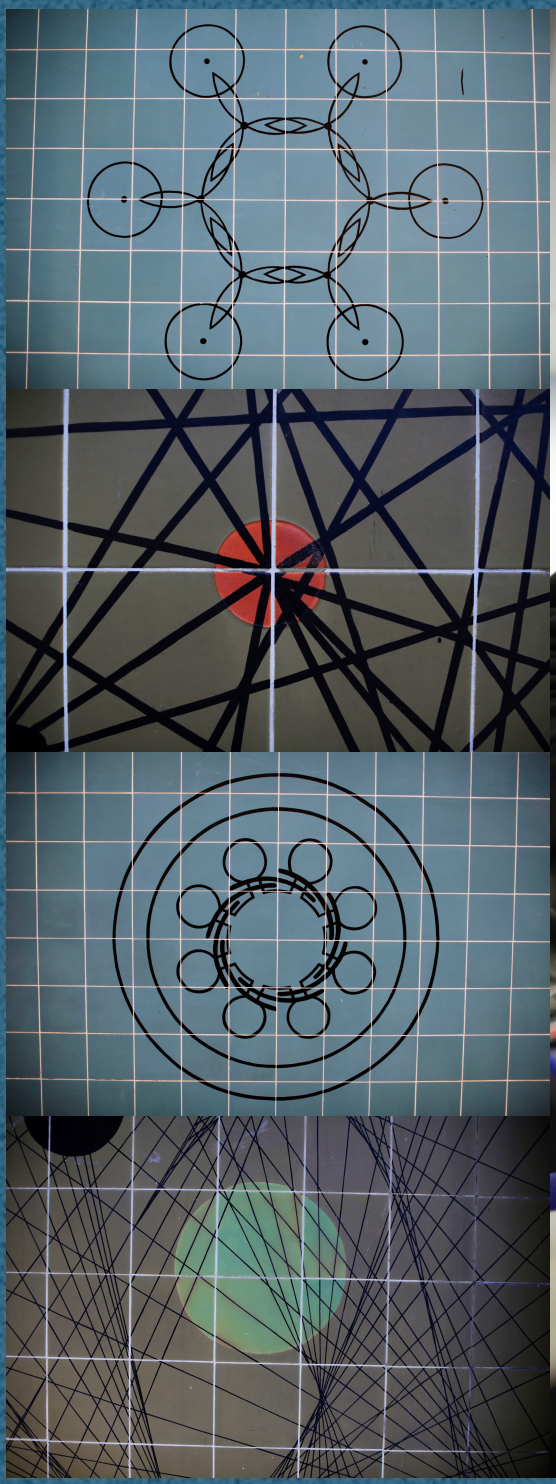
Queen Mary
University of London

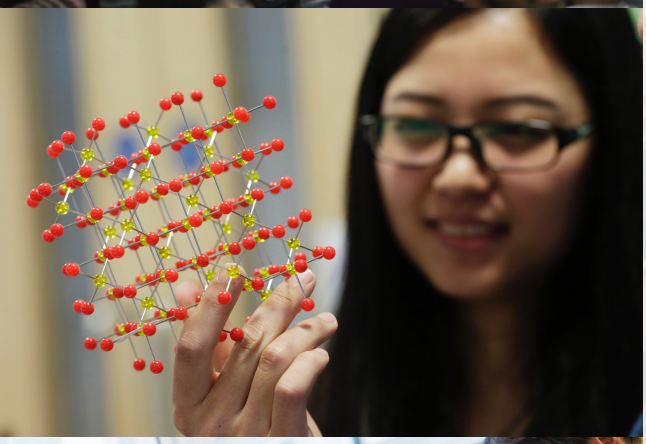
School of Physics and Astronomy



www.ph.qmul.ac.uk

Queen Mary University of London

One of the largest UK research-focussed universities, with around 4,000 staff and 18,000 students. QMUL was ranked 9th in the 2014 UK Research Excellence Framework.



Queen Mary University of London is one of the members of the prestigious Russell Group containing the leading research-intensive universities in the UK. Research and teaching are organised within three academic faculties, namely Science & Engineering, Arts & Humanities, and Medicine & Dentistry.

The School of Physics & Astronomy has 49 academic staff, 36 research staff, 21 professional support staff, and 108 research students, organised within four research groups than span many aspects of modern physics research.

