale. As technology continues to advance, who knows what other wonders we may uncover in the realm of the infinitesimal? Small may be tricky, but it is also undeniably fascinating.

# Product heating reinvented and (re)shaped

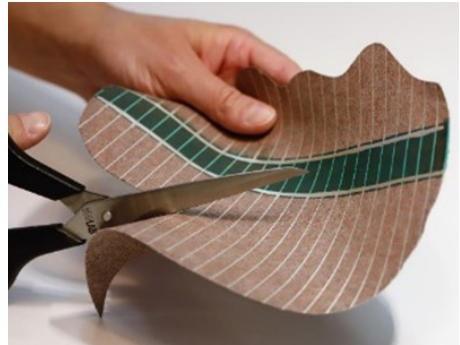
by Murielle Schreck and Fabian Schmid

The D-MATL and ETH spin-off qCella AG offers a novel heating technology for products. Heating objects close to people rather than entire rooms, such as car interiors, thus becomes an attractive option. qCella's approach is comfortable, energy-efficient and can be applied to a wide range of products - from shoe soles to airplane seats.

The team behind qCella consists of three Materials Alumni: Murielle Schreck, Fabian Schmid and Weyde Lin.

And naturally, the fuel to drive our whole adventure stems from a material innovation: The qCella heating mats are made of a material Murielle invented during her doctorate in the group of Prof. Markus Niederberger.

We call it a copper inside cellulose fiber composite, for which we have a patent pending. It is not a composite in the traditional meaning, but more of a hybrid material. Murielle has found a unique way of combining copper and cellulose fibers by growing copper in the form of small ( $> 200$  nm) particles within the fibers. The combination of different properties of the materials – cellulose fibers are electrically insulating and copper is conductive – provides us with the right electrical resistance for resistance heating. Then, we manufacture the heating mats from this copper cellulose composite in the same way as you produce paper. Because this paper-like structure is made completely of our copper inside cellulose fibers, it is electrically conductive everywhere and heats up homogeneously over the entire area, which gives us certain advantages over existing heating solutions. Also, we use sustainable materials, as cellulose is renewable, and copper can be recycled indefinitely.

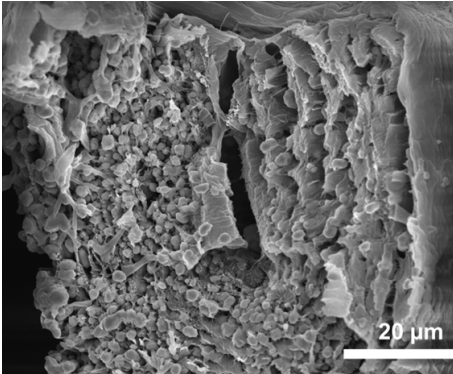


The qCella® Heating Mat

The homogeneous heating and the paper-thin structure are the main advantages of the qCella® Heating Mats compared to heating wires, which are the common solution used on the market to heat products. Heating wires require an upholstery layer to distribute the heat evenly. A lot of heat is lost across this layer. Using our heating mats, such upholstery becomes obsolete. Therefore, almost no heat is lost, lower temperatures and less electrical power are necessary, making heating much more energy efficient. In addition, the heating mats, being a paper, can be cut into any shape and size, providing amazing design flexibility. At the moment, we are focusing on two markets. One is the market of heated products for the automotive and aviation industry, e.g., heated seats. Today, there are still far more internal combustion engine-powered vehicles than electric cars. One reason for this is the reduced range



