Dear Researchers

Welcome to the SUPA Graduate School 2018/19.

SUPA is a pan-Scotland strategic alliance for research and graduate training in Physics. Eight major universities work in partnership to create the SUPA Graduate School which offers postgraduate research students world class research opportunities, expert supervision, links to national and international facilities, advanced specialist courses, professional development training, networks, industry engagement, outreach, exchanges and placements, careers and other events, which all draw upon the knowledge and experience of the whole physics community across Scotland and beyond. This collaborative approach ensures that the SUPA Graduate School can offer the best possible opportunities for research students to acquire all of the skills needed to launch a successful career whether that be in academia, industry, enterprise or public and other sectors.

In the most recent UK wide research assessment exercise, REF2014, the ‘research power’ of SUPA combining quality and scale of activity was judged to have significantly exceeded that of Cambridge, Oxford, Imperial and UCL; U. Strathclyde was given the top ‘grade point average’ of any physics school and the joint PHYESTA submission from U. Edinburgh and U. St Andrews came 3rd equal in the UK. The ‘impact’ of Scottish physics research is extremely high.

The SUPA Graduate School offers over 50 advanced courses, mostly delivered via the SUPA video network, as well as other events and training opportunities. Please take maximum advantage of the training offered. The SUPA Graduate School always strives to provide education and training at the highest international level in physics as well as the broader skills needed to establish you in a successful career.

I am delighted that you have chosen to pursue your post-graduate studies in Scotland, welcome to our community, I wish you every success.

Alan Miller
SUPA CEO

Disclaimer:

Every effort has been made to ensure that the information contained within this brochure is correct at the time of publication. SUPA Graduate School courses are subject to on-going development which could necessitate cancellation of, or alteration to, the advertised courses. The SUPA Graduate School reserves the right to make changes at any time without prior notice.

Please note that the term ‘credits’ is only used in this handbook to refer to ‘SUPA Hours Equivalent Credits’ (the number of face to face hours per course that students are credited with towards their minimum coursework requirements). This term does not refer to ECTS or any other crediting system.

Should you notice any errors or inaccuracies, please let us know by emailing admin@supa.ac.uk.
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EPSRC/STFC Centres for Doctoral Training

Condensed Matter
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Intelligent Sensing and Measurement
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Tel: +44 (0)191 3342133

The Scottish Data-Intensive Science Triangle
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Graduate School Committee

The SUPA Graduate School Committee (GSC) oversees the operation of the SUPA Graduate School in relation to prize studentships, video-linked courses, induction, career events, summer schools and support for physics based doctoral training centres. The SUPA CEO assumes the role of Director of the Graduate School; GS Coordinators assist the CEO in fulfilling the aims and objectives of the strategy.

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Physics studies within SUPA are grouped by Theme (Astronomy & Space Science, Condensed Matter & Material Science, Energy, Nuclear & Plasma, Particle Physics, Photonics, and Physics & Life Sciences). Most specialist courses are delivered by video-conferenced lectures via the My.SUPA e-learning portal in the SUPA VC classrooms of each university partner; some courses may include tutorials, labs, hands-on-sessions and residential sessions.

All physics Postdoctoral Research Associates/Fellows employed by SUPA partner institutions are welcome to attend any SUPA Graduate School courses, career and other events. PDRA/Fs should register for courses as non-assessed participants.

Course Requirements for SUPA Students

All doctoral research students (PhD and EngD) are expected to undertake a minimum of 40 hours of advanced specialist studies and 20 hours of Professional Development training during the first two years of their studies (as agreed by all 8 SUPA partner institutions). Some Themes, Doctoral Training Centres and/or Universities may require their students to undertake more. Additional information about these requirements can be obtained from your local SUPA Graduate School Committee member.

Advanced Specialist Courses

SUPA Graduate School students can choose, in consultation with their supervisors, from the following to make up their minimum of 40 hours of advanced specialist studies in physics or related scientific areas.

Specialist Training includes:

- SUPA Graduate School Lectures
- SUPA Distance Learning Courses
- SUPA Residential Courses
- Summer School lectures as recommended and approved
- Non-SUPA courses where appropriate and approved

(please refer to ‘Non-SUPA Courses’ section for more information)

Professional Development Training

The development of generic skills forms an increasingly important and vital element of the research student experience. Expanding on Professional Development Training makes planning and management of research projects, publication, report and thesis writing, more effective, while also contributing to professional development for the purpose of broadening future career prospects, options and success.

All SUPA partner institutions offer researcher development opportunities and the SUPA minimum requirement of 20 hours can be accumulated via approved Departmental/School, University or Research council programmes. Some Professional Development Training topics are more effectively covered for physics graduate students when addressed within a physics context, and SUPA provides training opportunities in these areas.

Professional Development Training includes:

- SUPA Graduate School Lectures
- SUPA Distance Learning Courses

- SUPA Residential Courses
- Non-SUPA courses where appropriate and approved

(please refer to ‘Non-SUPA Courses’ section for more information).

Earning and Tracking Credit

In order to earn credit to satisfy the SUPA Course Requirement, students must enrol for a course on My.SUPA and, for Advanced Specialist Courses, pass the assessment. No credit can be given if a student has not met these criteria.

The credit for each SUPA course is listed in this catalogue. Students can track the amount of credit they have earned over the course of their doctorate by checking their profiles on My.SUPA. (More information about how to do this can be found in the ‘Getting Started with My.SUPA’ section of this handbook.)

Course Availability

Some SUPA Advanced Specialist courses run biennially. Consult the online extended handbook for details of courses which will next run in 2019/20.

In the event of under subscription of a course resulting in the possibility of cancellation, enrolled students will be contacted to discuss alternative options.

Some courses may become oversubscribed, where this happens, later registrations will be added to a waiting list. Some courses will close registration earlier in advance of the course beginning to enable pre-work to be completed. Details of this will be in the course information page on MySUPA.

Course Selection

Students generally take Advanced Specialist courses within their main theme, but all students, especially those working on interdisciplinary projects, are welcome to take courses from across the SUPA Graduate School. The SUPA courses provide an opportunity for students to broaden their physics knowledge at postgraduate level.

All students must discuss their plan of study and specific course selections for both the Advanced Specialist courses and Professional Development Training with their supervisors.

SUPA Assessment Policy

Assessment for all SUPA Advanced Specialist courses is mandatory unless the student decides to attend the course as a non-assessed student (in this case the student will receive no credit towards their 40-hour requirement). Courses are assessed by various methods as appropriate to the subject area. Examples of assessment include: continuous assessment, dissertations and oral examinations. Information about assessments for specific courses can be found in the course listing in the full catalogue. Students are advised to check the course assessment with the lecturer at the start of each course.
If a student does not take the assessment for a course, no credit will be allocated. Students taking non-SUPA courses must agree an assessment with their lecturer(s) and have this approved by their supervisor before the commencement of the course. Please refer to the ‘Non-SUPA Courses’ section of this handbook for more information.

Lecturers are required to notify students of the assessment details by the start of the course and to report students’ marks by the marking deadline. All marks will be on a 0-100 point scale, with a pass mark of 50. (Where SUPA postgraduate courses are part of the final year undergraduate curriculum, the pass mark may be 40.)

There is no assessment requirement for Professional Development Skills Training.

Special Circumstances

When unforeseen circumstances arise which adversely affect student performance on SUPA courses, the student is asked to inform their local Graduate School Committee member and provide documentary evidence. The Graduate School Committee will decide an appropriate course of action. Evidence should be supplied prior to the end of enrolment for the following semester whenever possible.

Enrolling for SUPA Courses

To enrol for SUPA courses, log on to the My.SUPA portal (http://my.supa.ac.uk) and follow the enrolment instructions posted on the front page. Before you enrol for the first time, you will be informed about SUPA’s videoconference recording policy and asked for your consent. (For more information about this policy, please email admin@supa.ac.uk.)

When using My.SUPA to select courses please note that during the enrolment period most course areas are available with read-only access to some materials. All course materials will be made available to enrolled students once registration is closed. For more information about using My.SUPA, please refer to the ‘My.SUPA and Videoconferencing’ section of this handbook. Students must enrol for courses in order to be eligible to earn credit for them.

Enrolment will typically stay open until the end of the second lecture for short courses and the end of the second week for full semester courses. If you miss the enrolment open period, late enrolment may be possible with the permission of the lecturer. Please contact the SUPA Administration team at admin@supa.ac.uk after receiving confirmation of acceptance on the course.

If you decide to withdraw from a SUPA course while enrolment is open, you can do so by going to the relevant course page and clicking on the ‘Unenrol me from SUPA[XXX]’ link.

Please note that if you decide not to complete a course, it is very important that you unenrol on My.SUPA. If you do not unenrol, your SUPA transcript will still contain a record of this course and your mark will be listed as 0. After unenrolling, you can also sign up for the course as a non assessed student in order to be able to continue to attend the lectures.

Once enrolment has closed, it will not be possible to unenrol on My.SUPA and you will need to make a request to admin@supa.ac.uk.

Please note that if you have not signed up through My.SUPA you may not attend the lectures.

During the enrolment period it is possible for students to switch from a non-assessed student to a fully enrolled student on a course. This is particularly important for students who would like to try out a course before fully committing. To switch from being a non-assessed student contact the course lecturer or admin@supa.ac.uk.

Non-Assessed SUPA Courses

In cases where a student would like to attend a course without completing the coursework, it is possible to register as a non-assessed student (audit). It is important to note that you will NOT receive credit for courses which you audit. Instructions for registering as a non-assessed student are posted on the My.SUPA portal (http://my.supa.ac.uk). Before you register for auditing the first time, please see the recording section of SUPA’s Privacy Policy. (For more information about this policy, please email admin@supa.ac.uk.)

Attending SUPA Courses

Videoconferenced Lectures

Most SUPA courses are taught via videoconferencing. To attend, go to your local institution’s SUPA videoconference room.

For more information on videoconference facilities, please refer to the ‘SUPA Video Conference Room Locations’ and ‘Getting Started with Videoconferencing’ sections of this handbook. Generally, videoconference lectures last approximately fifty-five minutes.

Distance Learning Courses

Courses listed as ‘Distance Learning’ have no live videoconferenced lectures. Enrolment on these courses will give you online access to recordings, notes, problem sheets and discussion forums. You will be expected to work through the materials and activities, meet deadlines set by the course lecturer and participate in relevant activities. Opportunities will be provided for you to upload your exercises and receive feedback.

Tutorials/Hands-on sessions/Labs

Some courses may require you to attend tutorials and lab sessions in person. Please check the online timetable and My.SUPA course pages for information about where the tutorials take place.

Residential Courses

Courses listed as ‘Residential’ are face-to-face sessions for which you may have to travel and perhaps stay overnight.

