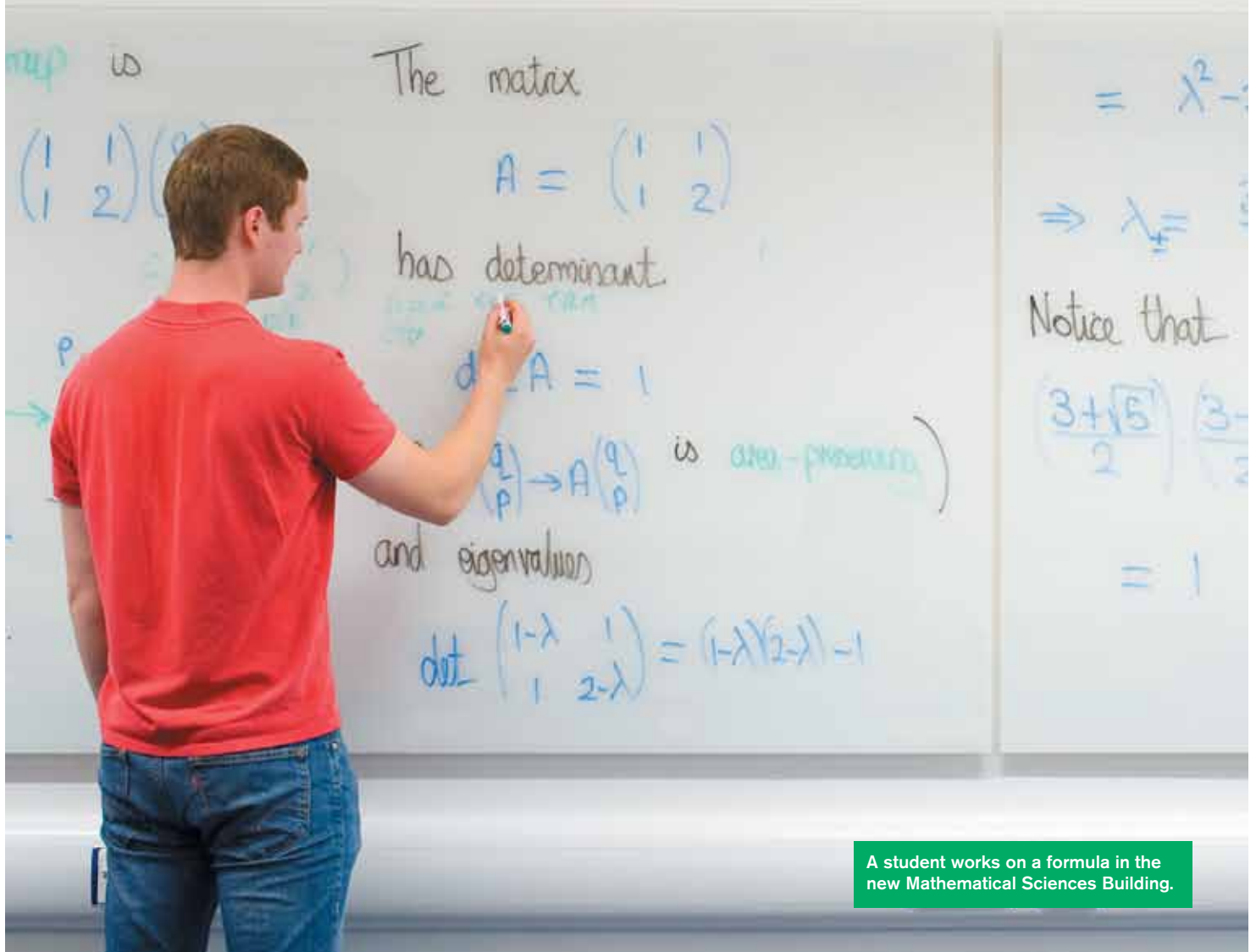




Mathematics@Nottingham

School of Mathematical Sciences Newsletter 2012

Be inspired
to go further



A student works on a formula in the new Mathematical Sciences Building.

Research bursaries

Prestigious summer research projects give students invaluable experience.

Our sports stars

Meet the Olympians who fit in training around their degree.

International opportunities

Your degree could give you the chance to experience life overseas.

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Hello and welcome

First of all, thank you for your interest in studying in the School of Mathematical Sciences at Nottingham. Choosing where to spend the next three or four years of your life can be a difficult decision and there are many factors to consider. We've put this newsletter together to give you a greater insight into our school and to help you decide whether The University of Nottingham is the place for you.

The school provides a large and dynamic environment in which to study mathematics with academic staff who are at the cutting edge of their field. What's more, independent reviews of our teaching have singled out our wide choice of modules and the approachability of our staff for particular praise. This means you will be learning from excellent teachers who work at the forefront of their field. We also have a genuine interest in your personal development and will ensure that you receive all the support you need in the transition from school or college to university and throughout your degree.

