**Institution: Loughborough University**

**Unit of Assessment: B10 Mathematical Sciences**

## a. Overview

The Unit of Assessment B10 of Loughborough University is based in the Department of Mathematical Sciences. Its research covers a range of areas of mathematics and is divided into 6 research groups: Dynamical Systems, Geometry and Mathematical Physics, Global Analysis and PDEs, Linear and Nonlinear Waves, Mathematical Modelling, and Stochastic Analysis. There is no formal division into pure and applied mathematics at Loughborough University, and although differences are recognised, staff in all the groups are encouraged to interact and collaborate with each other. In RAE 2008 the Unit submitted 31.8 FTE to the Pure and Applied Mathematics sub-panels, in this REF the Unit is submitting 33.8 FTE.

## b. Research strategy

Following good results in RAE 2008 (100% of the research in pure mathematics and 90% of the research in applied mathematics was deemed to be of international standard or better) the Unit's strategic goal has been to enhance its international profile further and cement its position as one of the leading centres for mathematics research in the UK.

During the period following RAE 2008, the Unit has broadened its research base, building on existing strengths in key areas. Following the departure of two members of staff working in the area of general relativity, the Unit has strategically decided to change the research priorities to other areas. This has allowed investment in other research directions, including geometry, analysis and dynamical systems.

The creation of synergies between disparate areas of mathematics is an important part of the research strategy of the Unit. A good example of this is a strong research centre in stochastic dynamical systems formed from the Stochastic Analysis group together with Bartsch, Khanin and Lian from the Dynamical Systems group. Another example is one of the strongest integrable systems centres in the UK formed from the Geometry and Mathematical Physics group together with El and Khusnutdinova from the Linear and Nonlinear Waves group. Each of the research groups has a well-defined strategy as part of the overall strategy of the Unit. The group members (Head of Group in bold) and the research directions of the groups are described below.

The main achievements of the Dynamical Systems group (Bartsch, Khanin, Lian, **Neishtadt**, Winn) over the last few years include reaction rate calculation in transition state theory with time-dependent invariant manifolds (Bartsch), the solution of the long-standing Moser problem about smooth linearisation of commuting circle diffeomorphisms (Khanin), the extension to infinite dimension of fundamental results in ergodic theory, including the multiplicative ergodic theorem (Lian), the proof of the existence of stability islands of large total measure created by separatrix crossings in slow-fast Hamiltonian systems (Neishtadt), and the proof of a conjecture in random matrix theory (Winn). The focus for the future is on the study of random matrices, quantum graphs, the dynamics of slow-fast systems, ergodic theory, and, on the more applied side, the development of transition state theory and adiabatic theory of motion of charged particles.

The Geometry and Mathematical Physics group's (Bolsinov, Brown, Chekhov, Ferapontov, Hallnas, Mazzocco, Novikov, Prendergast-Smith, **Veselov**) main achievements include the bi-Hamiltonian approach to the stability analysis of integrable systems (Bolsinov), a new approach to the birational geometry of high codimension Fano 3-folds via their Sarkisov links (Brown), topological recursion for quantum Riemann surfaces and new algebraic structures in the theory of Teichmueller spaces (Chekhov, Mazzocco), a new approach to the integrability of nonlinear PDEs in 2+1 dimension (Ferapontov, Novikov), applications of the theory of quantum Calogero-Moser problems to representation theory and special functions (Hallnas, Veselov) and proof of the Morrison-Kawamata cone conjecture in several important cases (Prendergast-Smith). Building on these achievements the group will continue to be focussed on the theory of integrable systems and

their interplay with geometry in a wide sense and representation theory.

Recent achievements of the Global Analysis and PDEs group (Garetto, Hunsicker, **Strohmaier**) on the analysis side include contribution to the study of the well-posedness of weakly hyperbolic PDEs in spaces of generalized functions (Garetto), analytic and numerical aspects of spectral theory with singular potentials (Hunsicker) and on manifolds including spectral determinants and Casimir energy, as well as scattering theory on manifolds with cylindrical ends (Strohmaier). Recent results in global analysis include the study of perverse signatures on stratified manifolds (Hunsicker) and of the eta-residue for projective pseudo-differential operators (Strohmaier). The focus moving forwards will be centred around modern microlocal techniques and other new methods in analysis as well as their applications in geometry and topology.

