

GRADUATE SCHOOL COURSE CATALOGUE 2026/27

SUPA Course Catalogue 2026/27

The Scottish Universities Physics Alliance, SUPA, is a collaboration of eight Physics departments across Scotland. The SUPA Graduate School shares teaching across these institutions. Upon enrolling for post-graduate studies in a SUPA university, you are automatically admitted to the SUPA Graduate School.

This catalogue contains information about how SUPA functions as well as current courses offered by SUPA.

General information about how to register, join courses and get credit for non-SUPA courses is on pages 4-11. A list of courses appears on pages 13-16, while longer course descriptions can be found on pages 17-48.

Each course description contains helpful information about the course. For example, the status indicates if the course will be offered this year. Some courses are offered only in alternate years, and some courses may be suspended temporarily. Please check the status of a course to find out if it will be available this year.

The title of the course appears at the top of the course description. The underlined course title is also a link that leads to the registration page for the course.

The catalogue is updated multiple times during the year. Please check back as we will post new information as we receive it. Details for many semester 2 courses are not finalized until the end of semester 1.

SUPA courses are shared in various ways. Some are held in the SUPA classrooms. Information about where to find the SUPA classrooms and how to gain access is listed on pages 7-8. These rooms are linked by Zoom. Participants can join these classes from their local SUPA classroom or can join the zoom call from any location, using a personal device. Other courses are shared entirely online or in other locations. Information about how to join a course will be posted on the my.supa page for the course.

Students are strongly encouraged to attend courses live, as they happen. Interacting with the lecturer and other students during class time has been shown to have a positive impact on student learning. For any questions or concerns, please contact admin@supa.ac.uk

Welcome to SUPA!
The SUPA Team

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The SUPA Graduate School

SUPA courses fall into two general categories, Specialist and Professional Development. Courses taken prior to enrolment in a PhD will not count toward the PhD course requirements.

Specialist Courses

Specialist courses are closely related to a student's research interests. Frequently, students take courses within their research theme. However, students are encouraged to take the courses most relevant to their work, regardless of theme. Specialist courses are listed by theme on pages 12 – 29.

Doctoral students are expected to take 40 hours of specialist courses in the first two years of their studies. For example, a student might take a 24-credit course in their first year, and a 16-credit course in their second year. Your university may have additional requirements.

All specialist courses are assessed. Students must pass the assessment to get credit for the course. Courses are assessed by various methods. The assessment for a specific course can be found in the course listing. Students are advised to check the type of assessment with the lecturer at the start of a course.

Students may audit Specialist courses. This may be appropriate if students are interested in the topic and want to attend lectures but do not have time to complete the course work. Students must enrol as non-assessed to audit courses. Students do not receive credit for audited classes.

Professional Development Courses

Professional Development courses appeal to students in a variety of research areas. Professional development training can help students manage their research projects and improve their writing and coding skills. These courses may also broaden career options. Doctoral students are expected to take 20 hours of Professional Development courses in the first two years of their studies. Your own university may have additional requirements.

Professional Development courses will have an informal or ongoing assessment. These courses are listed on pages 42-47.

My.SUPA

My.SUPA is an online space for managing your SUPA activities. Students must register with My.SUPA before they can enrol for courses:

- Go to http://my.supa.ac.uk
- Click 'Create a new account'
- Register using your university email address

An email will be sent to you with a verification link. If you do not yet have a university email address, use the best address for contacting you. Please change the email address on your account to your university email as soon as possible.

Student transcripts will be recorded by SUPA and information may be provided to departments via the Graduate School Committee and the Executive Committee for student progression. Students can view their transcripts through my.supa. See, "How do I obtain a copy of my SUPA transcript", page 10.

Enrolling on Courses

Students must discuss their course selections with their supervisors.

Students must enrol for SUPA courses to attend or receive credit for them. To enrol, log on to My.SUPA and follow the instructions. When 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.
Enrolment for Semester 1 opens in early September. Enrolment for Semester 2 opens in December.

Enrolment will typically stay open until the end of the first week of the course, for short courses and the end of the second week for full semester courses. After the open enrolment period, late enrolment may be possible with the lecturer's permission. Once you have permission from the lecturer to enrol late, contact the SUPA Administration team at admin@supa.ac.uk.

After you have enrolled on a course, you will be able to check the course page on My.SUPA for information such as lecture notes, recordings, and updates. During the enrolment period, students usually can access a limited portion of the course materials. The remaining course materials will become available to enrolled students once registration is closed. Some courses will close enrolment before the course start date. Details about enrolment closing will be in the course information page on My.SUPA.

During the enrolment period, students may change their enrolment status between being assessed and non-assessed, (also known as auditing). To make these changes, first withdraw from the course on My.SUPA and then enrol again with the new status. If you have difficulty changing your enrolment status after enrolment has closed, contact admin@supa.ac.uk and notify the course coordinator.

To withdraw from a SUPA course, go to the course page and click the 'Unenrol me from SUPA [XYZ]' link. If you are not going to complete a course, it is important to unenrol.

We strongly encourage you to check My.SUPA course pages regularly as this is the main method for sharing course information. On the my.supa course page, you can share messages with everyone in the course by using the News Forum. Messages posted on the News Forum will be sent to you via the email address you provided to SUPA.

My.SUPA Support

If you experience difficulties while using My.SUPA, please email admin@supa.ac.uk. To report errors on the site or to request technical help, please contact webmaster@supa.ac.uk.

Accessing Lectures

SUPA courses are delivered in a variety of ways, such as through videoconferencing, face to face, and distance learning. The course description will explain how the course is shared.

In-Person Courses

In-Person Courses are taught with participants together in one room. Students and lecturers attend in person. Depending on the location of the course, students may have to travel and possibly stay overnight. Some lectures that are presented through video conferencing may have tutorials, labs or discussions that students must attend in person. These will be listed as both video conferencing and in-person. Please consider these aspects when registering for a course. An in-person course that spans several days in succession may be listed as Residential.
Travel: If you are required to travel to attend a SUPA course, SUPA will reimburse travel expenses. SUPA will cover the cost of accommodation only if there is not enough time to travel on the day of the event. Consult the lecturer if you are uncertain about start and end times. There is a simple, online form to request travel funds. You must apply for travel funds and receive confirmation from SUPA before you travel.
The accommodation allowance is up to £80 per night. Any expenses over £80 must be justified in your claim form. When claiming reimbursement, follow the procedures for claiming expenses at your university. Ensure you complete the departmental travel claim form clearly stating SUPA and the course name.

Distance Learning Courses

Enrolling in Distance Learning courses will give you online access to recordings, notes, problem sheets and discussion forums. Students are expected to work independently and participate in activities set by the course lecturer. Students will submit exercises and receive feedback. There are no live broadcasts of lectures.

Videoconferencing

Many SUPA courses are taught via videoconferencing. Lectures may be shared through zoom or Teams. In some cases, students go to the local SUPA classroom to attend the course. Instructions for individual courses and links to lectures will be shared through the my.supa course pages. Students may also join lectures from a personal computer or other device.

The SUPA Classrooms

Joining from the SUPA Classroom



Starting up:

- Turn on the projectors, (using the remote control), or screens, (using the power switch), at the front of the room.
- The SUPA Classrooms are set up as zoom rooms, so the controls are the same as in a zoom call. The touch screen monitor on the front desk has the controls for joining a call. Tap the touchscreen monitor on the front desk to wake it. If it has been turned off, turn it on using the power switch on the lower right side.
- A list of upcoming lectures will appear on the monitor. Touch the item on the monitor to join the call.
- If you are only presenting to people locally who are in the room with you, you still need to join a zoom call to use the projectors. If a zoom call has not been booked in advance, join an instant zoom call.
- If you are joining a zoom call through a link that someone else created, enter the call information on the touch screen and the classroom will join the call.
- The controls on the monitor are the same as for a zoom call. However, the control bar disappears if the monitor has not been touched recently. If you do not see the zoom controls, try tapping the screen to make them visible.
- For most people joining the call, Speaker view is recommended. The lecturer may prefer Gallery view. These options can be selected from the touchscreen monitor as in a zoom call.
- You can mute attendees, for example if there is a noise that is disrupting the call.
- Details on joining and Assistance available during calls

Shutting down:

- The zoom call will automatically end on the hour.
- To end a call before the hour, press Leave Meeting from the touchscreen monitor.
- Please switch off the projectors or screens at the front of the room. Please do not turn off the touchscreen monitor. When you leave, please turn off the room lights.

Booking the SUPA Video Conferencing Classrooms, the SUPA timetable

The SUPA classrooms are primarily used to deliver SUPA courses. However, they are also used for local meetings. If you would like to reserve a SUPA classroom, please consult the timetable, and contact SUPA by filling in this form.
The access codes for all SUPA video conferencing rooms can be found here.

SUPA Classroom Locations

University of Aberdeen
Aberdeen: OA MT 302 - This is not a dedicated SUPA classroom, but SUPA calls are often shared here. Alternately, students can join calls from a personal device.