The School of Mathematical Sciences provides a great foundation on which to develop further goals and aims in your life. You might want to make the most of the opportunities we offer to study abroad, and you can be assured that a degree in mathematics from our school is well regarded and an excellent foundation for later employment. If you have any questions, please contact us using the details on page 12. Good luck with your decision-making and we hope to welcome you onto campus soon.

Professor David Riley
Head of the School of Mathematical Sciences

News

Personal tutor gives Oscar-winning performance

Students have judged a professor in the School of Mathematical Sciences to be an award-winning personal tutor.

Stephen Coombes, Professor of Applied Mathematics, won a Personal Tutor Oscar in a new scheme set up by the Students' Union to recognise excellence in pastoral care. Almost 400 nominations were received and Professor Coombes was a winner in the "Helped me get the most out of my course/prepare for my future" category.

The other categories were "Helped me with a difficult issue" and "Best all-rounder".

News

See us on iTunesU and YouTube



The University has recently been included on iTunesU, the education iTunes store, and University of Nottingham maths students now have access to free educational video and audio podcasts.

Find out more at www.nottingham.ac.uk/itunesu

The University of Nottingham also has its own YouTube Education channel, which includes several mathematical playlists. The videos and screencasts there include sessions of general interest and selected mathematics lectures as given to our students, along with other useful resources.

Find out more at www.youtube.com/user/nottmuniversity

News

Top employers talk to our students

As part of the Professional Skills module, open to all second-year maths students, several leading employers have visited the school this academic year to give advice on career development and opportunities in their organisations. Visitors have included representatives of PwC, Rolls-Royce and Teach First.

The module also teaches skills such as teamwork, organisation and time management; all attributes which are important to future employers.

For more information about your career options as a Nottingham maths graduate, please see www.nottingham.ac.uk/mathematics and follow the links to "Prospective students" and "Careers".

Student profile

"I'm glad I came here – the module choices have been brilliant and the staff have been excellent. There's one big auditorium, a seminar room and lots of work space for undergraduates and postgraduates. There are lots of things to do on campus too. If I could choose again I would definitely come here."

