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Imperial Physics Postgraduate Taught Programmes

Professor Toby Wiseman, Director of Postgraduate Taught Studies

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Plan

- Quick introduction and some practical details
- Introduction to the master's courses
- Q & A

- Slides and recording will be available at: https://www.imperial.ac.uk/physics/students/postgraduate-admissions/open-days/

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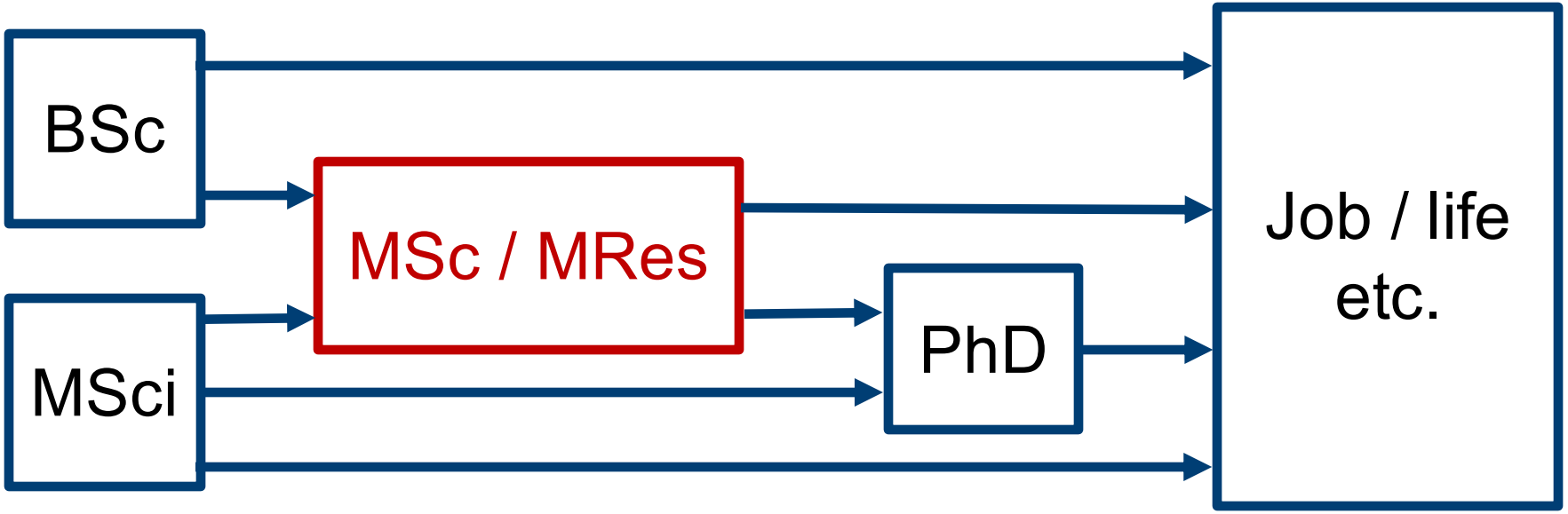
Pathways through higher education



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Physics Taught Programmes at Imperial

- 3-year BSc (180 ECTS)
- 4-year MSci (240 ECTS)
- 12-month MSc or MRes (90 ECTS)
- 2 x 9-month MSc with Extended Research (120 ECTS)

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There are 6 Physics PGT programmes

1. Physics MSc three streams:
    I. physics MSc
    II. with Quantum Dynamics
    III. with Extended Research (2 x 9 months)
    IV. with Fusion and Plasma Physics (NEW!)
2. MSc Optics & Photonics (O&P) and MRes Photonics
3. MSc Quantum Field & Fundamental Forces (QFFF)
4. MRes Machine Learning & Big Data (MLBD)
5. MRes Soft Electronic Materials (SEM)
6. MSc Security & Resilience: Science & Technology (SRST)

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There are 6 Physics PGT programmes

1. Physics MSc + three specialised streams:
   I. physics MSc
   II. with Quantum Dynamics
   III. with Extended Research (2 x 9 months)
   IV. with Fusion and Plasma Physics (NEW!)
2. MSc Optics & Photonics (O&P) and MRes Photonics
3. MSc Quantum Field & Fundamental Forces (QFFF)
4. MRes Machine Learning & Big Data (MLBD)
5. MRes Soft Electronic Materials (SEM)
6. MSc Security & Resilience: Science & Technology (SRST)

MSc vs MRes

- MSc*: ~2/3 taught/practical modules, ~1/3 research project (June-September)
- MRes: ~1/3 taught/practical, modules, ~2/3 research project (January-September)

* MSc Physics with Extended Research programme is ~50:50

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Programme Directors

Prof Stephen Warren
MSc Physics,
MSc Physics with Extended Research

Prof Ben Sauer
MSc Physics with Quantum Dynamics (QD)

Dr Robert Kingham and Dr Yasmin Andrew
MSc Physics with Plasma Physics and Fusion (PPF)

MSc Physics and streams

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Programme Directors

Prof Andrew Tolley
MSc Quantum Fields and Fundamental Forces (QFFF)

Profs Chris Dunsby and Mark Neil
MSc Optics & Photonics (O&P)
MRes Photonics

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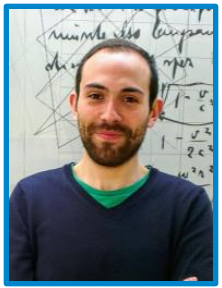
Programme Directors

Dr Bill Proud
MSc Security and Resilience: Science and Technology (SRST)



Prof David Colling and Dr Nick Wardle
MRes Machine Learning and Big Data (MLBD)

Dr Piers Barnes
MRes Soft Electronic Materials (SEM)

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Practical details

Tuition fees

- Details vary by programme (see College website); as an example, for 2026 entry to the MSc Physics it's £16,800 for Home students and £38,900 for Overseas students

Scholarships

- Master's-level scholarships are few and far between, but worth checking specific schemes on the College scholarships website and sources in your home country

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Practical details

Entry requirements

- Varies by programme, so check individual programme webpages
  - 1st class for Physics MSc and QFFF
  - 2:1 for O&P, MLBD, SEM, SRST
  - More details at: https://www.imperial.ac.uk/study/courses/

Applications

- Apply online through the College online application portal: https://www.imperial.ac.uk/study/apply/postgraduate-taught/

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Practical details

Why do an MSc/MRes?

- Specialist study/training in a particular topic
- Preparation for particular further research or employment
- Substantial research project component

[MSci] vs [BSc + MSc/MRes] vs [MSci + MSc/MRes]?

