In our first year physics and astronomy modules we have students with various degree intentions. Some students are planning to complete a degree involving this School. Some are with our School just for this year, getting in some physics or astronomy education before specialising in another topic. Some may wish to change from physics towards another degree option, some may wish to change from another degree topic to physics or astronomy. Some may wish to keep options open between a degree in phys/astro and in another discipline. This document aims to give some advice on module choices for level two for session 2018-19 for students who are now considering a degree involving this School. Please also read the detailed programme requirements in the University’s Course Catalogue. *If you see any disagreement between the Course Catalogue please inform me – the Course Catalogue is normally the definitive document.*

To enter our second year physics modules having taken first year here, students will normally need to have passed (a grade of 7.0 or more) PH1011 Physics 1A, PH1012 Physics 1B, and MT1002 Mathematics. Those wishing to take an Astronomy 2 module will normally need, in addition, to have passed AS1001 Astronomy and Astrophysics 1 or PH1502 Gateway Skills 1A. If first year assessment has not gone as hoped, students are encouraged to communicate as soon as possible with their Adviser of Studies for guidance.

All students who wish to enter an honours degree programme in this School need to attain decently in PH2011 Physics 2A and PH2012 Physics 2B. Additionally, they need to have attained decently in a pair of 15 credit maths modules MT2501 Linear Mathematics and MT2503 Multivariate Calculus. Those students aiming for a degree in astronomy also do Astronomy AS2001 or AS2101 in second semester. Students aiming for, or wishing to keep open the possibility of, a joint degree in maths and physics as well as the BSc in Mathematics should do additional level two maths modules, either in the pure maths or the applied maths requirements as noted in the tables below. Other joint degrees have requirements for “their” modules. Students normally need 240 pre-honours credits, so a range of first and second year modules should be successfully passed by the end of second year. The regulations provided by the centre of the University state the requirements in more detail.

We list the most of the main options below, with the number of credits for that module in brackets.

**Physics, Theoretical Physics, Sem 1**
- PH2011 (30) 10 am, Physics 2A
- MT2503 (15) noon, Multivariate Calculus
- MT2501 (15) noon, Linear Maths

**Physics, Theoretical Physics, Sem 2**
- PH2012 (30) 10 am, Physics 2B
- Choice (30)

**Astronomy, Sem 1**
- PH2011 (30) 10 am, Physics 2A
- MT2503 (15) noon, Multivariate Calculus
- MT2501 (15) noon, Linear Maths

**Astronomy, Sem 2**
- PH2012 (30) 10 am, Physics 2B
- AS2001 (30) 11 am or possibly [AS2101 (15) 11 am and choice (15)]

**Physics & (Applied) Maths, Sem 1**
- PH2011 (30) 10 am, Physics 2A
- MT2503 (15) noon, Multivariate Calculus
- MT2501 (15) noon, Linear Maths

**Physics & (Applied) Maths, Sem 2**
- PH2012 (30) 10 am, Physics 2B
- MT2506 (15) 9 am, Vector Calculus
- MT2507 (15) noon, Maths Modelling
The Chemistry & Physics joint degree and the Computer Science and Physics degree requires a larger than normal number of credits in second year, unless one of the modules was taken in the year of entry.

There is not a clash between for example Linear Maths and Multivariate Calculus at noon in first semester, as these run on different days of the week.

The set of second year maths modules is

<table>
<thead>
<tr>
<th>Module Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT2501</td>
<td>Linear Maths, Either Sem 1 or Sem 2</td>
</tr>
<tr>
<td>MT2502</td>
<td>Analysis, Sem 1</td>
</tr>
<tr>
<td>MT2503</td>
<td>Multivariate Calculus, Sem 1</td>
</tr>
<tr>
<td>MT2504</td>
<td>Combinatorics &amp; Prob, Sem 1</td>
</tr>
<tr>
<td>MT2505</td>
<td>Abstract Algebra, Sem 2</td>
</tr>
<tr>
<td>MT2506</td>
<td>Vector Calculus, Sem 2</td>
</tr>
<tr>
<td>MT2507</td>
<td>Maths Modelling, Sem 2</td>
</tr>
<tr>
<td>MT2508</td>
<td>Statistical Inference, Sem 2</td>
</tr>
</tbody>
</table>
Choice of Degree Subject
At the end of level one you may have several degree options open to you, depending on what modules you have done this year. It is not unusual for students to choose on entry to honours a different programme to that which they stated on entry to the University - you may wish to reflect on which degree programme you most wish to do.

Are you going to be particularly interested in what is involved in a degree in physics, theoretical physics, astrophysics, mathematics, chemistry, materials science, computer science, philosophy, or various joint honours degrees involving these?

Do you wish to do a BSc honours degree or the (more advanced and longer) MPhys/MMath/ MSci “integrated masters” degree?