Travel Policy

If you are required to travel to attend a course, tutorial or lab session SUPA will reimburse travel expenses. Follow your local procedures for claiming expenses and ensure you complete the departmental travel claim form clearly stating SUPA and the name of the course. SUPA will cover the costs of accommodation where travel is unreasonable but not where there is sufficient time to travel. Some courses will require overnight accommodation and you should consult the lecturer if you are in doubt regarding start and end times or evening activities. The accommodation allowance is up to £80 per night. If this is unachievable this must be justified in your claim form.
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<td>GLA</td>
<td>VC/F2F</td>
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<td>GLA</td>
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<td>Biomedical Applications of Lasers, Beams and Radiation</td>
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<td>STRA</td>
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<td>Hands on Writing</td>
<td>HOW</td>
<td>EDI</td>
<td>F2F</td>
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<td>UWS</td>
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<td>TBC</td>
<td>F2F</td>
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</table>
The Astronomy and Space Physics courses cover a broad range of topics aimed at widening students’ knowledge of the field. They range from advanced extensions of subjects covered at undergraduate level to the introduction of new interdisciplinary sciences. We recommend that students take a mixture of core material, advanced courses (usually 16-20 hours equivalent credit) and more general topics, including computing and data reduction modules, to gain a broad grounding in astronomical methods and modern research areas.

Each course is self-contained, although background reading or another SUPA course may be recommended to bring students from various backgrounds up to speed. Students from other theme areas are very welcome to take Astronomy and Space Physics courses, with particular modules likely to be of interest for Life Sciences and Plasma Physics students, but they should remember that a basic understanding of astronomy and astronomical terms will be assumed by course lecturers.

A typical programme, building to the core requirement of 40 hours of Technical Courses might include:

- A SUPA technical Astronomy course (these generally constitute 16-20 hours)
- A technical SUPA course in another field or a second Astronomy course
- Non-SUPA courses as appropriate (e.g. for students changing specialities)
- Summer Schools in Astronomy and Space Physics

Astronomy students should note that certain Astronomy courses are only run biennially. Each student must consult their PhD supervisor to construct a suitable programme before registering, and students are encouraged not to over-register. The 40 hour course requirement is taken over the first and second years, although students from all years can take extra subjects for interest.

Semester 1

**Advanced Data Analysis - Astronomy (SUPAAAA)**
Lecturer: Keith Horne
Institution: St Andrews
Hours Equivalent Credit: 15
Assessment: Any 3 of 2 Homework sets and 2 Data Analysis Projects.

This is a final year undergraduate course organised by the University of St Andrews

Course Summary

This module develops an understanding of basic concepts and offers practical experience with the techniques of quantitative data analysis. Beginning with fundamental concepts of probability theory and random variables, practical techniques are developed for using quantitative observational data to answer questions and test hypotheses about models of the physical world. The methods are illustrated by applications to the analysis of time series, imaging, spectroscopy, and tomography data sets. Students develop their computer programming skills, acquire a data analysis toolkit, and gain practical experience by analysing real data sets.

**Gravitational Wave Detection (SUPAGWD)**
Lecturer: Harry Ward
Institution: Glasgow
Hours Equivalent Credit: 16
Assessment: Essay and Oral Examination

Course Summary

This course is for students interested in the physics of gravitational wave detection. Starting from the fundamentals of Einstein’s General Theory of Relativity, the wave nature of weak field spacetime curvature perturbations will be derived in the transverse traceless gauge. Interactions of gravitational radiation with matter will be explored, leading to the basic principles of gravitational wave detectors. A full description of currently operating detectors will include instrumental noise sources, such as thermal, seismic, optical, and the standard quantum limit. Current topics discussed will include squeezing, and other non-classical light techniques for reducing optical noise in interferometric systems.

Astrophysical sources of gravitational waves will be discussed, including expectations for source strengths from coalescing compact binary systems, pulsars, etc. together with a discussion of the data analysis techniques that are required for signal extraction and parameter estimation. An update will be given on the new astrophysics that has been deduced from the gravitational wave signals so far observed, and the promise of future “multi-messenger astronomy” will be explored. Plans for future detectors on the ground and in space will also be presented.

**Magnetofluids and Space Plasmas (SUPAMSP)**
Lecturer: Moira Jardine
Institution: St Andrews
Hours Equivalent Credit: 27
Assessment: Exam

This is a final year undergraduate course organised by University of St Andrews
Astronomy & Space Physics

Course Summary
The interaction of a magnetic field with a partially or fully ionised gas (or plasma) is fundamental to many problems in astrophysics. Star formation in particular is heavily influenced by the magnetic fields of molecular clouds, and once stars and discs form they can generate their own magnetic fields by dynamo activity. This is a final year undergraduate course run by University of St Andrews. The behaviour of this magnetic field is at the heart of many of the most interesting observations of young stars and their accretion disks. This module covers the basics of magnetohydrodynamics (MHD) with applications to star formation, accretion discs and stellar magnetospheres. Topics include reconnection, coronal heating, dynamo theory, angular momentum transport, stellar winds and magnetic braking.

Advanced Cosmology (SUPAACO)
Lecturer: Andrew Liddle
Institution: Edinburgh
Hours Equivalent Credit: 20
Assessment: Take home problem set
This is a final year undergraduate course organised by the University of Edinburgh.

Course Summary
This course is intended to present the current understanding of some of the main topics in cosmology, at a sufficiently high level that it allows a contact with the research literature. The focus will be on the development of structure in the universe, and how this can be related to cosmological initial conditions and exotic physical processes that operate at early times and energies.

Semester 2
Plasma Astrophysics (SUPAPLA)
Lecturer: Lyndsay Fletcher, Eduard Kontar, Moira Jardine
Institution: Glasgow
Hours Equivalent Credit: 10
Assessment: Online Quiz, worked examples, short essay
This is a biennial course which will not run in 2018/19 but will run in 2019/20

Course Summary
The course will give an overview of the physics of plasmas, and introduce applications in astrophysics. Beginning with basic definitions and ideas such as plasma waves and kinetic theory, the course will develop fundamental concepts in astrophysical plasma diagnostics, including cyclotron and synchrotron radiation, bremsstrahlung and recombination emission, wave-particle interactions and plasma emission (coherent and maser). Magnetohydrodynamics will be studied as a tool for understanding dynamos, solar and solar-terrestrial environments, and magnetospheres. The course will conclude with topical lectures on plasmas in different astrophysical environments. Students are strongly advised to take the Semester 1 course on Plasma Physics in the Nuclear and Plasma Theme first.

Astrobiology and the Search for Life (SUPAASL)
Lecturer: Charles Cockell, et al
Institution: various
Hours Equivalent Credit: 20
Assessment: Exam
This course is cross-listed with the Physics and Life Sciences Theme.

Course Summary
This course looks into the origin, evolution and distribution of life in the Universe, broadly considered as ‘astrobiology’. The objective of the course is to provide a perspective in geology, biology and chemistry at an introductory level.

SUPA Observing Course (SUPAOBS)
Lecturer: Aleks Scholz
Institution: St Andrews
Hours Equivalent Credit: 10
Assessment: Mock observing proposal as homework

Course Summary
This course will enable PhD students to carry out astronomical observations with large telescopes. The course includes 5 lectures on the basics of professional observations, given by observatory director Dr. Aleks Scholz, covering planning observations, proposal writing, calibration, feasibility, operating large telescopes, future facilities, and on-the-fly data reduction. This core will be complemented by 5 lectures on specialised observing techniques, given by staff members in St Andrews, e.g. multi-object spectroscopy, robotic telescopes, integral field units, submm interferometry. The course will include observing training with the James Gregory Telescope in St Andrews. Each group will be assigned a week of the semester for nighttime observations under the supervision of Dr. Aleks Scholz. For students outside St Andrews the practical training is organised as residential course in 1-2 weeks of the semester.

The Sun’s Atmosphere (SUPATSA)
Lecturer: Nicolas Labrosse
Institution: Glasgow
Hours Equivalent Credit: 17
Assessment: 50% oral exam, 50% report on computer-based project

Course Summary
This course provides a comprehensive introduction to the physical processes at work in the solar atmosphere, and to the principles and practice of research in the physics of the solar atmosphere. It is compulsory to all students enrolled on the MSc in Astrophysics, and optional to all students on the MSc in Theoretical Physics. Its aims are:

- To develop the students’ knowledge of emission processes of electromagnetic radiation; plasma physics; instrumentation; data analysis; theory and modelling – all in the context of the study of the solar atmosphere.
- To offer initial training in solar physics research which will be useful for students interested in pursuing a career in astrophysics or theoretical astrophysics
Condensed Matter and Materials Physics (CMMP) is a diverse subject covering many different specialities and attracts PhD students arriving from a wide range of backgrounds with different balances of theoretical and practical training. The program of study is therefore tailored individually for each student, in consultation with his or her PhD supervisor. The overall range and level of courses offered aim to introduce students to subject areas outside the immediate confines of their thesis research, as well as providing more specialist knowledge directly relevant to each dissertation. It is envisaged that during the first two years of study every student will complete a minimum of two physics-content courses, at least one summer school, plus at least one module covering transferable skills. A typical program will comprise the following elements:

**CMMP courses organised by SUPA:** These are either graduate specific or advanced masters courses made available to all centres over the SUPA videoconferencing network. Courses offered are listed below and form the backbone of the CMMP graduate school programme.

**Core courses organised by SUPA:** Those of particular interest to CMMP students include Advanced Data Analysis and courses in different programming languages such as C++ and Python.

**Non-SUPA courses as appropriate** (e.g. for students changing specialities)

**Summer Schools:** Examples of appropriate summer schools include ‘Physics by the Lake’ for those with an interest in theory and HERCULES (Grenoble, France) for those doing research involving neutron and X-ray scattering at central facilities.

**Professional Development modules**

**Courses offered by other themes**

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### Semester 1

**Advanced Statistical Physics (SUPAASP)**

**Lecturer:** Luigi Del Debbio  
**Institution:** Edinburgh  
**Hours Equivalent Credit:** 22  
**Assessment:** Hand-in exercises  

This is a final year undergraduate course organised by the University of Edinburgh  

**Course Summary**

In this course we will discuss equilibrium phase transition, of the first and second order, by using the Ising and the Gaussian models as examples. We will first review some basic concepts in statistical physics, then study critical phenomena. Phase transitions will be analysed first via mean field theory, then via the renormalisation group (RG), in real space. We will conclude with some discussion of the dynamics of the approach to equilibrium.

**Introduction to Computational Chemistry (SUPACCH)**

**Lecturer:** Herbert Fruchtl  
**Institution:** St Andrews  
**Hours Equivalent Credit:** 9  
**Assessment:** Continuous assessment through assignments  

**Course Summary**

The course will provide an introduction to practical computational chemistry techniques. The focus is on an introduction to the current state-of-the-art computational chemistry codes together with the theory behind the methods. Ab initio, DFT and classical methods, as well as cheminformatics, will be introduced along with how they are used in practice by researchers in Scotland.