- depends on your personal, professional & academic goals
- financial considerations (loans, living costs etc)
- visa implications for international students (eg, switching MSci to BSc)

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Further information

- **Programme information**
  https://www.imperial.ac.uk/physics/students/postgraduate-admissions/master-level-programmes/

- **Programme handbooks (2025)**
  https://www.imperial.ac.uk/physics/students/current-students/taught-postgraduates/

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Further information

- **Fees and funding** https://www.imperial.ac.uk/students/fees-and-funding/
- **International Student Support** https://www.imperial.ac.uk/students/international-students/
- **International Student Support** https://www.imperial.ac.uk/study/fees-and-funding/scholarships-search/

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Imperial Physics
Postgraduate Taught Programmes

Some more detailed information slides from each programme

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Physics MSc at Imperial College

Stephen Warren, Director Physics MSc

MSc Physics (12 month)

MSc Physics with Quantum Dynamics (12 month)

MSc Physics with Fusion and Plasma Physics (NEW) (12 month)

MSc Physics with Extended Research (2x9 month)

MSc Programme Structure

Quantum Dynamics and Fusions streams are similar – main difference is fewer electives (more compulsory)

Component	Term	ECTS
Compulsory: ACP and Maths Methods	1	7.5 + 7.5
4 electives: no more than two at level 6 (inc. ACP)	1 & 2	30
Self study project	1 or 2	7.5
Research Computing Skills	1 & 2	7.5
Professional Skills (Graduate School)	1 & 2	
Research project (**Extended Research stream**)	3 **(year 2)**	30 **(60)**
Total (**Extended Research stream**)		90 **(120)**

MSc Physics Projects

- Three month or nine month (extended research stream) full time research project in association with a research group.
- May be hosted at Imperial or off site (e.g. at the NPL, RAL, Culham etc.) with an additional Imperial co-supervisor.
- For MSc with Quantum Dynamics – project must be in the field.
- MSc projects can be individual or with a partner

Entry requirements

- Require 1st Class Honours
- Usually in Physics
- Engineering/Maths may be acceptable provided degree included significant physics content

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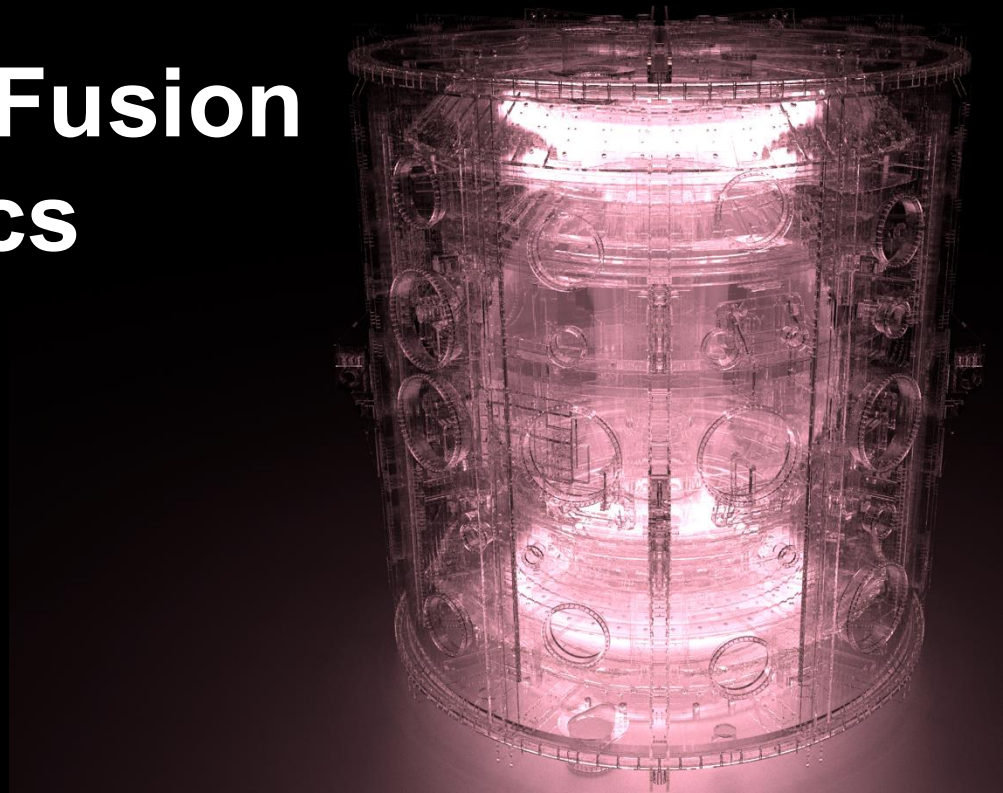
Department of Physics

MSc Physics with Fusion and Plasma Physics



MSc Physics with fusion and plasma physics

Core modules

- Advanced Theoretical Plasma Physics
- Inertial Confinement Fusion
- Magnetic Confinement Fusion
- Mathematical Methods for Physicists
- Plasma Physics
- Research Methods for Plasma Physics
- Statistical Methods for Experimental Physics
- Research Project
- Self-Study Project

Deepen your knowledge of plasma physics and its application to fusion to prepare for a research career

You can choose one or two optional modules – from a broad set common to MSc Physics – to the value of at least 7.5 ECTS.

https://www.imperial.ac.uk/physics/students/current-students/taught-postgraduates/

Course structure

More details

Module Title	Type	Term	% Exam	% Coursewk	% Practical	ECTS
Mathematical Methods for Physicists	Compulsory	Autumn	80%	20%		7.5
Plasma Physics	Compulsory	Autumn	100%			7.5
Statistical Methods for Experimental Physics	Compulsory	Autumn	80%	20%		7.5
Self-Study Project	Compulsory	Autumn	80%	20%		7.5
Research Methods for Plasma Physics	Compulsory	Autumn/Spring	0%	100%		7.5
Advanced Theoretical Plasma Physics	Compulsory	Spring	100%			5.0
Inertial Confinement Fusion	Compulsory	Spring	100%			5.0
Magnetic Confinement Fusion	Compulsory	Spring	100%			5.0
MSc Research Project	Core	Spring/Summer		65%	35%	30.0
either 2x 5 ECTS, e.g., Hydrodynamics	Elective	Spring	100%			10.0
or 1x 7.5 ECTS, e.g., Space Physics	Elective	Spring	95%	5%		7.5

← **92.5 ECTS total**

← **90 ECTS total**

Note: 1 ECTS ~ 20 hours of total study (contact + independent).

Specialised fusion and plasma physics modules
Overview

Research Methods for Plasma Physics

Gain practical experience with essential simulation tools in plasma physics research while improving your Python skills. Develop a clear understanding of key experimental diagnostics for plasma measurement and learn how to effectively analyse experimental data.

Advanced Theoretical Plasma Physics

Study the basic topics of plasma physics in a more detailed and mathematical way. Create advanced theoretical methods to improve the quantitative analysis of plasma physics needed for research.

Inertial Confinement Fusion

Explore the advanced plasma physics concepts specific to laser-driven fusion and the associated fields of shock physics and high-energy density physics.
Uncover the connections to laboratory astrophysics and high-intensity laser plasmas.

Magnetic Confinement Fusion

Dive into the advanced plasma physics concepts specific to tokamaks, stellarators, and other magnetic confinement devices.

