

The University of Warwick leads the UK with a ground-breaking Centre for Complexity Science, to connect and develop interdisciplinary research in complexity science at all levels, train a new generation of complexity scientists via a doctoral training centre (DTC), understand, control and design complex systems, produce breakthroughs in the principles and applications of complexity science, link with end-users as sources of real-world problems and beneficiaries from the resulting knowledge and trainees, and sustain a lively intellectual and practically based environment for complexity science.

RESEARCH DEGREES

PhD IN COMPLEXITY SCIENCE

MASTER'S DEGREES

MSc IN COMPLEXITY SCIENCE

MSc IN COMPLEX SYSTEMS SCIENCE
(Erasmus Mundus)

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RESEARCH GROUPS

Complexity, Emergence & Upscaling

In mathematically-oriented research we attempt to crystallise clear and applicable definitions of a system being complex, in the sense of being more than the direct combination of its components. The notion of Emergent behaviour is a key focus of our attention, and connects to the question of forecastability versus chaos in complex systems and more mathematically to non-uniqueness of Gibbs phases. We are researching general methodologies for variable reduction on networks, the identification of continuum limits in particle systems, and of coherent phenomena in turbulent systems. Application areas include weather and climate.

Complex Fluids and Complex Flows

Complex fluids present two key challenges: how a small fraction of interacting particles conspire to dominate their flow properties, and how those properties influence particular flows. Application areas include flow of people, cars – granular materials – diagnosis of cancer, hypertension and heart disease.

Clustering, Condensation and Jamming

Clustering phenomena are ubiquitous with applications ranging from raindrops to galaxies, and from Facebook to traffic jams. A key question we address is: how fast and how large do clusters grow and what is their asymptotic shape? Problems such as traffic flow have conserved quantities but no absorbing state, leading to phase separation between a localised condensate (e.g. traffic jam) and a background (e.g. flowing traffic) at critical density: understanding these has applications to biology (molecular transport, ant trails), social sciences (traffic and transport modelling) and physics (granular media, Bose Einstein condensation).

CENTRE FOR COMPLEXITY SCIENCE

(incorporating the Complexity Science
Doctoral Training Centre)

www.warwick.ac.uk/go/complexity

Complex Networks and their Dynamics

The interplay between the connectivity of a network and its dynamics are central to key challenges today, such as epidemiology, biodiversity, neuroscience and markets. Application areas include infectious diseases, neural computing, data storage, dynamics of opinions and markets.

Network Statistical Inference

The inference of network structure is a key approach we use in applications spanning multiple fields, from molecular biology to health and economics. We have developed novel methods and technical for network learning, including Bayesian approaches, MCMC and penalized likelihood methods. Application areas are diagnosis of cancer, hypertension, heart disease and data storage.

Statistical Mechanics

Here our strategy is to apply a well-developed set of tools to new contexts. In granular materials geometrical frustration is mapped onto pseudo-thermal fluctuations leading to new insights and scaling laws. In molecular biology we have brought together statistical mechanics, computational statistics and massively parallel single-cell expression assay data to shed light on how DNA sequences known to act in the regulation of gene transcription (CRMs) interact to control the expression of a key mammalian gene (MyoD1). In Social Dynamics we are exploring the relevance of statistical mechanics models of consensus formation – particularly the Axelrod Model – to social phenomena. Application areas are granular materials, dynamics of opinions and markets and molecular biology.

RESEARCH DEGREES

PHD IN COMPLEXITY SCIENCE

Standard Duration: 3 years

We aim at training graduates able to understand, control and design complex systems, produce breakthroughs in the principles and applications of complexity science, link with end-users as sources of real-world problems.

APPLICATION FACT FILE (RESEARCH DEGREES)

Entry requirements

A postgraduate degree that would be equivalent to the Centre's MSc in Complexity Science

English language requirements

IELTS 6.5, TOEFL (iBT) 92 or equivalent

Application

All applications are made online at www.warwick.ac.uk/go/pgapply

Application deadline

Applications are welcomed throughout the year

Tuition fees

(2011/2012 fees. Please note fees for 2012/13 will be published online in spring 2012.)

Home/EU: Full-time £3,900, Part-time £2,340

Overseas: (Band 2 – lab based) Full-time £15,460, Part-time £9,276

Funding

Home/EU applicants are eligible to apply for EPSRC funding for our 1+3 integrated programme. Details of this, the Chancellor's Scholarships and other funding opportunities are available from: www.warwick.ac.uk/go/graduateschool

TAUGHT MASTER'S DEGREES

MSc IN COMPLEXITY SCIENCE

Standard Duration: 1 year

Places available: 12

The DTC teaches a coherent core of complexity science concepts which unify the field across disciplines: interacting agents and networks; probabilistic modelling and statistical inference; dynamics and chaos; statistical mechanics, emergence and self-organisation; simulation of complex systems; quantification of complexity, scaling and extreme events. Research projects range widely over areas such as informatics, biomolecules, distributed computing, complexity measures, ecology, economics, epidemiology, finance, gene expression, health, metabolic networks, neuroscience, operational research, plasma physics, production processes, transport (at levels from air, road and human to information and cell) and turbulence.