**Open Quantum Systems (SUPAOQS)**

**Lecturer:** Michael Hartmann  
**Institution:** Heriot-Watt  
**Hours Equivalent Credit:** 14  
**Assessment:** Continuous Assessment based on tutorials  

This is a biennial course which will run in 2018/19 but will not run in 2019/20  

**Course Summary**

The course focuses on the dynamics of quantum systems interacting with their surroundings. Due to the inevitable interaction between a quantum system and its environment peculiar quantum features such as the existence of quantum superpositions and entangled states are quickly destroyed. Starting from a microscopic model, we will derive an equation of motion, the so called master equation, describing the dynamics of a quantum system in the presence of an environment. We will then examine the properties of the dynamics of an open quantum system as described by the master equation and explore two aspects of both fundamental and applicative importance in physics: First we will consider the fragility of quantum superpositions (e.g. Schrödinger cats) and entanglement under the influence of a quantum environment since controlling or suppressing environmental perturbations is essential for future quantum technologies. Then we will discuss how the fact that every quantum system is inevitably connected to an environment can be invoked to (at least partly) explain the quantum-classical border.
Quantum Field Theory (SUPAQFT)
Lecturer: Jonathan Keeling
Institution: St Andrews
Hours Equivalent Credit: 30
Assessment: Continuous Assessment
This is a final year undergraduate course organised by the University of St Andrews.

Course Summary
Quantum field theory combines classical field theory with quantum mechanics and provides analytical tools to understand many-particle and relativistic quantum systems. This course aims to introduce the ideas and techniques of quantum field theory. I will use examples drawn mainly from condensed matter physics to illustrate the ideas and application of quantum field theory.

Modern Topics in Condensed Matter Physics (SUPATOP)
Lecturer: Phil King, Peter Wahl
Institution: St Andrews
Hours Equivalent Credit: 35
Assessment: Problem Sheets, Presentations, Essay
This is a final year undergraduate course organised by the University of St Andrews.

Course Summary
The aim of this module is to give an introduction to a variety of modern topics of condensed matter physics that can be realised at the surfaces of materials and in low-dimensional solids. As well as surface properties and probes, we will cover the introductory concepts of topologically non-trivial materials – states of matter that are not characterised by spontaneous symmetry breaking but rather by a distinct topological order of the underlying electronic system. This has recently come to prominence in condensed matter physics with the realisation that seemingly conventional band insulators come in topologically trivial and non-trivial classes, the latter being known as topological insulators. This course will cover the underlying principles and introductory theory of these exotic states of matter, will introduce the probes necessary to investigate them and their application in the study of other quantum materials, and will provide a survey of the current state of experimental results in this new and rapidly evolving field.

Superconductivity (SUPAQCM)
Lecturer: Andrew Huxley
Institution: Edinburgh
Hours Equivalent Credit: 20
Assessment: Problem Sheets
Course Summary
The course will introduce the theory of superconductivity and superfluidity, assuming prior knowledge of undergraduate noninteracting-electron condensed matter physics, thermodynamics and electromagnetism. Note that this is undergraduate course "Quantum Condensed Matter Physics".

Maths Primer (SUPAPRI)
Lecturer: Patrik Öhberg
Institution: Heriot-Watt
Hours Equivalent Credit: 6
Assessment: Continuous Assessment
Course Summary
The course will be in the form of a maths primer intended for beginning PhD students in condensed matter, solid state and photonics. The topics which will be covered include: Matrix diagonalisation, functional derivatives, complex integration and residues, Fourier transforms, and a discussion on different notations which the students will encounter during their studies.

Geometry and Physics of Soft Condensed Matter (SUPAGPSM)
Lecturer: Davide Marenduzzo
Institution: Edinburgh
Hours Equivalent Credit: 20
Assessment: Continuous Assessment
Course Summary
In this course, we explore how to build theories for complex fluids; we will often be taking examples from the world of biology. The focus of the course will be to emphasise generic features in order to build up a repertoire of theoretical tools that are widely applicable to analyse a diversity of soft materials. Topics covered may vary from year to year depending on the specialisms of the staff involved but will include:

- Physics and nonequilibrium thermodynamics of binary mixtures
- Symmetries and phases of liquid crystals
- Topological defects in liquid crystals
- Hydrodynamic theories of complex fluids
- Topological properties of DNA: knots and supercoiling

Semester 2
Chaikin and Lubensky’s Principles of Condensed Matter (SUPACLP)
Lecturer: Alexander Morozov
Institution: Edinburgh
Hours Equivalent Credit: 25
Assessment: Continuous Assessment
This is a biennial course which will run in 2018/19 but will not run in 2019/20
Course Summary
This course will primarily involve a combination of directed reading and face-to-face discussion meetings by the participants on topics chosen from Chapters 1-6 of the graduate text 'Principles of Condensed Matter Physics' by P. Chaikin and T. Lubensky (Cambridge University Press). Assessment will be based on performance in both the student discussions and selected problems
Electronic Structure Theory (SUPAEST)
Lecturer: Andreas Hermann
Institution: Edinburgh
Hours Equivalent Credit: 20
Assessment: Problem Sheets, Project
This is a biennial course which will not run in 2018/19 but will run in 2019/20
Course Summary
This course will introduce the methods and approaches used in parameter-free descriptions of the electronic structure of materials, which aim to solve the quantum mechanical many-electron problem. We will discuss underlying ground state theories, such as wave-function based correlation methods and density functional theory, and their implementations in high-performance computing environments. We will study how to use the linear response ansatz and many-body perturbation theory to extract excited state information from those calculations, and thus accurately simulate spectroscopic and inelastic scattering experiments. Assignments will involve calculations on realistic materials on the UK’s national supercomputer.

Electron Microscopy (SUPAELM)
Lecturer: Wuzong Zhou
Institution: St Andrews
Hours Equivalent Credit: 10
Assessment: Exercises.
Course Summary
This is a ScotCHEM course available to all SUPA and ScotCHEM students. It is a biennial course and will not run in 2018/19, but will run in 2019/20
The course will introduce the basic principles of electron microscopy and discuss several commonly used techniques for microstructural analysis of solid state materials. Lectures are given on:
- Introduction, interaction of electrons with the solid;
- Scanning electron microscopy;
- Energy dispersive X-ray spectroscopy;
- Electron diffraction
- High resolution transmission electron microscopic imaging.

Matrix Product States and Tensor Networks (SUPAMPS)
Lecturer: Luca Tagliacozzo
Institution: Strathclyde
Hours Equivalent Credit: 24
Assessment: Continuous assessment: marked exercises and a final presentation
This is a biennial course that will run in 2018/19 but will not run in 2019/20.
Course Summary
The course will provide an overview of the field of matrix product and tensor network approaches to many systems.

Everything around us is a many-body system, from the quantum vacuum proved by high-energy accelerators, to a material studies in a laboratory, to complex systems like us, living organisms. The richness and beauty of our world is indeed a result of a variety of collective emerging phenomena obtained by combining together a large number of few basic constituents. The difficulty in understanding the emergence arise as a consequence of the exponential complexity of many body systems in the number of their constituents. Tensor networks provide a novel theoretical and computational framework to analyse collective emergence in many body systems.

Quantum Materials and Devices Theory (SUPAQMDT)
Lecturer: Ian Galbraith
Institution: Heriot-Watt
Hours Equivalent Credit: 20
Assessment: Problem Sheets and Literature Review
Course Summary
This course will focus on the theoretical description of quantum materials and related devices where the small size plays a crucial role in determining their properties and behaviours. The fundamental aim is to provide the students with a working knowledge of contemporary theoretical nanophysics. The course explains how nanophysical phenomena can be understood and how predictions for behaviour can be made.

Non-Equilibrium Statistical Mechanics (SUPANSM)
Lecturer: Martin Evans
Institution: Edinburgh
Hours Equivalent Credit: 14
Assessment: Project
This is a biennial course and will run in 2018/19, but will not run in 2019/20.
Course Summary
The course explores the theory of systems out of equilibrium, be they relaxing to equilibrium or held out of equilibrium by external agencies. The lectures fall into two parts. The first 8 lectures cover core techniques and ideas in non-equilibrium statistical mechanics, and are given by Martin Evans. The remaining lectures cover specialist topics, and will be given by guest lecturers to be announced.

Quantum Magnetism and Phase Transitions (SUPAQMPT)
Lecturer: Bernd Braunecker, Jonathan Keeling
Institution: St Andrews
Hours Equivalent Credit: 18
Assessment: Continuous Assessment
This is a biennial course which will not run in 2018/19, but will run in 2019/20.
Course Summary
These lecturers cover two closely related themes: models of magnetism, and quantum phase transitions. The two parts are strongly linked in that many of the models we will introduce to describe magnetism turn out to be paradigmatic models of quantum phase transitions. The course is intended to be relevant not just for those working on traditional solid state systems, but also those working on cold atom physics, where many of the same models and questions are also relevant.
Response Functions (MBQT 2) (SUPARFN)
Lecturer: Brendon Lovett
Institution: St Andrews
Hours Equivalent Credit: 12
Assessment: Two assessed problem sheets
This is a biennial course, it will run in 2018/19 but will not run in 2019/20.
CM-CDT students should note that Quantum Field Theory is a prerequisite for this course
Course Summary
Response functions and Green’s functions provide a powerful mathematical language in which to describe the physics of many-body quantum systems. This course is a short introduction to them.

Quantum Materials and Devices Experiment (SUPAQMDE)
Lecturer: Brian Gerardot
Institution: Heriot-Watt
Hours Equivalent Credit: 20
Assessment: Problem sheets and literature review
Course Summary
This course will focus on the how to experimentally realize and probe quantum materials and related devices where the small size plays a crucial role in determining their properties and behaviours. The fundamental aim is to provide the students with a working knowledge of contemporary experimental nanophysics. The course explains how nanostructures can be fabricated for desired outcomes and how the physical phenomena such as quantization and quantum coherence can be probed.

Introduction to Soft Condensed Matter (SUPASCM)
Lecturer: Ian Galbraith
Institution: Heriot-Watt
Hours Equivalent Credit: 20
Assessment: Problem Sheets
Course Summary
Our technological age is enabled by stuff - carbon fibre, steel, concrete, high efficiency glass, sapphire coatings, toothpaste, silicon wafers, plastics, dental implants, bullet proof vests, non-stick pans, Gore-Tex, liquid crystals, car tyres, detergents ... Big bucks and world domination from mastery of stuff!

Soft condensed matter (SCM) relates to states of matter which are neither crystalline nor simple liquids, including, most of our bodies (we are soft machines!), and plastic materials such as polymers.

This course provides an introduction to the behaviour and underlying physics of such materials emphasising where universal behaviour, driven at length scales between the quantum and macroscopic occur.
Our courses relate to two major aspects of the theme’s activities: solar and nuclear power. They are designed to be accessible to all Energy Theme students – so that nuclear students could take the solar power course and vice versa. In addition to these courses, students are encouraged to select courses relevant to their interests and projects from other themes (particularly Condensed Matter and Materials Physics, Photonics and Nuclear and Plasma Physics).