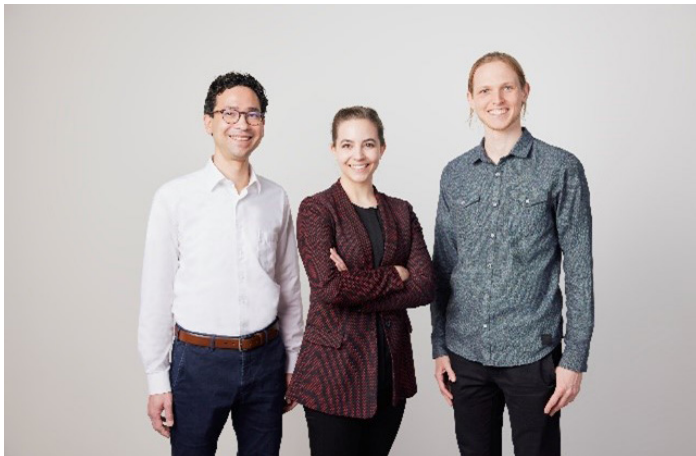
Light microscope picture of the copper inside cellulose fibers.



SEM image of the copper particles inside a cellulose fiber

of electric cars due to quickly drained batteries compared to fuel-powered vehicles, especially in winter. We want to change that with our more energy-efficient heating solution. Energy efficiency is also crucial for the aviation industry. One of qCella's biggest supporters is the Swiss company Caynova AG, which offers the world's first seat heating and cooling system for airplane seats. The second market is wearable heating that includes everything from heated gloves to heated shoes and heated pain relievers. For example, we are designing prototypes of heated shoe soles together with Stuco AG, a Swiss producer of safety and work shoes.

Currently, we finance ourselves with three so-called non-dilutive grants. This is money that we get without having to give away parts of our company. One grant comes from ETH directly (ETH Pioneer Fellowship), one from the Swiss Confederation and from the Swiss National Science Foundation (Bridge Proof of Concept) and the third grant originates from a foundation called the Gebert Rűf Stiftung. Furthermore, we also won the Venture Kick startup competition. The next steps are now to make our heating mats market entry-ready, to expand R&D efforts and to upscale production. To do this, we are looking for new talents and offer internships with industry-standard salaries, master projects and master's thesis positions for Materials Science students. If you are interested in joining us in this adventure, don't hesitate to reach out! We are still located in the HCI building for another two to three years.



The qCella team: Weyde Lin, Murielle Schreck, Fabian Schmid (from left)

Open positions

<https://qcella.com/careers/>

Contact details

[info@qcella.com](mailto:info@qcella.com)