Research in Linear and Nonlinear Waves (El, Khusnutdinova, Linton, M. McIver, **P. McIver**) includes development of the theory of dispersive shock waves and soliton gases in classical and superfluids (El), the theory of nonlinear bulk strain waves in layered structures with different types of bonding and interfacial defects (Khusnutdinova), a new interaction theory for scattering by defects in an array (Linton), an existence proof for acoustic Rayleigh–Bloch modes in the vicinity of one-dimensional axisymmetric arrays (M. McIver) and the discovery of a new type of trapped mode for a floating structure (P. McIver). Following the appointment of Prof Linton to the Deputy Vice-Chancellor position at Loughborough University and a further retirement from the group, we will seek to strengthen and re-focus this group. The future research will focus on the development of analytical and numerical methods for the description of a broad range of wave phenomena in fluids, solids and optical media, with particular emphasis on the challenges associated with multiple-scale effects.

The main strategic direction of Mathematical Modelling group (Archer, Janson, Kenny, Sirl, **Smith**, Thiele, Tseluiko) has been the development and applications of novel mathematical techniques to a diverse set of physical and industrial problems. In particular, considerable progress has been made in the area of energy-related solid materials modelling, especially with regard to the nuclear and solar energy sectors (Kenny, Smith), in the solution of fluid flow problems (especially those concerned with thin film flows), based on innovative low-dimensional and coarse-grained models that bridge the different scales (Archer, Thiele, Tseluiko) and in the study of networks, neuron and epidemic models (Janson, Sirl). Research in the future will address the robustness of transition state methods and the development of innovative models to sequentially or concurrently bridge length scales for complex fluids and elastic media.

Research of the Stochastic Analysis group (Bahsoun, Feng, Foondun, Lorinczi, **Zhao**) is focused on developing rigorous concepts and mathematical tools to understand random phenomena and their connections with other areas of mathematics. Main achievements in the past few years include new results on the intermittence, stationary solutions, stable/unstable manifolds of stochastic partial differential equations (Foondun, Zhao), Levy processes and probabilistic approach to nonlocal operators (Foondun, Lorinczi), extension of rough path theory to functional integrations and local times (Feng, Lorinczi, Zhao), metastable intermittent systems and escape rate (Bahsoun) and new ideas of random periodic solutions, one of the fundamental problems in stochastic dynamical systems (Feng, Zhao). Future research will be focussed on stochastic dynamical systems and SPDEs, including study of random periodic solutions, invariant measures and periodic measures.

Since RAE2001 mathematics research at Loughborough has grown in both quantity and quality. In RAE2001 Loughborough submitted 31 FTE to applied mathematics. By 2008 the Unit had strategically grown the breadth of its research and the submission included 20.4 FTE to applied mathematics and 11.4 FTE to pure mathematics. This submission includes 33.8 FTE and the groups above demonstrate work in a number of focussed areas across a range of topics in pure and applied mathematics and at the interface between them. The strength of the appointments made over the past decade have helped to create an environment in which cutting edge mathematical research can thrive. Responding to comments from the RAE 2008 sub-panels one of the Unit's strategies was to increase its research student numbers. During this REF period the Unit

has increased its PhD student population by 25% to a current cohort of 50 students.

The Unit will continue to strengthen its research portfolio over the coming years with new appointments at both senior and junior level, with a specific goal to increase the number of prestigious fellowships in the Department (both through encouraging the best staff to apply and by attracting outstanding researchers from outside), and by creating groups with the critical mass to compete at the highest levels internationally. The Unit is currently in the process of planning a significant investment, including a professorial appointment, in the applied area of research. This will build on the existing research groups and on Loughborough University's strengths to contribute to the many challenges that dominate the engineering and physical science landscape.

**c. People, including:**

**i. Staffing strategy and staff development**

The overall aim of the Unit's staffing policy is to encourage and enable staff to develop as research-leading academics and to reward them appropriately, while renewing the staff base both through early career appointments and occasional senior appointments from outside. This is achieved through the following coherent package of measures.

Candidates for lectureships are required to have an established international research reputation or show evidence of exceptional promise in the case of early career researchers. New appointees undertake up to three years of probation. During this time, probationers have a light teaching load (approximately 1/3, 1/2 and 2/3 of the norm in years 1, 2 and 3 respectively) and no significant administrative duties, specifically to facilitate development of their research activities. A member of senior staff is appointed as probationary advisor, a key part of his/her role being to monitor progress in research, including advice with the preparation of grant applications.