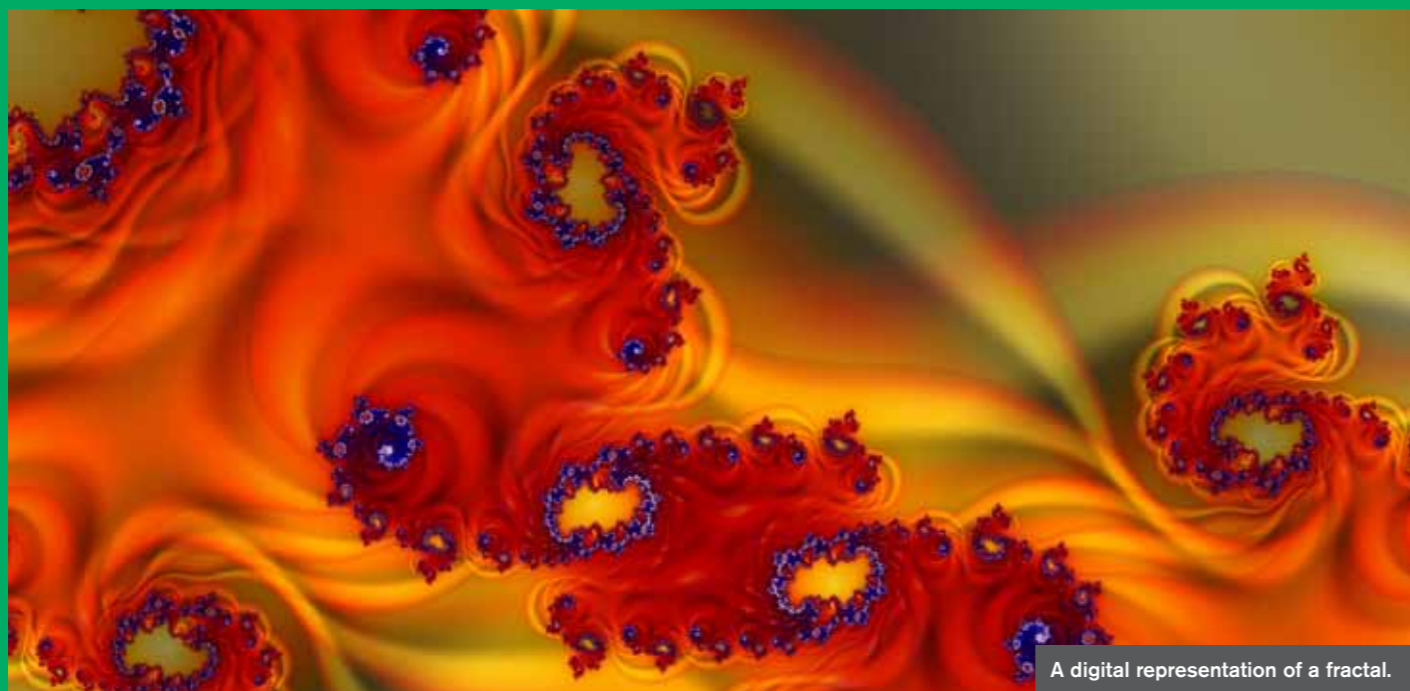
Hannah Williams
MMath Mathematics

Find out more about Hannah's experience at www.nottingham.ac.uk/ugvideos/hannahwilliams



Scan the code to watch this video on your smartphone.

Hannah is preparing for her lecture in the new Mathematical Sciences Building on University Park Campus.



A digital representation of a fractal.

Will I be awarded a research bursary?

Over the last few years, a number of our students have been chosen to take part in prestigious summer research projects. A research bursary allows students in the middle years of their degree to experience research for themselves.

The bursary is open to students from all sciences at all universities and is a competitive process. For those who are successful, it is highly rewarding and a valuable addition to their CV. Last year, Nottingham student Robert Kropholler (MMath Mathematics) was awarded a Nuffield Undergraduate Research Bursary in Science and worked with Dr Joel Feinstein, Associate Professor in the School of Mathematical Sciences at Nottingham.

The project Robert worked on involved an investigation of the properties of various two-dimensional shapes, especially arcs, ranging from polygonal arcs through to the more complicated fractal arcs. In particular, Robert looked at differentiation of functions defined on these sets. Mathematically precise descriptions of the objects under consideration were required and then delicate arguments were put forward in order to investigate various conjectures. These conjectures concerned the problem of when functions whose derivative is constantly zero must be constant on the set. Robert produced a counter-example to the original conjecture, and gave a solution to the problem for a variety of interesting classes of planar sets, including self-similar fractal arcs.

Robert said: "I really enjoyed working on this project: it helped me gain invaluable experience in the field of mathematical research which is a career path that I hope to follow in the future. The project gave me insight into research in the area of analysis, which is something that I didn't know much about, but is now something that I would like to continue looking at. This project has increased my confidence in my ability to do mathematical research, and has confirmed my decision to continue with mathematical research to PhD level and beyond.

I learnt a lot from this project from fairly classical concepts in analysis and their applications, which I now have a much better understanding of, through to more recent developments in the field. It has also shown me a wealth of counter-examples in analysis such as: everywhere continuous, nowhere differentiable functions; an interesting array of fractals; functions which are continuous, non-constant and have derivative zero everywhere. I have also learnt a lot about areas of mathematics that I would not otherwise come across in my undergraduate course including fractal geometry and Hausdorff dimension."

The application process

- The scheme will be advertised and you will be able to talk to the supervisors before applying internally
- Those judged to be the strongest pairings at Nottingham will put forward full applications

The project

- Successful applicants will work with their supervisor over the summer on a six- to eight-week project
- You will work with your supervisor at a convenient time – these meetings will be less formal than lectures
- As there is only a "light-touch" final report to complete, you may find you have more time to follow up interesting topics

A brand new home

Students who joined the department in 2011 not only began a new course, they also enjoyed brand new facilities.

The new Mathematical Sciences Building opened in time for the 2011-12 academic year and has been well received by staff and students. It is located in the heart of University Park Campus and has dedicated spaces for research, teaching, collaborative learning, social activities and administration.

As well as office accommodation for staff and research students, there are:

- small discussion areas
- an undergraduate common room
- an undergraduate computer room

- an undergraduate group study room
- an undergraduate quiet study room
- a postgraduate workroom
- a large adjoining lecture theatre
- a seminar room

The building was designed to contribute to the educational process by integrating academics and students throughout all levels of the building and by providing numerous opportunities for social and academic interaction. It is arranged around a central atrium which brings daylight into the heart of the building and provides a striking open space.

James Shuttleworth, BSc Mathematics and Philosophy, said: "The brand new maths building is a great place to study, and I especially enjoy using the dedicated computer rooms and group study areas. It's in a great location right in the centre of campus."



The new Mathematical Sciences Building, which has proved popular with students and staff.



The new Mathematical Sciences Building is in the centre of University Park Campus.



The atrium in the new building.

Our sports stars

One of the advantages of coming to Nottingham is the opportunity it provides to pursue interests outside your course. These are the stories of three maths students who, with the support of the University, have combined their studies with intensive sport training and are now competing with the best in their fields.