We are based in the G O Jones building on the Mile End Road campus. The building underwent a significant refurbishment recently and was re-opened in 2014. We have new laboratories to support the experimental programmes of the research groups, together with a refurbished astronomical telescope on the roof for teaching and outreach.

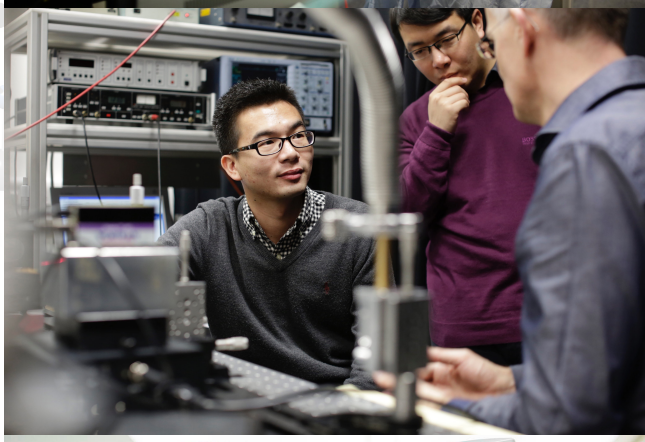
Each year we recruit 150 students, offering three year and four year degrees in Physics, some with specialisation in Theory, Particle Physics and Astronomy. We also offer masters courses, including a long-standing taught course in Astrophysics.

The School is a member of the South East Physics network (SEPnet), a consortium of 9 universities in the South East of England. This has a focus on undergraduate diversity, graduate training, and employability.

Centre for Condensed Matter and Materials Physics

Understanding the connection between atomic structure, fundamental laws of physics, and the properties of materials that have enabled the creation of the modern world.

Condensed Matter and Materials Physics in Queen Mary University of London has significant experimental, theoretical and computational programmes of work. Experiments are based around two clean rooms and modern characterisation and chemical laboratories. We are also significant users (and contributors to) the UK's synchrotron, neutron and muon spectroscopy facilities on the International Harwell Campus. Theoretical work is concerned with the properties of materials, including fluids, and on high-accuracy methods for modelling the forces between atoms. Computational work supports both experimental and theoretical work, and uses a wide range of simulation methodologies, some of which we are pioneering.



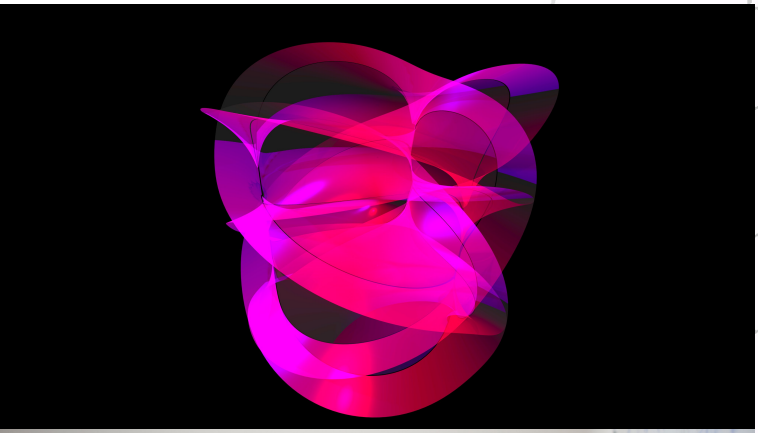
We work on a diverse range of materials. These include ceramics, organic and molecular materials, hybrid materials and metals. Research topics include optical and electronic properties of materials, phase transitions including ferroelectric and magnetic transitions, high-pressure work, nanoparticles including carbon nanotubes, fullerene balls and quantum dots, disordered crystalline materials, radiation damage in ceramics, the origin of anomalous properties such as negative thermal expansion, glasses and fluids including supercritical fluids.

We have a particular expertise in software development for materials research, with international users of our products. We have government funding to work with companies for commercial exploitation of these skills.

Centre for Research in String Theory

Research at the CRST covers a breadth of avenues on the mathematical structure of strings and quantum field theories as well as interfaces with particle physics and cosmology.

Building on an internationally recognised history of research achievements, the Centre for Research in String theory (CRST) maintains a broad research programme at the forefront of quantum field theory, string theory and M theory. The Centre's key strengths, which lie in some of the most active areas of research in theoretical high-energy physics world-wide, include scattering amplitudes, holography, black holes, topological field theory, supersymmetry and string cosmology.



