

# LOOKING FORWARD TO YEAR 2

Henrique Araújo, Head of Year 2

22 May, 2024

# YEAR 2 AT A GLANCE

Total of 60 (62.5) ECTS including “core modules” and “options”

## Core modules (3+1)

- Quantum Physics
- Thermal Physics & Structure of Matter
- Differential Equations & Electromagnetism
- Advanced Practical Physics (Lab & Computing)

*Underpins all modern physics*

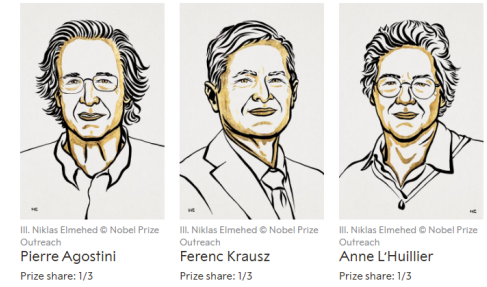
*Energy & environment, solid state devices, ...*

*Delving into another fundamental force*

*Physics is an experimental science at heart!*

## Options (3)

- Two physics options from:
  - Sun, Stars & Planets
  - Environmental Physics
  - Communicating Physics
  - Maths Methods (core for BScT/MSciT)
- One iExplore option → Imperial Horizons, Business for Professional Engineers and Scientists (BPES)



The Nobel Prize in Physics 2023 was awarded to Pierre Agostini, Ferenc Krausz and Anne L'Huillier "for experimental methods that generate attosecond pulses of light for the study of electron dynamics in matter"

# TIMETABLE

- A week in the life of a Year 2 student: core modules, seminars and tutorials

Week 1 02-Oct	Lectures	Time	Mon - 2	Tues - 3	Wed - 4	Thur - 5	Fri - 6	Notes			
		09-10	Comm Phys Training Day					Seminar:			
		10-11						Y2 Welcome & Lab	Assessments:		
		11-12									
		12-1									
	Other:	1-2				Quantum Physics		Quantum Physics		Problem sheets:	
	2-3	Structure of Matter									Structure of Matter
	3-4										
4-5											
5-6											

Week 2 09-Oct	Lectures	Time	Mon - 9	Tues - 10	Wed - 11	Thur - 12	Fri - 13	Notes				
		09-10	Sun, Stars & Planets	Lab (ABCDEF1E2) )		Lab (ABCDEF1E2) )	YA Language Classes	Seminar: TPSoM				
		10-11						S (ABC)	Student-Staff Social 12:30-14:00	Assessments:		
		11-12		S (DEF)								
		12-1		Time available for Personal Tutorials				Time available for Personal Tutorials				
	Other:	1-2				Quantum Physics			Time available for Personal Tutorials			
	P. Tut Week	2-3									Structure of Matter	Problem sheets:
		3-4										
4-5		Differential Equations										
5-6			Quantum Physics									

Week 3 16-Oct	Lectures	Time	Mon - 16	Tues - 17	Wed - 18	Thur - 19	Fri - 20	Notes				
		09-10	Sun, Stars & Planets	Lab (ABCDEF1E2) )		Lab (ABCDEF1E2) )	YA Language Classes	Seminar: QP				
		10-11						Time for AT (G-L)	S (ABC)	Time for AT (DEF)	Assessments:	
		11-12		Time for AT (ABC)				S (DEF)				
		12-1										Time for AT (ABC)
	Other:	1-2				Differential Equations						
	Ac. Tut Week	2-3							Structure of Matter			
		3-4										
4-5		Differential Equations										
5-6			Quantum Physics									

	Lectures	Time	Thur - 19	Fri - 20	Notes						
		09-10	Sun, Stars & Planets	YA Language Classes	Assessments:						
		10-11				S (GHI)	Problem sheets:				
		11-12						Time for AT (JKL)			
		12-1							Time for AT (GHI)		
	Other:	1-2				Quantum Physics					
	Ac. Tut Week	2-3								Structure of Matter	Differential Equations
		3-4									
4-5		Differential Equations									
5-6			Quantum Physics								