Thomas Green

MMath Mathematics (third year)

Clubthrower – winner of the International Wheelchair and Amputee Sports Federation World Junior Championships in Dubai and the British Universities and Colleges Sport Athletics Championships

Thomas Green, whose recent achievements include breaking into the senior Great Britain Disability Athletics Team and finishing seventh overall in his first senior international event, has been voted Nottingham's "Disabled Sportsman of the Year".

He won the City Council award after a year which has seen him rise to fifth place in the world rankings.

After the awards, Thomas said: "It felt fantastic to win the award. It was great to be at an evening with so many talented sportspeople, and to actually be recognised with an award was very flattering."

Thomas' primary aim now is to qualify for the Rio 2016 Paralympic Games, but with progress quicker than expected and the support of Nottingham behind him, Thomas hasn't ruled out London 2012.

In the meantime, he is also keen to get more students involved in disability athletics and has been using his blog to get more people engaged at University. You can read his blog at

<http://thethomasgreenblog.wordpress.com>

David Florence

BSc Mathematical Physics (graduated 2005)

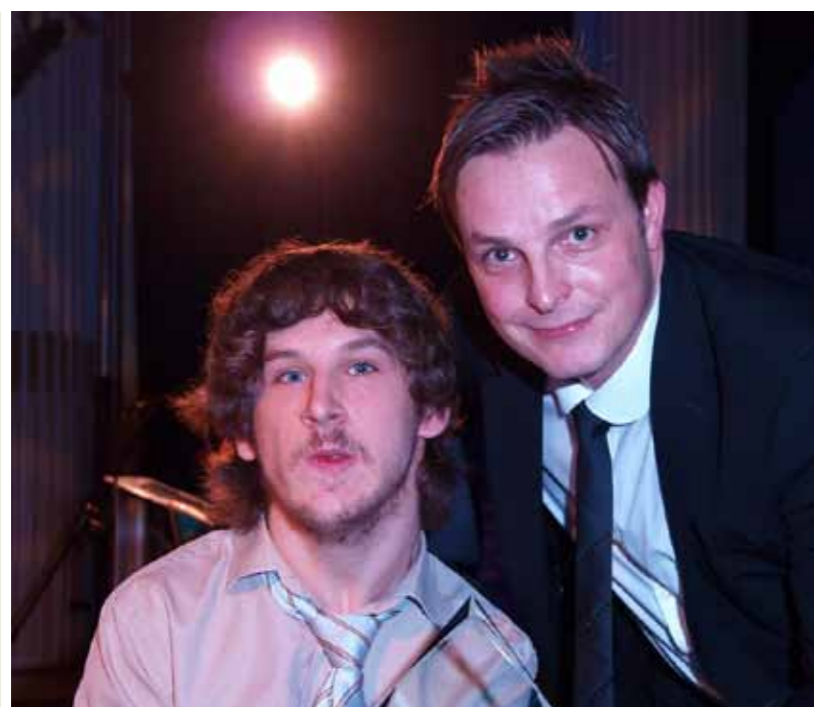
Slalom canoeist – Olympic silver medallist at the 2008 Beijing Olympics

"I first tried canoeing during a family day at the beach. I loved the sport straight away and progressed until eventually I reached Olympic level. The Beijing Olympics were an incredible experience. To compete on such a big stage was amazing – it's a much bigger spectacle than any other race.

I'm now training hard for selection for the London Olympics, which takes place in April. Generally I train twice a day, six days a week.

I was attracted to The University of Nottingham because I wanted to train at the National Water Sports Centre and I had always done well at school in mathematics and physics. My favourite aspect of the course was learning to understand complex mathematics.

I actually finished University before the Olympic Games, but in my time at the University I was supported through the bursary scheme and by the sports department. My tutor, Professor Edward Armour, was very helpful when I had difficulties balancing my sport and academic studies. It took me some time to work out the balance; however, I had a lot of fun at Nottingham, as well as achieving a good degree and sporting success."



Thomas Green (left) is presented with the Nottingham City Council Disabled Sportsman of the Year Award. Image courtesy of Digital Imaging by www.sport-on-wheels.com



Silver medallist and maths graduate David Florence in action.

“Beautiful campus, fun city, fantastic teaching, great environment and constant support; a very enjoyable five years!”

Anne Panter

BSc Mathematics and Economics (pictured right)



Anne Panter

BSc Mathematics and Economics (graduated 2009)

Member of the GB Women's Hockey Team at the 2008 Beijing Olympics

School of Mathematical Sciences (MS): How did you start out in your sport and what was the journey you took to play at the Olympics in Beijing?

AP: I started out playing at school and then progressed through to England junior sides. From there I went on to get my first full cap for England in 2002. After a few years sidelined with injuries I made a return in 2007, in time to be selected for the Beijing Olympics.

