

As soon as I arrived in Antwerp, I wanted to check commuting options to and from the campus. One of the difficulties was the far location, since the campus is located quite outside of the city and was about 8.5 km away (in one direction) from my place of residence. Unfortunately, public transportation is not reliable means of commuting, as there are often delays, cancellations and strikes. However, I was lucky to have an amazing host who lent me

her spare bike for the whole duration of my stay. Therefore, I cycled every day for about 17 km. Another positive side apart from staying physically fit is that the weather was surprisingly good, which made my rides more enjoyable. What I liked the most during my internship is that every day was different, and I never had a boring day! I did so many experiments in so various labs, even went on other campus to measure my samples in other set-up. Of course, I had amazing not only supervisors but also rest of the colleagues with whom I immediately connected. We would always take lunch breaks together and even hang out after work time. Such a friendly and warm atmosphere made my experience unforgettable and best so far.

### **Tasks at the Physics Department**

The starting protocol of my internship was functionalization of carbon nanotubes with aryl diazonium salts which introduce luminescent defects into the nanotubes. The sample preparation usually took couple of days, after which the next step was spectroscopic characterization, since optical properties of carbon nanotubes come from their excitonic structure. Employing Absorbance and Photoluminescence (PL) measurements was something I was working on daily. From these techniques I managed to assign peaks which come from either bright singlet excitons or phonon sidebands. Moreover, PL measurements revealed the relative increase in defect density, which we were hoping to achieve. For more accurate measurements on quantification of defect density, I learned how to operate on two different Raman set-ups. For obtaining the lifetimes of singlet excitons, I used the Time correlated single photon counting method and therefore learned how to use another instrument and gained more not only theoretical knowledge but also experimental one. The final goal was to then study triplet excitons using ODMR. For this method, we needed to achieve very low temperatures by pumping liquid helium through the cavity in which we placed our sample which we exposed to continuous laser excitation and constant microwave field, while sweeping magnetic field. This causes shift of triplet sublevels and resonance transition when microwave energy matches energy difference between spin states. With ODMR we managed to perform laser power dependence, temperature dependence and vary microwave modulation frequency to obtain as much information as possible of the triplet system under investigation. Understanding better the triplet excitons can help in employing these materials in optoelectronic devices, as they are currently limited for these applications due to low quantum efficiencies stemming from large discrepancy between 15 dark, non-emitting states out of which 12 are triplet and, only one bright singlet emissive state. During my internship, we have discovered important and new properties of our system which make it possible for quantum (bio)sensing applications. These results we are planning to publish soon.

### **Free time**

Before arriving to Antwerp, I had no expectations of the place or the people whatsoever. So, I was excited to see what kind of opinion I will form. I am outgoing person who likes to explore the city, so that is what I used to do every weekend. I found the city breathtakingly

beautiful, and I truly thought the people were exaggerating when they say that Antwerp is beautiful city you would always want to come back to. That is true though, even after 2 and half months, my awe and enthusiasm never diminished. I found it amazing that by going out on Thursday, Friday or Saturday and going into bars you would find a live gig, maybe a jazz, rock, or alternative music, doesn't matter. There is always something for everyone. So many good coffee shops, vintage shops, beautiful architecture, and on top of that friendly and warm people! Not even one month after my internship I managed to meet so many people, not just internationals, but also local Belgians. People are so approachable, relaxed, and friendly that I really wasn't expecting this positive outcome. Of course, I continued to see the new Belgian friends for the rest of my internship. Also, it is very useful when you get to meet the locals, as you much quicker discover new and cool places to see. Another positive thing is that everyone speaks English quite well, so I never had issue with language barrier. As for the downside, the food is more expensive in markets compared to in Germany.

### **Final remarks**

To conclude, I am immensely happy that I ended up doing this internship. Not only did I get to travel and get to know the other research group, I made connections within and outside of the working environment, but I also ended up getting a PhD position in the same research group! After no expectations of one place, I ended up falling in love with everything Antwerp had to offer and now I decided I want to stay here for another 4 years. I would recommend people to apply for internships abroad, as in the end, you never know where life can take you next and which possibilities it will offer. And finally, I am very grateful to have been awarded ERASMUS funding, which helped me tremendously financially.



Fig 1: Grote Markt (left) and Rubens square (right), famous squares in Antwerp

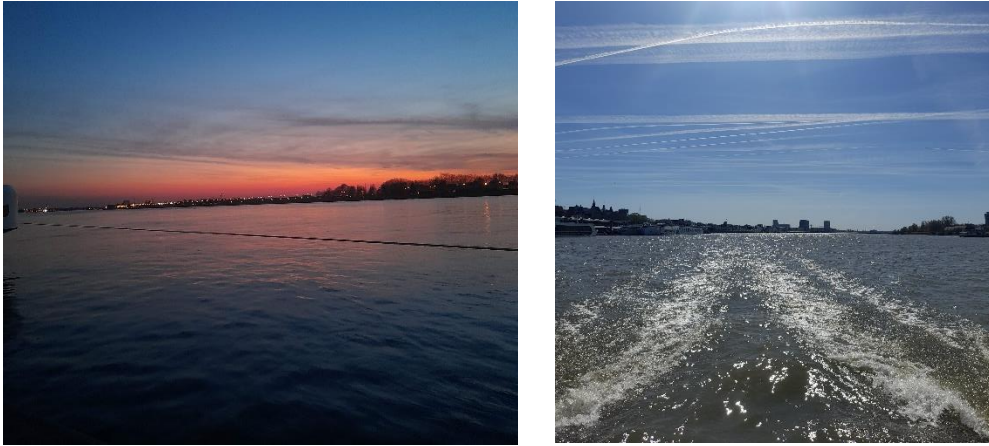


Fig 2: River Scheldt. With water bus you can discover other places close to Antwerp.