LinkedIn page

<https://www.linkedin.com/company/qcella>





The first prototype of a heated shoe sole including qCella's heating mat

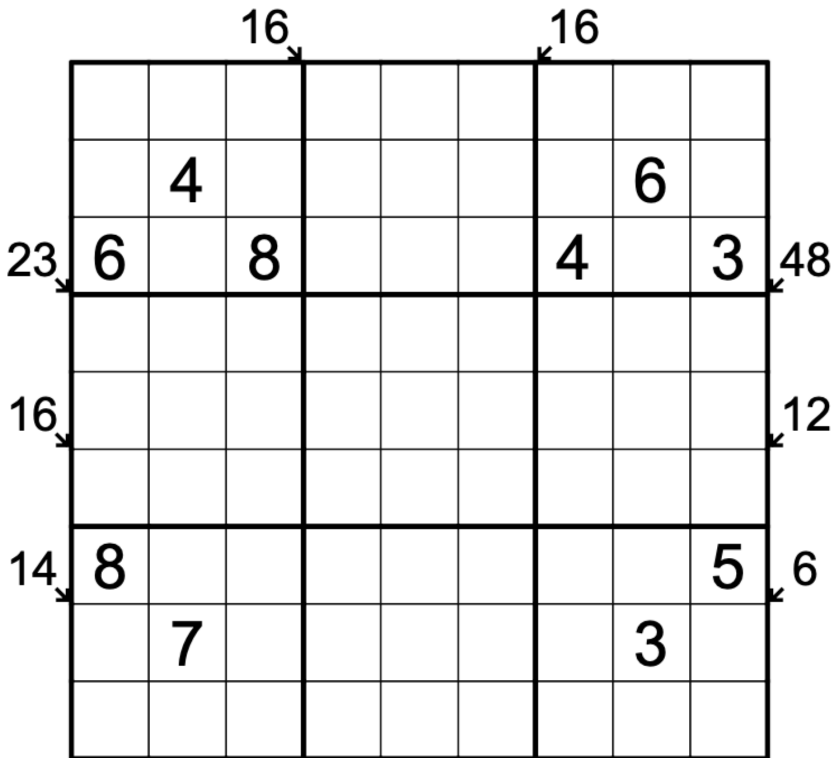


The qCella® Heating Mat

# A little killer Sudoku

by Jonas Weber

Normal sudoku rules apply. The numbers outside the grid with the arrow pointing to a diagonal, are so called little killer clues. The number indicates the sum of all the digits along the indicated diagonal. Digits may repeat on such a diagonal when allowed by normal sudoku rules.



# PHÄNOMENA

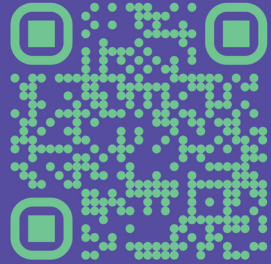
Phänomena 25 is a science city in Dietikon with the goal to make current scientific topics more accessible for the broad public. It will take place from april to october 2025. Our department will take part in it as a specialist partner.

We are currently looking for students who are interested in creating the different exhibits and testing their endurance.

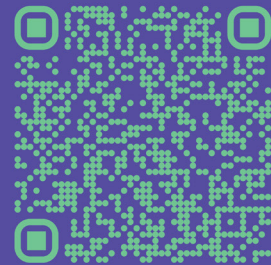
All bachelor and master levels are welcome to help. You will work as a HiWi and get paid accordingly.

Prof. Lucio Isa will be working on samples that are complex fluids.

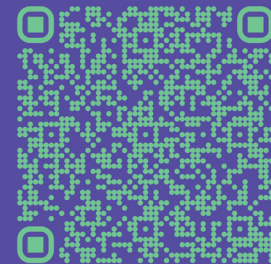
Aishwarya from the group magnetism and interface physics happily supports projects that show magnetism and spintronics.



Website of Phänomena 25



Here you find the contact information for Aishwarya



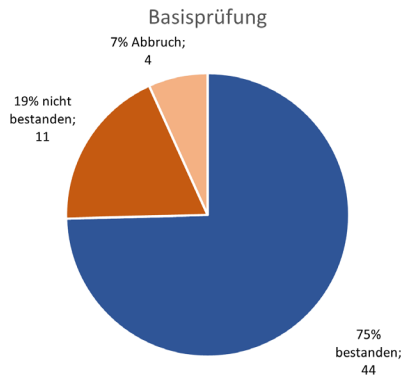
Here you find the contact information for Prof. Isa