University of Dundee
Ewing Building Basement
The classroom video conferencing system is currently offline. Students should join calls from a personal device and are welcome to meet in the classroom

University of Edinburgh
James Clerk Maxwell Building, Room 1301
Contact: SOPA Helpdesk
+44 (0)131 650 5900
Email: sopa-helpdesk@ed.ac.uk

University of Glasgow
Kelvin Building, Room 255a
Contact: SUPA
Email: admin@supa.ac.uk

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

University of St Andrews
There is no dedicated SUPA classroom. Students may book a room and join from a personal device.
To book a room contact Dimali Vithanage
Email: da16@st-andrews.ac.uk

University of Strathclyde
John Anderson Building, Room 813
Contact: Timothy Briggs, Leanore Ferrans and Jamie McLaugh
+44 (0)141 548 3376
Email: physics-itsupport@strath.ac.uk

University of the West of Scotland
Henry Building, room F.318
Contact: Tom Caddell
+44 (0)141 848 3550
Email: tom.caddell@uws.ac.uk
The classroom video conferencing system is currently offline. Students should join calls from a personal device and are welcome to meet in the classroom.

Non-SUPA Credits

Students may complete their course requirements through courses offered outside SUPA. This applies to both Specialist and Professional Development courses. Examples of appropriate Specialist courses include Master's (MSci/MPhys/ MSc) and bachelor's courses. Attendance at national and international summer schools designed for research students (e.g. those organised by doctoral training centers or SUSSP) is also encouraged. Professional Development courses may be provided by a University, Research Council, VITAE or other organisations. Students are encouraged to take these opportunities with their supervisor's agreement.

Getting Credit for Non-SUPA Courses

A student will need to submit information about the course for it to be added to their SUPA record. For both professional development and specialist courses, students should complete the non-SUPA course form. The information needed is slightly different for the professional development and specialist courses and this is indicated on the form.

For **Professional Development** courses, the student's full name, the course name, date of completion, course description, course provider and number of credits are needed on the form. The course description should contain 3 –5 sentences about the content and should be emailed to your supervisor and admin@supa.ac.uk.

For **Specialist** courses, students must submit their full name, the course name, date of completion, course provider and number of credits on the form. Additional information is required, and this depends on whether the course was marked or unmarked.

Marked courses: These include master's and bachelor's level modules. The ideal arrangement is that the course coordinator arrange an assessment for the student. Even if postgraduate students are not typically assessed, the course coordinator may have a method for assessing them and students should consult the course coordinator about this. Students are not expected to register on the course through the host university. Instead, the course coordinator should email the student's marks to admin@supa.ac.uk, making it clear whether the student passed. All non-SUPA courses and marks will be reviewed by the GSC. The GSC cannot organise assessment for non-SUPA courses.

Unmarked courses: SUPA recognises that National and International Summer schools are valuable learning experiences even though they typically do not include an assessment. In these cases, and in any non-SUPA specialist course that cannot arrange an assessment, students must write a reflection on the course. The reflection may be up to 4000 words and should be submitted through the non-SUPA course form linked above. The reflection should include a brief (under 200 word) overview of the course content. Please then explore how the course content related to your own research. If that is not possible, please discuss the content you found most valuable.

The number of hours awarded for a course is based on the contact hours or the total length of the lectures, in hours. For a single non-SUPA course, students can earn at most 20 hours of credit. Please note that this limit of 20 hours was put in place for students beginning in 2020/21. In previous years, the credit limit for a single non-SUPA course was 30 hours. Students who began their studies prior to 2020/21 will be allowed to claim up to 30 hours of credit for a single non-SUPA course.

Frequently Asked Questions

Is there a timetable for the SUPA courses?
The SUPA timetable can be found here.

How do I obtain a My.SUPA password and username?
Go to the My.SUPA portal (http://my.supa.ac.uk) and click on the 'Create a new account' link.

How do I reset my My.SUPA password or username? Either use the 'Lost Password?' link in the login box on the My.SUPA portal or by email admin@supa.ac.uk.

Who do I contact if I am having difficulty using My.SUPA to enrol (or unenrol) for courses? admin@supa.ac.uk.

How can I contact my lecturer?
On the My.SUPA course page, in the 'Course Description' area, the lecturer's name will appear as a link that allows you to send them an email.

What if I am unable to attend a SUPA lecture?
If you are ill or find you have a conflicting obligation, please inform your lecturer.

How can I obtain a copy of my SUPA transcript?
You can track the number of course hours you have completed by viewing your online transcript in My.SUPA. To do so, log in to My.SUPA and 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 Coordinator, please email admin@supa.ac.uk.

Who is my local SUPA representative?
On the contacts page of this handbook, page 12, you can find the names of the SUPA Graduate School Committee representatives. They can answer many questions about SUPA.

I am organising an event; can SUPA help me promote it?
Yes. If 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 description of your event and electronic copies of any promotional materials (such as fliers or posters), 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. There is no funding available to attend other Summer Schools or conferences.

Can I claim travel expenses from SUPA?
Yes, if the events or courses were organised by SUPA and students must travel to attend. SUPA will cover reasonable costs, defined as: public transport or mileage on shared rides equivalent to public transport costs, meals or accommodation. Students must apply for funding and receive confirmation in advance of travel.

SUPA pays for transportation to the Annual Gathering from within Scotland. Attendees do not need to apply for this funding in advance. However, please check if group travel arrangements have been made for your university. For example, if a bus has been hired for people at your university to travel to the Annual Gathering, you should not plan to travel separately and be reimbursed. Extenuating circumstances will be considered.

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. Do not send claims to the SUPA administration team unless specifically instructed to do so.

Access
If you have any difficulty accessing course materials, including lectures, or if lectures do not appear to be running as scheduled, please contact admin@supa.ac.uk as quickly as possible.

Course Availability
If a course is cancelled, students will be contacted to discuss alternatives. If a course is oversubscribed, students will be admitted in the order that they registered. When a course is full students will be added to a wait list.

Course Credit
The credit for each course is included in the course description.

Individual and Extenuating Circumstances
Students may have unique, individual circumstances that affect their studies. For example, students with dyslexia may need additional time to complete exams. If you require any additional support in completing assessments, please contact the course lecturer who will follow guidelines established by the host university.

If unforeseen circumstances, such as an illness, adversely affect a student, course instructors and SUPA management may have some flexibility in assigning credit. The student should inform their local Graduate School Committee member and provide evidence of these unforeseen events as soon as possible. The Graduate School Committee will review cases individually.

SUPA Contacts

SUPA Team

Linda Hadfield, Director
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Glasgow
G12 8QQ
Email: admin@supa.ac.uk

SUPA Webmaster
Sean Farrell
+44 (0)131 451 3048
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SUPA Graduate School Committee

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List of current SUPA courses 2026/27

Please note, some courses may appear twice, as they are relevant to more than one SUPA theme.

Course Title	Semester	Hours	Page
Astronomy and Space Sciences			
Advanced Data Analysis Astronomy (SUPAAAA)	1	27	18
Gravitational Wave Detection (SUPAGWD)	1	16	18
Astrobiology and the Search for Life (SUPAASL)	2	20	19
SUPA Observing Course (SUPAOBS)	2	15	19
Condensed Matter and Material Science			
Introduction to Computational Chemistry (SUPACCH)	1	9	21
Quantum Field Theory (SUPAQFT)	1	30	21
Modern Topics in Condensed Matter Physics (SUPATOP)	1	32	22
Advanced Statistical Physics (SUPAASP)	1	22	22
Quantum Mechanics for Scientists and Engineers, Discussion (SUPAQMSE)	1	18	22
Soft Condensed Matter Physics (SUPASCM)	2	16	23
Quantum Magnetism and Quantum Phase Transitions (SUPAQMPT)	2	18	23
Electronic Structure Theory (SUPAEST)	2	20	23
Non-Equilibrium Statistical Mechanics (SUPANSM)	2	12	24

Energy

Solar Power (SUPASPR)	2	14	26
Laser Driven Plasma Acceleration (SUPALDP)	2	16	26

Nuclear Physics

Nuclear Instrumentation (SUPANIN)	2	6	28
Quarks and Hadron Spectroscopy (SUPAQHS)	2	8	28

Particle Physics

Advanced Statistical Physics (SUPAASP)	1	22	30
Detectors (SUPADET)	1	16	30
Collider Physics (SUPACOP)	2	18	31
Quarks and Hadron Spectroscopy (SUPAQHS)	2	8	31
Flavour Physics (SUPAFLA)	2	16	31

Photonics

Introduction to Practical Experimental Optics and Microscopy (SUPAEOM)	1	15	33
Nanophotonics (SUPANAN)	1	27	33
Ultrafast Photonics (SUPAUPH)	2	10	34
Photonic Sensors (SUPAPHS)	2	TBC	34
Optical Metrology (SUPAOMY)	2	TBC	34