MSc IN COMPLEX SYSTEMS SCIENCE (ERASMUS MUNDUS)

Standard Duration: 2 years

Places available: 20

**This is a joint MSc taught by the consortium:
University of Warwick (UK), Chalmers University
of Technology and University of Gothenburg
(Sweden), Ecole Polytechnique (France)**

We teach the tools to analyse complex systems and to understand their emergent behaviour. Students are offered a variety of research project opportunities to develop experience applying this to fresh challenges from the real world and within academic research. We offer an exceptional cross-disciplinary environment and experience, with the programme based around three leading research centres:

Centre for Complexity Science (Warwick);

Complex Systems Institute (Paris);

Complex Adaptive Systems (Gothenburg).

Mobility between these centres is a key aspect of the programme: all students spend extended time at two or more of the centres.

This programme is suitable for those who are willing to bridge the gap between theoretical and data-based projects, and mathematically-oriented students who are keen to experience science in a variety of European countries. Graduates are expected to go on and work in areas such as finance, biomedical research companies, forecasting agencies and academia.

APPLICATION FACT FILE (TAUGHT MASTER'S DEGREES)

Entry Requirements

MSc in Complexity Science: At least a 2:i undergraduate degree in a scientific, mathematical or analytical subject, with some orientation towards modelling problems in quantitative mathematical terms.

MSc in Complex Systems Science: Applicants should be competent in mathematics and/or mathematical modelling, to the level of a mathematically based undergraduate degree (including but not restricted to sciences and engineering). That degree also needs to be of high standard. We are happy to consider equivalent professional experience.

English Language Requirements

IELTS 6.5, TOEFL (iBT) 92 or equivalent

Start Date

MSc in Complexity Science: last week September

MSc in Complex Systems Science: Last week of August or September, depending on chosen institution

Application

All applications are made online at www.warwick.ac.uk/go/pgapply

Application Deadline

MSc in Complexity Science: applications are welcomed throughout the year

MSc in Complex Systems Science: Early January (see www.warwick.ac.uk/go/cssm for precise day) for applicants wishing to be considered for Erasmus Mundus Scholarships. Later applications can be considered from applicants with other funding.

Tuition Fees

(2011/2012 fees. Please note that fees for 2012/13 will be published online in spring 2012.)

MSc in Complexity Science

Home/EU: Full-time £6,080, Part-time £3,040

Overseas: (Band 2, lab based) Full-time £16,000, Part-time £8,000

MSc in Complex Systems Science (fees set in Euro)

Home/EU: €4,000 per annum

Overseas: €8,000 per annum

Funding

MSc in Complexity Science: Home/EU applicants are eligible to apply for EPSRC funding for our 1+3 integrated programme (EU-only fees). This and other funding opportunities are listed on the Graduate School Website: www.warwick.ac.uk/go/graduateschool

MSc in Complex Systems Science: Funding is available for both EU and non-EU students through the EAEAC Erasmus Mundus Scholarships, see www.warwick.ac.uk/go/cssm for full details.



Qingyi Feng

*Erasmus Mundus Master's
in Complex Systems Science
Centre for Complexity Science*

“I got my first Master’s degree in Environmental Science in China and applied for an Erasmus Mundus Master’s in Complex Systems Science hoping to treat my research interest more seriously. Among Warwick, Paris and Gothenburg I chose the first two and started my journey from here because English was the only thing I was familiar with.

With no friends or family here, I thought my first year abroad would be very tough, but it turned out to be the best experience I have ever had!

The Complexity Centre in Warwick is very friendly, though we all have different cultural and academic backgrounds. The modules are well organised and the lecturers considerate and patient. The academic atmosphere is really good: we have seminars almost every week, many workshops and innumerable opportunities to attend conferences all over the world!

I have also gained a lot of new friends from different countries. I spent my first Christmas at a very kind English lady’s house and we established a lifelong friendship.

I’m planning to apply for a PhD in Complexity Science here, because I feel more confident now and I do love Warwick.”



Maryam Ghaffari Saadat
MSc Cognitive Systems
Department of Computer Science

“I considered applying to the University of Warwick for its excellent reputation for cutting-edge research and providing a high quality education. I was offered a position to study MSc Cognitive Systems and was awarded a generous scholarship by the Department of Computer Science, which covered one third of my tuition fees.

The University has provided me with the opportunity to carry out interdisciplinary research and direct my studies by choosing modules that are most relevant to my research project. Furthermore, as a consequence of Warwick’s collaboration with influential professionals all around the world, I have had a chance to attend seminars given by inspirational scientists such as Professor Dan Arieli.

I plan to pursue a career in interdisciplinary research. Accordingly, with the support of academic staff from both departments, I have recently applied for a scholarship to continue my research as a PhD student and extend my Warwick experience for a few more years.”