

Royal Holloway Travel Award Report

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I study the laser trapping of atmospheric aerosol for my PhD. Atmospheric aerosol directly and indirectly affects the radiative balance of the planet, to an extent which remains one of the largest uncertainties in climate change studies. My project uses Mie spectroscopy to investigate the optical properties of single atmospheric aerosol particles, measuring the properties to an unprecedented precision over a large wavelength range. My research involves extending the current technique to look at the light scattering of atmospheric aerosol in the ultraviolet wavelength range, increasing the amount of information gained from a single spectrum, and allowing the fitting process to theoretical models to become more accurate.

My funding is provided by a studentship through the Department of Earth Sciences, as well as a CASE award from the Science and Technology Facilities Council, covering my tuition and maintenance. However, I lack additional funding for conferences and research trips, and so I was incredibly fortunate to receive the Bill Chaloner Memorial Award, which allowed me to attend the Aerosol Science Summer School 2019, held at the University of Vienna. This was matched funding in addition to funding acquired from the Department of Earth Sciences Research Committee.

The Summer School began on the Sunday with a tour of the city and university, which was a great opportunity to explore the city of Vienna and to meet the other participants and lecturers. From Monday to Friday, the days each consisted of a series of 4 lectures, covering different aspects of aerosol sciences. As no background training in aerosol science was available through my undergraduate degree, and Royal Holloway offers no in-depth training, this series of lectures was incredibly useful to attain a much wider overview of aerosol science than would otherwise be possible. Having completed a literature review as part of my annual monitoring meeting process, I had gained a good understanding of light scattering by atmospheric aerosol, however this course was able to give me insights into a wide array of fields, from health effects to particle statistics. Several of the courses such as aerosol sampling and measurement touched upon areas of my research where I am only indirectly involved, and so were extremely useful for me to learn more about these process and to consider how our sampling can be improved.



Figure 1: *The Vienna Aerosol Science Summer School 2019 Cohort, taken on the stairs of the Department of Physics building at the University of Vienna.*

The most useful sections were those concerning optical measurements of aerosol particles, as these directly relate to my research. Dr. Helmuth Horvath, who has published extensively in the field of aerosol optical properties, presented two lectures on aerosol optics and on visibility and atmospheric optics. The first lecture was very useful, as it gave me a much clearer understanding of the electromagnetic theory that underpins aerosol optics, and the mathematics-based approach

to this definitely helped to improve my understanding. Additionally, the second lecture covered radiative transfer and forcing, which are both directly related to the atmospheric nature of my research, and will become very important when I begin to apply my data to atmospheric models.



Figure 2: An image of me during the field experiment at Hohe Wand.

On the Saturday, there was the option to attend a field experiment at the nearby mountain of Hohe Wand, where measurements were taken using a mobile Condensation Particle Counter (CPC) to compare observed particle number concentrations in urban and remote environments. The extinction coefficient was also calculated from measurements of the radiance of distant objects. Having not had the chance to undertake field work during my undergraduate degree, this was a very exciting experience for me. Moving forward, the training I undertook during this summer school has been very useful in providing me with a much broader understanding of aerosol science, and will allow future experiments and publications to be conducted with knowledge and training of complimentary techniques. This will result

in improved quality of experimental work, analysis and presentation of data in future publications, and will therefore benefit both myself and the Department.

Finally, the summer school was an excellent chance to network with my future peer group of young aerosol researchers and European experts, helping to build my scientific profile, as well as improve my communication skills. Talking to other PhD students from my field gave me a new perspective on much of my current research, and the connections I have made through this summer school I am sure will last for many years to come. I am still in contact with several students to discuss how our research is progressing, and hopefully this may lead to future collaboration. The informal coffee breaks between each lecture were a very good opportunity to discuss the lecture content further with the lecturers themselves, and I found this extremely useful.

In summary, my attendance on the Vienna Summer School would not have been possible without the Bill Chaloner Memorial Award, and so I am very grateful to the University for this grant. The Summer School was invaluable to my overall PhD experience, both in terms of training and networking opportunities, and I would advise any future postgraduate students to seek out summer schools and to apply for the Royal Holloway Travel Awards.