**Semester 1**

**Solar Power (SUPASPR)**

*Lecturer:* Ifor Samuel et al  
*Institution:* St Andrews  
*Hours Equivalent Credit:* 14  
*Assessment:* Problem Sheets and reports on laboratory experiments.

This course will not run in 2018/19, but will run again in 2019/20.

This is a final year undergraduate course organised by the University of St Andrews.

**Course Summary**

This course will provide an introduction to solar photovoltaics (PV). Lectures will introduce the problem of energy supply, and the amount of solar power potentially available. The general principles of PV will be covered, followed by lectures on a range of current and future PV technologies: crystalline, polycrystalline and amorphous silicon, thin film inorganic semiconductors, and organic semiconductor PV. Three lab sessions will enable students to explore key ideas in the lectures.

This is an intensive two-day course, using a range of invited lecturers from SUPA institutions.

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**Semester 2**

**Laser Driven Plasma Acceleration (SUPALDP)**

*Lecturer:* Dino Jaroszynski, Paul McKenna  
*Institution:* Strathclyde  
*Hours Equivalent Credit:* 16  
*Assessment:* Continuous Assessment

This is a final year undergraduate course organised by the University of Strathclyde. This course is cross-listed with the Nuclear and Plasma Physics Theme.

**Course Summary**

This course will address the topical research in laser plasma interactions, laser-plasma acceleration and plasma based radiation sources. It will be divided into four connected parts starting with a thorough but brief introduction to the main theoretical concepts of laser-plasma interactions. The second and third parts will address the interaction of intense laser pulses with under-dense and over-dense plasma respectively, with particular emphasis on laser-plasma acceleration, absorption, propagation, electron transport, plasma waves, shock waves, radiation mechanisms, non-linear optics of plasma etc. The fourth part will introduce students to the main concepts of free-electron lasers, which are important tools for scientists investigating the structure of matter. Students will proceed quickly from basic concepts to advanced and current applications such as compact radiation and particle sources, inertial fusion energy, fast ignition etc. They will gain a good introduction to laser-plasma interactions, which will provide a good basis for postgraduate research in this area.
The Nuclear and Plasma Physics (NPP) theme covers a wide range of subject areas, including a number of different specialities. Depending on their individual backgrounds and areas of research, PhD. students will be required to attend a different set of SUPA courses. The decision on which courses to include should be made in consultation with the student’s PhD supervisor. Typically, a two year course program will include:

- Specific NPP lectures taken from the course list
- Core skills classes, such as C++ Programming and Data Analysis, where appropriate
- Transferable skills courses such as an Entrepreneurship course

Where the number of courses taken exceeds the minimum requirement, students and their supervisors should agree on which courses should contribute towards the overall assessment. There are several Doctoral Training Centres that are part of NPP. PhDs in these Centres are usually four years in duration, where the whole of the first year is dedicated to formal courses and mini-projects. In these cases the student will normally decide on their PhD topic at the end of the first year. Students should contact the Doctoral Training Centre administrators to establish the course requirements.

**Semester 1**

**Accelerators (SUPAACCC)**

**Lecturer:** Dino Jarosznyski, M Wiggins, B Ersfeld, G Vieux  
**Institution:** Strathclyde  
**Hours Equivalent Credit:** 8  
**Assessment:** Continuous Assessment  
**Course Summary**  
Particle accelerators are a valuable tool in probing high-energy physics (up to the Large Hadron Collider at CERN) that is vital in helping us to understand the universe. They also have a wealth of more down-to-earth societal applications such as radiotherapy machines for treating cancer. This course gives a concise introduction to the field of conventional accelerators that use radio-frequency or microwave radiation in order to accelerate charged particles (electrons, protons, ions) to high energy.

**Biomedical Applications of Lasers, Beams and Radiation (SUPABAL)**

**Lecturer:** Bernhard Hidding, Grace Gloria Manahan  
**Institution:** Strathclyde  
**Hours Equivalent Credit:** 12  
**Assessment:** Continuous Assessment  
**Course Summary**  
Lasers, particle beams and radiation such as x-rays are essential instruments for imaging, drug research and treatment in life sciences. The course would address both established and cutting edge radiation generation methods for a variety of biomedical applications, as well as occurrence of radiation in nature and their effects. Then, the mechanisms of interaction of the different types of radiation on the nuclear, atomic, molecular, cell and system level (e.g. the patient) are discussed. Finally, fundamentals and progress in biomedical applications such as x-ray radiography, magnetic resonance tomography (MRT), positron emission tomography (PET), electron microscopy and other radiology imaging techniques, radiation-assisted drug R&D as well as laser surgery, cancer radiotherapy with photons, electrons, protons, neutrons and ions, and other treatment techniques will be covered. Next to providing an overview on the physics behind these techniques, the course will also include practical considerations and is intended to facilitate and support interdisciplinary research projects and collaborative applications.

**Plasma Physics (SUPAPPH)**

**Lecturer:** Adrian Cross, Kevin Ronald, Bengt Eliasson, Declan Diver  
**Institution:** Strathclyde  
**Hours Equivalent Credit:** 12  
**Assessment:** Multiple Choice Exam and Continuous Assessment  
**Course Summary**  
This course will address fundamental concepts in plasmas, from plasma creation from a neutral gas through to full ionization. Basic plasma timescales and length scales will be derived, such as the plasma, cyclotron and collision frequencies, skin depth, sheath extent and Larmor radius. Waves and instabilities in fully ionized (and magnetized) fluid and kinetic plasmas will also be addressed. The many natural and man-made types of plasma and their applications will be outlined and in particular magnetically confined plasmas will be discussed with examples, including tokamaks.

**Semester 2**

**Quarks and Hadron Spectroscopy (SUPAQHS)**

**Lecturer:** Bryan McKinnon, Derek Glazier  
**Institution:** Glasgow  
**Hours Equivalent Credit:** 8  
**Assessment:** Continuous Assessment  
**Course Summary**  
This course will address fundamental concepts in plasmas, from plasma creation from a neutral gas through to full ionization. Basic plasma timescales and length scales will be derived, such as the plasma, cyclotron and collision frequencies, skin depth, sheath extent and Larmor radius. Waves and instabilities in fully ionized (and magnetized) fluid and kinetic plasmas will also be addressed. The many natural and man-made types of plasma and their applications will be outlined and in particular magnetically confined plasmas will be discussed with examples, including tokamaks.

**Quarks and Hadron Spectroscopy (SUPAQHS)**

**Lecturer:** Bryan McKinnon, Derek Glazier  
**Institution:** Glasgow  
**Hours Equivalent Credit:** 8  
**Assessment:** Continuous Assessment  
**Course Summary**  
This course will address fundamental concepts in QCD, why are models necessary when you’ve got QCD, quark model predictions of hadronic states, properties of the nucleon and its resonances, “missing” baryonic resonances, pentaquarks - salutory lesson or crucial discovery, experimental techniques, partial wave analysis, the search for exotic states: hybrid mesons, glueballs.
Nuclear & Plasma Physics

Laser Driven Plasma Acceleration (SUPALDP)
Lecturer: Dino Jaroszynski, Paul McKenna
Institution: Strathclyde
Hours Equivalent Credit: 16
Assessment: Continuous Assessment
This is a final year undergraduate course organised by the University of Strathclyde. This course is cross-listed with the Energy Theme

Course Summary
This course will address the topical research in laser plasma interactions, laser-plasma acceleration and plasma based radiation sources. It will be divided into four connected parts starting with a thorough but brief introduction to the main theoretical concepts of laser-plasma interactions. The second and third parts will address the interaction of intense laser pulses with under-dense and over-dense plasma respectively, with particular emphasis on laser-plasma acceleration, absorption, propagation, electron transport, plasma waves, shock waves, radiation mechanisms, non-linear optics of plasma etc. The fourth part will introduce students to the main concepts of free-electron lasers, which are important tools for scientists investigating the structure of matter. Students will proceed quickly from basic concepts to advanced and current applications such as compact radiation and particle sources, inertial fusion energy, fast ignition etc. They will gain a good introduction to laser-plasma interactions, which will provide a good basis for postgraduate research in this area.

Astrophysical Plasmas (SUPAAPL)
Lecturer: Lyndsay Fletcher, Eduard Kontar, Moira Jardine
Institution: Glasgow
Hours Equivalent Credit: 10
Assessment: Online Quiz, worked examples, short essay
This is a biennial course and will not run in 2018/19 but will run in 2019/20

Course Summary
The course will give an overview of the physics of plasmas, and introduce applications in astrophysics. Beginning with basic definitions and ideas such as plasma waves and kinetic theory, the course will develop fundamental concepts in astrophysical plasma diagnostics, including cyclotron and synchrotron radiation, bremsstrahlung and recombination emission, wave-particle interactions and plasma emission (coherent and maser). Magnetohydrodynamics will be studied as a tool for understanding dynamos, solar and solar-terrestrial environments, and magnetospheres. The course will conclude with topical lectures on plasmas in different astrophysical environments. Students are strongly advised to take the Semester 1 course on Plasma Physics in the Nuclear and Plasma Theme first.

Nuclear Instrumentation (SUPANIN)
Lecturer: Tom Davinson
Institution: Edinburgh
Hours Equivalent Credit: 4
Assessment: Continuous Assessment

Nuclear Reaction Theory and Nuclear Forces (SUPANRT)
Lecturer: Mikhail Bashkanov
Institution: Edinburgh
Hours Equivalent Credit: 6
Assessment: Questionnaire/Quiz
This is a biennial course which will run in 2018/19 but will not run in 2019/20.

Course Summary
This course will assume an undergraduate level knowledge of nuclear physics and quantum mechanics and will describe various theoretical descriptions of nuclei and nuclear reactions at a level relevant to a postgraduate experimental physicist. The course will introduce students to the theoretical formalisms commonly encountered in the field of nuclear and hadron physics.

The students will understand basic models of nuclear structure (liquid drop model and Fermi gas model), be able to explain the origin of nuclear shapes and excitation modes, be able to outline the theoretical description of the Nucleon-Nucleon potential from boson field theory, be able to understand the terms used to parameterise phenomenological NN potentials, show understanding of the role of three-nucleon forces in the nucleus, outline the theoretical formalism for describing elastic and inelastic scattering reactions, understand the classi cation of reactions as compound, direct or pre-equilibrium, show understanding of the process of partial wave analysis and phase shifts in reaction theory, understand the reaction theories describing fission and fusion and their application in nuclear energy generation.
The SUPA Graduate School runs an extensive programme of Particle Physics courses to provide new graduate students with the necessary skills required to carry out research. The Particle Physics courses are divided into categories corresponding to whether the student is undertaking theoretical or experimental research, core lectures are compulsory for first year students in both areas.

Theory Students are strongly recommended to attend all the ‘Common Core’ and ‘Theory Core’ courses. Experimentalists are strongly recommended to attend all the ‘Common Core’ and ‘Experiment Core’ courses. Theory students are also welcome to attend courses in the experiment core and vice versa. Students should discuss with their supervisor which optional courses they should attend.