Within the last 10 years, CRST members have held prestigious competitive long-term fellowships funded by EPSRC, STFC and the Royal Society. The Centre maintains a stimulating research environment for PhD students, post-doctoral researchers and faculty. PhD students from CRST have pursued careers within and outside academia. Several graduates hold high profile positions in finance and industry, applying their theoretical physics training in areas ranging across banking, insurance, risk analysis and aerodynamics. The CRST also has a tradition of innovative initiatives in Arts/Science interactions.

Mathematical structures and results in areas of algebra, geometry and combinatorics, arising from researching questions in esoteric sounding concepts such as holography and extra dimensions have the potential to find applications in unexpected areas of applied mathematics.

Particle Physics Research Centre

Understanding basic questions about matter and energy from the study of elementary particles,which will help explain the nature of our Universe.

The PPRC plays a leading role in a range of international particle physics experiments, maintaining a balance between the exploitation of current experiments and construction of new experiments.

We work on both energy and intensity frontier experiments. The first includes ATLAS at CERN, and future involvements in the Future Circular Collider and the International Linear Collider. The second is focussed on a wide range of neutrino experiments, including in Japan (T2K, Hyper-Kamiokande) and Canada (SNO+).

In ATLAS, we played a major role in the design and commissioning of the calorimeter trigger and the semiconductor tracker,and are working on the next upgrade.

Members of PPRC worked on the construction of the electromagnetic calorimeter and the data quality of the photosensors for T2K. They are currently building the data acquisition systems for two future neutrino experiments, Hyper-Kamiokande and ANNIE (USA), helping calibrate SNO+ and Hyper-Kamiokande, and will work on the photomultipliers for Hyper-Kamiokande.

The group is also strongly involved in the Grid computing for LHC analysis through the GridPP Project and exploitation.

Background image used with permission of Kamioka Observatory, The University of Tokyo

Astronomy Unit

Understanding the origin and ultimate fate of the Universe, the nature and evolution of planetary systems in our Galaxy, the physics of the Sun and other stars, and the Solar wind.

Astronomy research at QMUL involves ground- and space-based observations, data/image analysis, high performance computing, and theoretical work that relies on in-depth mathematical analysis. The Unit has groups specialising in cosmology, extrasolar planets, planetary formation and dynamics, space plasma physics, and Solar and stellar physics. Observational work uses both space- and ground-based observatories such as VISTA, the world's largest infrared survey telescope (QMUL led the project to build this telescope), the European Southern Observatory, NASA/ESA's Cassini mission to Saturn, and ESA's Cluster mission to study the solar wind. We are also involved in a number of forthcoming ESA and NASA missions such as Euclid, JUICE, PLATO, Solar Orbiter and Solar Probe+.

Our research addresses the most important questions in modern astrophysics. What is the origin and ultimate fate of the Universe? How long after the Big Bang did the first galaxies form? How common are planetary systems, and how have they formed and evolved? How do they compare with our Solar System? What are the physical processes that determine the interior structures of the Sun and other stars? What are the processes that drive the solar wind and determine its dynamical evolution?

In tackling these questions, the Astronomy Unit has developed significant expertise in statistical data analysis, image analysis, advanced mathematics and computational modelling. While we apply these techniques to problems in astrophysics, they also apply to problem-solving in a much wider context.

Working with others

The School of Physics and Astronomy has a good record in working with external partners for outreach, impact and exploitation, arts, media and employability

The diversity that spans both our teaching and research is reflected in our efforts to promote our work and skills to a wider market.

We work with industries in two regards. First is the employability of our graduating students through active programmes of engagement with industry for internships and recruitment. Second is working with industries and public sector on projects that exploit our expertise. For example, our skills in software and algorithms find applications in publicly-funded projects with a number of small companies. One such with a global reach is CrystalMaker, who we are helping develop new capabilities for their core materials-modelling product. Other software tools we have developed have wide use in many other countries.

We run active a vibrant outreach programme, which includes public lectures, visits to schools and other organisations, summer programmes for sixth form students, and participation at national events. We engage with the national media for public-interest projects. We also have a strong programme in engagement with the arts through working with artists and art organisations.

We are always interested to explore new opportunities in any of these areas.

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Contact us

School of Physics and Astronomy
Queen Mary University of London
Mile End Road
London
E1 4NS

http://ph.qmul.ac.uk

physics@qmul.ac.uk

General: +44(0)20 7882 6962

Admissions: +44 (0)20 7882 6958

Outreach and Work Experience: +44(0)20 7882 6963