The Head of Department and Heads of Research Groups discuss research plans with colleagues individually as part of an Annual Review process designed to nurture staff, promote research awareness and activity, and identify the need for support. As part of this process all academic staff complete an annual Personal Research Plan, which facilitates discussions and areas for development both for individuals and within the Unit.

The staffing strategy is completely in line with the research strategy of the Unit to achieve top quality research. All the appointments since RAE 2008 have been based primarily on the research quality and potential of the candidates. In many cases the vacancies were advertised for all the research areas of the Department in order to attract the best possible candidates, but some appointments were made strategically to strengthen specific research areas.

The Unit has been enhanced by 8 lectureship appointments since 2008: Lian joined the Dynamical Systems group, Hallnas and Prendergast-Smith the Geometry and Mathematical Physics group, Garetto the Global Analysis and PDEs group, Tseluiko the Mathematical Modelling group, Bahsoun, Feng and Foondun the Stochastic Analysis group. The strategic readership appointment of Brown, together with the lectureship for Prendergast-Smith, extended the expertise of the Department to the area of algebraic geometry, which is of growing importance, in particular, in connection with the research in integrable systems.

As part of a long-term strategy to bring world-leading academics to Loughborough for extended periods, the Unit has also appointed two distinguished researchers as Professors: Leonid Chekhov (Steklov Institute, Moscow) and Konstantin Khanin (Toronto), who are world-class experts in mathematical physics and dynamical systems respectively, with close contacts with the Unit. Professor Khanin is on research leave from Toronto from August 2013 for a year, while for Professor Chekhov this is already the third research visit to Loughborough (the first two were in 2009 and 2010 and funded by the EPSRC).

The development of young, talented researchers into international leaders is an essential part of the strategy of the Unit. Senior staff provide guidance to junior staff, in particular through submissions of joint research proposals and joint supervisions of PhD students. They also use their

exceptionally strong international links to enable early career researchers to develop important contacts. The new arrivals Foondun, Hallnas and Tseluiko have all been successful in obtaining EPSRC grants through the first grant scheme with support from the Unit allowing them to appoint postdocs for an additional 3-month period.

The Unit is also conscious of the importance of managing workloads so that senior staff are able to maintain their internationally-leading research. Sabbatical study leave is available for all staff. In addition, staff can request their teaching duties to be concentrated into one semester each year, thus freeing the other for research. The Unit encourages staff to enhance their research leadership skills and Mazzocco was one of ten academics from across the University to be selected to participate in an EPSRC-funded Developing Future Research Leaders programme.

During the period since RAE 2008 there have been several promotions on the basis of research quality and leadership: Ferapontov was promoted to a personal Chair in Mathematics, Thiele to a personal Chair in Applied Mathematics and Theoretical Physics, and El, Kenny, Khusnutdinova and Strohmaier to Readerships. There have also been several promotions at the Senior Lecturer level (Archer, Bahsoun, Hunsicker, Janson, Lorinczi, Ward, Winn).

The vibrant research environment in the Unit is enhanced by the presence of a number of visiting, part-time and emeritus professors. Currently at Loughborough are Prof Hudson, who is one of the co-founders of quantum stochastic calculus, Prof Grimshaw, who is one of the world's leading experts in nonlinear waves, and Prof Knobloch, who is visiting from Berkeley and is a leading expert in the nonlinear dynamics of dissipative systems. Both Hudson and Grimshaw were part of RAE 2008 submission and have continued to play an active research role in the Department since then. The Unit has an extensive visitor programme supported by grants from EPSRC, the EU, the LMS, and the Royal Society, as well as by the Unit itself.

Since 2008 Loughborough University has awarded Honorary Degrees to two very distinguished mathematicians: Professor Shige Peng, a plenary speaker at the International Congress of Mathematicians 2010, and Professor Sergei Novikov, Fields Medal, 1970, and Wolf Prize, 2005. Both of them have strong connections with the Department.

Loughborough University is committed to achieving equality for all, including mandatory recruitment and selection training which embeds its Equality and Diversity policy. The Unit is preparing a submission for an Athena SWAN silver award and was one of 30 departments that contributed to the 2013 London Mathematical Society (LMS) "Advancing Women in Mathematics: Good Practice" scheme. Both Hunsicker and Mazzocco are members of the LMS Women in Mathematics Committee.