# TIMETABLE

- A week in the life of a Year 2 student: Advanced Practical Physics (Laboratory)

Week 1 02-Oct	Lectures	Time	Mon - 2	Tues - 3	Wed - 4	Thur - 5	Fri - 6	Notes					
		09-10	Comm Phys Training Day					Seminar:					
		10-11											
		11-12											
		12-1											
	Other:	1-2									Y2 Welcome & Lab		Assessments:
		2-3											
		3-4									Quantum Physics	Quantum Physics	Problem sheets:
		4-5				Structure of Matter	Structure of Matter						
		5-6											

Week 2 09-Oct	Lectures	Time	Mon - 9	Tues - 10	Wed - 11	Thur - 12	Fri - 13	Notes	
		09-10	Lab (ABCDE1E2 )	Lab (GHUL1L2)		S (GHI)	Lab (GHUL1L2)	Seminar:	
		10-11						S (ABC)	S (JKL)
		11-12		S (DEF)					
		12-1		Sun, Stars & Planets			Student-Staff Social 12:30-14:00	YA Language Classes	Assessments:
	Other:	1-2		Time available for Personal Tutorials					
	P. Tut Week	2-3	Quantum Physics			Sun, Stars & Planets	Time available for Personal Tutorials		
		3-4	Structure of Matter			Structure of Matter		Problem sheets:	
		4-5	Horizons		Differential Equations		Quantum Physics		
		5-6			Quantum Physics	Time available for Personal Tutorials	Differential Equations		

Week 3 16-Oct	Lectures	Time	Mon - 16	Tues - 17	Wed - 18	Thur - 19	Fri - 20	Notes	
		09-10	Lab (ABCDE1E2 )	Lab (GHUL1L2)		S (GHI)	Lab (GHUL1L2)	Seminar:	
		10-11						S (ABC)	S (JKL)
		11-12		Time for AT (G-L)		Time for AT (ABC)			
		12-1		Sun, Stars & Planets		Time for AT (DEF)	Time for AT (JKL)	Time for AT (GHI)	Assessments:
	Other:	1-2					YA Language Classes		
	Ac. Tut Week	2-3	Quantum Physics			Sun, Stars & Planets			
		3-4	Structure of Matter			Structure of Matter		Problem sheets:	
		4-5	Horizons	Differential Equations		Staff community & department interaction time	Quantum Physics		
		5-6		Quantum Physics			Differential Equations		

# TIMETABLE

- A week in the life of a Year 2 student: socials, optional talks, personal tutor meetings,...

Week	Lectures	Time	Mon	Tues	Wed	Thur	Fri	Notes				
Week 1 02-Oct		09-10	Comm Phys Training Day					Seminar:				
		10-11										
		11-12										
		12-1										
	Other:	1-2								Y2 Welcome & Lab		Assessments:
		2-3										
		3-4									Quantum Physics	Quantum Physics
	4-5				Structure of Matter	Structure of Matter						
	5-6											
Week 2 09-Oct		09-10	Lab (ABCDE1E2)	S (ABC)		S (GHI)	Lab (GHIJ1L2)	Seminar:				
		10-11										
		11-12										
		12-1						Sun, Stars & Planets	S (DEF)			TPSoM
	Other:	1-2				Student-Staff Social 12:30-14:00		Assessments:				
	P. Tut Week	2-3	Quantum Physics	Time available for Personal Tutorials			Sun, Stars & Planets	YA Language Classes				
		3-4	Structure of Matter				Structure of Matter	Time available for Personal Tutorials	Problem sheets:			
	4-5	Horizons	Differential Equations			Quantum Physics						
	5-6		Quantum Physics		Time available for Personal Tutorials	Differential Equations						
Week 3 16-Oct		09-10	Lab (ABCDE1E2)	S (ABC)		S (GHI)	Lab (GHIJ1L2)	Seminar:				
		10-11						Time for AT (G-L)				QP
		11-12							S (DEF)	Time for AT (ABC)		
		12-1						Sun, Stars & Planets		Time for AT (GHI)		Assessments:
	Other:	1-2						YA Language Classes				
	Ac. Tut Week	2-3	Quantum Physics				Sun, Stars & Planets					
		3-4	Structure of Matter				Structure of Matter		Problem sheets:			
	4-5	Horizons	Differential Equations			Quantum Physics						
	5-6		Quantum Physics		Staff community & department interaction time	Differential Equations						