Course Title	Semester	Hours	Page
Physics and Life Sciences			
Biophotonics (SUPABPH)	1	27	35
Introduction to Practical Experimental Optics and Microscopy (SUPAEOM)	1	15	35
Astrobiology and the Search for Life (SUPAASL)	2	20	36
Biological Physics (SUPABPS)	2	12	36
Physics Education Research			
Physics Education Research Foundations (SUPAPERF)	2	10	37
Physics Education Research Current Topics (SUPAPERT)	2	10	37
Plasma Physics			
Plasma Physics (SUPAPPH)	1	12	38
Laser Driven Plasma Acceleration (SUPALDP)	2	16	38
Plasma Physics II (SUPAPPT)	TBC	12	38
Quantum Technologies			
Quantum Mechanics for Scientists and Engineers, Discussion (SUPAQMSE)	1	18	39
Theoretical Foundations of Quantum Technologies (SUPATFQ)	1	20	39
Quantum Communication and Networking (SUPAQCN)	1	10	40
Quantum Devices (SUPAQMD)	2	30	40
Physical Systems for Quantum Technologies (SUPAPSQ)	2	20	40
Quantum Magnetism and Quantum Phase Transitions (SUPAQMPT)	2	18	41
Introduction to and Applications of Quantum Computation (SUPAAQC)	2	10	41
Quantum Metrology	2	10	41

Course Title	Semester	Hours	Page
Professional Development Training			
Maths Primer (SUPAPRI)	1	6	43
FPGA Programming for Physicists (SUPAFPP)	1	12	43
C++/Object Oriented Programming (SUPACOO)	1	12	44
ROOT (SUPAROO)	2	9	45
Introductory Data Analysis (SUPAIDA)	2	6	45
Advanced Data Analysis for the Physical Sciences (SUPAADA)	2	14	45
Industry Skills (SUPAISC)	2	5	46
Mathematical Modelling (SUPAMMD)	2	33	46
Presenting Your Research (SUPAPYR)	2	12	46
Introduction to Machine Learning (SUPAIML)	TBC	TBC	47
Introduction to Python (SUPAPYT)	2	8	47
Outreach Training – Glasgow (SUPAOTG)	2	10	47
Software Carpentry (SUPASWC)	2	16	48

Astronomy and Space Sciences

Theme Leader: Aurora Sicilia Aguilar, University of Dundee

The Astronomy and Space Sciences 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 Sciences courses, with 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 specialist courses might include:

· A SUPA specialist 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
Students should note that certain Astronomy courses are only run biennially. Each student must consult their PhD supervisor to contract 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.



TNG (Telescopio Nazionale Galileo) Dome, La Palma, Canary Islands

Semester 1

Advanced Data Analysis Astronomy (SUPAAAA)

Status: Offered in 2026/27
Lecturer: Juan Hernandez Santisteban
Institution: St. Andrews
Delivery: Live in person, and recorded lectures. No live broadcast.
Hours Equivalent Credit: 27
Assessment: Three assessments

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 hypothesis about models of the physical world. Students develop their computer programming skills, build a data analysis toolkit, and gain practical experience by analysing real data sets. The two projects involve periodogram analysis of quasi-periodic oscillations in the HST light curve of an eclipsing dwarf nova, and a cross-correlation radial velocity analysis and mass estimation for a black hole binary, based on spectra from the Keck 10m telescope.

Students should expect to spend around 100 hours on coursework out with lecture time.

Gravitational Wave Detection (SUPAGWD)

Status: Offered in 2026/27
Lecturer: Peter Murray
Institution: Glasgow
Delivery: video conferencing - Tues 11:00 and Fri 13:00
Hours Equivalent Credit: 16
Assessment: Two sets of problem exercises plus Oral Examination

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. Students are expected to spend 100 hours on this course.

Semester 2

Astrobiology and the Search for Life (SUPAASL)

Status: TBC
Delivery: zoom, not in the SUPA classroom
Institution: Various
Hours Equivalent Credit: 20
Lecturer: Charles Cockell
Assessment: Report

This course investigates the origin, evolution and distribution of life in the Universe, broadly considered as 'astrobiology'. The objective of the course is to provide a perspective on 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).

SUPA Observing Course (SUPAOBS)

Status: Offered 2026/27
Lecturer: Aleks Scholz
Institution: St Andrews
Delivery: Live in person, and recorded lectures. No live broadcast.
Hours Equivalent Credit: 15
Assessment: Mock observing proposal as homework
Coursework: Students should expect to spend 20 hours on this course.

The course includes 5 lectures on the basics of professional observations, given by observatory director Dr. Aleks Scholz. This will be complemented by 5 lectures on specialised observing techniques.
Students will be offered an exclusive tour of the James Gregory Telescope in St Andrews, on a voluntary basis. We will also have observing sessions using telescopes in St Andrews that students can join remotely.

Condensed Matter and Material Science

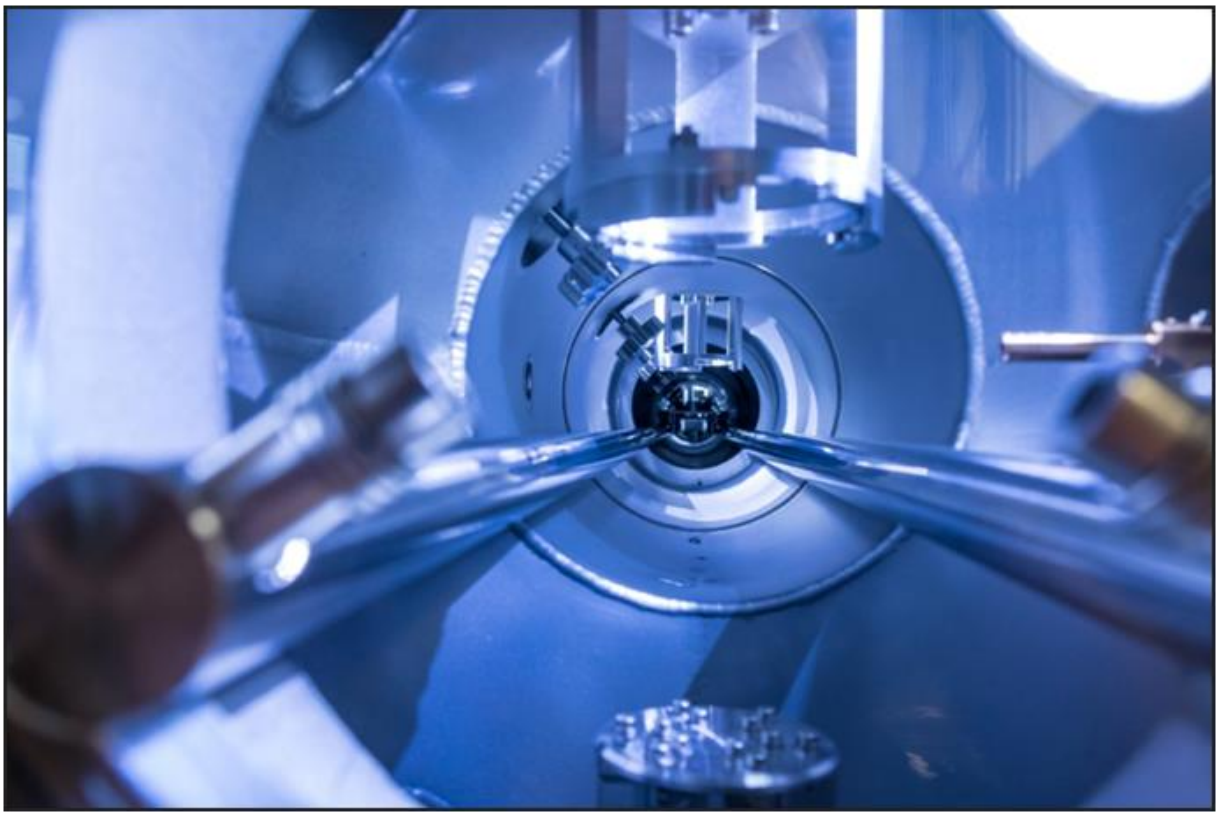
Theme Leader: Donald MacLaren

Condensed Matter and Materials Sciences (CMMS) 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 confine 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 programme will comprise the following elements:

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

Core courses organised by SUPA: Those of particular interest to CMMS 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.



Center for Designer Quantum Materials © Tricia Malley Ross Gillespie www.broaddaylightltd.co.uk

Semester 1

Introduction to Computational Chemistry (SUPACCH)

Status: Offered in 2026/27
Lecturer: Herbert Fruchtl
Institution: St. Andrews
Delivery: Video conference
Hours Equivalent Credit: 9
Assessment: Continuous assessment through assignments

The course will introduce 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 for molecular systems, solids and surfaces, as well as cheminformatics, will be introduced along with how they are used in practice by researchers in Scotland.

Quantum Field Theory (SUPAQFT)

Status: Offered in 2026/27
Lecturer: Jonathan Keeling and Bernd Braunecker
Institution: St Andrews
Delivery: Live in person, and recorded lectures. No live broadcast.
Hours Equivalent Credit: 30
Assessment: Continuous assessment

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)

Status: Offered in 2026/27
Lecturer: Bernd Braunecker, Sebastian Buchberger, Peter Wahl and Andreas Rost
Institution: St Andrews
Delivery: Live in person, and recorded lectures. No live broadcast.
Hours Equivalent Credit: 35
Assessment: Problem Sheets, Presentations, Computational Exercises
Course work: Students are expected to spend 150 hours on this course, including both time in lectures and independent working.

The aim of this module is to introduce a variety of contemporary topics of condensed matter physics research. Topics covered in this module include topology, Fermi liquid theory, electronic properties of surfaces and low-dimensional solids, and many body problems in condensed matter physics. This course will cover the underlying principles and introductory theory of these 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 evolving field. The module consists of a series of 21 lectures covering these topics and includes practical computational examples to develop a numerical approach to solving physics problems and a journal club session where students present a research paper.