MS: How did you find your time in Beijing?

AP: It was a fantastic experience. It's hard to put into words exactly what the experience was like; I'd dreamed about competing in the Olympics since I was eight years old, so it was very special, but probably nothing like I'd imagined it. You're in a kind of bubble while you're there – you're so focused on your event that a lot of stuff tends to pass you by. I possibly only really appreciated what I'd been a part of once I got back.

MS: What was your best memory of that time?

AP: My best memory was against Japan: it was our fourth game and we needed to win to keep alive our hopes of a semi-final spot. The score was 1-1 with two minutes to go and we won a penalty corner. The call from the bench was to run a relatively complicated corner routine; we executed it perfectly and scored to win the match. Moments like that are what we train so hard for.

MS: Do you intend to compete in London?

AP: I'm hoping so. At the moment we have a training squad of 29 athletes. In June next year that will be cut down to the final 16 who will represent Team GB in London.

MS: What was it that attracted you to the School of Mathematical Sciences at The University of Nottingham?

AP: I needed to be somewhere close to my training venue in Loughborough, but I also wanted to study at a university with a high academic reputation. The University of Nottingham was the perfect choice for me to combine both hockey and my studies.

MS: What would a typical university day be like for you?

AP: Probably very unlike most students' days! I would normally get up at 7am, eat a quick breakfast, train and rush back home to shower, eat a second breakfast and then drive from Loughborough to Nottingham in an attempt to get to my first lecture on time; spend the day in lectures, normally fitting in another training session at some point, with the occasional visit to the library for a Starbucks and bit of studying; after my last lecture I would drive back over to Loughborough for hockey sessions, either Great Britain or club.

MS: How would you sum up your time at The University of Nottingham?

AP: Beautiful campus, fun city, fantastic teaching, great environment and constant support; a very enjoyable five years!

MS: How would you like to use your maths degree?

AP: Once I've finished playing hockey, I would really like to pursue a career in finance. I've always been interested in the corporate world and some of my course at Nottingham was geared towards that area. I'm chipping away at a Chartered Institute of Management Accountants course, in preparation for a future career.

A virtual classroom to help with revision

Have you ever wondered what you would do if you were revising in the holidays and needed help? An innovative idea in the School of Mathematical Sciences means our support doesn't stop when you go home.

Elluminate is an online room that acts as a virtual classroom and uses communication tools including voice conversations, public and private text chat, break-out rooms for group work, quizzing and polling, emoticons and a webcam. Connection to the Elluminate room is through a web browser and the software will enable you to talk to and text others in the room. The room also includes several visual tools, such as a shared whiteboard area, the ability to share applications and upload PowerPoint presentations, and file transfer. You can even borrow headsets and graphic tablets to make your time in the room more beneficial.

For teaching officer Sally Barton, Elluminate is an invaluable resource for supporting students who are at home studying for exams, including those who are based overseas. It's also useful if you need to be at home because of illness and want to catch up while recuperating.

A relatively new resource, Elluminate has already proved popular. Some of our students have said:

"The Elluminate room is such a useful resource and I would highly recommend it. The best thing is

being able to go back and watch recordings over and over again, as in sessions with your tutor you often forget how they got to the solution. When I was revising with friends they could watch it as well and they said it was really helpful too."

Dominic Gibbs, BSc Mathematics and Computer Science

"The room was very helpful. It gave me a chance to work on things I didn't understand during lectures. And the element of being able to be taught at the pace that suited me helped me tremendously."

Florent Sivakumaran, BSc Mathematics and Economics

"The Elluminate Room was very interactive, allowing us to communicate with Sally as well as other students. It's like a drop-in session that you can attend from the comfort of your own home, which is great for students like me who have a family to work round or for when people are revising from home."