# TIMETABLE

- Advanced Practical Physics (Computing): at the end of Term 3, after exam season

**TERM 3**

Week 1					Week 2					Week 3					Week 4					Week 5					Week 6					Week 7					Week 8					Week 9									
M	T	W	T	F	M	T	W	T	F	M	T	W	T	F	M	T	W	T	F	M	T	W	T	F	M	T	W	T	F	M	T	W	T	F	M	T	W	T	F	M	T	W	T	F	M	T	W	T	F
29/04/2024	30/04/2024	01/05/2024	02/05/2024	03/05/2024	06/05/2024	07/05/2024	08/05/2024	09/05/2024	10/05/2024	13/05/2024	14/05/2024	15/05/2024	16/05/2024	17/05/2024	20/05/2024	21/05/2024	22/05/2024	23/05/2024	24/05/2024	27/05/2024	28/05/2024	29/05/2024	30/05/2024	31/05/2024	03/06/2024	04/06/2024	05/06/2024	06/06/2024	07/06/2024	10/06/2024	11/06/2024	12/06/2024	13/06/2024	14/06/2024	17/06/2024	18/06/2024	19/06/2024	20/06/2024	21/06/2024	24/06/2024	25/06/2024	26/06/2024	27/06/2024	28/06/2024					

	B					B																																												
EXAMS	E	E	E	E	E																																													
COMPUTING											R					HI	R				HI																													
POSTER EXHIBITION																																																		
COMM PHYS (EL)																																																		
OTHER																																																		

BBQ TBC

# LECTURES, SEMINARS & TUTORIALS

## Lectures

- “Live” in LT1 for core courses
- Office Hours are mostly “salon style”

## Seminars

- Weekly, covering topics from the three core modules
- Tables per small group of 5-6 students
- Be amazed how multiple heads think better than one...

## Academic Tutorials

- 5 per term, also in small groups
- Typically cover problem sheets, but can propose topics

## TERM 1 SEMINARS

Week	Subject
2	Structure of Matter (TPSoM)
3	Quantum Physics (QP)
4	Structure of Matter (TPSoM)
5	Quantum Physics (QP)
6	Differential Equations (DEEM)
7	Quantum Mechanics (QP)
8	Thermal Physics (TPSoM)
9	Quantum Mechanics (QP)
10	Differential Equations (DEEM)
11	Thermal Physics (TPSoM)

# PHYSICS OPTIONS

**Sun, Stars and Planets:** Term 1, with exam in Term 3

**Mathematical Methods:** Term 2, with exam in Term 3

**Environmental Physics:** Term 2, with exam in Term 3

**Communicating Physics:** Terms 1 and 2; assessments end of Term 2 (Presentation) and start of Term 3 (Formal Report). This module is capped at 20 students and has additional application process.

## Requirements

F303 and F303 – two Physics electives required

F325 and F390 – Maths Methods and one other Physics elective required

F309 – two Physics electives required

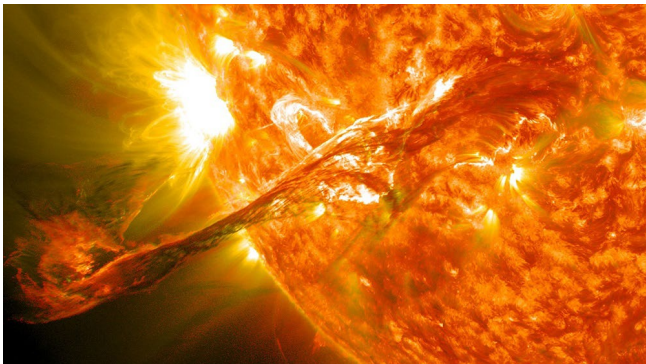
I-Explore module does not count towards degree mark, but you must pass for credit.