Semester 1

Accelerators (SUPAACC)
Lecturer: Dino Jaroszynski, Mark Wiggins, Bernhard Ersfeld, Gregory Vieux
Institution: Strathclyde
Hours Equivalent Credit: 8
Assessment: Continuous Assessment
This course is cross-listed with the Nuclear & Plasma Theme
Course Summary
Particle accelerators are a valuable tool in probing high-energy physics (up to the Large Hadron Collider at CERN) that is vital to help us understand the universe. They also have a wealth of more down-to-earth societal applications such as radiotherapy machines for treating cancer. This course gives a concise introduction to the field of conventional accelerators that use radio-frequency or microwave radiation in order to accelerate charged particles (electrons, protons, ions) to high energy.

Detectors (SUPADET)
Lecturer: Stephan Eisenhardt, Richard Bates, Andrew Blue
Institution: Glasgow & Edinburgh
Hours Equivalent Credit: 16 (11 lectures, 1x2hr lab & 1x3hr Lab)
Assessment: Assignment sheets
Course Summary
The course will give a comprehensive overview on the many techniques and technologies utilised in the building of particle physics detectors. The series of 11 hours of video lectures is complemented by 5 hours of residential laboratory sessions. The course is self-contained and requires no prior knowledge of the field. Students will be assessed using problem sheets.

Group Theory for Nuclear and Particle Physics (SUPAGTH)
Lecturer: Saverio D’ Auria
Institution: Glasgow
Hours Equivalent Credit: 10 (8 lectures and 2 tutorials)
Assessment: Continuous Assessment
Course Summary
This course will cover the fundamentals of group theory from a particle physics perspective, in particular as prerequisite for Gauge Theories

Quantum Field Theory Particle Physics (SUPAQFTPP)
Lecturer: Richard Ball
Institution: Edinburgh
Hours Equivalent Credit: 20
Assessment: Written Exam 80 %, Coursework 20 %
Joint Master’s and PhD course delivered by face to face lectures at the University of Edinburgh. (Non-Edinburgh students are welcome to attend the lectures in Edinburgh in person)
Course Summary
Summary This course is an introduction to perturbative relativistic quantum field theory, for scalars, fermions, and gauge fields, in both the canonical and path integral formulations
The course begins with a review of relativistic wave equations. It introduces the Lagrangian formulation for classical fields and then discusses the canonical quantisation of free fields with spins 0, 1/2 and 1. An outline is given of perturbation theory for interacting fields and Feynman diagram methods for Quantum Electrodynamics are introduced. The course also introduces path integral methods in quantum field theory. This gives a better understanding of the quantisation of gauge theories and forms an essential tool for the understanding and development of the ‘standard model’ of particle physics. Topics include: Path integral formalism, Feynman rules, LSZ formalism, loop diagrams and regularisation and renormalization of divergencies.
Advanced Statistical Physics (SUPAASP)
Lecturer: Luigi Del Debbio
Institution: Edinburgh
Hours Equivalent Credit: 22
Assessment: Hand-in exercises
This is a final year undergraduate course organised by the University of Edinburgh
Course Summary
In this course we will discuss equilibrium phase transition, of the first and second order, by using the Ising and the Gaussian models as examples. We will first review some basic concepts in statistical physics, then study critical phenomena. Phase transitions will be analysed first via mean field theory, then via the renormalisation group (RG), in real space. We will conclude with some discussion of the dynamics of the approach to equilibrium

Relativistic Quantum Field Theory (SUPARQF)
Lecturer: Christof Englert
Institution: Glasgow
Hours Equivalent Credit: 20
Assessment: Open book exam
Common Core Joint Master’s & PhD course
Course Summary
The course will cover the following topics: classical Lagrangian field theory, Lorentz covariance of relativistic field equations, quantisation of the Klein-Gordon, Dirac and electromagnetic fields, interacting fields, Feynman diagrams, S-matrix expansion and calculating all lowest order scattering amplitudes and cross sections in Quantum Electrodynamics (QED).

Semester 2
Collider Physics (SUPACOP)
Lecturer: Christos Leonidopoulos, Mark Owen, Tony Doyle
Institution: Edinburgh & Glasgow
Hours Equivalent Credit: 18 (16 lectures & 2 tutorials)
Assessment: Problem sets (40%), Literature Review (60%)
Course Summary
The SUPACOP lectures provide the common core for all particle physics students in semester 2. The course covers three main subject areas:
- Electroweak and Higgs Physics
- QCD
- Beyond the Standard Model (BSM) Physics (including Supersymmetry)
The objective of the course is to provide a general overview of theoretical, phenomenological and experimental aspects of electroweak theory, QCD and BSM physics, concentrating on the most influential and/or recent measurements from colliders.

Discussion Classes (SUPADCL)
Lecturer: Aidan Robson, Matthew Needham
Institution: Glasgow
Hours Equivalent Credit: 8
Assessment: Presentation
Course Summary
This course provides students with an opportunity to investigate current topics of interest relating to current Particle Physics research, and to present them. Presentations are recorded and participants receive staff and peer feedback.

Flavour Physics (SUPAFLA)
Lecturer: Matthew Needham
Institution: Edinburgh
Hours Equivalent Credit: 14 (12 lectures & 2 practical)
Assessment: Continuous Assessment
This course includes two lab sessions based in Edinburgh which students will be required to attend in person.
Course Summary
Flavour Physics attempts to answer some of the most profound open questions in modern physics, such as how do we understand the pattern of masses in the Standard Model and what is the origin of CP violation. This introduction to Flavour Physics consists of two parts, dealing separately with Flavour Physics of the quark and lepton sectors.

Lattice QCD (SUPALAT)
Lecturer: Christine Davies
Institution: Glasgow
Hours Equivalent Credit: 6
Assessment: Project
Course Summary
The course will provide an introduction into the methods of lattice QCD. In particular, we will discuss gluon actions, algorithms, quarks on the lattice, algorithms for that, how to do a lattice calculation, systematic errors and recent results.

Quarks and Hadron Spectroscopy (SUPAQHS)
Lecturer: Bryan McKinnon, Derek Glazier
Institution: Glasgow
Hours Equivalent Credit: 8
Assessment: Continuous Assessment
This course is cross-listed with the Nuclear & Plasma Theme
Course Summary
The course will cover the following topics: Introduction to fundamentals of QCD, why are models necessary when you’ve got QCD, quark model predictions of hadronic states, properties of the nucleon and its resonances, “missing” baryonic resonances, pentaquarks - salutory lesson or crucial discovery, experimental techniques, partial wave analysis, the search for exotic states: hybrid mesons, glueballs.
Particle Physics

Gauge Theory in Particle Physics (SUPAGAT)
Lecturer: Peter Boyle, Einan Gardi
Institution: Edinburgh
Hours Equivalent Credit: 40
Assessment: Take home exam

Joint Master’s and PhD course delivered by face-to-face lectures at the University of Edinburgh. (Non-Edinburgh students are welcome to attend the lectures in person in Edinburgh.)

Course Summary
This course provides a comprehensive treatment of the field theoretical approach to the Standard Model of particle physics; it is taught in two parallel threads.

The QED and QCD thread begins with path integral quantisation and renormalisation of Quantum Electrodynamics (QED). It then moves on to a detailed study of Quantum Chromodynamics (QCD), beginning with quantisation, Feynman rules and renormalisation, and then applying a wide range of topics in modern perturbative QCD to collider physics, including deep inelastic scattering and Higgs production.

The electroweak physics and lattice field theory thread focuses on the field theoretical construction and application of the standard model of particle physics, including the Goldstone theorem and the Higgs mechanism, weak decays and flavour physics. Further focus is on detailed calculations in perturbation theory and comparison with experiment. The final part of the course provides an introduction to non-perturbative methods via lattice field theory.

Each thread will have two hours of lectures and two hours of tutorial workshops every week, giving a total of 40 lecture hours and 40 tutorial hours. Students are expected to engage with the material presented in lectures by working through and discussing weekly formative problem sheets in the tutorial sessions. There will be a total of 4 summative hand-ins, which will be marked and individual written will be feedback provided on each. Individual feedback will also be administered verbally during tutorial sessions.
The programme offered within the Photonics Theme involves a selection of lecture courses which we hope will be of interest to you. Additionally there are opportunities to take part in some distance learning courses. It may also be useful for you to look at courses offered through other themes, especially Condensed Matter and Material Physics and the Core courses. Students are also encouraged to attend Photonics related seminars hosted across Scotland.

**Semester 1**

**Polymers and Liquid Crystals (SUPAPLC)**

Lecturer: Graham Turnbull  
Institution: St Andrews  
Hours Equivalent Credit: 13  
Assessment: Continuous Assessment  
This course is biennial and will not run in 2018/19, but will run again in 2019/20.  
**Course Summary**  
This module is delivered in a self-directed distance learning format, through the my.SUPA course pages, there are no face-to-face lectures. This module describes the materials science and device physics that underpins modern display technologies. The syllabus includes an overview of types of displays and characterisation of display properties. The module then focuses on two contemporary display technologies: liquid crystal displays and organic semiconductor (OLED) displays.

**Maths Primer (SUPAPRI)**

Lecturer: Patrik Öhberg  
Institution: Heriot-Watt  
Hours Equivalent Credit: 6 (transferable skills)  
Assessment: Continuous Assessment  
**Course Summary**  
The course will be in the form of a maths primer intended for beginning PhD students in condensed matter, solid state and photonics. The topics which will be covered include: Matrix diagonalisation, functional derivatives, complex integration and residues, Fourier transforms, and a discussion on different notations which the students will encounter during their studies.

**Experimental Atomic & Quantum Optics (SUPAEAQO)**

Lecturer: Paul Griffin, Jonathan Prichard  
Institution: Strathclyde  
Hours Equivalent Credit: 20  
Assessment: Continuous Assessment  
**Course Summary**  
The course will provide graduate-level training focused on providing the core knowledge needed for early career researchers and is designed to complement material covered in other courses such as SUPASTA. There is an emphasis on self-teaching, with the guidance of having clearly identified relevant reference materials to use as a starting point, and on learning basic coding skills for practical computing in the lab. The course will cover Atomic Structure, Atoms in Magnetic Field, Atom-Light Interactions, Interactions in Hot Atomic Media, Optical Dipole Trapping, Laser Cooling, Atomic Metrology, Data Analysis, and Experimental Electronics.