Advanced Statistical Physics (SUPAASP)

Status: Offered in 2026/27
Lecturer: Tyler Shendruk
Institution: Edinburgh
Delivery: Video conference - Zoom
Hours Equivalent Credit: 22
Assessment: Report

In this course we will discuss equilibrium phase transitions, of 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. Momentum space approaches will be briefly discussed. We will conclude with a study of stochastic dynamics and the approach to equilibrium, and we will discuss nonequilibrium dynamics and nonequilibrium phase transitions.

Quantum Mechanics for Scientists and Engineers, Discussion (SUPAQMSE)

Status: Offered in 2026/27
Lecturer: Niclas Westerberg
Institution: Glasgow
Delivery: Video conference
Hours Equivalent Credit: 18
Assessment: Weekly tutorials, where 1 question each week is selected as a marked hand-in exercise (marked at a pass/fail level).

In this course, we will study quantum mechanics at a level suitable as an introduction to the subject or as a refresher. The aim is to end the course with a working understanding of typical problems and techniques. The course will consist of two weekly sessions, supplemented by online lectures and material by David Miller and relevant books, where we go through important concepts and solve some exercises, respectively.

Semester 2

Soft Condensed Matter Physics (SUPASCM)

Status: Offered in 2026/27
Lecturer: Patrick Pietzonka
Institution: Edinburgh
Delivery: Live in person, and recorded lectures. No live broadcast.
Hours Equivalent Credit: 16
Assessment: Coursework

Soft Condensed Matter Physics studies complex fluids in which intermediate level structures with length scale between small molecules and the macroscopic world exist: colloidal particles, polymers, and aggregates spontaneously formed by soap-like (surfactant) molecules. This course emphasises the generic features of these systems (most importantly, Brownian motion) and develops simple models to account for their behaviour. It will also look at how the principle of soft matter physics can give insight into biological problems.

Quantum Magnetism and Quantum Phase Transitions (SUPAQMPT)

Status: This is a biennial course which will not be offered in 2026/27, but will return in 2027/28
Lecturer: Bernd Braunecker, Jonathan Keeling
Institution: St. Andrews
Delivery: Video Conference
Hours Equivalent Credit: 18
Assessment: Continuous Assessment

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.

Electronic Structure Theory (SUPAEST)

Status: This is a biennial course which will be offered in 2026/27, but not 2027/28
Lecturer: Elton Santos
Institution: Edinburgh
Delivery: Video Conference and in-person
Hours Equivalent Credit: 20
Assessment: Problem Sheets, Project

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.

Enrolment on this course is limited to fifty participants. Please sign up as soon as possible to ensure your place.

Non-Equilibrium Statistical Mechanics (SUPANSM)

Status: This is a biennial course. It is offered in 2026/27 but will not be offered in 2027/28.
Lecturer: Tyler Shendruk
Institution: Edinburgh
Delivery: Video Conference
Hours Equivalent Credit: 12
Assessment: Peer-to-Peer Teaching
Coursework: Over the term, students are expected to spend a total of 25 hours on this course.

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 half of the lectures cover core techniques and ideas in non-equilibrium statistical mechanics. The remaining lectures cover specialist and current topics of research. This course is assessed by means of peer-to-peer teaching, with each student presenting lectures on course content.

Energy

Theme Leader: Lethy Jagadamma, University of St Andrews

Our courses relate to two main topics: solar and nuclear power. The courses are designed to be accessible to all Energy Theme students. Nuclear students can take the solar power course and vice versa. In addition to these courses, students are encouraged to select relevant courses from other themes. Courses in Condensed Matter and Materials Sciences, Photonics, Nuclear and Plasma Physics, may be especially helpful.

Examples of Summer Schools:



Semester 2

Solar Power (SUPASPR)

Status: This is a biennial course and is not offered in 2026/27 but is expected in 2027/28
Lecturer: Ifor Samuel and invited lecturers from across SUPA
Institution: St. Andrews
Delivery: In Person
Hours Equivalent Credit: 14
Assessment: Problem Sheets and reports on laboratory experiments

This course is an introduction to solar photovoltaics (PV). Lectures will discuss 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, taking place in St Andrews. Dates will be determined closer to the time.

Laser Driven Plasma Acceleration (SUPALDP)

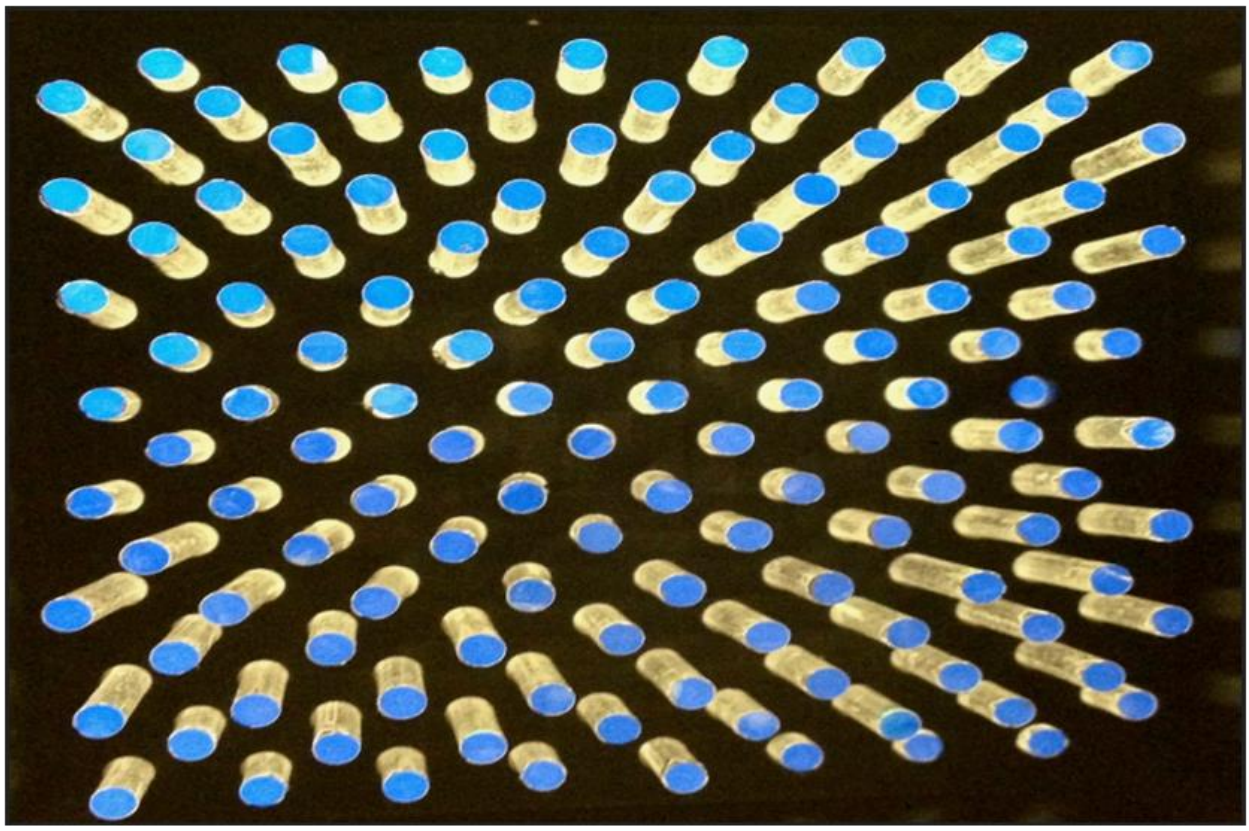
Status: Offered in 2026/27
Lecturer: Dino Jaroszynski, Paul McKenna and Bernhard Ersfeld
Institution: Strathclyde
Delivery: zoom, in the SUPA Classroom
Hours Equivalent Credit: 16
Assessment: Continuous Assessment

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.

Nuclear Physics

Theme Leader: David O'Donnell, University of West of Scotland

The Nuclear and Plasma Physics (NPP) theme covers a wide range of subject areas, including several different specialities. Students should consult their PhD supervisor about which courses to take.



POM Matrix, Muon Imaging System, University of Glasgow/Lynkeos Technology

Semester 2

Nuclear Instrumentation (SUPANIN)

Status: Offered in 2026/27
Lecturer: Tom Davinson
Institution: Edinburgh
Delivery: zoom in the SUPA Classroom
Hours Equivalent Credit: 6
Assessment: continuous assessment

The objective of this short course of lectures is to provide students with an insight into the state-of-the-art of nuclear instrumentation technology and techniques - particular emphasis will be given to topics either not found, or not well-covered, in the standard textbooks. Topics will include noise, interference, grounding and other black arts, the origins of detector energy and time resolution, ASICS, data acquisition and analysis, and digital signal processing.

Quarks and Hadron Spectroscopy (SUPAQHS)

Status: Offered in 2026/27
Lecturer: Oliver Jevons
Institution: Glasgow
Delivery: zoom in the SUPA Classroom
Hours Equivalent Credit: 8
Assessment: End of term exam, lasting approximately 2 hours

The course will provide an introductory look at topics which fall under the remit of modern experimental hadron physics, generally considered under one of two broad categories: hadron structure and hadron spectroscopy. Lectures will introduce concepts which are studied in experiments today, from the probability distributions which can be used to 'image' protons and neutrons, to the searches for exotic states lying at the extremes of QCD.