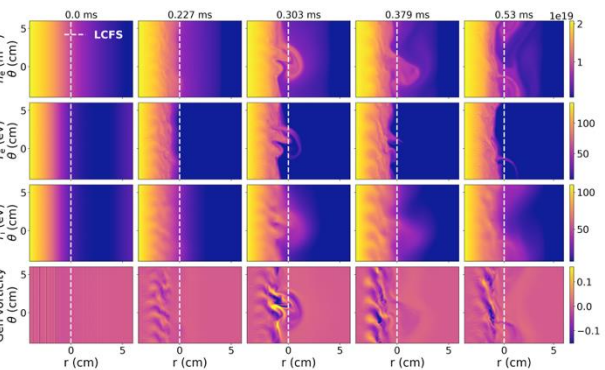
This module includes particle confinement, magnetic equilibrium and stability, and plasma-surface interaction.

MSc PFPP Co-directors

Dr. Yasmin Andrew

Blackett 308C
y.andrew@imperial.ac.uk

https://profiles.imperial.ac.uk/y.andrew



Dr. Robert Kingham

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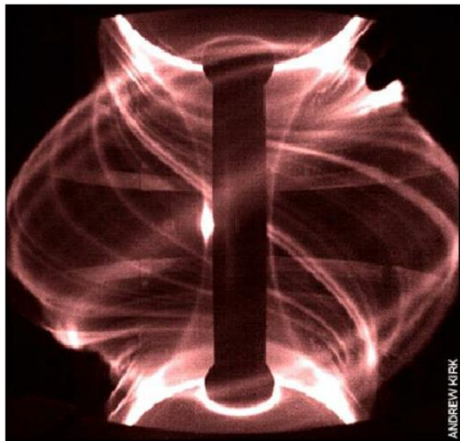

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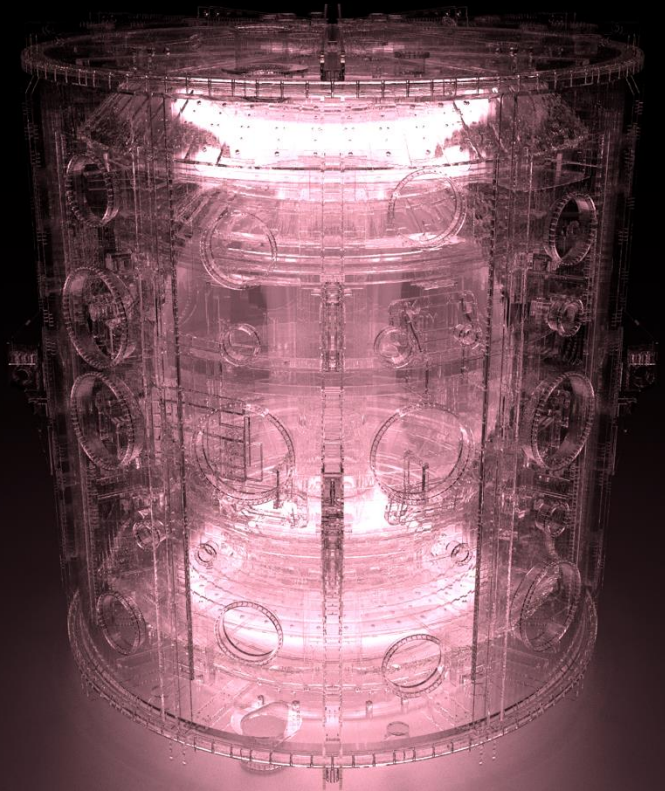
Department of Physics

Learn more about studying MSc Fusion and Plasma Physics:



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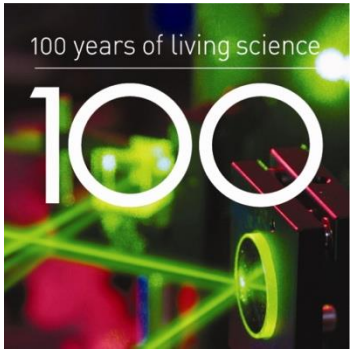
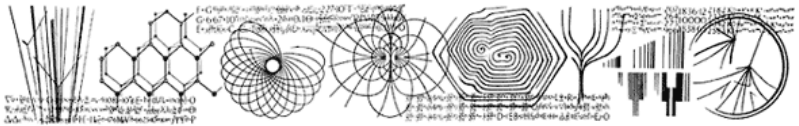
MSc Optics and Photonics and MRes Photonics



Course co-directors: Chris Dunsby, Mary Matthews James McGinty and Mark Neil,

Department of Physics PG event
December 2025

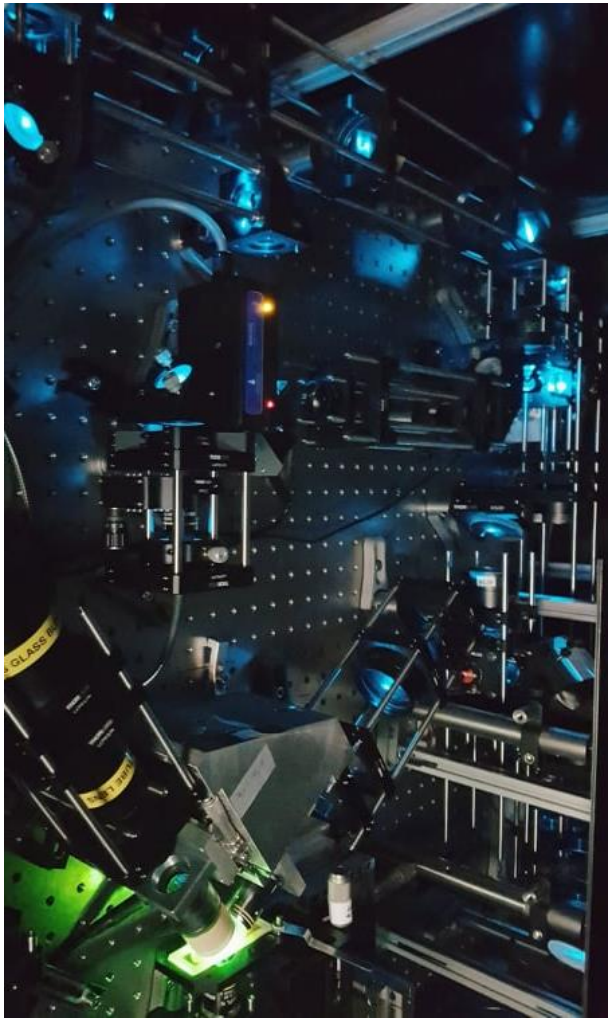
Light Community, Department of Physics
Imperial College London
www.imperial.ac.uk/research/photonics