What sort of degree do you need for your career or future study wishes?

The single honours and joint honours degrees involving our School are as follows:-

- BSc Astrophysics
- BSc Physics
- BSc Physics and Computer Science
- BSc Physics and Philosophy
- BSc Physics and Mathematics
- MPhys Astrophysics
- MPhys Physics
- MPhys Theoretical Physics
- MPhys Theoretical Physics and Mathematics
- MSci Physics and Chemistry

We believe that these programmes all provide our students with interesting and useful learning opportunities and with the skills and knowledge that will open up a good range of career and postgraduate study opportunities.

We have some comments from our graduates about their careers in the Careers section of the School’s Students and Staff web page. The University Careers Centre has a wealth of information online. The UK Institute of Physics has some comments at [http://www.iop.org/careers/i-am-at-university/index.html](http://www.iop.org/careers/i-am-at-university/index.html) and the “prospects.ac.uk” web site allows you to look at careers options with your subject. Graduates from all our programmes have acquired a wide range of knowledge and skills in physics, mathematics, and IT skills that can make them attractive to research/development/sales in physics-based industry, medical physics, patent agencies, education, computing, financial services, etc. The more general graduate and professional skills that are developed as part of the degree programme also open up more general “any graduate” career options.

All our programmes can lead to post-graduate study for a PhD. If you know that you would like to do a PhD in a particular area (astronomy, physics, theoretical physics, etc) then it is probably worth considering doing a named degree in that area, but students who do well in their programme are likely to find that they can move from one area to another given the underlying core material that is in all of the programmes. A PhD can lead on to research work in universities or in industry, or a wider range of career opportunities inside or outside physics and astronomy.
Honours students have core modules and a set of modules from which they can choose, depending on the flavour of their degree programme. Our honours modules are informed by the research being carried out in the School in astrophysics, biophysics, condensed-matter physics, millimetre-waves, photonics, and theoretical physics, as well as on-going work on physics education. There are opportunities to get directly involved in this research. Our single- and joint-honours degree programmes are all accredited by the UK Institute of Physics.

The different programmes all have within them a set of modules that cover the core of physics. Thus all students will take modules covering Quantum Mechanics, Thermal & Statistical Physics, Electromagnetism, Nuclear and Particle Physics, and Computational Techniques. All students do additional work on mathematical techniques, either in our Maths for Physicists module or with the School of Mathematics and Statistics. All students do a final-year project. For those doing a single honours degree the project will often be with one of the School’s research teams running a particular investigation or development. All students doing a degree wholly within the School will take the module “Transferable Skills for Physicists”, in which they develop advanced research/professional skills at the same time as gaining credit for investigating areas of science of particular interest to them; students on the joint degrees with Mathematics, Computing and Philosophy do some of this work within an extended module that also includes nuclear and particle physics.

The astrophysics programmes apply these core ideas along with the material in second level astrophysics to investigate the universe around us. Computational, observational, and theoretical skills and knowledge are developed in this programme. A recent highlight was the discovery by students on the observational astrophysics module of a new extra-solar planet as part of their work.

The physics programmes provide a wide range of modules. Students on these programmes have a set of core modules and a wide choice of others. These are usually the programmes within the School with the most students. Students include in their honours programme two laboratory modules in which they can explore aspects of physics and develop relevant laboratory skills. In recent years several physics students have been in the top few in the UK or internationally in various “Physics Student of the Year” competitions, based primarily on the work in their final year projects.

The theoretical physics programme allows the development of mathematical physics to a high level. These students do not usually do the honours laboratory modules, but spend additional time on topics such as Special Relativity and Quantum Field Theory. A recent highlight was the international recognition of a student doing a theoretical physics project for his development of new ideas in invisibility cloaks.

So the first choice you have in our degree programmes is the degree title. Depending on the degree title there will be different modules that then become compulsory in your programme, as well as the core modules for all students mentioned above. In most cases there will also be a range of optional modules.

The single-honours degree programmes can have a fair amount of choice within them, primarily in SH and (where relevant) the M-year. This allows students to choose modules of particular interest to them. At level-four such choice modules may include Gravitational & Accretion Physics, Observational Astrophysics, Advanced Quantum Mechanics, Laser Physics, Physics of Music, Fluids, Signals & Coherence, Principles of Optics, and Communicating & Teaching Science. At MPhys level modules currently include Quantum Optics, Biophotonics, Foundations of Quantum Mechanics, General Relativity, Monte-Carlo Radiation Transport Techniques, Contemporary Astrophysics, Nanophotonics, and Magnetofluids & Space Plasmas, amongst others.