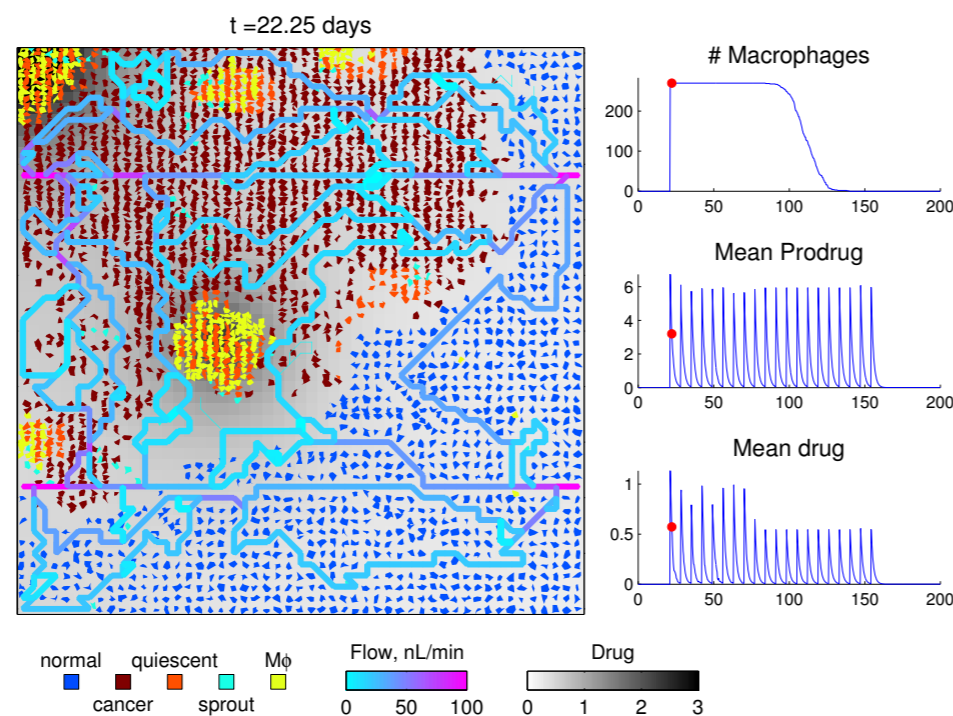
Ngoc Tran, MMath Mathematics

Sally's work also highlights issues that are likely to affect first-year mathematicians in the transition from school or college to university. One of these is moving from seeing maths as learning formulae and answering lots of similar questions to realising that maths is about thinking through a problem and finding a relevant strategy.

In response, "puzzled" sessions have been introduced that incorporate games such as Quarto, which promote strategic thinking and challenge perceptions. The nature of the games is such that overseas students can compete with home students and indeed students can compete with staff (and even beat them!).

"Puzzled" is also interpreted more generally as the sessions are an opportunity to ask about any areas of mathematics that students are puzzled by. Students wanting to be stretched more can also use the sessions to find additional challenges. The sessions provide an opportunity for informal interaction between staff and students which enable everyone to get to know each other better.

A screenshot of the online Elluminate room.



Graduate profile

Name: Helena Nicol
Course: BSc Mathematics
Graduated: 2011
Now: Graduate Training Scheme – Deloitte Audit

A maths degree from The University of Nottingham is well recognised by national and international employers. Helena Nicol, who graduated in 2011, has started work at one of the "Big Four" accountancy firms, Deloitte.

"After graduating, I started training to become a chartered accountant at Deloitte. I work mainly in audit, which involves visiting clients and assessing whether their annual accounts present a true and fair view of their financial position.

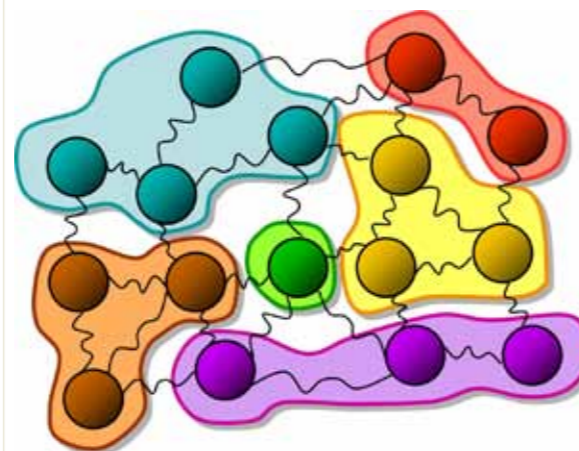
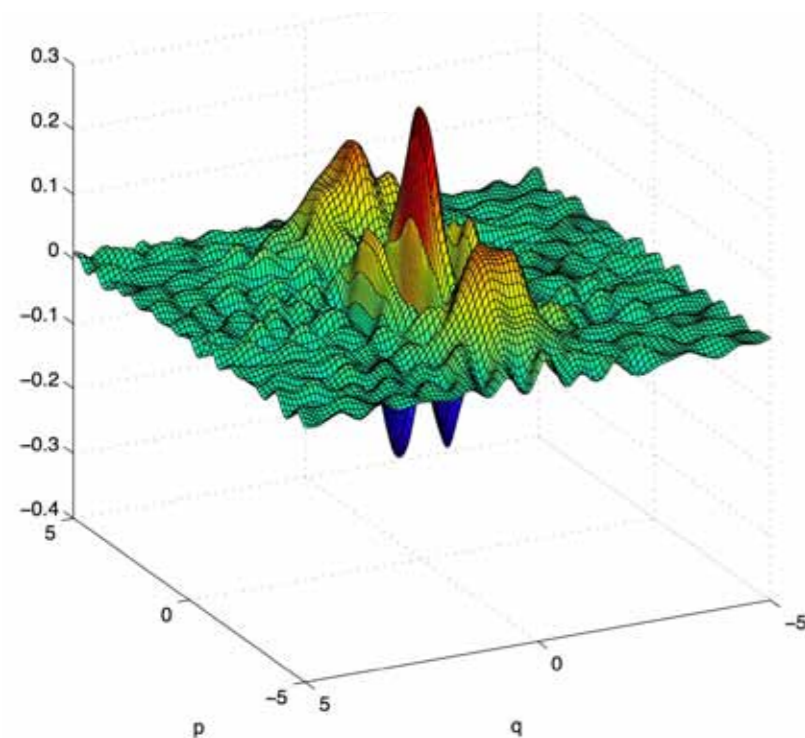
While I'm not using Fermat's last theorem on a daily basis, studying maths gave me a great foundation for life as an accountant. I spend a lot of time looking at and analysing data, producing statistical samples, as well as picking out anomalies and potential errors. Maths is all about being logical and solving problems, which are fundamental skills in accountancy; being accurate and concise has proved to be very useful too, especially when faced with deadlines. I was also able to study modules such as Communicating Mathematics, Mathematical Finance and Mathematics for Engineering Management which all gave insights into the working and financial world.