Particle Physics

Theme Leader: Victoria Martin, University of Edinburgh

The Particle Physics courses are divided into categories corresponding to whether the student is undertaking theoretical or experimental research areas.

All experimental particle physics students should take all the following courses: Detector Physics, Collider Physics and Flavour Physics unless there is a good academic reason to make a different choice and in consultation with their supervisor.

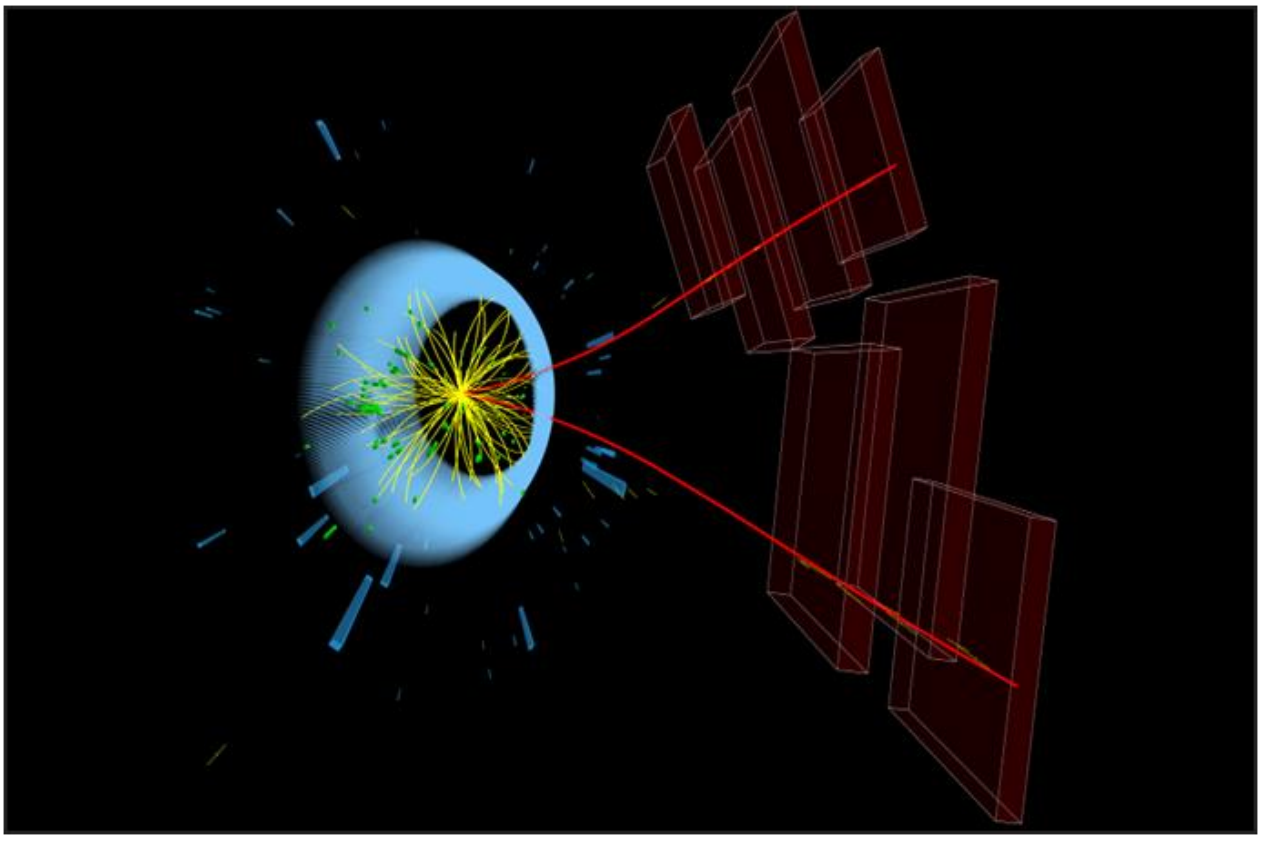
Recommended Professional Development courses:

Presenting Your Research (SUPAPYR)

Examples of Non-SUPA courses:

Relativistic Quantum Field Theory is offered as a local master's course in Glasgow. Students who want to take this course can attend in person and apply for credit as they would for a non-SUPA course. See page 9 on applying for non-SUPA credit.

SUPA students may want to take courses at the Higgs Centre for Theoretical Physics. Please check their events calendar for seminars, short courses and summer schools. If interested, please apply for travel funding.



A candidate Bs meson decays into two muons, © CERN 2019

Semester 1

Advanced Statistical Physics (SUPAASP)

Status: Offered in 2026/27
Lecturer: Tyler Shendruk
Institution: Edinburgh
Delivery: Video conference
Hours Equivalent Credit: 22
Assessment: Report

In this course we will discuss equilibrium phase transitions, of 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 approach to equilibrium.

Detectors (SUPADET)

Status: Offered in 2026/27
Lecturer: Kenneth Wraight, Dima Maneuski, Stephen Eisenhardt, Richard Bates, Andrew Blue
Institution: Glasgow/Edinburgh
Delivery: Video conference
Hours Equivalent Credit: 16
Assessment: Assignment Sheets

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.

Semester 2

Collider Physics (SUPACOP)

Status: Offered in 2026/27
Lecturer: Giuseppe Callea, Liza Mijovic and Mark Owen
Institution: Edinburgh and Glasgow
Delivery: zoom in the SUPA Classroom
Hours Equivalent Credit: 18
Assessment: Peer Review (40%), Literature Review (60%)

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.

Quarks and Hadron Spectroscopy (SUPAQHS)

Status: Offered in 2026/27
Lecturer: Oliver Jevons
Institution: Glasgow
Delivery: zoom in the SUPA Classroom
Hours Equivalent Credit: 8
Assessment: End of term exam, lasting approximately 2 hours

The course will provide an introductory look at topics which fall under the remit of modern experimental hadron physics, generally considered under one of two broad categories: hadron structure and hadron spectroscopy. Lectures will introduce concepts which are studied in experiments today, from the probability distributions which can be used to 'image' protons and neutrons, to the searches for exotic states lying at the extremes of QCD.

Flavour Physics (SUPAFLA)

Status: Offered in 2026/27
Lecturer: Mark Whitehead and Phillip Litchfield
Institution: Glasgow
Delivery: zoom in the SUPA Classroom
Hours Equivalent Credit: 16
Assessment: continuous assessment

Flavour Physics attempts to answer some of the most profound open questions in modern physics such as how we understand the pattern of masses in the Standard Model (and beyond), and the violation of spacetime symmetries such as CP symmetry. This introduction to Flavour Physics consists of two parts, dealing separately with Flavour Physics of the quark and lepton sectors.

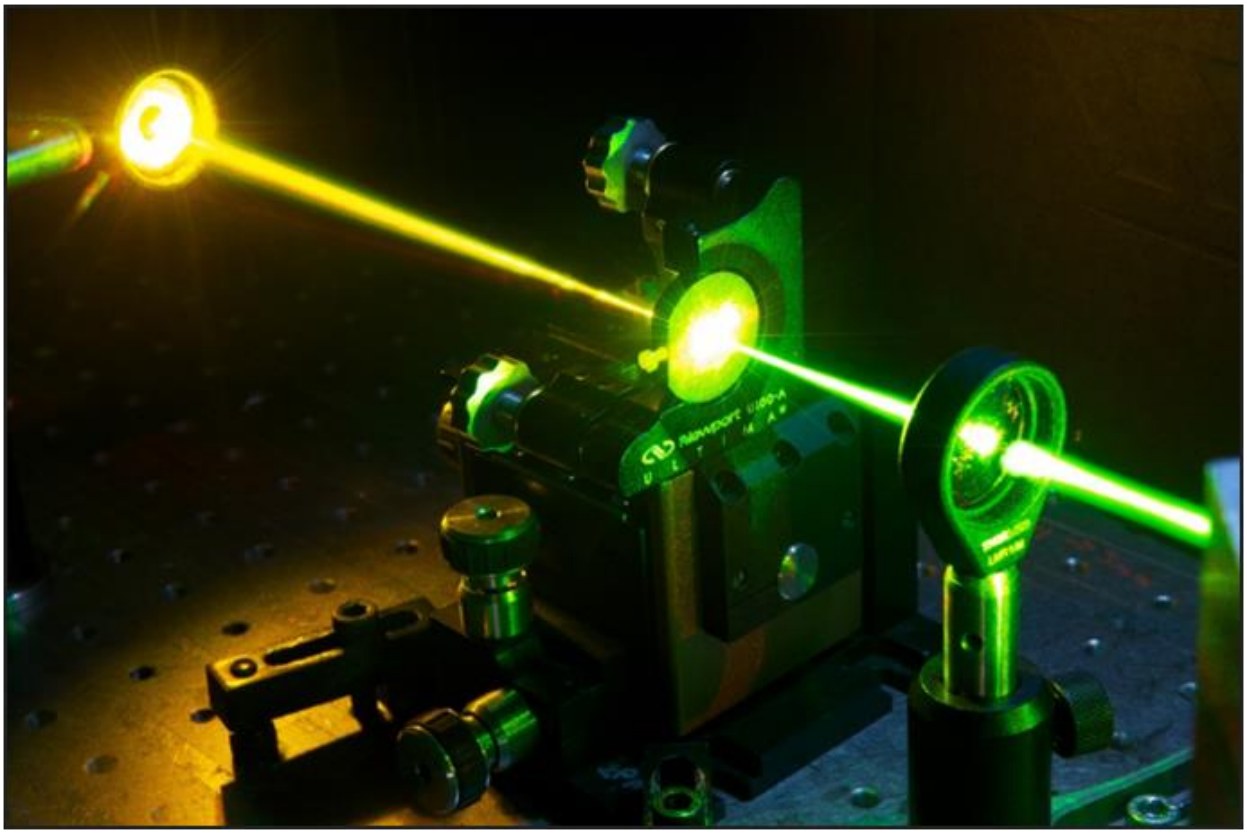
Photonics

Theme Leader: Robert Thomson, Heriot-Watt University

The Photonics Theme contains lecture and distance learning courses. We hope these are of interest. Courses offered through other themes, especially Condensed Matter and Material Sciences, may also be useful. Students are encouraged to attend Photonics related seminars hosted across Scotland, even though these seminars are not awarded credit.