The joint degree programmes allow students to spend about half their time in physics and about half their time on another subject. This can allow good access to work at the interfaces between disciplines. The MSci
Chemistry and Physics students spend JH doing entirely Chemistry modules and SH entirely Physics. The fifth year is a combination. The joint degrees with Mathematics are also popular, and the two Schools continue to work together to allow students to create a useful joint programme as readily as is possible with the wide choice of modules that can be available in maths. Those students with an interest in philosophy can take the joint degree with that school, developing their ways of thinking and looking at the world from both a physical and a philosophical viewpoint.

Doing a joint degree necessarily means that there is less time available for phys/astro study due to having only about half the honours credits from this School. For the MSci Chemistry and Physics the physics modules taken before level-five are almost fixed, and shown later in this document. The BSc Philosophy and Physics programme has the physics content of JH defined, but there is room for some choice of physics modules in SH, as shown in a later table. The BSc joint degree with maths has some choice of PH modules in the final semester, and a choice of Maths or Physics for the project area. The MPhys joint degree with Maths has some choice of physics modules in SH, and a wider choice in the MPhys year, where students can choose to do a project in either mathematics or theoretical physics. The reduced choice of PH modules in joint degrees is of course balanced by the introduction of relevant and interesting modules from the other discipline.

All of our degree courses should develop the thinking, numeracy, research, and problem-solving skills that are crucial to many future career opportunities, and for PhD study. When considering which of our programmes you may wish to do, please consider which you are going to find most interesting.

**Module Choices**

Some programmes allow room for choice modules in second year. The choice of modules is up to the student’s interests and future study and career plans, whether or not they have the module’s pre-requisite qualifications, and what fits in the University’s timetables. Advisers of Studies are not really in a position to advise what might be most interesting or useful (or easy) for a given student. It may be useful to try to keep open more than one degree option, and your choice of modules can be important for this. Please look at the range of modules that is available across the University. Additional mathematics is likely to be useful in a physics degree; chemistry and computing modules may also be well aligned with a degree in the School. But some students may wish to take for example science methods, scientific thinking, philosophy, music, or economics modules to broaden their degree experience.

Students normally take 120 credits in second year, except for those in the joint degrees with Chemistry and with Computer Science, who may be required to take 150. It is not recommended to take more than the normal number of credits in the year.

**Pre-advising**

All students are asked to take part in the pre-advising process that happens from shortly after Spring break or at the start of the summer. We accept that students may still choose different modules and programmes when it comes to advising at the start of second year, but it is still very helpful to have the pre-advising process completed. This means that students have considered which programme and modules they wish to do, and have had the chance to talk with their adviser and others about this, well in advance of the busy start to the new session. It means that the University has a better idea about how many students will be in different classes, thus allowing appropriate rooms to be booked.

Students are asked to realise that choosing their modules is an important responsibility. You should check degree requirements for your intended honours programme(s), as shown in the University Course Catalogue.
and/or the relevant School literature. The normal procedure would be for you to fill in your module choice online and then to get this approved during the 10-15 minutes advising meeting in September. Please bear in mind that second year module choices have major implications for the rest of your degree programme. 
https://www.st-andrews.ac.uk/students/academic/academic-advising/events/advising/

Advising
The September consultation period is organised as follows. First get acquainted with the University and School Orientation Week timetable – it has a number of interesting events, and provides you with various bits of useful information. Note: you are supposed to be present in St. Andrews during all of the Orientation week. During this week some days are allocated for advising meetings, and the Thursday and Friday for the start of teaching. The advising meetings are normally run by the respective Adviser of Studies in his/her office. Each student normally meets their Adviser for 10-15 minutes, although additional appointments may be made if needed. You should book your place on a sign-up sheet which has defined time slots. The sign-in sheets are available on the main academic notice board or on the office door of the Adviser, or via an on-line tool. Please look at emails from your adviser or the noticeboard to see which your adviser is going to use. Make sure that you sign in in time, as there is only a limited amount of time allocated for Advising by the University. You may be faced with late matriculation fees otherwise. Your module choices can be approved only after you have seen your Adviser IN PERSON, and you can matriculate only after this has happened.

Preparation
The work that you did in first year in your core physics, mathematics (and where appropriate Astrophysics) is going to be important for your studies in second year. We suggest that you spend some time over the summer working on the material you covered in first year, including making summary sheets of key ideas, working on tutorial sheets, etc. The studies you do here we wish and need to make for the long term. The more familiar you are with ideas, the more your brain can “chunk” multiple ideas in to one concept, and reduce the load on working memory as you study things in the future.

Additional Information
The School’s Pre-Honours and Honours handbooks will be updated during the summer, and will be made available on line. We are not expecting any major changes in the physics and astronomy modules at second year, though depending on numbers we may introduce one more afternoon from which to choose your selected afternoon a week on workshop and lab. We are currently discussing possible developments on the computing component of the module.

Your adviser of studies will be happy to answer queries you may have.

Bruce Sinclair 25.6.18

Updated with section on “Module Choices” 26.6