From the CM-CDT Director – Prof Ian Galbraith

As 2017 begins, staff and students of the CM-CDT look back on a very busy 2016, and believe it or not the CDT staff’s thoughts are already turning to 2018 - more of that below. Along with business as usual, the tail end of last year brought the submission of the Mid-term review documents. Our paymasters at EPSRC will use these to ensure we deliver what we committed to in the funding bid we made three years back. Part of that submission package was case studies of individual students, scientific topic areas and outreach activities. Thanks to those of you who helped with them. When you see them I hope you think they look pretty impressive – we were certainly happy with how they turned out and they reflect well on our activities in the Centre.

We will soon be recruiting our 9th cohort and graduating our 40th successful PhD student. For a Centre such as ours, whose main function is to train the scientific leaders of the future, a key indicator of the Centre’s success will be in the career trajectories of our graduates. Tracking this is a tricky task and so we have established a LinkedIn group for the CM-CDT Students and Alumni and encourage our students to sign up so they can keep in touch with each other and the Centre.

Hard as it is for us to believe the next EPSRC call for CDT renewals is expected at the end of 2017 so we are already beginning to think of how to best configure ourselves to continue the successful activity we have developed over these last 8 years. The landscape is uncertain and it is not clear what the preferred flavour of CDT submission will look like next year, but hopefully there will still be room for a refreshed but recognizable science-based CDT such as our own to flourish for another five years – watch this space!

From the CM-CDT Operations Director – Dr Chris Hooley

As ever, the 2016/17 academic year started busily, with the arrival of a new cohort of 16 students, and a successful induction event at Merchants’ Hall in Edinburgh. The start of our taught-course programme came hard on its heels, with courses on Superconductivity, Advanced Statistical Physics, Interacting Electrons in Solids, Modern Topics in Condensed Matter Physics, Quantum Field Theory, and Open Quantum Systems in the first semester. Student achievement across this broad spectrum has been strong – sometimes exceptionally so – and we continue to gather useful feedback from our students to improve our taught courses further.

This was also the first semester in which we used the new upgraded videoconference system, featuring better video and audio quality plus more flexibility in terms of patching in remote users – an important feature now, as several of our students are based outside Scotland for part of their studies. Thanks to all our students and staff, as well as the good folk of SUPA, for helping us to iron out the teething problems with that system, which seems now to be bedding in well, and is certainly an improvement on its predecessor.
Other CM-CDT events of the past few months included an all-student meeting in St Andrews on 28th November, as well as supervisors’ meetings at Heriot-Watt (14th November), Edinburgh (22nd November), and St Andrews (24th January). In addition, along with the Bristol/Bath CDT in condensed matter physics, we co-sponsored a very successful scientific meeting, “Frontiers in Condensed Matter Physics”. This was held in Bristol on 9th and 10th January, and attracted an impressive range of UK and international speakers. Let me once again take this opportunity to record our thanks to our excellent CM-CDT office staff, Julie Massey and Wendy Clark, for all the hard work they put into keeping this packed programme of events unrolling smoothly.

On top of all this, our students continue to make key contributions to world-class research in condensed matter physics, undertake placements with our Industrial Associates, teach the undergraduates at their home universities, and maintain an active outreach programme in local schools and science centres. Hats off to them!

Our students recent publications are listed [here](#).

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**My Placement at Attocube – Art Branny**

Hi, I am Art Branny. I started my placement in the beginning of the 4th year of my PhD at Attocube Systems who are based in Munich, in Germany. My time at Attocube had two phases. The first phase played to my strengths. I was designing an optical, experimental set-up to measure a physical quantity. Despite this project playing to my strengths, the interesting thing was that the company’s priorities were different to those I’ve found in academia. Even though the work was similar, my focus had to shift more towards timing, accuracy, robustness, reproducibility and reliability. It was a mind-opening and it made me look at my PhD and science through a different lens.