# Prüfungsstatistik

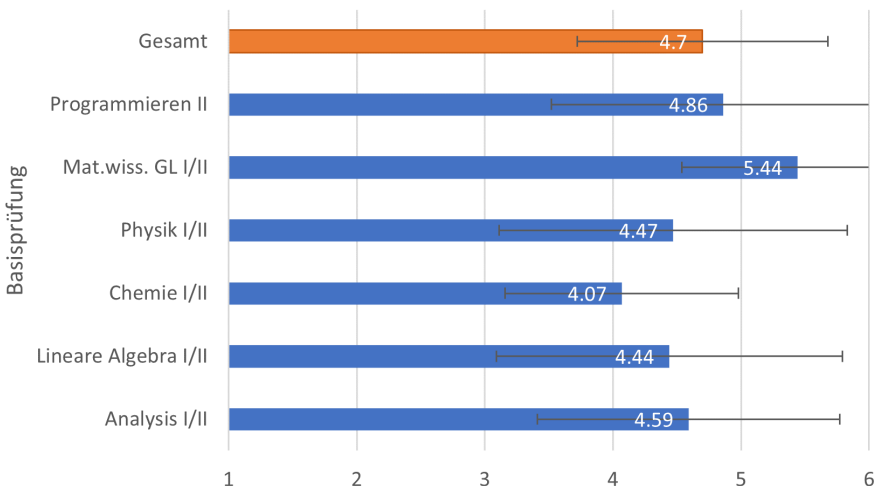
von Aline Maillard

Sommerprüfungs-Session ist um, das Semester wieder in vollem Gange und unsere Erstis wurden zu «Zweitis». Und das auch sehr erfolgreich. Ein sagenhafter Basisprüfungs-Schnitt von 4.7 wurde diesen Sommer erzielt, und 75 % aller Erstis sind nun fleissig im dritten Semester am Weitermachen.

Und auch dieses Jahr waren die Schnitte aller Fächer in der Basisprüfung genügend; das zweite Jahr in Folge! Hut ab und herzliche Gratulation!

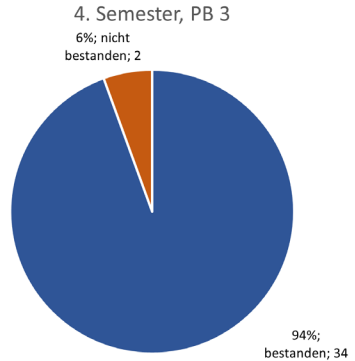


Mittelwerte Basisprüfung

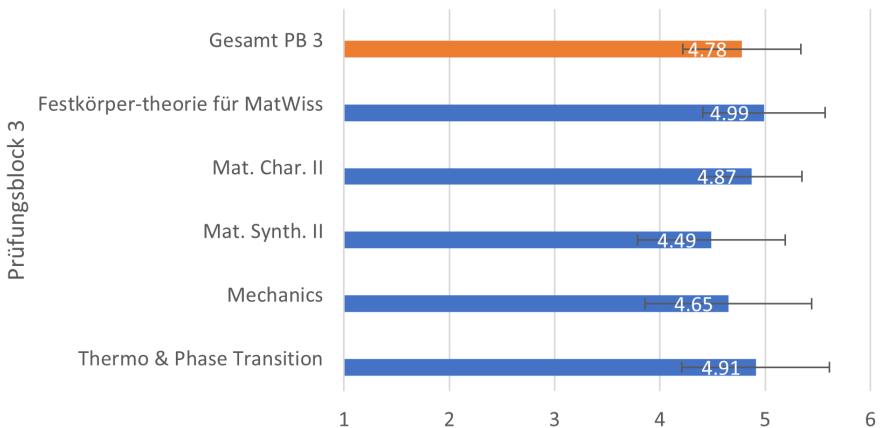


Ausserdem sind alle Schnitte angestiegen, bis auf *Chemie I/II*, wo der Schnitt von 4.2 minim zurückgegangen ist auf 4.07. Aber das ist definitiv kein Grund zur Sorge. Alles in allem also eine Glanzleistung unserer ehemaligen Erstis!

Auch die Prüfungsergebnisse aus dem 4. Semester sind Grund zur Freude; auch hier ist der Gesamtschnitt im Vergleich zu letztem Jahr angestiegen. Lediglich der letztjährige Schnitt von *Materials Synthesis II* mit 4.63 konnte dieses Jahr knapp nicht übertroffen werden. Aber alle anderen Schnitte wurden verbessert. Welch freudige Nachricht! Gratulation!