Examples of Photonics Summer Schools:

Bad Honnef Physics School "Ultracold Atoms and Molecules"
SUSSP 79 Summer School in Photonic Sensing and Spectroscopy



A diamond microlens Raman laser being pumped by a green laser. Image courtesy of Prof Alan Kemp, University of Strathclyde.

Semester 1

Introduction to Practical Experimental Optics and Microscopy (SUPAEOM)

Status: Offered in 2026/27
Lecturer: Jonathan Taylor
Institution: University of Glasgow
Delivery: In-person practical labs, asynchronous lectures, and tutorials
Hours Equivalent Credit: 15
Assessment: Continuous assessment via submitted lab notebooks

This course is very popular and unfortunately has limited space. Enrolling through the my.supa system is the first step in registering for the course but does not guarantee a place. The lecturer will review all the interested students and will contact those who will be admitted. Please do not assume you will be admitted to the course but have a back-up option for another course to take.

This course is aimed at students with a grounding in optical theory but seeking to expand their lab skills in optics and imaging. It covers:
- basic design, construction and precision alignment of experiments from kit optical components (e.g. Thorlabs components)
- understanding of microscope objective lenses and their properties for optical experiments
- hands-on use of a variety of microscope and camera systems
- understanding of camera properties such as read noise, and selection of optimal camera technology
- designing and constructing with laser safety in mind
- computational techniques for image deconvolution

Nanophotonics (SUPANAN)

Status: Offered in 2026/27
Lecturer: Andrea Di Falco, Graham Bruce
Institution: St. Andrews
Delivery: Live in person, and recorded lectures. No live broadcast.
Hours Equivalent Credit: 27
Assessment: Tutorials

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 band structure, 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 cavities 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

Ultrafast Photonics (SUPAUPH)

Status: Offered in 2026/27
Lecturer: Derryck Reid
Institution: Heriot-Watt
Delivery: Distance Learning
Semester: 2
Hours Equivalent Credit: 10
Assessment: Online Assessment

This is a short, distance learning course operated by Heriot-Watt University via their Canvas virtual learning environment. To complete the course students must carry out an online assessment using the Canvas system, which means they must first apply for an account. Details for doing this appear on the UPH my.SUPA page. SUPA students must first register on my.SUPA by Monday 11 January 2027, after which they will receive Canvas log-in details. Registration will be closed after this deadline.

Photonic Sensors (SUPAPHS)

Status: Not currently offered. To begin in 2027/28
Lecturer: TBC
Institution: Heriot-Watt
Delivery: Video Conferencing
Semester: 2
Hours Equivalent Credit: TBC
Assessment: TBC

This course aims to give an understanding and awareness of modern photonic sensing devices and systems and include contextualisation through topical case studies.

Topics included: Fundamentals of UV-to-IR light detection; Fibre sensors; Interferometric sensing; Field sensing; Spectroscopic and fluorescence sensors; Nanophotonic sensors; Single-photon detection' Quantum sensors; Topical case studies, such as LIDAR; FBG structural health monitoring; integrated photonic sensing systems; bio-chemical sensing; gravitational wave detection.

Optical Metrology (SUPAOMY)

Status: Offered in 2026/27
Lecturer: TBC
Institution: Glasgow, Strathclyde and Heriot-Watt
Delivery: Distance Learning
Hours Equivalent Credit: TBC
Assessment: TBC

Topics discussed in this course include introduction to optical metrology; Principles of laser interferometry; Non-ideal interferometers; Fringe counting interferometry; Laser stabilisation and comparison techniques; Diode lasers in metrology.

Physics and Life Sciences

Theme Leader: Stuart Reid, University of Strathclyde

The theme of Physics and Life Sciences (PaLS) covers a large breadth of both physical and life sciences. As students have a variety of backgrounds and experiences, and are pursuing diverse PhD projects, the exact courses to be taken should be discussed with the student's supervisor. Students are welcome to take relevant courses from any theme and non-SUPA courses.

Many students in this theme appreciate the professional development course, Mathematical Modelling, offered in semester 2.

Examples of Summer Schools and non-SUPA courses:
St Andrews Biophotonics Summer School
Diffuse Optical Tomography workshop, University of Strathclyde

Semester 1

Biophotonics (SUPABPH)

Status: Offered in 2026/27
Lecturers: Carlos Penedo-Esteiro, Juan Varela and Paolo Annibale
Institution: St. Andrews
Delivery: Live in person, and recorded lectures. No live broadcast.
Hours Equivalent Credit: 27
Assessment: Attendance, news and views article, presentation
Coursework: Students are expected to spend 27 hours on lectures and 115 hours on independent work.

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, optogenetics and methods to measure forces in biology.

Introduction to Practical Experimental Optics and Microscopy (SUPAEOM)

Status: Offered in 2026/27
Lecturer: Jonathan Taylor
Institution: University of Glasgow
Delivery: In-person practical labs, asynchronous lectures, and tutorials
Hours Equivalent Credit: 15
Assessment: Continuous assessment via submitted lab notebooks

This course is very popular and unfortunately has limited space. Enrolling through the my.supa system is the first step in registering for the course but does not guarantee a place. The lecturer will review all the interested students and will contact those who will be admitted. Please do not assume you will be admitted to the course but have a back-up option for courses to take.

This course is aimed at students with a grounding in optical theory but seeking to expand their lab skills in optics and imaging. It covers:
- basic design, construction and precision alignment of experiments from kit optical components (e.g. Thorlabs components)
- understanding of microscope objective lenses and their properties for optical experiments
- hands-on use of a variety of microscope and camera systems
- understanding of camera properties such as read noise, and selection of optimal camera technology
- designing and constructing with laser safety in mind
- computational techniques for image deconvolution

Semester 2

Astrobiology and the Search for Life (SUPAASL)

Status: TBC
Lecturer: TBC
Institution: Edinburgh
Delivery: zoom, not in the SUPA Classroom
Hours Equivalent Credit: 20
Assessment: Report

This course investigates 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)

Status: Offered in 2026/27
Lecturer: Chris Brackley and Gavin Melaugh
Institution: Edinburgh
Delivery: Live in person, and recorded lectures. No live broadcast.
Hours Equivalent Credit: 12
Assessment: Oral assessment; students will give a short (10mins+questions) oral presentation about a biological physics journal article of their choice. A list of suitable papers will be provided, but it can also be on any biological physics article presenting original research (i.e., not a review). Presentations will be done via Teams in April/May, with sessions including talks from 5-7 students. They should give an explanation of the paper and its importance within the field aimed at an audience of other students who have taken the course. Shared: Part of undergraduate teaching

This course provides an introduction to Biological Physics, covering a variety of different topics and models within this interdisciplinary space. It is also a level 11 undergraduate course at the University of Edinburgh and will be taught to SUPA students as a Distance Learning course.

Physics can provide a very real and very valuable insight into the behaviour of complex biological systems, and a physical approach to biological problems can provide a new way of looking at the world. This course will introduce you to the basics of biological systems and then provide examples of how familiar physical principles underlie complex biological phenomena. It 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 predictions about biological systems, from the folding of a protein into a unique three-dimensional structure within a reasonable time frame, 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.

To get the most out of the course, students should be familiar with basic concepts from statistical physics (partition functions, free energies, entropy, canonical and grand canonical ensembles, random walks and diffusion). The course comprises 12 lectures and is assessed through an oral presentation based around a biophysics paper of the student's choosing.

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Physics Education Research

Theme Leaders: Nic Labrosse, University of Glasgow
and Anna Wood, University of Edinburgh

The Physics Education Research courses offered through SUPA are discussion courses. Participants will read and discuss a paper or chapter of a book every week. While it is ideal to take the Physics Education Research Foundations course first, it is possible to take the courses in any order. Students who are not based in the theme are welcome to participate.

Students in this theme have taken non-SUPA courses in the Education department, such as Developing as a Teacher in Higher Education, formerly offered at the University of Glasgow.