### ii. Research students

The Unit sees the training of research students as one of its most important responsibilities; accordingly, significant resources are allocated to this activity. Following the last RAE, the Unit decided strategically to use part of the income to increase the funding for PhD studentships. The PhD student population in the Unit has grown since 2008 by over 25% with more than 50 currently registered students. Students contribute enormously to the research of the Unit and some have gone on to become valuable members of the mathematics academic community all over the world.

In particular, the following former PhD students completed since 2008 and now have lectureships: Zhang, PhD 2008, Associate Professor at Fudan University (China); Guo, PhD 2011, Lecturer in Applied Mathematics at the University of Nottingham's China campus in Ningbo (China); Bektur, PhD 2012, Lecturer at Sakarya University (Turkey); Kittiratanawasin, PhD 2011, Lecturer at Kasetsart University in Bangkok (Tailand); Tiong, PhD 2012, Lecturer at the University Malaysia Sarawak (Malaysia); Izosimov, PhD 2012, Assistant Professor at Moscow State University (Russia). Several others have research positions at various universities: Fitzgerald, PhD 2009, Oxford; Patidar, PhD 2009, Heriot-Watt; Roidos, PhD 2010, Hanover; Tymis, PhD 2012, Crete, as well as leading research centres and companies: Vernon, PhD 2010, Los Alamos; Gheewala, PhD

2010, Mercedes. Izosimov is also a winner of prestigious *Dynasty Foundation* Fellowship Contest, 2012.

The Unit receives and applies for funding for studentships from a number of sources including the EPSRC Mathematical Sciences Doctoral Training Grant (DTG). The allocation from the EPSRC increased from 1.05% in 2008 to 1.84% in 2010 and further to 1.9% of the mathematics DTG pot in 2013. The Unit has also been successful in bidding for PhD studentship funding from the EPSRC, the EU, NC3R and industry. Over the REF period 5 PhD studentships were funded by EPSRC projects. Students are also funded through the Marie-Curie Initial Training Network on "Multiscale complex fluid flows and interfacial phenomena".

The award of studentships is a highly competitive process, which ensures they are only awarded to very high quality students. It is the policy of the Unit that the EPSRC Mathematical Sciences DTG studentships are only awarded to students with a first class honours degree or an MSc with distinction and whose projects meet the departmental strategic aims.

At least two members of staff are responsible for monitoring the progress of each student: their supervisor(s) and the independent reviewer (IR). The supervisor provides guidance on the academic content of the project and the training that the student should receive. They have regular meetings with the student and monitor the progress of the student. The IR monitors the overall progress of the student and assists if any problems arise. Students prepare a report of approximately 10,000 words at the end of their first year and produce a record of seminars and training courses attended. If progress is satisfactory further reports are required at the end of their second and third year. Otherwise, a meeting between the student, supervisor and IR is held to determine future action.

All students are expected to broaden their mathematical training by attending and being assessed in courses that are not directly related to their PhD topic. The Unit is a member of the Mathematical Sciences Taught Course Centre (MAGIC) joining 19 UK universities. These courses cover a wide range of mathematical topics, such as algebraic geometry, differential topology, stochastic processes and numerical analysis. Loughborough University itself is the largest supplier of core MAGIC courses: Dynamical Systems (Neishtadt), Integrable Systems (Veselov), Lie groups and Lie algebras (Bolsinov), Nonlinear Waves (Grimshaw/El/Khusnutdinova). The Unit also runs MSc programmes in Industrial Mathematical Modelling and in Mathematical Finance, and students attend appropriate lectures from these courses.

Students are required to attend appropriate regular weekly seminars and give at least 3 presentations during their candidature. Each year a one-day workshop is organised in the Unit, at which PhD students present their work. The best presentation is awarded the Sir David Wallace Prize. PhD students are expected to attend conferences and meetings at other institutions to disseminate their research and interact with other researchers when opportunities arrive. The Unit guarantees that all PhD students are funded to attend at least one such event annually. PhD students have also participated in programmes organised by Loughborough University members of staff at various research institutes (Max Planck, Hausdorff, Isaac Newton).