**Nanophotonics (SUPANAN)**

Lecturer: Andrea Di Falco, Wiliam Whelan-Curtin  
Institution: St Andrews  
Hours Equivalent Credit: 27  
Assessment: Tutorials and Exam  
**Course Summary**  
Nanophotonics deals with structured materials on the nanoscale for the manipulation of light. Photonic crystals and plasmonic metamaterials are hot topics in contemporary photonics. The properties of these materials can be designed to a significant extent via their structure. Many of the properties of these nanostructured materials can be understood from their dispersion diagram or optical bandstructure, which is a core tool that will be explored in the module. Familiar concepts such as optical waveguides and cavities, multilayer mirrors and interference effects will be used to explain more complex features such as slow light propagation and high Q cavaties in photonic crystal waveguides, Propagating and localised plasmons will be explained and will include the novel effects of super-lensing and advanced phase control in metamaterials.
Semester 2

Semi-quantum Theory of Atom Light Interactions (SUPASTA)

Lecturer: Gian-Luca Oppo
Institution: Strathclyde
Hours Equivalent Credit: 24
Assessment: Essay (60%) and Presentation (40%)

Course Summary
The course is beneficial to students interested in the interaction of laser light with atoms and materials. It provides useful theoretical and numerical skills that have become basics in many research fields in quantum optics, photonics, quantum information processes, light-matter interaction and their applications. Topics covered include: second quantization, raising and lowering operators, density matrix approach, the Lindblad form of decay rates, two and three level atoms, Rabi oscillations, electromagnetically induced transparency, coherent population trapping, enhanced refractive indices, slow light, sub-natural line widths, self-focusing, spatial solitons during propagation, light-matter interaction in optical cavities, Maxwell-Bloch equations, optical bistability, cavity solitons, parametric down-conversion and optical parametric oscillators.

Ultrafast Photonics (SUPAUPH)

Lecturer: Derryck Reid
Institution: Heriot-Watt
Hours Equivalent Credit: 10
Assessment: Online Assessment
This is a Distance Learning Course.

Course Summary
This is a short distance learning course operated by Heriot-Watt University via their Vision virtual learning environment. It has a formal accredited value of 5 SCQF credits. To complete the course students must carry out an online assessment using the Vision system, which means they must first register for an account. Details for doing this appear on the mysupa page

Solid-State Lasers (SUPASSL)

Lecturer: Alan Kemp
Institution: Strathclyde
Hours Equivalent Credit: 14
Assessment: Assessed tutorial assignment

Course Summary
An introduction to the physics, engineering, and thermal management of solid-state lasers, in particular diode-pumped solid-state lasers. Topics covered include: the underlying science and properties of lasers, eg energy levels, stimulated emission, population inversion, gain, threshold and slope efficiency; laser rate equations; common solid-state laser designs, including gain media, optical pumping schemes, operational modes (continuous wave, tuneable and pulsed); approaches to and modelling of thermal management in solid-state and semiconductor lasers; and laser case studies, including semiconductor disk lasers (VECSELs), and the uses of diamond in lasers.
The Theme of Physics and Life Sciences (PaLS) covers a large breadth of both physical and life sciences. As students come from a wide range of backgrounds and experiences, and are pursuing diverse PhD projects, the exact courses to be taken should be discussed with the student’s individual supervisor. Students are also invited to select relevant courses from any of the themes and or to take appropriate and relevant non-SUPA courses within their home institution, but it is essential that the appropriate assessment (in the form of examination, written assignment or oral assignment) be discussed and agreed with the PaLS Theme Leader (Gail McConnell) in advance.

Semester 1

Biophotonics (SUPABIP)
Lecturer: Kishan Dholakia Carlos Penedo-Esteiro, Malte Gather
Institution: St Andrews
Hours Equivalent Credit: 33
Assessment: Attendance, news and views article, assessed problem sheet
This is a final year undergraduate course organised by University of St Andrews.

Course Summary
The module will expose students to the exciting opportunities offered by applying photonics methods and technology to biomedical imaging, sensing and detection. A rudimentary biological background will be provided where needed. Topics include fluorescence microscopy and assays including time-resolved applications, super-resolution imaging, optical tweezers for cell sorting and DNA manipulation, single molecule studies, photodynamic therapy, lab-on-a-chip concepts and bio-MEMS.

Biomedical Applications of Lasers, Beams and Radiation (SUPABAL)
Lecturer: Bernhard Hidding, Grace Gloria Manahan
Institution: Strathclyde
Hours Equivalent Credit: 12
Assessment: Continuous Assessment
Course Summary
Lasers, particle beams and radiation such as x-rays are essential instruments for imaging, drug research and treatment in life sciences. The course would address both established and cutting edge radiation generation methods for a variety of biomedical applications, as well as occurrence of radiation in nature and their effects. Then, the mechanisms of interaction of the different types of radiation on the nuclear, atomic, molecular, cell and system level (e.g. the patient) are discussed. Finally, fundamentals and progress in biomedical applications such as x-ray radiography, magnetic resonance tomography (MRT), positron emission tomography (PET), electron microscopy and other radiology imaging techniques, radiation-assisted drug R&D as well as laser surgery, cancer radiotherapy with photons, electrons, protons, neutrons and ions, and other treatment techniques will be covered. Next to providing an overview on the physics behind these techniques, the course will also include practical considerations and is intended to facilitate and support interdisciplinary research projects and collaborative applications.

Introducing Biology to Physicists (SUPAIBP)
Lecturer: Ulrich Zachariae
Institution: Dundee
Hours Equivalent Credit: 22
This is an undergraduate course run by the University of Dundee.

Course Summary

Physics of Biological Evolution (SUPAPBE)
Lecturer: Bartek Waclaw
Institution: Edinburgh
Hours Equivalent Credit: 10
Assessment: Problem Sheets
This is a biennial course which will not run in 2018/19, but will run in 2019/20

Course Summary
The course will discuss the basics of biological evolution and examples of physicists’ contributions to it. The emphasis will be on problems that can either be solved by the methods of statistical/quantum physics, or those investigated by researchers who considered themselves to be physicists.
Semester 2

Astrobiology and the Search for Life (SUPAASL)
Lecturer: Charles Cockell, et al
Institution: various
Hours Equivalent Credit: 20
Assessment: Online multiple choice test
This course is cross-listed with the Astronomy and Space Physics Theme.

Course Summary
This course looks into the origin, evolution and distribution of life in the Universe, broadly considered as ‘astrobiology’. The objective of the course is to provide a perspective in geology, biology and chemistry at an introductory level. The course will include lectures on the limits and conditions for life on Earth through time and how these may apply elsewhere in the universe. The course looks at the current scientific approaches used to address the hypothesis of life elsewhere in the Universe. The subjects discussed include: the formation of planetary systems and the conditions required for habitability, detection methods for extrasolar planets, the diversity of known exoplanet systems, the origin of life, evidence for earliest life on Earth, the geological and biological history of the Earth, conditions past and present on Mars and the icy moons of the giant planets, and finally the Search for Extra-Terrestrial Intelligence (SETI).

Biological Physics (SUPABPS)
Lecturer: Simon Titmuss, Rosalind Allen
Institution: Edinburgh
Hours Equivalent Credit: 12
Assessment: Written Assessment
This is a level 11 undergraduate course organised by the University of Edinburgh. It would provide a physics based introduction to Biological Physics for students who have not taken such a course as undergraduates. This course will be taught to SUPA students as a Distance Learning course.

Course Summary
There is an increased research effort in the school devoted to problems at the interface between biology and physics. There is also increasing recognition that physics can provide a very real - and very valuable - insight into the behaviour of complex biological systems, and that a physical approach to biological problems can provide a new way of looking at the world. This course will introduce the students to the basics of biological systems, and then provide examples of how familiar physical principles (thermodynamics, statistical mechanics) underlie complex biological phenomena. This course will introduce you to the wonders of biology: the organisms, cells, and molecules that make up the living world. We will demonstrate the power of physical concepts to understand and make powerful predictions about biological systems, from the folding of a protein into a unique three-dimensional structure within a reasonable timeframe, through the motions of proteins to drive biological processes, to the locomotion of bacterial cells. The physical concepts will be substantially familiar, but their applications will be novel. Where possible, examples will be drawn from the recent scientific literature.

Introductory Biology School (SUPAIBS)
Lecturer: Maciej Antkowiak
Institution: St Andrews
Hours Equivalent Credit: 15
Assessment: Continuous Assessment
This is a Residential course running annually and will be restricted to 20 places.

Course Summary
Students entering the PALS theme come from a variety of backgrounds, and your needs as graduate students are enormously varied. Some of you will be handling biological materials, some will be carrying out molecular experimental projects, and some will be involved almost entirely with theory or simulation. In order to be productive PhD students, however, all students need a basic grounding in Biology and the challenges of biological research. This short course is designed to give you a taster, an exposure to the language of biology, taught by biologists with extensive experience of working at the interface with the physical sciences. The Summer School will consist of three half-days of lectures from members of the School of Medicine and the School of Biology at St Andrews that will cover the very basics (the structure of a cell, cellular contents, and how they can be manipulated). The rest of the course will consist of two half-day practical sessions, covering the basics of handling and manipulating biological cells, performing useful microscopy, and taking quantitative measurements. Many of you coming into the PALS theme are likely to need to handle some biological materials (e.g. for microscopy or related applications), and we aim to teach you how to keep cells alive, or if tissues or samples are fixed, what to look for to ensure samples are of good quality. For those students undertaking non-experimental programmes, we hope that this exposure will demonstrate the “messy” nature of biological experiment and its associated inherent uncertainty.

Mathematical Modelling (SUPAMMD)
Lecturer: Marco Thiel
Institution: Aberdeen
Hours Equivalent Credit: 33
Assessment: Manuscript in form of 4 page paper; description of modelling project
This is a final year undergraduate course organised by the University of Aberdeen.

Course Summary
This course shows you how to develop mathematical descriptions of phenomena. We use mathematical techniques to describe a large variety of “real-world” systems: spreading of infectious diseases, onset of war, opinion formation, social systems, reliability of a space craft, patterns on the fur of animals (morphogenesis), formation of galaxies, traffic jams and others. This course boosts your employability and teaches tools that are highly relevant for almost every researcher.
All SUPA students are required to complete 20 hours of Professional Development Training during the first two years of their PhD studies. SUPA Professional Development Training Courses are listed on the following pages. However, students may also participate in Professional Development Training run by their local departments and universities or run by Vitae (a UK-wide organisation sponsoring Skills Training) or their Research Councils.

Please note that enrolment for Professional Development Training is often run separately from enrolment procedures for Advanced Specialise Courses. Information about enrolment procedures for each course will be posted on My.SUPA course areas and announced to all students via email. If you have any questions about enrolment for SUPA Professional Development Training Courses, please email admin@supa.ac.uk.