The STEM Education Innovation workshop, supported by IOP is also recommended: STEM Education by the Lake

Semester 2

Physics Education Research Foundations (SUPAPERF)

Status: This is a biennial course. It is not offered in 2026/27 but is expected in 2027/28.
Lecturer: Ross Galloway and Linda Hadfield
Institution: Glasgow
Delivery: Zoom, live discussions
Hours Equivalent Credit: 10
Assessment: Written weekly summaries, Annotated Bibliography at the end of term

Students in all themes are welcome, and no previous knowledge of physics education is required. We will read approximately one paper every week, depending on the length. Students will write a short summary or reflection on the paper each week for assessment. Class time will be spent discussing the content of the paper. Reading will include research papers and texts.

Physics Education Research Current Topics (SUPAPERT)

Status: This is a biennial course. It is offered in 2026/27 but will not be offered in 2027/28.
Lecturer: Ross Galloway and Linda Hadfield
Institution: Glasgow
Delivery: Zoom, live discussions
Hours Equivalent Credit: 10
Assessment: Written weekly summaries, Annotated Bibliography or Research Proposal at the end of term

Students in all themes are welcome. While it would be helpful to take the Foundations course first, interested students will benefit from this course even if they have no previous experience. We will read approximately one paper every week, depending on the length. Students will write a short summary or reflection of the paper each week for assessment. Class time will be spent discussing the content of the paper. We will respond to students' interest in the selection of papers, and students will be encouraged to lead the discussion. For their final project, students will submit an annotated bibliography of the papers covered, or a research proposal.

Plasma Physics

Theme Leader: Declan Diver, University of Glasgow

Semester 1

Plasma Physics (SUPAPPH)

Status: Offered in 2026/27
Lecturer: Kevin Ronald, Bengt Eliasson, Declan Diver
Institution: Strathclyde
Delivery: Video Conference
Hours Equivalent Credit: 12
Assessment: Multiple Choice Exam and Continuous Assessment

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

Laser Driven Plasma Acceleration (SUPALDP)

Status: Offered in 2026/27
Lecturer: Dino Jaroszynski, Paul McKenna, Zheng-Ming Sheng and Bernhard Ersfeld
Institution: Strathclyde
Delivery: zoom in the SUPA Classroom
Hours Equivalent Credit: 16
Assessment: Continuous Assessment

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.

Plasma Physics II (SUPAPPT)

Status: TBC
Lecturer: Declan Diver
Institution: Glasgow
Delivery: zoom in the SUPA Classroom
Hours Equivalent Credit: 12
Assessment: Multiple Choice Exam and Continuous Assessment

Quantum Technologies

Theme Leaders: Sonja Franke-Arnold, University of Glasgow and John Jeffers, University of Strathclyde

Quantum Technology is an emerging and rapidly evolving field. Within this theme there are three general areas, Quantum Measurement, Computing and Communication. Through their research, students may explore fundamental quantum physics questions and develop applications. Research projects may be theoretical, experimental or a combination of both.

Semester 1

Quantum Mechanics for Scientists and Engineers, Discussion (SUPAQMSE)

Status: Offered in 2026/27
Lecturer: Niclas Westerberg
Institution: Heriot-Watt
Delivery: video conferencing
Hours Equivalent Credit: 18
Assessment: Weekly tutorials, where 1 question each week is selected as a marked hand-in exercise (marked at a pass/fail level).

In this course, we will study quantum mechanics at a level suitable as an introduction to the subject or as a refresher. The aim is to end the course with a working understanding of typical problems and techniques. The course will consist of two weekly sessions, supplemented by online lectures and material by David Miller and relevant books, where we go through important concepts and solve some exercises, respectively.

Theoretical Foundations of Quantum Technologies (SUPATFQ)

Status: Offered in 2026/27
Lecturer: Sarah Croke (Glasgow), Jonathan Pritchard (Strathclyde) and John Jeffers (Strathclyde)
Institution: Various
Delivery: Video Conference
Hours Equivalent Credit: 20
Assessment: Problem sets
Course work: Students will spend about 50 hours total on this course, including lectures and assignments

This course will provide the background theory relevant to Quantum Technologies.
Part I (3 lectures) – Basic Atomic Physics: Historical introduction to atomic physics, Angular momentum; Atomic structure; Atom-light interactions.
Part II (3 lectures) – Basic Photonic Quantum Optics: Field quantisation, single-mode fields and quantum states; beam splitters and interferometers; non-classical light and its generation.
Part III (3 lectures) – Applications of Quantum Information: Quantum key distribution, Quantum sensing; Qubits, classical and quantum gates; introduction to quantum algorithms.

Quantum Communication and Networking (SUPAQCN)

Status: Offered in 2026/27
Lecturer: Alessandro Fedrizzi and Daniel Oi
Institution: Strathclyde and Heriot-Watt
Delivery: zoom in the SUPA Classroom
Hours Equivalent Credit: 10
Assessment: Essay

This course will provide a comprehensive and contemporary overview of theoretic and applied topics in Quantum Communication and Networking. The theory part will provide background on open and closed quantum systems, quantum optics of single and few-photon states, entanglement theory and quantum key distribution and networking paradigms. The applied part will touch on physical implementations of quantum key distribution (QKD), on components and protocols required for networks, and satellite QKD. Two lectures delivered by industry partners will introduce commercial aspects of QKD implementations and deployed quantum networking scenarios.

Semester 2

Quantum Devices (SUPAQMD)

Status: Offered in 2026/27
Lecturer: Margherita Mazzera and Cristian Bonato
Institution: Heriot-Watt
Delivery: Teams call, not in the SUPA Classroom
Hours Equivalent Credit: 30
Assessment: two 3-hour take-home exams (one per module, 50% each). An oral viva with one-to-one discussion of research papers might be required if the 50% threshold for passing is not reached in either one of the take-home exams.
Course Work: Approximately 7 hours per week outside of class

(1) Introduction to nanophysics, qubits and the density matrix formalism.
(2) Nanofabrication: Overview of the most common nanofabrication techniques and Nanostructure characterisation.
(3) Quantisation by confinement, effect of confinement on transport properties of solids, Effect of confinement on excitons, screening and energy renormalization.
(4) Spins in quantum mechanics, spin polarisation and readout, Nuclear spin baths, Applications to quantum sensing and quantum computing.
(5) Intro to superconductivity, macroscopic quantum model, London equation, Meissner effect, Josephson junctions, kinetic inductance.
Devices: kinetic inductance detectors, SQUIDs, SSPDs, superconducting qubits

Physical Systems for Quantum Technologies, SUPAPSQ

Status: Offered in 2026/27
Lecturer: Paul Griffin, Sam Bayliss, Alessandro Fedrizzi, Martin Weides
Institution: Various
Delivery: zoom, in the SUPA Classroom
Hours equivalent credit: 20
Assessment: Problem sets and essay
Course work: Students will spend about 50 hours total on this course, including lectures and assignments

This course will introduce physical systems and experimental techniques relevant to Quantum Technologies. Part I (3 lectures, Paul Griffin) – Atoms: Laser cooling and atomic clocks; Atoms in optical lattices; Rydberg atoms in tweezers for quantum computation; Part II (2 lectures, Sam Bayliss) Spin Qubits: Spin-light interfaces; Physical systems; Initialisation, readout and control of spin qubits; Applications to quantum sensing and quantum networks; Part III (2 lectures, Alessandro Fedrizzi) – Photonics; Part IV (2 lectures, Martin Weides) – Superconducting Qubits: Quantum circuits, materials and interfacing concepts.

Quantum Magnetism and Quantum Phase Transitions (SUPAQMPT)

Status: This is a biennial course which will not be offered in 2026/27, but will return in 2027/28
Lecturer: Bernd Braunecker, Jonathan Keeling
Institution: St. Andrews
Delivery: Video Conference
Hours Equivalent Credit: 18
Assessment: Continuous Assessment

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.

Introduction to and Applications of Quantum Computation (SUPAAQC)

Status: Offered in 2026/27
Lecturer: Viv Kendon, Sarah Croke & Guest Lecturers
Institution: Heriot-Watt, Glasgow and Strathclyde
Delivery: zoom in the SUPA VC rooms
Hours Equivalent Credit: 10

This course will introduce quantum computation, starting with a foundational discussion of what we mean by computation, and introducing quantum computational models. Students will be introduced to examples of quantum algorithms and potential applications of these, and a brief introduction to quantum error correction. The course will include independent study of applications of quantum algorithms in the literature, shared with other students through journal club presentations, which will also form the assessment for the course.

Quantum Metrology (SUPAQMO)

Status: Offered in 2026/27
Lecturer: Alessandro Fedrizzi
Institution: Heriot-Watt, Glasgow and Strathclyde
Delivery: zoom in the SUPA VC rooms
Hours Equivalent Credit: 10

This SUPA course will provide a comprehensive and contemporary overview of theoretic and applied topics in Quantum Metrology. The theory part will provide background on classical and quantum estimation theory, single- and multi-parameter estimation, and introduce important metrology tools like the (quantum) Fisher information, the (quantum) Cramer-Rao bound, maximum-likelihood estimation and the standard quantum limit. The applied part will focus on platforms for quantum metrology and on applications, including for example quantum imaging with entangled photons, or atomic clocks.