All students are given the opportunity to gain experience in teaching both by delivering tutorials to undergraduates and by marking coursework. Before undertaking teaching work, students are required to attend a Professional Development course on Teaching Skills, which is specifically designed for PhD students. Students also attend seminars on good teaching practice in our Mathematics Education Centre and are supported to attend relevant national training events. The Department has a dedicated staff-research student liaison committee.

**d. Income, infrastructure and facilities**

The University has increased its research funding over the years since RAE 2008 (from £34.6M in 08/09 to £38.67M 11/12). As of August 2013 the Department of Mathematical Sciences had 10 EPSRC research grants (as principal investigators) worth more than £1.6M; the total new research grant income since 2008 is more than £5.8M. There has been considerable success in obtaining

EPSRC funds for energy-related materials modelling, especially with regard to the nuclear and solar energy sectors.

The Unit coordinated a £1.2M EPSRC-funded five-university Materials Modelling Consortium associated with functional coatings, and the 9-node Marie-Curie Initial Training Network on "Multiscale complex fluid flows and interfacial phenomena" (MULTIFLOW), supported by the EU under FP7, which is worth €6.2M (over £1M for the Loughborough node). The Unitis a part of the EPSRC PROMINENT consortium and the EU PERFORM 60 group, which work on projects associated with the Nuclear Industry. Recently, two EPSRC-funded nuclear modelling grants have been obtained in conjunction with India, worth over £500K. The Unit has coordinated the development of High Performance Computing (HPC) within the University, and led a £1.2M EPSRC bid to set up a regional centre to support industrially relevant research and direct industry usage of HPC.

Loughborough University was one of the nodes of the ESF programme MISGAM (2004-09), involving researchers from 14 countries, and hosted several international conferences and workshops, including the major international bi-annual event "*Equadiff 2011*" with more than 300 delegates.

The Unit runs regular internal seminar series in Analysis, Applied Mathematics, Materials Modelling, Mathematical Physics and Stochastic Analysis and takes part in the regional LMS-supported East Midlands Stochastic Analysis seminars (joint with Warwick and York). The traditional annual Loughborough Integrable Days are now part of the LMS-sponsored Collaborative Workshop Series Network on Classical and Quantum Integrability, involving Edinburgh, Glasgow and Leeds Universities. The Unit will host the next LMS Midlands Regional Meeting.

The Unit is launching the new Sir David Wallace Lecture series of annual lectures in Mathematics, named after the former Vice-Chancellor of Loughborough University, 1994-2006. Sir Michael Atiyah provisionally agreed to be the first lecturer in 2013-14 academic year.

Besides standard provision for all staff and research students of a desktop computer with high-speed network access and full technical support both for office and laptop machines, the Unit also maintains informal and dedicated computational clusters for research use, including the access to the University's HPC Centre. Software licenses for Mathematica, Maple, Matlab and the NAG libraries are provided for all staff and research students.

The University Research Office provides a complete service for the costing and pricing of research grants and contracts. It also actively targets funding opportunities, supports the drafting of applications and the negotiation of legal agreements, and provides post-award financial administration of grants and contracts.

After RAE 2008, the Unit decided to contribute an additional £15K annually to the University Library budget to buy more mathematical journals. The University now has comprehensive access to mathematics journals in the research areas represented within the Unit.

According to the University Research Strategy, the University will continue to provide facilities and infrastructure to attract and retain the very best academics. In line with this, as part of the capital investment, the University is planning to relocate the Unit to a newly refurbished building.

**e. Collaboration or contribution to the discipline or research base**

Members of the Unit have made significant contributions to the wider research base during the REF period. They are routinely involved in active collaborations, in some cases interdisciplinary, with researchers from all over the world (including Berkeley, Bonn, Chicago, Courant Institute, ETH Zurich, Imperial College, MIT, Warwick), and in the organisation of conferences and programmes at leading research institutions (Fields, Hausdorff, Isaac Newton, Max Planck, MSRI). During the REF period, members of the Unit have also held **Visiting Professorships**, including at Moscow

State University (Bolsinov, 2010-2011), the University of Nantes (Hunsicker, 2008-2011), Shandong University (Zhao, 2004- ) and Fudan University (Zhao, 2009-2012).