I'm due to gain my ACA qualification in three years' time at which point many doors will be open to me.

At the moment I'm quite interested in working in the public sector, maybe within a hospital or local education authority.

I found the social aspect of the campus and school really good – whether it's a wild night out or a quaint afternoon tea, Nottingham has it covered. Living on campus was amazing too as nothing was far away and there was always something going on. My tutor was brilliant, always efficient and helpful, especially when asking for job references. I had a fantastic three years at Nottingham and left feeling well prepared for the real world!

The careers service was also useful. I went to multiple company presentations and key skills sessions on assessment days and interview techniques as well as having my application and CV looked through. Despite what the media say, there were plenty of vacancies to apply for and I was offered multiple jobs. I think if you are proactive and spend some time doing research, there will be something out there."



Above: Pictorial representation of entanglement among multiple quantum particles (Phys. Rev. A Kaleidoscope Image Oct 2008, © G Adesso).
Left: Wigner function of the Schrödinger cat quantum state reconstructed with the statistical technique of homodyne tomography (© M Guta).

Taking maths further: quantum technology

Maths at Nottingham doesn't have to end when you graduate. In fact, some people find that their first degree is just the beginning.

Often, their degree reveals to them the variety of areas that mathematics covers and enables them to discover the opportunities their knowledge could open up. Our postgraduate courses and close involvement in research groups allow dedicated students to take their interest in maths to the next level.

We are currently entering a new technological era, where the fundamental properties of quantum systems are exploited in applications such as super-fast computation, high-precision metrology and secure cryptography. Quantum information science is a young and eclectic field joining quantum physics with information and computation, probability and statistics, and control theory.

Quantum mechanics was arguably the most successful scientific theory of the 20th century. As miniaturisation is moving to smaller and smaller scales, it becomes clear that the ultimate carriers of information are quantum systems such as atoms and photons, the building blocks of nature.

However, this information does not obey the rules of usual 0 and 1 bits, but is encoded in the state of quantum systems, the simplest one being a two-dimensional system called a qubit. At the heart of many quantum information applications is the notion of entanglement between systems, which is a correlation of a purely quantum nature. Exploiting entanglement, we can build encrypting devices for secure communication; we can implement mind-baffling experiments such as quantum teleportation; and we can solve

computational problems exponentially faster than the most advanced current supercomputer.

At Nottingham we have a young and active team of researchers studying a wide range of topics in quantum information science.

- We explore the mathematical theory of entanglement and its role for quantum communication and information processing, how to engineer quantum correlations experimentally and how to protect information transfer from data loss and malicious eavesdropping.
- We develop efficient statistical methods for the detection of entanglement between different parts of a system composed of several sub-systems, and the experimental reconstruction of quantum states from measurement data. We develop mathematics for key enabling components of quantum engineering such as quantum control, which deals with controlling the states and dynamics of quantum systems.
- We explore the relationship between quantum information and other fundamental theories such as relativity theory.
- The research group within the School of Mathematical Sciences organised a European workshop on Signatures of Quantumness in Complex Systems where the fundamental role of quantum effects in complex and even living systems was unveiled. The group is also involved in the organisation of a programme in quantum control at the Newton Institute in Cambridge which will take place in 2014.
- The Engineering and Physical Sciences Research Council (EPSRC) has selected the topic Developing Quantum Physics for New Quantum Technologies as a Physics Grand Challenge, and quantum information science is signposted as a growth area.