Professional Development Training

All SUPA students are required to complete 20 hours of Professional Development Training during the first two years of their PhD studies. Students may take courses offered through SUPA, from their own university and other providers.
Please note that enrolment times for Professional Development courses are often different from Specialist courses. Information about enrolment 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, please email admin@supa.ac.uk.

Courses run by Vitae and individual universities can be found at the following websites:

Vitae

University of Aberdeen: Postgraduate Research College

University of Edinburgh : Careers Service , Career and Researcher Development and Researcher Development, Careers Support

University of Glasgow: Research and Innovation Services

Heriot-Watt University: Research Futures

University of St Andrews: Lifelong Learning Institute

University of Strathclyde : Researcher Development

University of the West of Scotland: Researcher Development Concordat

Semester 1

Maths Primer (SUPAPRI)

Status: Offered in 2026/27
Lecturer: Patrik Öhberg
Institution: Heriot Watt
Delivery: Teams call, Lectures are pre-recorded, and class time is used for questions and discussion.
Hours Equivalent Credit: 6
Assessment: Continuous Assessment

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.

FPGA Programming for Physicists (SUPAFPP)

Status: Offered in 2026/27
Lecturer: Johannes Hernsdorf
Institution: Strathclyde
Delivery: Video Conference, not in the SUPA Classroom
Hours Equivalent Credit: 12
Assessment: Continuous Assessment
Course work: Students are expected to spend about 2.5 hours each week on independent work for this course, in addition to lectures.

Field programmable gate arrays (FPGAs) are configurable digital electronic devices capable of providing high-speed, low-latency and controlled latency digital interfaces to experiments. For example, FPGAs have been used in fluorescence lifetime measurements, various imaging methods, detection of photon correlations, gravitational wave detectors, and gravimeters. This course will equip students with the basic knowledge of how to interface physics experiments to digital electronics, and how to program FPGAs. An introduction to hardware description languages (HDLs) is given on the example of Verilog. HDLs are fundamentally different from computer programming languages and understanding them is crucial for the use of FPGAs. After completion, participants will be able to integrate FPGAs into their own experiments, create simple FPGA configurations, understand common problems and strategies to overcome them, and be aware of resources to help extend these skills.

C++/Object Oriented Programming (SUPACOO)

Status: Offered in 2026/27
Lecturer: Gary Robertson
Institution: Glasgow
Delivery: Lectures are shared through zoom in the SUPA Classroom. Labs are in person.
Hours Equivalent Credit: 12
Assessment: Continuous assessment; This course has priority booking for Particle Physics students. Please refer to the timetable and visit the My.SUPA course area for more information.

The course introduces the core concepts of C++ via four lectures and four laboratory tutorial sessions. This course assumes no prior knowledge of C++, but recommends some experience with the Linux file system and use of a text editor or integrated development environment (IDE). The course will be run in-person but both lectures and labs will have a remote connection available for those unable to travel to Glasgow. For the lab portion a personal computer or laptop is required but an online development environment is provided so a working C++ compiler on your local machine is not needed.

The aim of the course is to introduce the main C++ concepts and highlight those used commonly in research applications. The topics covered include:

- C++ syntax
- Data types and operators
- Input/output streams
- Conditional logic and loops
- External library functions (string, vector, stringstream, etc)
- Strings and arrays
- User defined functions
- User-defined classes
- Templated functions and classes
- Inheritance and polymorphism
- Pointers and memory management
- Random numbers and statistical distributions
- Code compilation and make
- Running code via command line
- Code style best practices

Semester 2

ROOT (SUPAROO)

Status: Offered in 2026/27
Lecturer: Marcos Miralles Lopez
Institution: Glasgow
Delivery: In-person, in SUPA VC room at the University of Glasgow
Hours Equivalent Credit: 9
Assessment: Continuous Assessment

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.

Introductory Data Analysis (SUPAIDA)

Status: Offered in 2026/27
Lecturer: David O'Donnell
Institution: UWS
Delivery: zoom call shared to SUPA VC Classrooms
Hours Equivalent Credit: 6
Assessment: Continuous Assessment

This course introduces 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.

Advanced Data Analysis for the Physical Sciences (SUPAADA)

Status: Offered in 2026/27
Lecturer: Ik Siong Heng
Institution: Glasgow
Delivery: Recorded lectures with interactive sessions through zoom, not in the SUPA Classroom. Local students are welcome to attend the lectures live and in person.
Hours Equivalent Credit: 14
Assessment: Moodle quiz at the end of lectures and tutorials
Course work: Students are expected to spend 100 hours on this course

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 analysing 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 those 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 newcomers to Bayesian inference who seeks to apply these methods to their data.

Industry Skills (SUPAISC)

Status: Offered 2026/27
Lecturer: Various external speakers, organised by SUPA
Institution: SUPA
Delivery: Distance Learning
Hours Equivalent Credit: 5
Assessment: Written reflections

In recorded interviews, individuals who started their career with a PhD in physics describe their career path and their current work. Students choose 5 interviews from those available, listen to the interview and answer reflective questions. This flexible format can be completed at any time during the term.

Students may choose from interviews that are publicly available at The Way We Work, on the supa webpage, and from recorded sessions of Careers Online at Lunchtime. Students may want to investigate the interviews before registering on the course.

Mathematical Modelling (SUPAMMD)

Status: Offered in 2026/27
Lecturer: Marco Thiel
Institution: Aberdeen
Delivery: Video conference
Hours Equivalent Credit: 33
Assessment: Students must engage with assignments.
Coursework: In addition to the lectures and tutorial, students should expect to spend about 100 hours on coursework during the term.

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.

Presenting your research (SUPAPYR)

Status: Offered in 2026/27
Lecturer: Cheryl Patrick
Institution: Edinburgh
Delivery: zoom call in the SUPA Classroom with 2 full-day, in-person sessions
Hours Equivalent Credit: 12
Assessment: Presentation

This highly interactive course explores how to present your research effectively to achieve the results you want. We will investigate some communication techniques and discuss how to tailor your presentations to suit your audience. We will try some design tools and discuss how visual materials can aid or hinder your ability to communicate. Finally, all students will get an opportunity to present about their own research, or another topic of their choice. Participants will receive staff and peer feedback in a supportive, non-judgemental environment.

Introduction to Machine Learning (SUPAIML)

Status: TBC
Lecturer: Rastko Sknepnek
Institution: Dundee
Delivery: Teams call, not in the SUPA Classroom
Hours Equivalent Credit: 30
Assessment: Continuous Assessment
Coursework:

In this module, you will learn basics of the theories behind modern machine learning techniques. During ten three-hour labs, you be asked to implement several key machine learning techniques and apply them to real-world problem, such as predicting house prices, recognition of handwriting, etc. This module can serve as a basis for preparing for a career in modern machine learning – a rapidly growing field of academic and industrial applications.
The module will cover:

- Basics of probability theory and statistics used in machine learning.
- Linear regression
- Logistic regression
- Naïve Bayes models
- Support vector machines
- Deep neural networks
- Hopfield model

Introduction to Python (SUPAPYT)

Status: Offered in 2026/27
Lecturer: Albert Borbely
Institution: Glasgow
Delivery: Lectures in a zoom call, not in the SUPA Classroom, and in-person lab
Hours Equivalent Credit: 8
Assessment: Assignment Problem

This is an introductory Python programming course where students are shown how to solve a wide range of problems. After completion students will be able to solve problems, both using strictly native Python modules as well as make use of the extensive library of external Python modules. This course is taught through practical lab sessions, primarily in person but also through zoom. Recorded lectures and slides are made available.

Outreach Training with the Glasgow Science Centre (SUPAOTG)

Status: Offered in 2026/27
Lecturer: Glasgow Science Centre Staff
Institution: Glasgow Science Centre
Delivery: In person
Hours Equivalent Credit: 10
Assessment: Presentation

This course takes place over 2 days, Thursday 25th February and Thursday 8th April. On the first day students will be introduced to ideas about science communication and education and will observe experienced science communicators. Students are encouraged to develop an activity about their research for general audiences. On the second day, some weeks later, students will have the opportunity to present their activity to general audiences in the museum. If students feel they cannot develop their own activity, some prepared activities will be available. Students must participate in both days to receive credit.
No previous experience or specialist knowledge is required.

SUPA will reimburse for travel to this course, but please complete the travel application form in advance. See page 6.

We expect that interest will be larger than the capacity for this course. Registering does not guarantee entry to the course. We will create a waiting list and admit students as space allows.

Software Carpentry (SUPASWC)

Status: Offered in 2026/27
Lecturer: Daniel Williams and Norman Gray
Institution: Glasgow
Delivery: In-person
Hours Equivalent Credit: 16
Assessment: Continuous Assessment

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. The course is practical, in the sense of describing how to work with specific tools, but we also make a point of discussing these in a wider context of good (reproducible!) scientific practice.

Researcher Development Framework

The Researcher Development Framework describes the knowledge, behaviours and attributes of successful researchers and encourages you to aspire to excellence through achieving higher levels of development. It is valuable for planning, promoting and supporting career development. Further information can be found online at: https://vitae.ac.uk/vitae-researcher-development-framework/

Plagiarism

While undertaking SUPA courses with assessment, you will be required to abide by your university's rules on plagiarism. Students will be subject to the disciplinary procedures of their university.