During the second part I became a test engineer – a role which is integral and essential to the company. This is because Attocube has a vast portfolio of available systems which are customisable. This means that every single project is new and exciting. Boredom was never an issue for me. During my time at Attocube, I had the opportunity to build a cryostat from start to finish, including testing.

The placement lasted nearly 3 months and it gave me a sense of feeling useful, confident in my own abilities and a boost to my self-esteem. It was also long enough to make me look at my own research from a different and fresh perspective. Now that I am back I feel more engaged, switched-on and more keen to do science than ever before. I’ve learnt a lot about the industry and even more about myself. I’ve noticed a few important factors which had a direct impact on me and on my engagement and I wanted to share one with you.

The company’s culture is everything. I am so glad to say that Attocube has a spirit and every single Attoemployee cultivates this spirit. I was welcomed with warmth, care and interest. I felt like a valuable part of the team from day one. This culture fuels personal interactions and the speed at which Attocube grows as a company. You can literally sense it on every corner. Being at Attocube felt like working for Google or Apple, but for physicists. I am aware that it will be hard to find a similar match in other companies or research groups, but at least now I know what excellent looks like.
Soapbox Science – Helen Cammack

On the 24th July 2016 CM-CDT students Helen Cammack and Katherine Rumble, along with CM-CDT alumna Anne Pawsey, appeared in Edinburgh’s answer to Speaker’s Corner in Hyde Park London: the Galleries Precinct on the Mound. All three were speakers for Soapbox Science; a platform promoting female researchers from across the sciences by providing them a rather high soapbox from which to share their research with passers-by. Having devised their own sets, created their own analogies and armed with self-made props, not even the typically Scottish weather could deter the unsuspecting Edinburgh audience with 790 visitors across all three hours. Thanks to the enthusiasm of the speakers, the volunteers and the organising team, the event was a resounding success.

http://soapboxscience.org/?page_id=2851

See Helen Cammack’s YouTube video of her time on the Soapbox
https://www.youtube.com/watch?v=5_w6iql2gMU

Photo of Katherine taken by Andrew Lim

Bristol Frontiers Conference - Katherine Brown

For many of those from the CM-CDT who attended the Bristol Frontiers of Condensed Matter Conference, this was the first conference they'd ever attended. This meant that there were no expectations going into this conference, and gladly the program set up by the organisers has set the bar for future conferences.

The four invited speakers: Prof. Triscone, Prof. Hatton, Prof. Hoffman, and Dr. Rost, all gave exciting and interesting talks, and did an excellent job of providing an introduction to their areas of research. A particular highlight of these was the talk given by Prof. Hatton about Skyrmions – a topic that few of us had encountered previously, but something we would now feel confident about researching further thanks to his good explanation. Similarly the talk given by Prof. Hoffman was fun, accessible, and a good example of how to explain specialist research to a general physics audience. All the other speakers also provided a stimulating range of talks, with an excellent balance between theoretical and experimental presentations.

Amongst the shorter talks we very much enjoyed the one given by Dr. McClarty about triplon modes because of his easy to follow explanation of a complicated theoretical calculation.

The lunchtime poster sessions provided a nice opportunity to talk to other students about their ongoing research, and also discuss the talks of the previous session. The chance to talk to PhD candidates from other institutions was also valuable from a social and networking perspective. (After his talk, the CDT students at Bristol and Bath admitted to being rather jealous that we’d been taught by Dr. Hooley.)
Over the past year we have continued to take part in many events, including science festivals and visits to local schools as part of the CM-CDT Outreach programme.

In June 2016 we took part in the Glasgow Science Festival, having the chance to have our own stand as part of the Family Days at the Kelvingrove museum. Our popular slime-making demo was a success this year as well, inviting children to think about phases of matter, and whether and why materials behave as liquids or solids. Visitors of all ages had the chance to make their own slime by mixing solutions of PVA and borax and their choice of food colouring. Equally entertaining was our demonstration of the properties of non-Newtonian fluids with a mixture of cornflour and water. Out of our smaller demos, the most popular was by far our film-canister rockets, flying high towards the tall museum’s ceilings and entertaining all the children, adults and our own volunteers alike.