Members of the Unit make significant contributions to the research base through their journal **Editorships**. In particular, both current Editors-in-Chief and one more member of the Editorial Board of *Nonlinearity* have affiliations with Loughborough (Neishtadt, Knobloch and Khanin), as does the Editor of *Mathematics Today* (Linton). During the REF period Unit members have served on the Editorial Boards of *Advances in Mathematical Physics* (Veselov); *Applied Ocean Research* (P. McIver); *Chaos* (Neishtadt); *Fluctuation and Noise Letters* (Janson); *Glasgow Mathematical Journal* (Brown, Subject Editor); *International Journal of Stochastic Analysis* (Zhao); *Journal of Physics: Condensed Matter* (Smith); *LMS Journal of Computation and Mathematics* (Brown, Editorial Advisor from December 2013); *Mathematical Physics Electronic Journal* (Khanin); *Journal of Nonlinear Mathematical Physics* (Ferapontov and Veselov); *Regular and Chaotic Dynamics* (Bolsinov, Neishtadt, Veselov); Chaos, Solitons & Fractals (Khanin) and the SIAM Book Series: Stochastic Dynamics (Zhao). Unit staff have also made contributions through the Editorial Council of *Functional Analysis and its Applications* and the Advisory Board of *Inverse Problems* (Veselov), and through guest editorship of special issue "Current Trends in Integrability and Nonlinear Phenomena" of *Journal of Physics A* (Mazzocco).

Staff in the Unit have also served as members of **learned societies and professional bodies** throughout the REF period, including LMS Women in Mathematics Committee (Hunsicker and Mazzocco), LMS Nominating Committee 2012-13 (Brown); LMS Council (Veselov); the Institute of Physics Liquids and Complex Fluids group committee (Archer); British Mathematics Colloquium Committee 2012 (Brown); the Institute of Mathematics and its Association Council and Research Committee (Linton); the Nanomaterials Committee of the Institute of Materials (Kenny); the Institute of Physics Ion and Plasma Surface Interactions group committee (Smith).

Further examples of staff contributions to the academic community include the **organisation of international conferences and research programmes**. During the REF period, Unit staff have served in particular as: **Director** of *East African Workshop on Applicable Algebraic Geometry*, Mombasa, Kenya (Brown); **Co-organisers** of conferences, including *Spectral Analysis on Noncompact Manifolds*, Hausdorff Research Institute for Mathematics, Bonn, June 2010 (Strohmaier); interdisciplinary programmes at the Isaac Newton Institute, Cambridge in May-August 2013 (Thiele) and at the Max Planck Institute for Complex Systems, Dresden, 2012, March and October (Smith and Thiele); the Thematic Programme "Dynamics and Transport in Disordered Systems", Fields Institute, Toronto, January-July 2011 (Khanin & Neishtadt); the programme "Analysis on Singular Spaces" at *MSRI*, Berkeley, autumn 2008 (Hunsicker); the trimester "Integrability in Geometry and Mathematical Physics" at Hausdorff Institute, Bonn, January-April 2012 (Veselov); and as a **Panel member** of the Programme Committee of the *International Congress of Mathematicians 2010*, Hyderabad (Veselov). They have also delivered plenary lectures at major events, including talks at the Sixth EUROMECH Nonlinear Dynamics Conference, St.Petersburg, 2008 and International Centenary Bogolyubov Conference, Moscow, 2009 (Neishtadt).

Unit members have been awarded **prestigious fellowships** during the period, including the EPSRC Advanced Research Fellowship (Mazzocco, 2006-12), EPSRC Postdoctoral Fellowship (Novikov, 2006-09), FWF Hertha Firnberg Fellowship (Garetto, 2006-2009), Imperial Junior Research Fellowship (Garetto, 2010-2013). They have coordinated major collaborative grants, including a 9-node EU initial training network (Thiele) and a five-university EPSRC grant across 5 different disciplines (Physics, Chemistry, Materials, Chemical Engineering and Mathematics) (Smith). They also contribute to the peer review mechanisms for the **Research Councils** and wider grant awarding bodies. Over the REF period, staff have served on the European Science Foundation Pool of Reviewers (Veselov) and the EPSRC Peer Review College and prioritisation panels (Linton, Mazzocco, Smith, Veselov). Furthermore, Linton is a member of the EPSRC's Strategic Advisory Network and served as Chair for the 2012 EPSRC Mathematical Sciences Doctoral Training Grant panel.