MSc Optics and Photonics

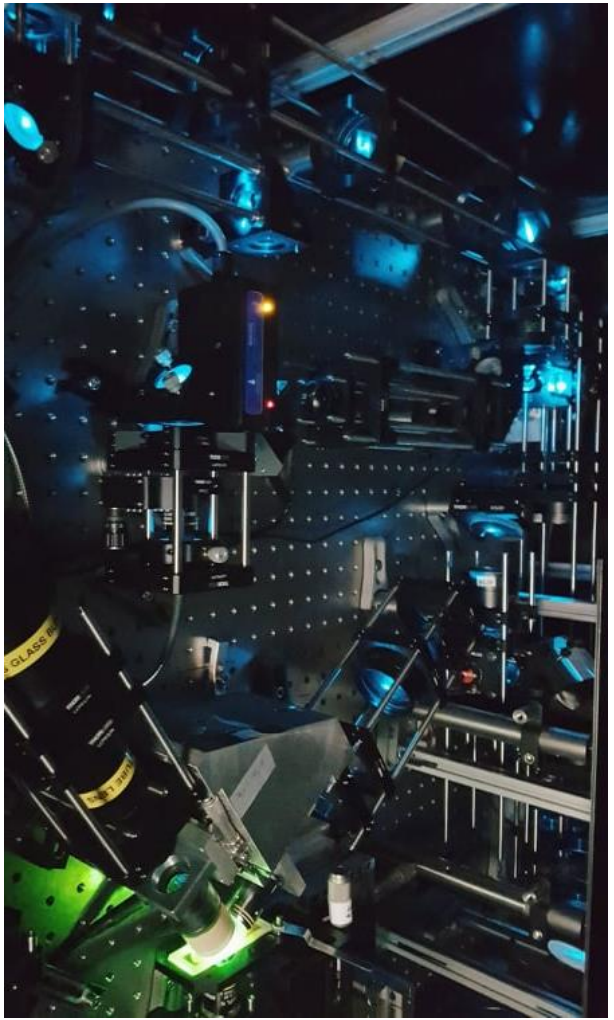
We enable people to develop advanced technical and professional skills in optics that are in demand in industry and academia

- Aimed at students wanting to develop a specialisation in optics leading to a professional career in Industry or Academia
- Students will have good BSc or MSci degree in physics (or a related discipline)
- A one-year (12-month) MSc



MSc Optics and Photonics

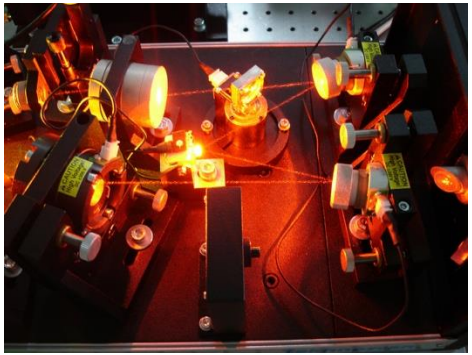
- Lectures
  - Foundation courses (Term 1)
  - From a set of option courses (Mostly term 2)
- Laboratory work
  - Demonstration experiments (Term 1)
  - Standard experiments (Term 1)
  - System-design project (Term 2)
- Self-study project (Term 2)
- Project (May-Sept)

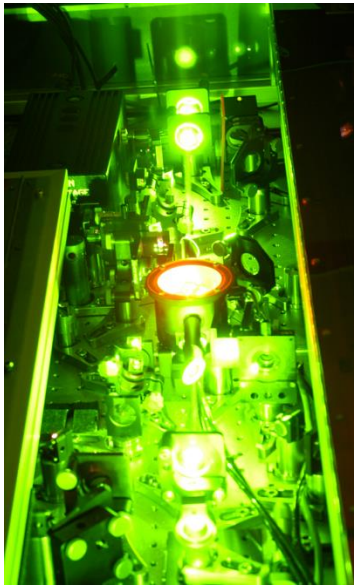


The Foundation Lecture Courses (MSc and MRes)

Compulsory modules (Term 1):

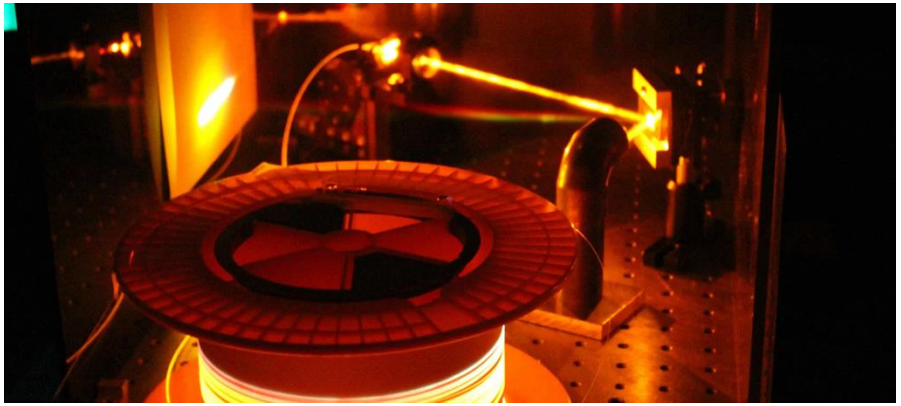
- Lasers
- Optical Measurements and Devices
- Imaging (Geometrical Optics and Wave Optics)





Elective Modules (MSc)

- Fibre and Ultrafast Lasers
- Optoelectronic Devices
- Biomedical Imaging
- Optical Design
- Laser Technology
- Optical Communications
- Quantum Optics



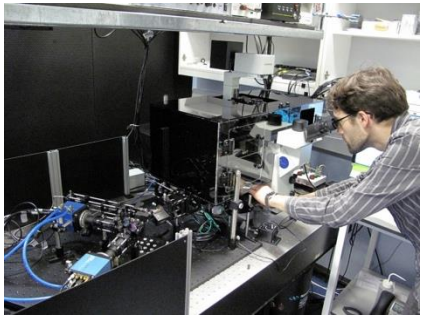
Laboratory work (MSc)

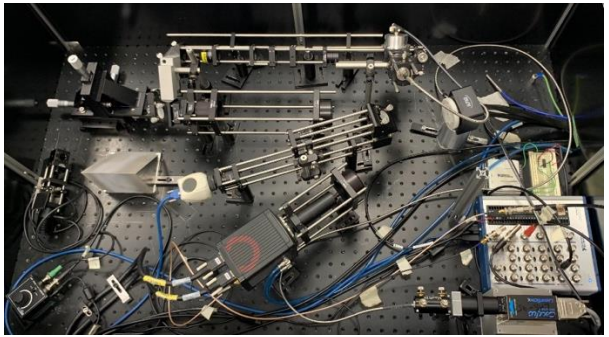
- Laboratory throughout Term 1 (also MRes)
  - Demonstration experiments (one afternoon)
  - Standard experiments (one week of afternoons)

