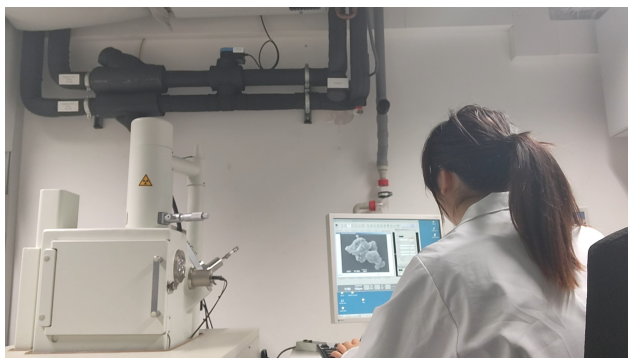


Max-Planck-Institut für Eisenforschung - Non-technical Report
Düsseldorf, Germany
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I am about to begin my third year of undergraduate Natural Sciences, having taken Chemistry and Materials Science in my second year. During the summer, I chose to take on this European placement as I thought it would be an unparalleled opportunity for international lab experience and to work on an interesting project - an assumption which turned out to be totally correct! Out of all the options, MPIE stood out to me based on a few factors. Although I did both French and German at GCSE, I have always preferred German as a language and culture, so I was keen for a placement where I could improve my (slightly rusty) German skills. I was also drawn by the project areas, in nanostructures and interfaces. Finally, I chose a slightly shorter placement length as I wanted some more flexibility with my summer (*e.g.* I am learning to drive back in the UK before the Cambridge term starts again) - however, as the placement came to an end I really regretted this, and wished I had more time at the Institute to keep going with the project!

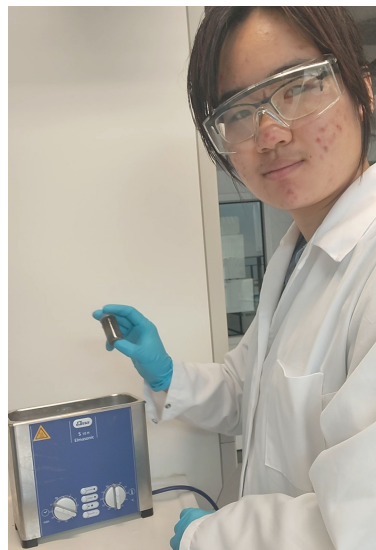
As one might expect, the research environment was totally different to studying at university. I was surprised by how much freedom and independence I was given to plan my own time, and could distribute this how I wanted between experimental work, analysis, reading, attending seminars, and preparing my presentation and report. The pace was also much more relaxed than being an undergraduate in full term at Cambridge, which is something I was initially surprised by, but soon realised it made sense since the work was not in 8-week bursts.



Using SEM to analyse the particles.

projects. It was very fulfilling to then give my own presentation on the work I'd done at the end of the placement!

Everyone was really friendly and in the very first week, I was invited to the annual barbecue and social hosted by my group leader. Before this barbecue, we all went into the Altstadt and

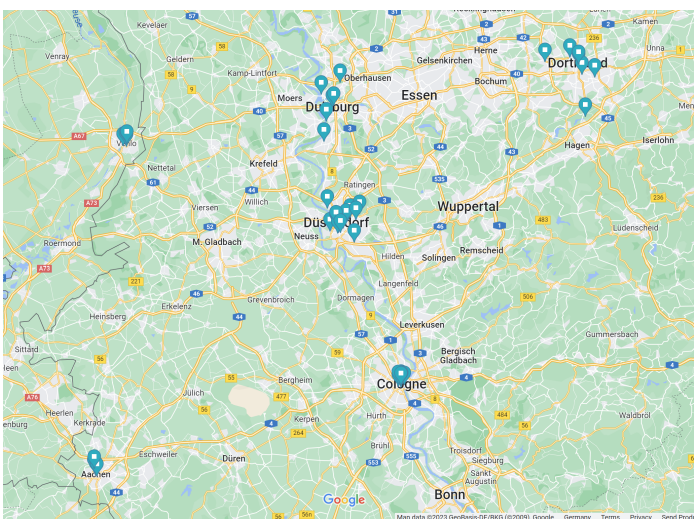


Ultrasonicing nanoparticles in the lab.