# SUN, STARS & PLANETS (20 LECTURES, TERM 1)

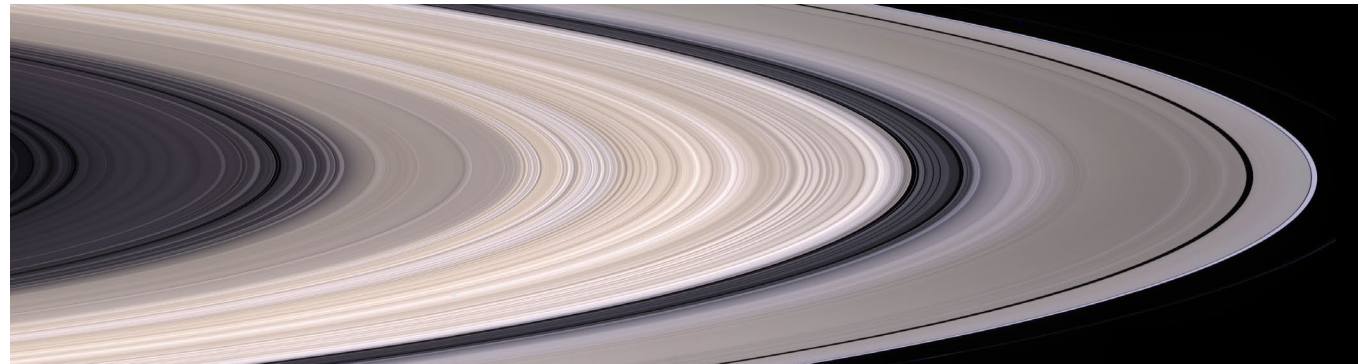
## STARS

- How do we model the interior of stars?
- How can we use the physics you already know to derive the equations of stellar structure?
- How do stars shine?
- What can we learn from stellar spectra?
- Why are there different types of stars?
- How can we understand the Sun's atmosphere?
- How can we learn about stars?  
What is their mass, temperature, lifetime?



## PLANETS

- How did the solar system form?
- Why are the planets' surfaces so varied?
- Why do we see the range of planetary atmospheres in the solar system?
- How do moons form and why are there ring systems?
- How do we find exoplanets around other stars?
- What are the currently known exoplanets like?
- What makes a habitable planet?



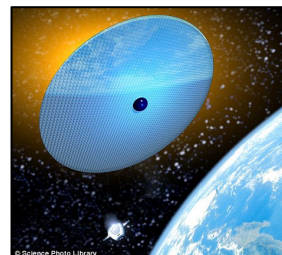
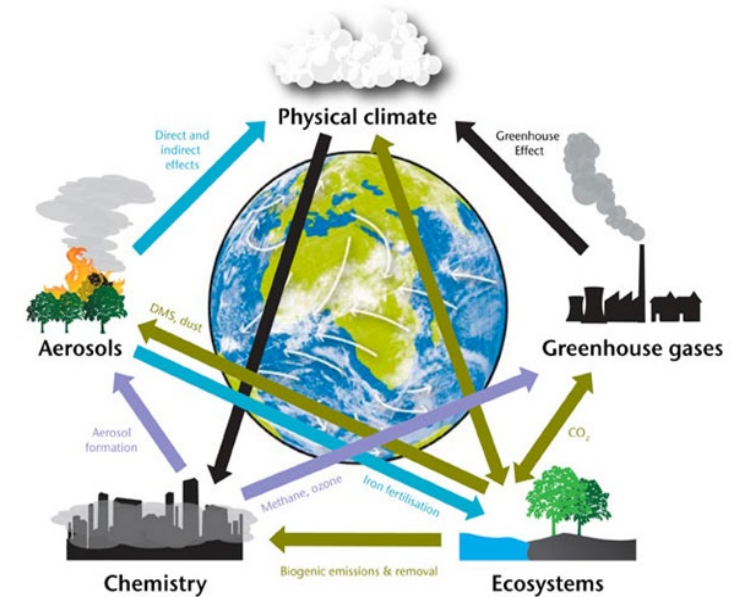
# ENVIRONMENTAL PHYSICS (16 LECTURES, TERM 2)

Humanity is facing a climate emergency: hydrocarbons, predominantly from fossil fuel burning, have altered the composition of the Earth's atmosphere, something which is having marked consequences now!