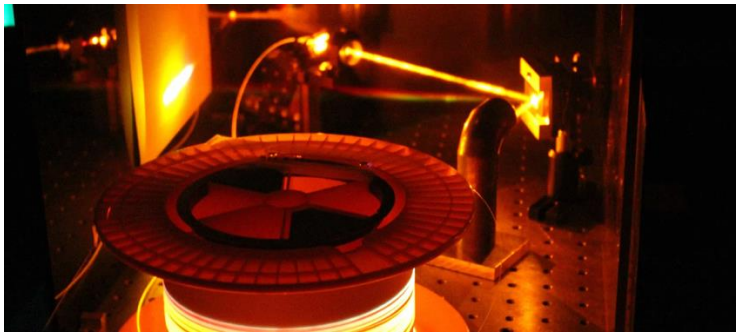
- System-design project (Term 2)
  - A 5-week experiment
    building system from scratch

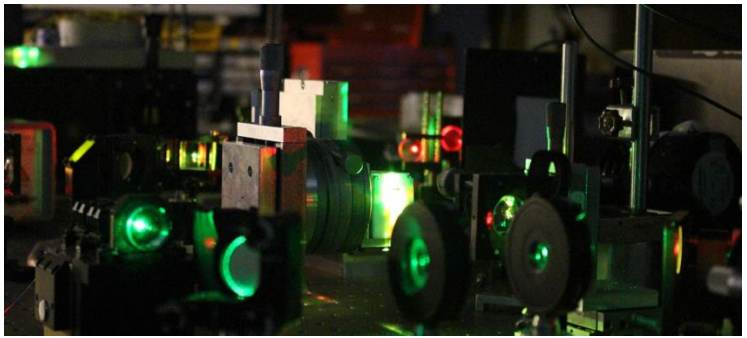
Project work (MSc)

- Self-study project in Term 2
- Summer project (4 months)









MRes (+PhD) in the Light Community

- Some PhD programmes may require applicants to take this course
- First term
  - Foundation courses same as for MSc in Optics and Photonics
  - Optics Lab: demonstration + standard experiments
- Long research project from January to September
  - Usually with future PhD supervisor

Where do our graduates go afterwards?

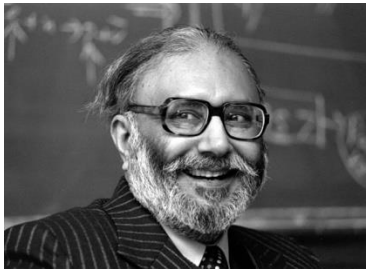
Positions in Industry:

- Optical design
- Data Storage
- Imaging
- Optical equipment and components
- Optical engineering/design
- Remote sensing
- Biomedical applications of optics
- …

University Research:

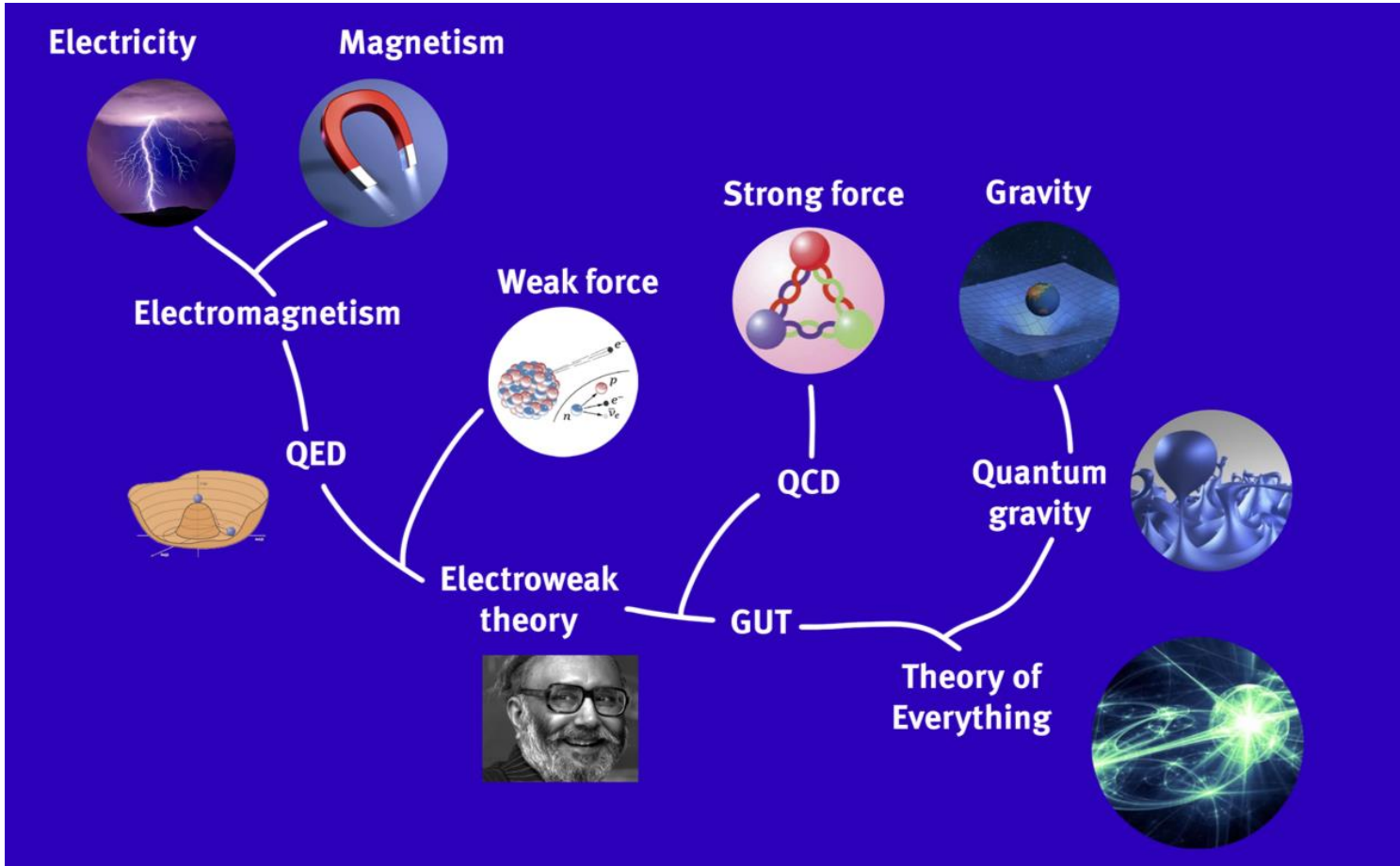
- Short-pulse high-power lasers
- Laser development
- Displays
- Quantum optics
- Adaptive optics
- Thin films
- Waveguides
- Solar energy
- …