The Imperial Cathedral in Aachen, Germany, where BSc Mathematics student Christopher Hobbis studied for a year.



Study abroad

Christopher Hobbis
BSc Mathematics (International Study)

"It was always my intention to study mathematics at university and I was keen on furthering the language skills I had acquired at school. The range of study paths at Nottingham impressed me very much and the opportunity to spend a year abroad as part of my course was a major factor in my decision.

There were several options in terms of which country we could choose, with varying numbers of potential host universities. I studied at RWTH Aachen University in Germany for one academic year.

In order to reach the required standard in German, I took modules (at stages four and five) from the University's Language Centre. I began this two years prior to my departure, picking up from where I had left off at A level.

At Aachen, the Erasmus Coordinator from their maths department was always available to answer any queries. The majority of the lecturers and assistants were happy to offer help with their material and took into account the fact that I was used to a different style of study than was prevalent there.

There was a large community of international students in Aachen throughout the year due to the excellence status awarded to the RWTH. I encountered over 100 students from up to 20 different countries, including four or five others from the UK, one of whom also studies mathematics (at York) and shared some modules with me during the first semester.

I received 12 months worth of Erasmus grant while I was away to help with living expenses and was able to claim back travel expenses for journeys to and from Germany and public transport within the state of Nordrhein-Westfalen.

It was helpful to experience a more intensive study pattern than I had previously, as this will hopefully hold me in good stead for the future, particularly the MSc course I have applied for at the end of my current degree. The range of courses I studied also provided me with more of an insight into my strengths and weaknesses in particular areas of mathematics. I feel that living on my own for the first time has made me more independent, and being able to practise and improve my language skills on a day-to-day basis and get to know people from a range of cultures was also a massive plus. I've made many new friends along the way and I would recommend such an exchange to anyone."

Favourite memory

I will have to list two memories, as I can't choose between them:

During a road trip with three Finnish students in the period between the two semesters, we witnessed an astounding Champions League Quarter Final at the San Siro in Milan. We certainly got value for money at €27, as Inter Milan

lost 5-2 against Schalke, a German first-division team.

Having joined a local pool club early in the year, I helped their first team to promotion at the end of the season and my efforts were rewarded with a tournament in my name a few weeks before my departure. A speech thanking me for my contribution was read out

before team mates and fellow club members, and I was presented with a new cue and personalised chalk holder to bring back to England with me.

For more information about study abroad opportunities in the School of Mathematical Sciences, please see www.nottingham.ac.uk/mathematics

Research project

Ashley Bradley
MMath Mathematics (third year)

Last summer, Ashley received internal funding to work on a research project about modelling dynamic behaviour of seals in aerospace engines.

"I have always had an interest in applied mathematics and many of the modules I have chosen to study at Nottingham have been in this area. I was in my third year and wondering what I wanted to do after leaving university. This project seemed like a great opportunity to see how the applied mathematics I'm taught at university is used in practice. My project looked at modelling the gap between highly rotating (rotor) and stationary (stator) components towards increasing efficiency in gas turbine engines. Asymptotic and numerical (Matlab) approaches were used to investigate the effect of tilt and swash in simplified face seal configurations.

Each week I was given targets to complete: working through previously published papers; applying different methods to the problems in order to obtain more general forms; solving problems analytically; plotting results; and creating a code in Matlab in order to solve the more difficult problems.

I was really well supported throughout the project. Dr Stephen Hibberd was extremely welcoming and answered all my questions. We had weekly meetings where I would explain what I'd done during the week and ask about anything I was unsure of. There were also PhD students close at hand if ever I got particularly stuck. At first I was scared that I wouldn't know what

I was doing and that I'd feel a little lost because it was unlike anything I had done before. However, the project was very well structured and I always felt like I had something to do and knew what was expected of me. They didn't expect me to know how to do everything and they knew that I would occasionally get stuck.

I was always encouraged to write up the methods I had used and the results I had found, culminating in a written report at the end of the internship. During my project I was asked to do a presentation on the work I had done – everyone in the research office did one. At the time, this was an extremely daunting prospect; however, I chose to take the opportunity as I have to do a presentation for my dissertation and thought this would be a perfect chance to get in some practice.

I would definitely recommend applying for research bursaries, especially if you're considering doing a PhD. It's a great way to see how the maths we learn at university is used in practice. It's also a good opportunity to improve your writing skills (writing the report at the end), numerical skills (using programmes like Matlab) and people skills (working together with your supervisor and as part of the research team), which can all be used when it comes to doing a written project such as the fourth-year dissertation. Having the chance to apply mathematics to practical situations and obtaining correct results was a great confidence booster. I now feel much more confident in my skills and more ready to apply for post-university opportunities."

For further information please contact
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Paper made from FSC-accredited 100% recycled material.
Printed January 2012.