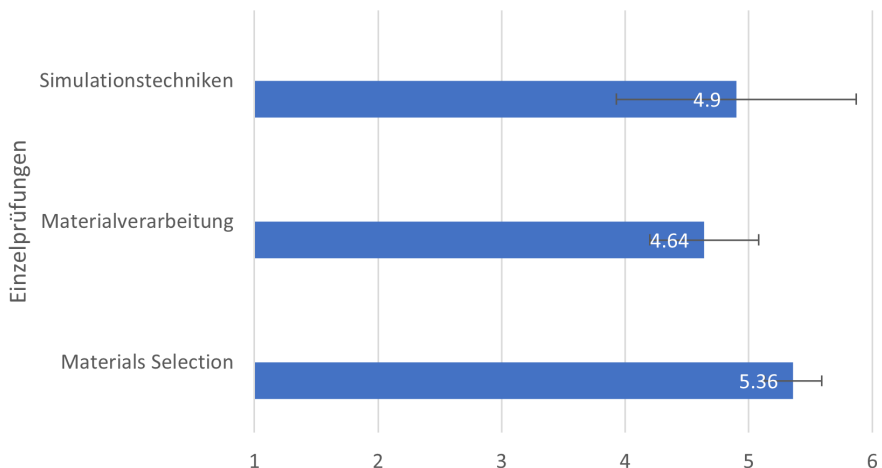


### Mittelwerte 4. Semester



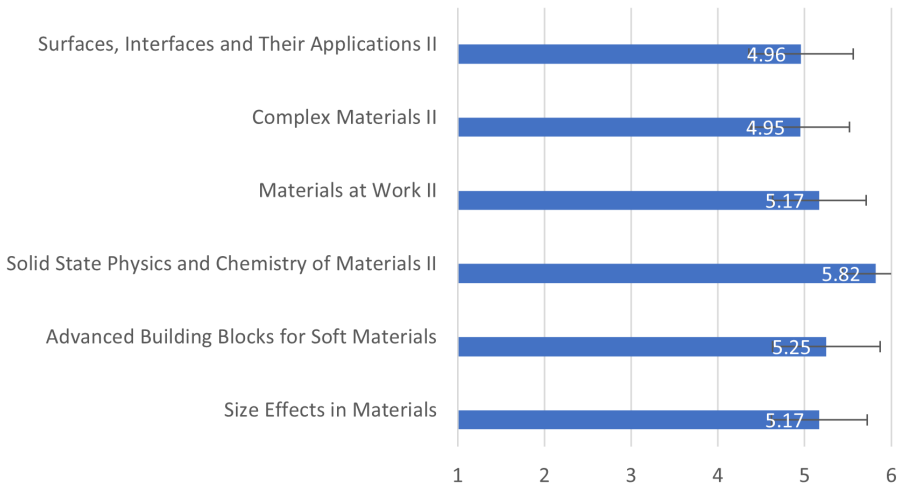
Im 6. Semester wurde *Materials Selection* von allen bestanden, *Materialverarbeitung* wurde von 2 Studierenden nicht bestanden und in *Simulationstechniken* waren es sogar überraschenderweise 6 Studierende. Da dies das erste Jahr war, in dem das 6. Semester gemäss neuem Curriculum durchgeführt wurde, haben wir hier noch keine Vergleichswerte zum letzten Jahr. Aber auch hier sind wir glücklich mit den Ergebnissen und zuversichtlich, dass die Prüfungen allenfalls im zweiten Versuch gut bestanden werden können! Gratulation an euch, und nochmals guten Endspurt, falls ihr noch etwas für den Bachelor-Abschluss nachholen müsst!

## Mittelwerte 6. Semester



Die Masterschnitte sind wie gewohnt erfreulich hoch und konnten an die Glanzleistungen vom letzten Jahr anknüpfen, wenn diese nicht sogar übertrffen. Auch wieder schön zu sehen ist, dass der letztjährige Schnitt von *Solid States Physics and Chemistry of Materials II* wieder einmal getoppt werden konnte! Wir hören also mit einer Spitzenleistung auf! Nächstes Jahr werden wir dann die Schnitte der angepassten und neu eingeführten Master Core Courses sehen, wir sind alle schon gespannt.