Information about Professional Development courses run by Vitae and individual universities can be found at the following websites:

**Vitae**: [http://www.vitae.ac.uk/events](http://www.vitae.ac.uk/events)
**University of Aberdeen**: [http://www.abdn.ac.uk/cops/graduate/generic-transferable-skills-242.php](http://www.abdn.ac.uk/cops/graduate/generic-transferable-skills-242.php)
**University of Dundee**: [http://www.dundee.ac.uk/opd](http://www.dundee.ac.uk/opd)
**University of Edinburgh**: [http://www.ed.ac.uk/schools-departments/institute-academic-development](http://www.ed.ac.uk/schools-departments/institute-academic-development)
**University of Glasgow**: [http://www.gla.ac.uk/researcherdevelopment/](http://www.gla.ac.uk/researcherdevelopment/)
**Heriot-Watt University**: [http://www.hw.ac.uk/services/aid.htm](http://www.hw.ac.uk/services/aid.htm)
**University of St Andrews**: [http://www.st-andrews.ac.uk/capod/students/pgresearch/gradskills/](http://www.st-andrews.ac.uk/capod/students/pgresearch/gradskills/)
**University of Strathclyde**: [http://www.strath.ac.uk/careers/pgr/](http://www.strath.ac.uk/careers/pgr/)
**University of the West of Scotland**: [http://www.uws.ac.uk/research/](http://www.uws.ac.uk/research/)

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**Semester 1**

**C++/Object Oriented Programming (SUPACOO)**
**Lecturer**: Sarah Boutle
**Institution**: Glasgow
**Hours Equivalent Credit**: 12 (4 x 1hour lectures and 4x2hr tutorials)
**Assessment**: Continuous Assessment

This course includes four lab sessions based in Glasgow which students will need to attend in person. This course has priority booking for Particle Physics students. Please refer to the timetable and visit the My.SUPA course area for more information.

**Course Summary**

This course introduces C++ via four pairs of lecture and computer lab. The computer lab gives you access to a Linux environment with C++ compiler and an Emacs or Vim text editors. As it sometimes slows when many people connect at the same time, you are encouraged to bring your own laptop with Linux or Mac OS to work directly in your day to day work environment.

The topics covered are the basic C++ that needs to get you going in your research. However, object-oriented notions, such as classes and inheritance, will not be covered in this introductory C++. The topics covered include: basic C++ syntax; standard C++ data types (bool, float, char, etc); standard C++ streams (cout, cin, error, etc); standard C++ operators (==, &&, %, etc); conditionals and loops (if, for, while, switch, case, etc); standard templated library types (string, vector, map, list, stringstream, etc); pointers and references; functions; overloading functions; passing argument to a function by reference; templated functions; how to compile your code as an executable or a shared library to be used by another piece of code; how to convert on data type to another data type; how to compute the time it takes to run your code; how to pass arguments at the command line.

**Introductory Data Analysis (SUPAIDA)**
**Lecturer**: Katherine Kirk
**Institution**: UWS
**Hours Equivalent Credit**: 6
**Assessment**: Continuous Assessment

**Course Summary**

This course provides an introduction to uncertainty in measurement. Topics will include: random error and relation to statistics; probability distributions and their properties; calculation and estimation of uncertainty; least squares model; applications of data analysis.

**Maths Primer (SUPAPRI)**
**Lecturer**: Patrik Öhberg
**Institution**: Heriot-Watt
**Hours Equivalent Credit**: 6
**Assessment**: Continuous Assessment

**Course Summary**

The course will be in the form of a maths primer intended for beginning PhD students in condensed matter, solid state and photonics. The topics which will be covered include: Matrix diagonalisation, functional derivatives, complex integration and residues, Fourier transforms, and a discussion on different notations which the students will encounter during their studies.
Vacuum Technology (SUPAVAC)
Lecturer: Richard Moug
Institution: Heriot-Watt
Hours Equivalent Credit: 10
Assessment: Continuous Assessment

Course Summary
This course will concentrate on the practical aspects of vacuum technology, and will be primarily of interest to students who are confronted with a vacuum system for the first time or are faced with using, maintaining or developing a system.

Semester 2
Software Carpentry (SUPASWC)
Lecturer: Norman Gray
Institution: Glasgow
Hours Equivalent Credit: 16
Assessment: Continuous Assessment

Course Summary
Many researchers need to write (computer) code of some type or other, though typically as an auxiliary activity – researchers should not turn into ‘programmers’. It is useful for researchers to do that part of their work effectively, now and in the (transferrable) future. The Software Carpentry course (SWC) aims to instil pragmatic good practice in scientists.

ROOT (SUPAROO)
Lecturer: Sarah Boutle
Institution: Glasgow
Hours Equivalent Credit: 9 (3 x 3 hour Labs)
Assessment: Continuous Assessment

Course Summary
ROOT is a primary data analysis framework tool developed by CERN and used in experimental particle physics and, increasingly, many other fields. This course is based on hands-on sessions in which you will learn the basic features of ROOT, through to producing a publication-quality plot from raw data.

Advanced Data Analysis (SUPAADA)
Lecturer: Martin Hendry
Institution: Glasgow
Hours Equivalent Credit: 10
Assessment: Series of multiple choice questions throughout lectures

Course Summary
This course will provide a comprehensive introduction to the principles and practice of advanced data analysis, with particular focus on their application within the physical sciences and on the (rapidly growing) use of Bayesian Inference methods.

Over the past few decades Bayesian inference methods, as a powerful tool for analyzing data, have been growing ever more common across a diverse range of fields of physics. Bayesian inference provides a natural framework in which to address key quantitative questions, constrain the parameters of physical models and measure how well competing models can describe the available data. They also provide an objective and straightforward framework in which to incorporate prior information about the models, obtained e.g. from previous analyses or from theory. Moreover, recent advances in computational methods also offer simple algorithms in which to implement Bayesian methods – even with very large and complex data sets – on a standard desktop computer.

These lectures will give a comprehensive introduction to Bayesian inference methods. The lectures will include some practical exercises designed to introduce some useful codes and algorithms – as well as to showcase the vast array of online resources available to support the “virgin Bayesian” seek to apply these methods to their data.

Hands on Writing: How to Master Scientific Academic Writing (SUPAHOW)
Lecturer: Marialuisa Aliotta
Institution: Edinburgh
Hours Equivalent Credit: This course is available online.

This course is offered as a Face to Face option for Edinburgh students only; attendance on this course will be restricted to 25 places.

Course Summary
The course is specifically tailored to PhD students in scientific disciplines. It will provide practical tools and strategies to help students understand key elements of good scientific writing. The course will cover the 5 steps of the writing process, from pre-writing to proofreading, and will focus on the structure and style of good academic writing. The course runs as a three-day residential workshop and will provide plenty of opportunities for students to develop and hone effective writing skills. Topics covered will include: purpose and structure of different sections (Introduction, Methodology, Data analysis and Results, Discussion and Conclusions, Abstract); use of language and grammar (parallel sentences, appropriate tenses, sentence coordination); supporting materials (figures and tables, bibliography, appendices).
Introduction to Python (SUPAPYT)
Lecturer: Michael Alexander
Institution: Glasgow
Hours Equivalent Credit: 8 (4 lectures & 2x2-hour tutorials)
Assessment: Assignment Problem
Course Summary
This course serves as a first introduction to the powerful, object-oriented scripting language Python, which combines ease of use with extensive functionality and simple extensibility. After completion, it’s intended that users will be familiar with the concepts and philosophy of Python, be able to use it to solve a wide range of everyday problems, and be able to extend its functionality with user defined classes and modules for more specialised problems.

Research Ventures (SUPAENT)
Lecturer: Various
Hours Equivalent Credit: 2 days (14 hours)
Schedule: June 2019
This course will be organised by the Researcher Development Department at the University of Glasgow.
Course Summary
This two day course will provide an insight into the process of research commercialisation, starting a business, finding funding and self-employment.

Industry Skills (SUPAISC)
Lecturer: Various external speakers
Institution: Venue TBC
Hours Equivalent Credit: 6
Course Summary
The SUPA industry skills course is delivered by representatives from industry and will focus on essential skills for future careers. NPL, Marks and Clerk, Optos, Thales, Coherent, Leonardo, Kaiam and Aridhia Informatics have been instrumental in the creation of this course. Topics covered in previous years have included Intellectual Property and Patents, Product Line Management, Risk Management, Decision Making Skills and Written Communication.
Universities offer many training options for physics graduate students to extend their knowledge and skills out-with the SUPA course offerings. SUPA students are encouraged to make the most of these opportunities with their supervisor’s permission. SUPA has established arrangements whereby non SUPA courses can count towards SUPA’s minimum requirements of 40 hours of Advanced Specialist courses and 20 hours Professional Development Training.

Non-SUPA Technical Skills

Undergraduate Masters (MSci/MPhys) honours and postgraduate Masters (MSc) courses in physics and astronomy are on occasion made available to SUPA students from any partner university. Under this arrangement, completion of these courses and the final assessment count towards the SUPA minimum 40 hour requirement.

Process – At the start of academic years 1 and 2 of a PhD, a student discusses and secures agreement to take such a course via their supervisor. In order for the result to be logged on My.SUPA, students should contact admin@supa.ac.uk with the course name, description and mark achieved, copying in their supervisor. All non-SUPA courses and marks will be reviewed by the Graduate School Committee.

Attendance at National and International Summer Schools designed for research students (e.g. those organised by doctoral training centres or SUSSP) is encouraged. Credit for attending Summer School lectures will only be accepted by approval of the Graduate School Committee where the student has been assessed either at the summer school or by local assessment following the summer school. Broadly, the taught content and assessment should be comparable to a Graduate School Advanced Specialist course of equivalent SUPA credits to those being requested for the Summer School.

Process – A student discusses and secures agreement via their supervisor and local SUPA Graduate School Committee member. The GSC representative requests GSC approval by circulation via the SUPA Graduate School Coordinator. In order for the result to be logged on My.SUPA, the GSC representative (or nominee) at the end of each academic year informs SUPA Central of the Summer School name, number of hours, and the student mark. The pass mark will be assumed to be 50%.

All other courses including bachelor’s level modules will only be accepted by approval of GSC where the course has been assessed.

SUPA Graduate School Coordinators cannot organise assessment for non-SUPA courses. There is an agreed 30 hours credit cap on a single non-SUPA advanced specialist course.

Non-SUPA Transferable Skills

All Professional Development Training courses organised for graduate research students by universities and/or the research councils, VITAE or other ‘approved’ bodies are accepted as SUPA-approved courses in order to make up the 20 hour requirement.

Process – The student informs admin@supa.ac.uk of the course name and number of hours when the course has been completed so that it can be logged on My.SUPA to make up the mandatory 20 hours. Students have the responsibility of ensuring that the information that they provided is correct.
Frequently Asked Questions

What is SUPA?
SUPA is the Scottish Universities Physics Alliance, a grouping of eight Physics departments across Scotland. The SUPA Graduate School facilitates shared learning across these institutions. After enrolling for post-graduate studies in a SUPA-member institution, you are automatically enrolled in the SUPA Graduate School and are subject to its academic policies.

Is there a timetable for the SUPA courses?
The SUPA timetable can be found on the My.SUPA website.

How do I use the videoconferencing equipment?
Training is made available locally. More information can also be found in the ‘My.SUPA and Videoconferencing’ section of this handbook. If you have a specific issue, please contact your local Graduate School Committee representative or a member of local support.