- This problem has the potential to massively disrupt our society
- The problem has its root in science and technology
- Science and technology could provide solutions to the underlying problem

## Environmental Physics

- Identifying the physical problem: why is the climate changing and how?
- Understanding the physical and societal issues: interdependencies between different variables, non-linear feedbacks, solutions must 'work' within socio-economic constraints
- Providing evidence-based physical solutions given an understanding of the consequences of the choices made: are they sustainable?



# MATHEMATICAL METHODS (22 LECTURES, TERM 2)

The module covers several mathematical techniques fundamental for performing computations across physics and necessary for a proper formulation of its foundations:

- **Calculus Of Variations:** Euler-Lagrange equation as a stationarity condition; Hamilton's Principle (Lagrangian mechanics); generalised coordinates and momenta, cyclic coordinates; Lagrangian for a charged particle using scalar and vector potentials; Lagrange multipliers; isoperimetric problems; Geodesics and the metric tensor.
- **Complex Variables:** Complex differentiation, analytic functions, Cauchy-Riemann equations, entire functions; Complex integration, Cauchy's integral formula and applications, Taylor's theorem; poles and branching points; Residue theorem and application to computing real integrals.
- **Fourier Transforms:** Review of Fourier transforms and Fourier integrals, computation of Fourier transforms using contour integration. Heaviside and sign function, delta function and Green's functions. Application of Fourier transforms to solving linear ODEs and PDEs.
- **Tensors:** Definition of vectors via their transformation properties, cartesian tensors, tensor algebra, contraction of tensor indices. Vectors and pseudo-vectors (or polar and axial vectors), cartesian tensors, LeviCivita symbol, cross product, grad, div, curl and Laplacian. Physical examples of Cartesian tensors. Contravariant and covariant vectors.
- **Numerical Methods:** Numerical integration (trapezium rule and Simpson's rule), Newton-Raphson method, Runge-Kutta algorithm.

# COMMUNICATING PHYSICS (TERMS 1+2)

Dr Michael Fox will talk to you about this module

# I-EXPLORE

I-Explore is a broad portfolio of degree credit modules that provides an opportunity for you to broaden your knowledge and tackle a subject area outside of your core discipline.

The module you take will be integrated into your programme and will count for credit towards your degree.

“The module preference selection period this year is **1-29 May 2024**. Eligible students will receive an email inviting them to enroll.”

Google “Imperial i-Explore” to find out more

## Module Options for Year 2 students 2024-25

### Autumn term only

#### 10 week - Multidisciplinary Project

- [Multidisciplinary Group Project](#)

#### 10 week - STEMM modules

- [Climate Change: Science and Solutions](#)
- [Mathematical Mysteries](#)
- [Origins](#)
- [Personalised Medicine: Hope or Hype?](#) (Term 1 Iteration)
- [Public Engagement: Connecting audiences and research](#)
- [The Science of Learning](#)

#### 10 week - BPES modules

Please note that module outlines below are provided as PDF documents. If you have any difficulty accessing these documents, please contact the [BPES team](#).

- [Accounting Online \[pdf\]](#)
- [Business Economics \[pdf\]](#)
- [Entrepreneurship Online \[pdf\]](#)
- [Managerial Economics Online \[pdf\]](#)

If you wish to choose a BPES module, please ensure you are available during the [BPES examination week](#). Examinations cannot be rescheduled to accommodate specific students' availability.

### Spring term only

#### 10 week - STEMM modules

- [Clinical Engineering and Surgical Robotics](#)
- [Interdisciplinary Research Computing](#)
- [Personalised Medicine: Hope or Hype?](#) (Term 2 Iteration)
- [Researching Academic Integrity in an Artificial Intelligence Driven World](#)
- [Science, Cooking and Performance](#)
- [Space Mining](#)
- [The Science of Crowds](#)

#### 10 week - BPES modules

Please note that module outlines below are provided as PDF documents. If you have any difficulty accessing these documents, please contact the [BPES team](#).