### Mittelwerte Master Core Courses



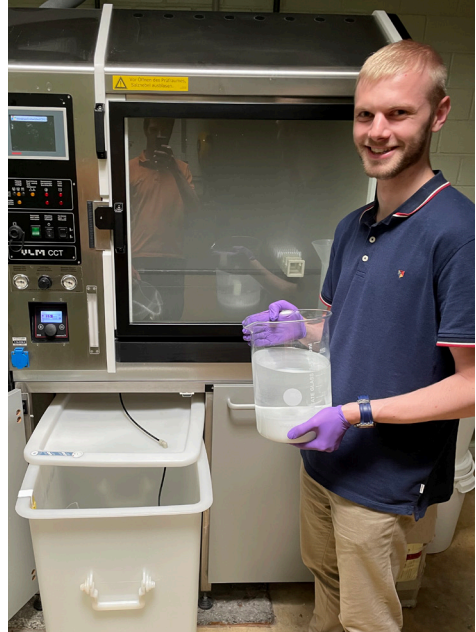
Also auch dieses Jahr, eine durchaus erfolgreiche Prüfungssession. Deshalb weiter so und durchbeissen!

Wie immer, ein herzliches Dankeschön an Sara Morgenthaler für die Bereitstellung der Prüfungsergebnisse.

# Working at Pilatus

by Philipp Lach

In spring 2023, I had the opportunity to do an internship with the Materials and Processes group at Pilatus Aircraft Ltd in Stans. My employment lasted six months, from the 6<sup>th</sup> of February until the 4<sup>th</sup> of August. During my time at Pilatus, I had the opportunity to work in all three sub-groups incorporated in the Materials and Processes team: Surfaces, Metals, and Composites and Polymers. Let me quickly introduce you to what each group actually does, if they are not hanging out in the coffee room or creating memes about one another. (As an intern, my job was to implement some of the ideas.)



The **Surfaces group** covers all processes and materials associated with surface treatments and coatings. Both inorganic coatings (for example anodizing layers) and organic coatings (Primer and Topcoat) play a significant role in corrosion prevention. The paint scheme of a manufactured part consists of several inorganic and organic coating layers. The individual coating layers serve the purpose of corrosion protection and adhesion promotion of the subsequent layer. Most of the time, however, a coating layer is used due to its beneficial properties in either adhesion promotion or corrosion protection. As a result, there can be up to five different coatings on the manufactured parts, depending on the substrate material. The topcoat serves an additional aesthetic purpose additionally, being the top-most layer of the coating scheme.



The Metals group covers the processes and treatments concerning the metal base material as well as the design of metal parts. Metal parts can range from very small parts, such as rivets, to very large structural parts, such as the wing of the airplane. Processing of the metal during production includes heat treatments, welding, soldering and other joining methods. The Metals group is also in charge of the material selection for much of the plane. As is often the case in aviation industry, aluminium is the most frequently used metal, followed by steel and finally titanium.

The Composites and Polymers group is responsible for the choice of composite and polymer material as well as the manufacturing of composite and polymer parts. Pilatus mainly uses carbon fibre plies preimpregnated with epoxy resin, which are cured in an autoclave to obtain the final part. For increased rigidity of the part, foam and honeycomb structures can be included in between the prepreg plies. The Composite group is also responsible for materials used as interior lining. For such parts, fire resistance to flammability is of great importance.

### **Main Projects**

From the beginning of my internship, I received two extensive projects, which I was allowed to manage and work on independently. From time to time, there were update meetings with the colleague supervising these projects, to address occurring problems and to check the progress.

The first project was my introductory project and involved additional testing for a recently qualified zinc-nickel surface treatment. Reference samples and treated samples were tested for visual appearance, adhesion of the coating, coating thickness and corrosion resistance.