In November 2016 we had a stand at the Dundee Science Festival, participating for two days at the Ardler Complex and the Menzieshill Community Centre. Here we demonstrated how to prepare colourful lava lamps out of a mixture of oil and water, Alka-Seltzer and plenty of glitter. As always, the mixture of cornflour and water interested children and adults alike and gathered a big crowd of visitors wanting to have a go at playing with and even punching the mixture. We also had a few smaller demos and science tricks to show children and spark their interest in concepts such as surface tension and pressure.

Our science festival activities aim to inspire children to think about phases of matter and the science of materials around them in a fun and interactive way. Most of them are simple enough, made with household items, and often adults show interest in reproducing the demos at home.

A group of us returned to Craigmount High School for their Science Week in March 2016, where we set up a quick demonstration of slime for a group of students during their lunch break. This was the second year we organised this activity and we hope to be in touch with them this year again.

In May 2016 we organised our first full-day outreach workshop at Leith Academy, where we organised many activities for a class of 14-year-old students for a full school day. These also included making lava lamps and slime and our mix of cornflour and water, but also other activities such as games to promote problem solving skills or introducing concepts of cryptography. This was also a good opportunity to talk to the students about what we study and for them to ask about careers in science.

Finally, as part of CDT outreach programme, we organise STEM Ambassador inductions, which include disclosure checks for our outreach volunteers. Our most recent ones, in December 2016 in Edinburgh and St. Andrews were well attended and will open more opportunities for outreach events at schools throughout Scotland.
Placement at Fidelity Investment Management Ltd - Jonathon Riley

Following the completion of my third year, I undertook a 3-month placement at Fidelity Investment Limited (FIL) as I am interested in a career in big data analytics and financial technology (FinTech), a growing global industry, and wanted industrial experience before completing my PhD. FIL is a London-based investment management company, with £285 billion under management, operating from 32 offices in over 20 countries.

During my placement, I was working with the Data Services team, in their Kent offices, automating database performance software. My main objectives were to convert an initial proof of concept (POC) project into production software and to automate the process for daily use. The subject of the work I was asked to perform was far removed from my academic research (understanding electron movements and behaviour in semiconductors), but utilised some of the key skills developed during my academic research. Over the three-month placement, I was required to learn various programming languages, and about big data architectures and programmes used widely in this field. Having spent the past three years programming and learning about obscure topics to complete my research, I was well prepared for the work I needed to do.

Working at such a large company and with secure, heavily regulated data, as well as real production servers, was at times frustrating, such as when I had to wait for access to be granted to a cluster of servers. However, it was also exciting to work with production systems and on real business problems, not just menial work. It was also sometimes nerve-racking knowing I was working on live systems and could cause serious damage to business processes if I was not careful. In the end, I was able to make a real impact on the project I was working on, performing an in-depth analyse of the software I was helping to develop and making recommendations of key areas that needed addressing before the software was put into proper use.

One thing I did not expect in doing a placement at such a large company was the friendliness and relaxed, down-to-earth culture at FIL. The open-plan office space encourages a great environment to work in and everybody in the team was extremely friendly and welcoming. Another unexpected benefit of working at FIL was the academic nature of the work I was asked to perform. Because I was working on a very recently developed system, there was a large degree of flexibility in my role and in the objectives of the overall software I was developing. While my main objectives were clear, I was allowed to complete them in whatever manor I saw best, within reason, and I was given the freedom to investigate related topics, such as machine-learning methods, to validate the work done prior to my arrival. I really felt I was in charge of my progression and had the ability to direct my role in the direction I thought was best for the business. My managers were also extremely supportive in building my skills and future career, helping me to register for big data conferences that I would otherwise be unable to attend.

Overall, I cannot recommend FIL highly enough. Placements are a great way to build transferable skills and to experience life in industry without committing to anything too long-lasting.

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