- [Corporate Finance Online \[pdf\]](#)

If you wish to choose a BPES module, please ensure you are available during the [BPES examination week](#). Examinations cannot be rescheduled to accommodate specific students' availability.

### Autumn & Spring term

#### 20 week - Imperial Horizons modules

##### Change Makers

- [Global Village: Innovation Challenge](#)
- [Global Village: Visual Arts Challenge](#)
- [My World: Be Happy](#)
- [Perspectives on Time and History \(NEW\)](#)

##### Humanities & Social Sciences

- [Advances in Modern Psychology](#)
- [Business & Economic Ideas](#)
- [Creative Writing](#)
- [Dynamics of Imagery in Arts and Design](#)
- [Humanities Project \(Year 2\)](#)
- [Law & Professional Ethics for Science & Technology](#)
- [Mind, Self & Social World: Philosophy & the Human Sciences](#)
- [Music Technology \(Year 2\)](#)
- [Politics](#)
- [Practical Art: Drawing from Observation \(NEW\)](#)
- [Revolutions & the Making of the Modern World](#)
- [Science Communication](#)
- [The Digital Transformation: Economics, Organisations, Society](#)
- [Why be good? Problems in the Philosophy of Morality](#)

##### Languages

Please note that for students in their I-Explore year, language modules can only be taken at Level 2 or above. Students are only permitted to take the language levels offered to their year group.

- [Arabic Level 2](#)
- [British Sign Language Level 2](#)
- [French Levels 2 - 5](#)
- [German Levels 2 - 5](#)
- [Italian Level 2 - 3](#)
- [Japanese Levels 2 - 3](#)
- [Korean Level 2](#)
- [Mandarin Levels 2 - 3](#)
- [Russian Level 2](#)
- [Spanish Levels 2 - 5](#)

# OPTIONS SELECTION

Blackboard: [Physics Yr1 Undergraduate \(2023-2024\)](#) >> **Year 2 Electives (2024-25)**

See module specs in usual place: google “imperial physics undergraduate courses” >> year 2

Preview Test: Year 2 Electives 2024-25

**Test Information**

Question Completion Status:

**Select by 14<sup>th</sup> June 5pm!**

**QUESTION 1**

Select Two Modules from the list below.

- Mathematical Methods
- Communicating Physics
- Sun, Stars & Planets
- Environmental Physics

10 points

Click Save and Submit to save and submit. Click Save All Answers to save all answers.

**Module specifications - internal only**

	Year 1	Year 2	Year 3	Year 4 / Masters	
<b>Year 2 (FHEQ 5) Modules</b>					
Module Title	Module Code	FHEQ Level	ECTS	Term(s)	Lecturer(s)
<a href="#">Advanced Practical Physics</a>	PHYS50001	5	10	Terms 1, 2 and 3	Dr Michael Fox
<a href="#">Thermal Physics &amp; Structure of Matter</a>	PHYS50002	5	10	Terms 1, 2 and 3	Dr Lorenzo Matteini
<a href="#">Differential Equations &amp; Electromagnetism</a>	PHYS50003	5	10	Terms 1, 2 and 3	Prof Alan Heavens
<a href="#">Quantum Physics</a>	PHYS50004	5	15	Terms 1, 2 and 3	Dr Steve Kolthammer
<a href="#">Communicating Physics</a> (elective)	PHYS50005	5	5	Terms 1, 2 and 3	Dr Mark Richards
<a href="#">Sun, Stars &amp; Planets</a> (elective)	PHYS50006	5	5	Term 1	Prof Juliet Pickering
<a href="#">Mathematical Methods</a> (elective - F300, F303 and F309, Core - F325 & F390)	PHYS50007	5	5	Term 2	Prof Dmitry Turaev
<a href="#">Environmental Physics</a> (elective)	PHYS50008	5	5	Term 2	Prof Helen Brindley

# HAVE A GREAT YEAR 2!



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not actual Year 2 footage....