Corrosion resistance was tested using a neutral salt spray chamber. In the chamber, concentrated sodium chloride solution is vaporized at 50 degrees Celsius. The number of hours it takes until the samples show corrosion gives an idea about the performance of the surface treatment compared to other treatments. For samples which have received all the surface treatments of a regular part, the minimum requirement is 3000 h in the salt spray chamber. And as you might have guessed, my samples showed the paint scheme of a regular part and therefore needed to sit in that chamber until eternity. Actually, they might still be in there, if no one else took them out. But seriously speaking, one thing I learned during my internship is that things take a long time in the aviation industry. So, if you are the progressive type and like to

have progress fast, I don't know if I would recommend the aviation industry for you. I mean, the fact that my introductory project was not finished before the end of my internship speaks for itself, I believe. And yes, I did work ;D

The second project aimed for the qualification of a new chromate-free pickling agent. I enjoyed this project very much because I managed it from start to finish. The only thing that was left to do was to write a report about the results. But regrettably I had to take a vacation, so I had to leave my colleagues with the paperwork. You may have heard that chromate is considered toxic and carcinogenic, which is why Pilatus, and likewise other airplane manufacturers, are committed to remove chromate from their production lines in accordance with the European REACH regulation. However, before replacing the chromate-containing product by the chromate-free product, tests need to be performed to ensure the equivalency of both products in terms of performance on the parts. And that's where my project came in.

I treated half of the specimens with the "old", chromate-containing agent and half with the "new", chromate-free alternative prior to testing, to achieve a comparison of the two products. The performance of both pickling agents was compared by visual inspection of the specimens, pitting analysis, determination of the coating removal rate and fatigue testing. Since you are probably familiar with all these tests, I will not bother explaining them. Doing so would just be boring to you and would cost me additional typing energy.

As I mentioned before, I oversaw this project from start to finish. This included drafting a test plan, organizing the production of samples with colleagues from the production and finally, performing the surface treatment in the galvanic shop (see figure 1) before doing the actual testing. Getting to dip my samples into solutions for a change was really cool (as in awesome) and hot (as in 38 degrees with long pants on, because I value safety).



Figure 1

## Additional Projects

Next to the two main projects I also worked on various smaller tasks during my six months of internship. Additional projects included testing aviation fuel for microbial contamination and in-service testing of a newly introduced surface coating, just to name a few. Most of these additional projects were very practical. I got to inspect parts with a borescope [sic!] during the airplane's maintenance, for example. However, it wouldn't be an internship if there wasn't any paperwork assigned to you, which no one wants to do. Although I must give credit to my co-workers for not loading me with this kind of work. You will be kept busy, but most of the tasks are actually interesting. Additionally, you are given a lot of trust to work on the tasks independently, which I appreciated.



Figure 2

## Personal Statement

Prior to the internship, I was hoping to get insight into various parts of airplane industry and gather experience for a possible future job in aerospace industry. I can fortunately say that the Pilatus site in Stans offers a lot in this regard. Since much of the assembly and production is in one place, I got a good overview of the plane manufacturing processes. Furthermore, I very much enjoyed working in the Materials and Processes group. The group's attitude is positive and laid back, which makes for an ideal working atmosphere. Additionally, most of the group members also joined activities outside of working hours (see figure 2). This is not at all a given, in my opinion, and it added to the already cheerful atmosphere in the group, which I highly valued.