Quantum Fields and Fundamental Forces MSc



1 October 2025

Quantum Fields and Fundamental Forces MSc



Research topics

- **String theory**

  Chester, Gauntlett, Hanany, Hull, Komatsu, Tseytlin, Waldram, Wiseman

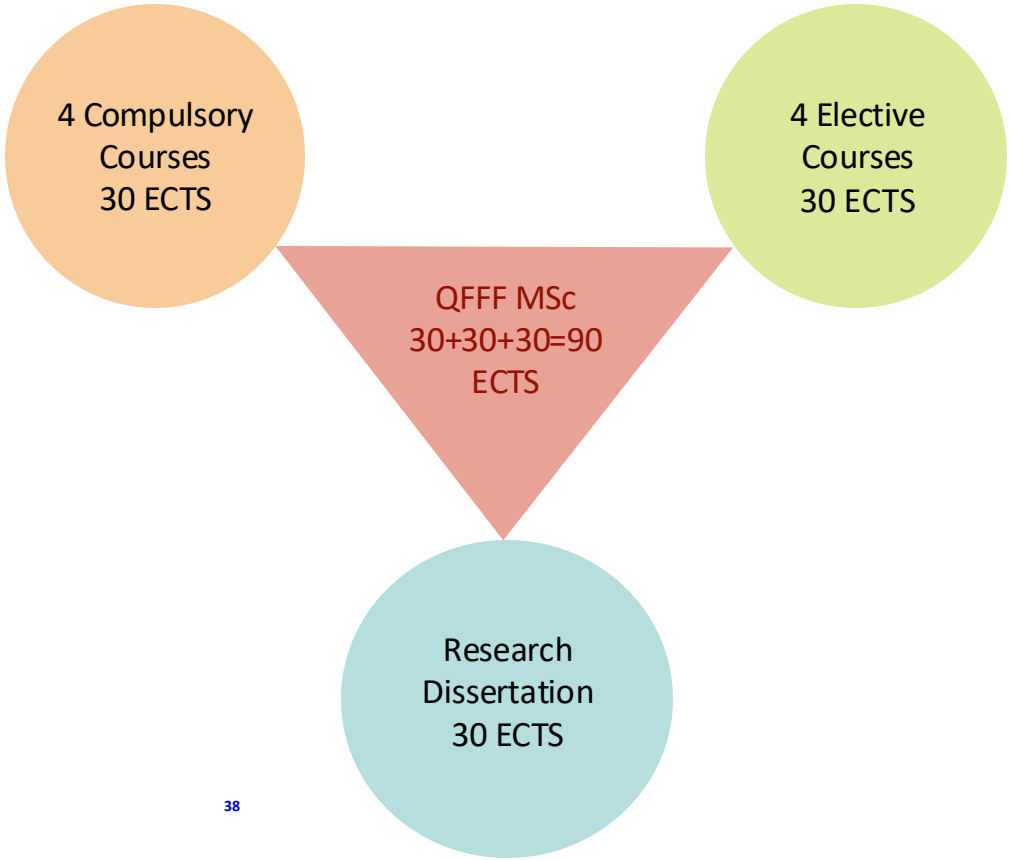
  - Supersymmetry, supergravity, branes, AdS/CFT, holography, integrability, CFTS, Bootstrap, Geometry, Gauge Theories
- **Cosmology, Gravity and EFTs**

  Contaldi, Magueijo, Rajantie, Tolley, de Rham, Wiseman

  - Inflation, CMB, dark matter, dark energy, gravitational waves, gravitational lensing (links with expts eg. Boomerang, Planck, LISA), Effective field theories and UV completion, Modified gravity, massive gravity
- **Quantum Gravity, Foundations of Quantum Mechanics** Dowker, Halliwell
  - Black hole physics, quantum gravity (Causal sets), decoherent histories, time in quantum mechanics
- **QFT, Particle Physics, Complexity** Evans, Hanany, Rajantie
  - Lattice field theory, topological defects, supersymmetry, complexity, networks

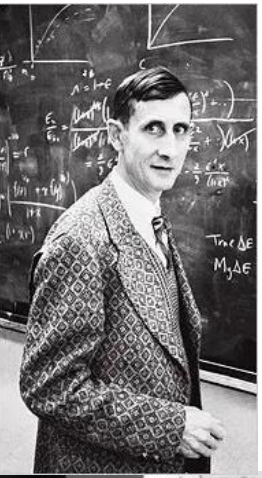
MSc Course Overview

Taught Component:



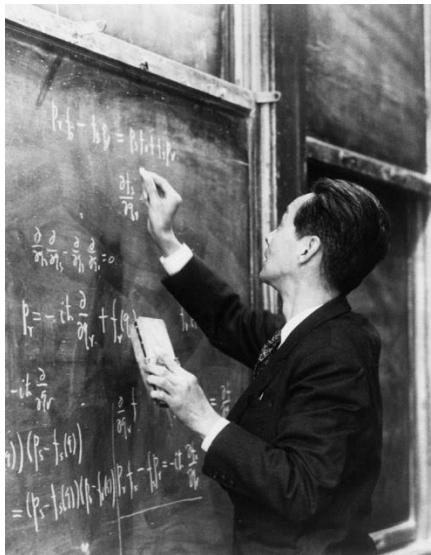
Research Component:

Compulsory Courses



- Quantum Field Theory
- Quantum Electrodynamics
- Particle Symmetries
- Unification

Lectures + Rapid Feedbacks + **Exams**



Elective Courses

MSc level

Advanced Quantum Field Theory

Differential Geometry

Relativity & Cosmology

Black Holes

String Theory

Supersymmetry

The Standard Model & Beyond

Lectures + Rapid Feedbacks + **Exams**

Undergraduate ($\leqslant$ 2 only)

Foundations of Quantum Mechanics

Group Theory

General Relativity

Quantum Theory of Matter

Quantum Information

Timetable

1st Term

Particle Symmetries

Group Theory

QFT

General Relativity

QED (cont. into 2nd term)