My research group was fairly small, with around 15 members. The Institute is really diverse, with people from Korea, China, India, Spain, and of course Germany. One of the highlights was definitely how many cakes and snacks were brought in from various national cuisines - every week there was something different to try! Moreover, my group held weekly seminars where a different member would present their research, which was a really good way to learn about different areas of materials science and hear about others'

did a scavenger hunt in teams, which was surprisingly fun and a really great way to get to know people and learn about the city. Even though I was only there for two months, everyone made me feel welcome and as much a part of the team as anyone else, and I made many good friends and memories. Next month, my supervisor will be visiting the UK, and I'm really excited to show her around as she did for me in Germany!

My project was on liquid metal core-shell nanoparticles, and my particular experiments were on the controlled synthesis of $\text{Ga}@\text{MoO}_x$ nanoparticles. This involved ultrasonication of Ga particles to obtain the desired size distribution and then carrying out a galvanic replacement reaction to add the MoO_x shell, analysing the results at every step, for which I had to learn several new pieces of software. As I was working on the nano-scale, I learnt both TEM and SEM, and was able to use these machines independently by the end of my placement, which was truly a privilege. Using the machines definitely put the theory from IB Materials into a lot of perspective, not to mention how incredible and surreal it felt to be able to see the success of my synthesis, projected onto the fluorescent screen right in front of me, despite being almost incomprehensibly tiny. I feel very fortunate to have had this opportunity as an undergraduate, as these machines are usually restricted to those much further along in their academic careers! After handing in my report, I was also able to make use of the remaining time by shadowing researchers using other machines, so I gained an insight into techniques such as FIB and nano-indentation.



Map of the cities I explored, with my specific pins which I used to plan my trips.



Decommissioned blast furnace at the Landschaftspark, Duisburg.

This all left me more tired than I expected to be on weekdays when I arrived home, but on the weekends which weren't pouring with rain, I battled German trains to take day trips to visit the surrounding cities. Düsseldorf is perfectly located for this; I visited Cologne, Duisburg, Aachen, Venlo, and Dortmund, and none of them were more than 90 minutes away by train.

Depart	To/Via	Platform	Q 18:01
18:03	Roermond via Tegelen, Reuver, Swalmen	4 ^b RS11	
18:05	Hamm (Westf.) Cancelled due to railway problems abroad	- RE13	
18:29	Nijmegen via Blerick, Venray, Vierlingsbeek, Boxmeer	1 ^b A-omni	
18:33	Schiphol ✈ → Hoofddorp via Eindhoven C., Utrecht C., Schiphol Airport ✈	3 Intercity	

Trying to get home from the Netherlands; the trains encouraged spontaneity rather than tight planning...

There were many highlights, and each city was unique in its own way, from Aachen's picturesque old town centre of narrow cobbled streets to Cologne's gothic cathedral towering over busy high streets. I was lucky enough to be able to take part in Cologne Pride when I was there - as my first Pride event, it was really inspiring and heartwarming to feel like I belonged, despite the language and cultural barrier. Another highlight was the

decommissioned blast furnace in the Landschaftspark in Duisburg. It has been preserved and opened to the public so one can climb all the way up and see the complex of the four furnaces, the casting house, ore bunkers, and the gasholder - so as well as some exciting views you can see all the intricate detail of the factory and how it operated! I was having so much fun that I didn't realise until my friend pointed out, that I was visiting a materials-related factory on my day off from my materials placement...

Overall I found the placement to be really enjoyable and rewarding, as I learnt a variety of valuable skills, both technical and general, and used machines which I would not have otherwise had the opportunity to. Having experienced the research work environment, I am now more likely to continue with a research career, especially completing a PhD. As well as the work aspects, I enjoyed living abroad and immersing myself in German culture - my language skills have greatly improved and I learnt a lot of local history. This would certainly not have been possible without the generous bursary provided by the Armourers & Brasiers and I am hugely grateful for this support, as well as to Lianne, and Ningyan and Frank at MPIE.