## Final Notes

In case you want to apply for an internship at Pilatus Aircraft Ltd, now that you have read this article, don't contact HR as your first step. If there is no internship advertised on the website for materials scientists, they will turn you down. (They turned me down the first time as well). Instead, you should contact someone within the Materials and Processes group. For contact information, you can either contact Sara Morgenthaler or me. The Materials and Processes group is always happy to have new interns with a background in materials science. Now let us assume that your application is accepted, and Pilatus offers you a stay in their intern flat like they offered me. I would like to offer you some pros and cons for living in the intern flat of Pilatus. On the one hand it is nice to talk to fellow interns after your day at work and the flat is rather near to Pilatus (20 min by foot, 7 min by bicycle). On the other hand, you need to consider that you will be living in Oberdorf NW, which is like, *rural rural*. The public transport is nothing compared to the public transport in Zurich. Additionally, there was no direct public transport from the flat to Pilatus when I was there. So, I highly recommend you get yourself a vehicle of some sort (preferably a bicycle). But once you are done ranting about the public transport and the smell of manure and the fact that there is nothing going on in Oberdorf NW, you can also appreciate that Nidwalden is a very green and beautiful place to live. It's a nice place to go hiking, running, skiing, and swimming in the lake.

Coming to an end, I sincerely hope this article was of any help to some of you and if you are interested, we can maybe have a chat at the next Stamm ;)

# Outdoor Kondi



by Alain Schwegler

Gerade als ETH-Student\*in sieht man nicht immer gerade viel von der Sonne. Wie gut trifft es sich doch da, wenn das Kondi auch gelegentlich im Freien stattfindet. Ende letzten Semesters war dies der Fall, und mehrere hundert Leute haben sich im Irchelpark auf der grossen Wiese neben den Tennisplätzen eingefunden. Genauer gesagt standen wir alle in dem Drittel der Wiese, der sich im Schatten befand. Auch wenn es schon Abend war, wurde es einem nämlich in der Sonne recht schnell heiss. Als es dann aber losging, verteilten sich alle um das grosse Podest in der Mitte der Wiese. Auf und um dieses Podest gab es fast ein Dutzend Instruktor\*innen, welche abwechselnd ordentlich Stimmung machten. Dies resultierte im kondi-typischen, synchronen Herumgehüpfe gepaart mit gelegentlichen «Hey» und «Hou» Schreien. Dabei fühlte man sich wie ein kleiner Arm einer riesigen Seeanemone und konnte sich so richtig schön verausgaben. Als kleines Extra machten noch grosse aufblasbare Bälle die Runde, welche man irgendwohin weiterkicken konnte, wenn sie bei einem landeten. Alles in allem gefiel mir diese Art des Kondis sehr gut. Die Stimmung, die gelebte Synchronität und das gelegentliche kühle Lüftchen waren wirklich ein fantastisches Erlebnis. Wem es nun auch in den Beinen und Armen juckt, dem kann ich nur empfehlen, Sonnenschutz und genügend zu Trinken mitzunehmen.

# Solution to the killer

|    |   |   |    |   |   |    |   |   |   |    |
|----|---|---|----|---|---|----|---|---|---|----|
|    |   |   | 16 |   |   | 16 |   |   |   |    |
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| 23 | 6 | 9 | 8  | 5 | 7 | 2  | 4 | 1 | 3 | 48 |
|    | 7 | 8 | 3  | 1 | 5 | 6  | 2 | 4 | 9 |    |
| 16 | 5 | 1 | 9  | 4 | 2 | 8  | 3 | 7 | 6 | 12 |
|    | 2 | 6 | 4  | 7 | 9 | 3  | 8 | 5 | 1 |    |
| 14 | 8 | 3 | 1  | 2 | 4 | 7  | 6 | 9 | 5 | 6  |
|    | 9 | 7 | 2  | 6 | 8 | 5  | 1 | 3 | 4 |    |
|    | 4 | 5 | 6  | 9 | 3 | 1  | 7 | 2 | 8 |    |

# Team & Kontakt

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Auflage: 100  
Jahresabonnement: Gratis für Aktivmitglieder des SMW

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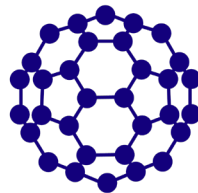
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Elena Kropf

Der SMW ist ein Teil des Verbandes der Studierenden an der ETH (VSETH)

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Aline Maillard, Michael Imhof



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