Quantum Information

Unification

Differential Geometry

2nd Term

Advanced Quantum Field Theory

Foundations of Quantum Mechanics

Relativity & Cosmology

Quantum Theory of Matter

Black Holes

Supersymmetry

The Standard Model & Beyond

String Theory

3rd Term

1. Exams
2. Special Topics
3. Dissertation

New Year's Tests: Quantum Field Theory & Particle Symmetries / Unification

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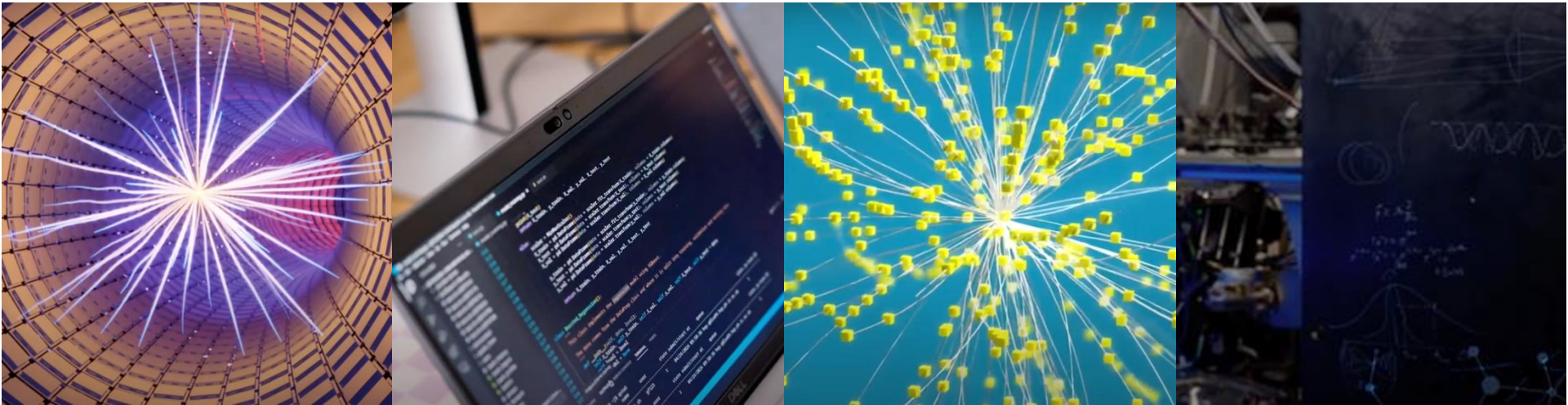
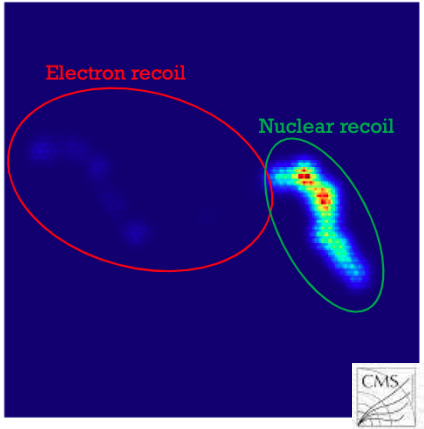
MRes: **Machine Learning and Big Data in the Physical Sciences**

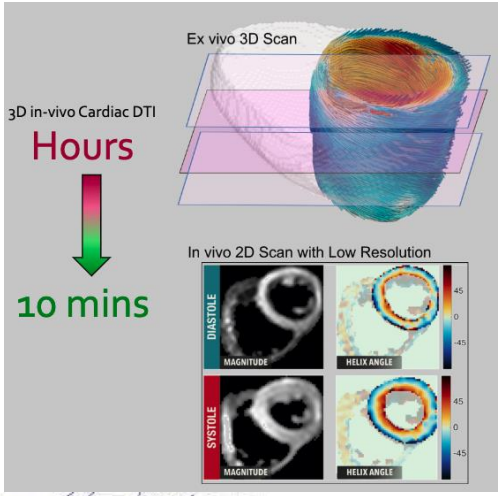


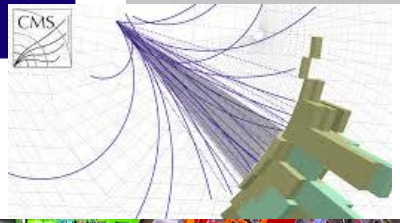
Why machine learning and big data in research?

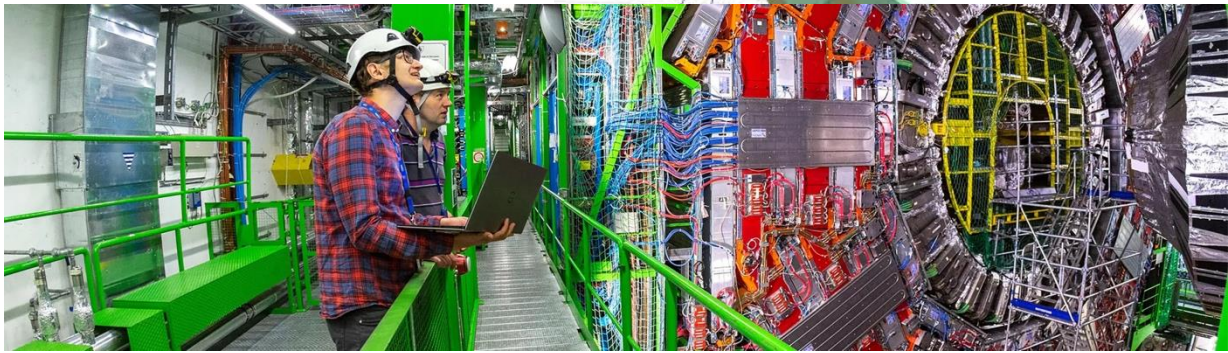
Science is driven forward by **data**! **Datasets** in the **physical sciences** can be **huge!**

Machine learning has a massive impact on research from improving **MR imaging** to discovering new particles at the **LHC**!



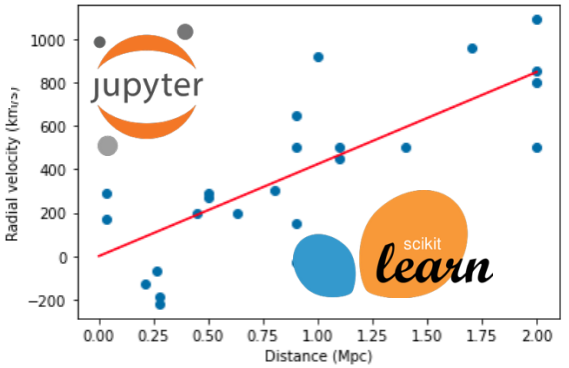






What will *you* learn?

Learn the **tools** and **techniques** used in **data-intensive research** in science and industry!



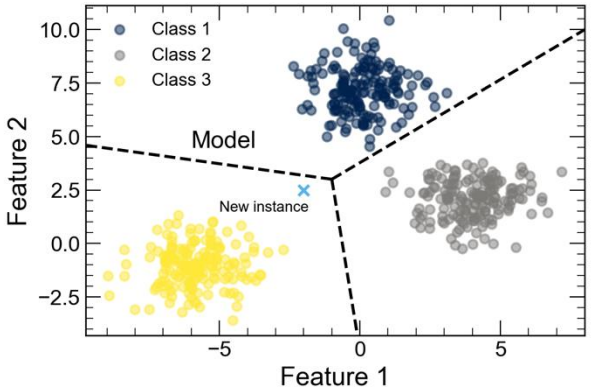
Core modules:
Term 1

- Statistical Methods for Experimental Physics
- Applied Machine Learning

Terms 2&3

- Research Project

2x Elective modules:
Lvl 6/7 UG & MSc options including
"***Accelerated processing for big data analysis***"!



What will *we* learn?

Research Focused

Use your **expertise in machine learning and big data** to contribute to some of the **most challenging** data-intensive fields of **research**

Work **hands on with data** and **world-leading experts** from our research groups in your **nine-month research project**!

Example projects from previous years:

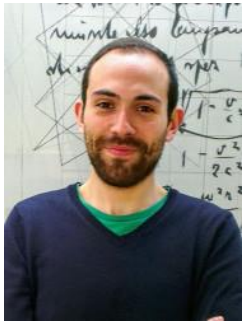
- “Using Machine Learning to classify Higgs boson interactions”
- “Photogrammetry/computer vision for upright radiotherapy patient positioning”
- “Machine Learning in the SHARKS Survey - a near-IR Survey of 20 Million Galaxies”
- “Searching for the Migdal Effect in nuclear scattering”
- “Interpretable Machine Learning for Space Weather Forecasting”
- “Applying machine learning to analysis of data of attosecond pulses from the LCLS X-ray laser”

Who are we?