How do I obtain a My.SUPA password and username?
To obtain a My.SUPA login, please go to the My.SUPA portal (http://my.supa.ac.uk) and click on the ‘Request a My.SUPA login’ link. Your new login and password will soon be emailed to you with instructions.

How do I reset my My.SUPA password or username?
You can reset them either by following the ‘Lost Password?’ link in the login box on the My.SUPA portal or by emailing admin@supa.ac.uk.

Who do I contact if I am having difficulty using My.SUPA to enrol (or unenrol) for courses?
If you encounter any difficulties while enrolling or unenrolling for courses on My.SUPA, please contact the SUPA Office at admin@supa.ac.uk.

How can I contact my lecturer?
The easiest way to do this is through My.SUPA. You can find your lecturer’s details in the ‘People and Locations’ or ‘Course Description’ area in the front page of the course area.

What if I am unable to attend a SUPA lecture?
If you enrol on a SUPA course, you are expected to attend the lectures. If you are ill or find you have a conflicting obligation, please inform your lecturer and contact the SUPA Office at admin@supa.ac.uk.

How can I obtain a copy of my SUPA transcript?
An electronic copy of your transcript is available on My.SUPA on the ‘Grades’ tab of your student profile. To obtain an official copy of your transcript certified by the SUPA Graduate School Co-ordinator, please write to the SUPA Office at admin@supa.ac.uk.

Who can I contact if I have a general question about the SUPA Graduate School?
All general enquiries about the SUPA Graduate School should be addressed to the SUPA Office at admin@supa.ac.uk.

Who is my local SUPA representative?
On the contacts page of this handbook, you can find the names of all SUPA GSC representatives. Do not hesitate to contact them if you have any queries or issues regarding SUPA Graduate School.

I am organising an event, can SUPA help me promote it?
Yes. As long as you are a SUPA member and your event is relevant to those working in Physics in Scotland, SUPA is happy to help with promotion. Please email admin@supa.ac.uk with a succinct description of your event and electronic copies of any promotional materials (such as fliers or posters) that you may have, and SUPA will work with you to promote your event.

Can SUPA help me fund my participation in an event or course not organised by SUPA?
Unfortunately, SUPA only provides funding for SUPA-sponsored and SUPA-organised events. If you are attending an event such as a summer school or conference not organised by SUPA, no funding is available.

Can I claim travel expenses from SUPA?
For SUPA events and courses to which PhD students must travel in order to attend (such as a residential course), SUPA will cover reasonable costs, defined as: public transport or mileage on shared rides equivalent to public transport costs, meals or accommodation.

How do I claim back my expenses from a SUPA event?
To claim back expenses for a SUPA event, please submit a claim form to your local department’s finance office, clearly stating the name of the SUPA event or course. SUPA Central does not process these claims, unless otherwise stated.
Getting Started with My.SUPA

My.SUPA

My.SUPA (http://my.supa.ac.uk) is an online space for managing all your SUPA-related activities.

We strongly encourage you to check My.SUPA regularly as this is our main tool for contacting you with important information such as requirements for your lectures, changes to the course timetable and event announcements.

Obtaining a Username and Password

To obtain a My.SUPA login, please go to the My.SUPA portal (http://my.supa.ac.uk) and click on the ‘Request a My.SUPA login’ link. You should always use your university email address when completing your request. Your new login and password will soon be emailed to you with instructions. If you forget your My.SUPA username or password, you can reset them either by following the ‘Lost Password?’ link in the login box on the My.SUPA portal or by emailing admin@supa.ac.uk.

For incoming first-year PhD students, SUPA should automatically create an account for you and contact you via email with your account details in early September. However, occasionally we do not receive complete details for incoming students and so cannot create accounts for them. If you have not received an email with your username and password by the time you are registering for SUPA courses, please email admin@supa.ac.uk.

Courses and My.SUPA

In order to register for SUPA courses, either as an enrolled or non-assessed student, you will need to use My.SUPA. Go to the My.SUPA portal (http://my.supa.ac.uk) and follow the enrolment instructions posted on the front page. Before you register for the first time, you will be informed about SUPA’s Privacy Policy and asked for your consent. (For more information about this policy, please email admin@supa.ac.uk).

When selecting courses on My.SUPA, please note that most courses are only available with read-only access to some materials during the registration period. All course materials will be made available to enrolled and non-assessed students once registration is closed. You will be expected to participate fully in the courses for which you have enrolled, whereas non-assessed students will simply be required to attend the courses. Please consult your supervisor and refer to the ‘SUPA Graduate School Basics’ and theme-specific sections of this handbook for more guidance on selecting appropriate courses.

The end dates of the SUPA registration periods are listed on Page 2. If you miss the deadlines, late registration may be possible but cannot be guaranteed. Please contact the SUPA Courses Office at admin@supa.ac.uk in this instance. Once you have registered for a course (either as non-assessed or enrolled), you will be able to check the course area on My.SUPA for information such as lecture notes and changes to the course schedule. You will also be able to communicate with your classmates and lecturer(s) individually (through the ‘People and Locations’ tab) and as a group (by using the News Forum). Messages posted on the course area News Forum will be automatically sent to the email address you have provided to SUPA.

If you would like to unenrol from a SUPA course during the enrolment period you can do so by going to the relevant course page and clicking on the ‘Unenrol me from SUPA[XXX]’ link.

If you would like to change between being a nonassessed student and full enrolment, please unenrol for the course and then re-register in the alternate role. This will only be possible during enrolment, at all other times should you wish to unenrol, please contact admin@supa.ac.uk. For fully enrolled students, it is crucial that you unenrol if you decide not to complete the course, or else your transcript will retain a record of the course.

Once enrolment has closed, unenrol requests should be sent to admin@supa.ac.uk and you should notify the course coordinator.

Transcripts and My.SUPA

As noted in the ‘Graduate School Basics’ section of this handbook, all SUPA students are required to complete 40 hours of Advanced Specialist Courses and 20 hours of Professional Development Training in the first two years of their PhD. You can track the number of course hours you have completed by viewing your online transcript in My.SUPA. To do so, after logging in to My.SUPA, click on your name in the upper right hand corner of the screen. (The link should say: You are logged in as [NAME]). This will take you to your user profile. Click on the ‘Grades’ tab to view your transcript. To obtain an official copy of your transcript certified by the Graduate School Director, please email admin@supa.ac.uk.

Timetable, Calendar and Events Forum

The latest version of the Graduate School Timetable, the SUPA Events Forum and the SUPA Calendar can be found on the My.SUPA homepage. If you would like to advertise an event through the Events Forum, please email admin@supa.ac.uk.

Further Training and Support

If you experience any difficulties while using My.SUPA, please email the SUPA Administration Office at admin@supa.ac.uk. To report errors on the site or to request technical help, please contact webmaster@supa.ac.uk.
Getting Started with Videoconferencing

SUPA Videoconference Booking Information & Room Locations

**SUPA Room and VC Booking**
Email: rooms@supa.ac.uk  
Web: www.supa.ac.uk/room_booking

**Aberdeen**  
Meston Building Room 302  
Contact: Michael Chung  
Tel: +44 (0)122 427 2750  
Email: m.chung@abdn.ac.uk

**Dundee**  
Ewing Building Basement  
Contact: Gary Callon  
Tel: +44 (0)138 238 4695  
Email: g.j.callon@dundee.ac.uk

**Edinburgh**  
James Clerk Maxwell Building Room 3307  
Contact: SOPA Helpdesk  
Tel: +44 (0)131 650 5900  
Email: sopa-helpdesk@ed.ac.uk

**Glasgow**  
Kelvin Building Room 255a  
Contact: Andrew Fraser  
Tel: +44 (0)141 330 6420  
Email: andrew.fraser@glasgow.ac.uk

**Heriot-Watt**  
Earl Mountbatten Building  
Room EM1.27  
Contact: Sean Farrell  
Tel: +44 (0)131 451 3048  
Email: s.j.farrell@hw.ac.uk

**St Andrews**  
Physics and Astronomy Room 307  
Contact: Ian Taylor  
Tel: +44 (0)133 446 3141  
Email: iat@st-andrews.ac.uk

**Strathclyde**  
John Anderson Building Room 813  
Contact: Timothy Briggs  
Tel: +44 (0)141 548 3376

**UWS**  
Henry Building  
Room F.318  
Contact: Tom Caddell  
Tel: +44 (0)141 848 3550  
Email: tom.caddell@uws.ac.uk

Videoconferencing

This page gives an introduction to using the videoconference facilities across the SUPA institutions. Videoconferences are primarily used in SUPA to deliver courses, however, they are also used for a variety of other purposes such as research meetings, seminars, interviews and distinguished visitor lectures. More information on using SUPA videoconference facilities, including video tutorials, can be found in Getting Started with Video-Conferencing at: [http://my.supa.ac.uk/](http://my.supa.ac.uk/).

Making a Booking

SUPA videoconferences must be booked in advance by SUPA. If you are attending a scheduled SUPA course or event, the booking has already been made for you. If you are organising a meeting or event and would like to use the SUPA videoconference facilities, please visit the SUPA website and use the booking form to make a booking (http://www.supa.ac.uk/room_booking).

Setting Up

SUPA videoconferences usually begin at five minutes past the hour. As the bookings are made in advance, the videoconference call will be made automatically, so there is no need to dial in. There are slight differences in the videoconference system and the layout of the videoconference rooms at each institution. (The system at UWS is different to other SUPA sites.) When you arrive in the room:

- If the projectors/screens are not turned on, use the remote control or control switch to turn them on.
- You will see the main page of the SUPA rooms list on the ceiling monitor. Wait here for the incoming call. When the call starts, you’ll be automatically taken to the Participants Screen.

Shutting Down

- SUPA lecture calls end at the hour.
- To end a call prematurely press the red handset button on the Vidyo remote control.
- Please switch off the screens/projectors by the remote control and the room light and lock the door.

Further Training and Support

Further training in the use of the videoconference facilities and assistance during videoconferences is available from local technical support at each site. The Getting Started with Video Conferencing My.SUPA page can be found at [http://my.supa.ac.uk/course/view.php?id=91](http://my.supa.ac.uk/course/view.php?id=91).
The Researcher Development Framework

The Researcher Development Framework describes the knowledge, behaviours and attributes of researchers and encourages them to aspire to excellence through achieving higher levels of development. It will be invaluable for planning, promoting and supporting the personal, professional and career development of researchers in higher education.

The Researcher Development Statement

The Researcher Development Statement sets out the knowledge, behaviours and attributes of effective and highly skilled researchers appropriate for a wide range of careers. Further information can be found online at: www.vitae.ac.uk/rdf

RDF Personal Development Planner

The Researcher Development Framework (RDF) has been incorporated into the professional Development Planner to allow researchers to identify the areas in the framework they want to develop further, create an action plan and record evidence of their progress. For further information visits: https://www.vitae.ac.uk/researchers-professional-development/about-the-viate-researcher-development-framework