Prof. David Colling

Programme Co-Director

d.colling@imperial.ac.uk



Dr. Nicholas Wardle

Programme Co-Director

n.wardle09@imperial.ac.uk

Visit our website:

https://www.imperial.ac.uk/physics/students/current-students/taught-postgraduates/machine-learning-big-data/

Interested in multidisciplinary research with real-world applications?

MRes in Soft Electronic Materials

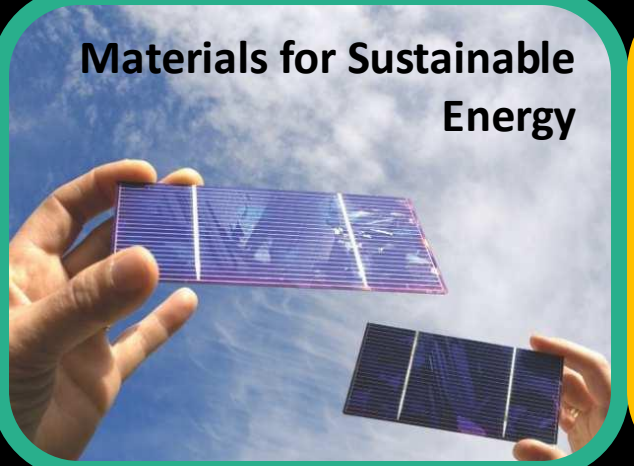
Imperial College London

https://youtu.be/5ZNxxalK_9o

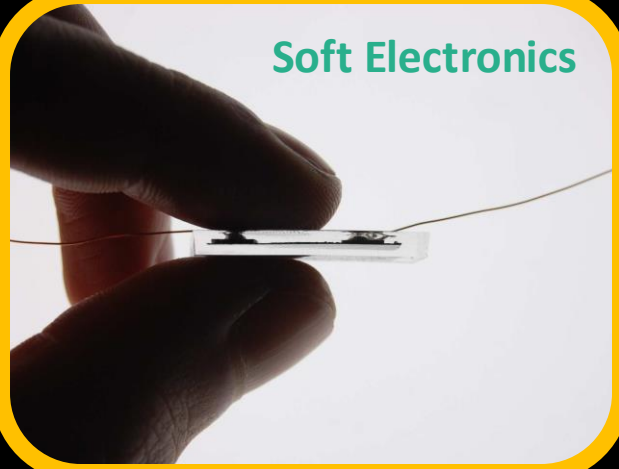
What is Soft Electronics?

Application Targeted Research

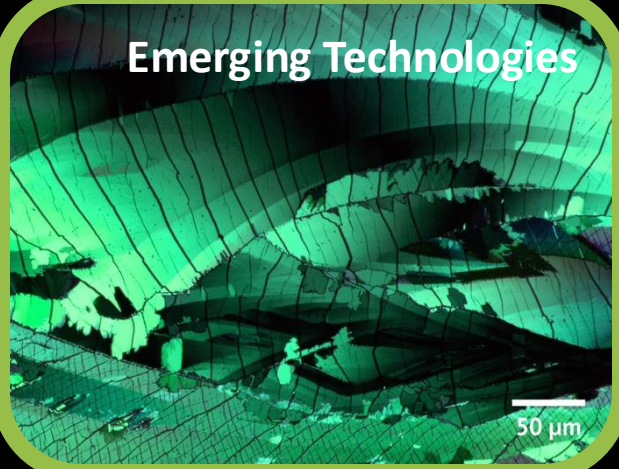
Electronics with Functional and Processable Materials



Energy generation (solar cells, solar fuels, thermoelectrics), conversion (LEDs) and storage (batteries, sustainable fuels and chemicals)



Bioelectronics, wearable electronics and sensors



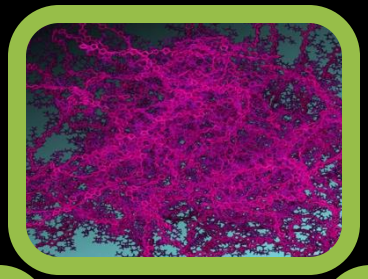
Chiral emitters and detectors, spintronics and neuromorphics

What Science is Involved?

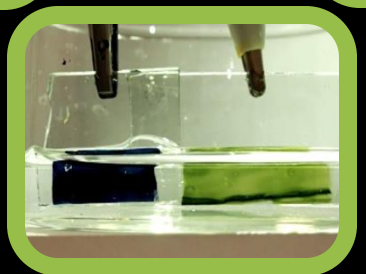
Uniquely Multidisciplinary

Physics, Materials, Chemistry, Bioengineering

Synthesis, modelling, characterisation, processing and devices





What does the Course Involve?

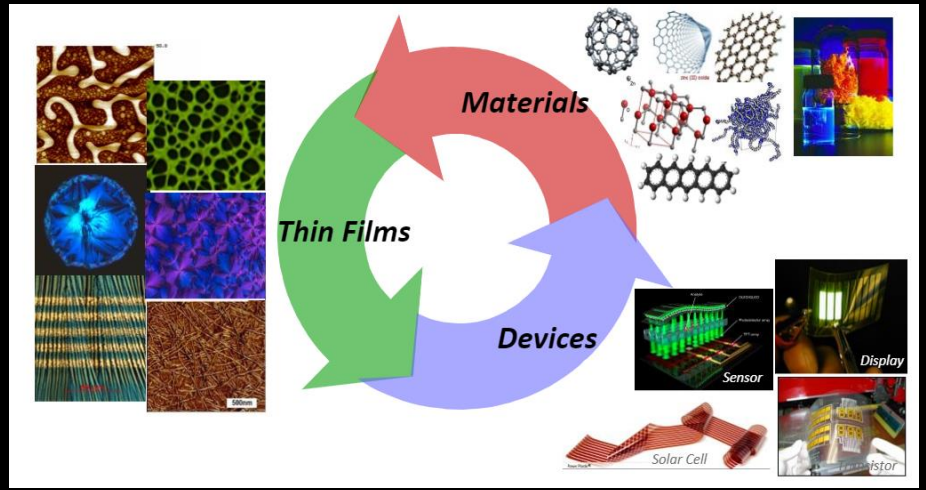
Research Focused

1/3 Lecture Courses:

- **Fundamentals of Organic and Inorganic Semiconductors and Optoelectronic Processes**
- **Materials Synthesis and Processing**
- **Materials Characterisation**
- **Device Physics and Applications**

2/3 Project:

- **Proposals from PIs in Physics, Chemistry, Materials, Chemical Engineering, Bioengineering**
- **List issued in October**
- **Range from theoretical to highly applied**

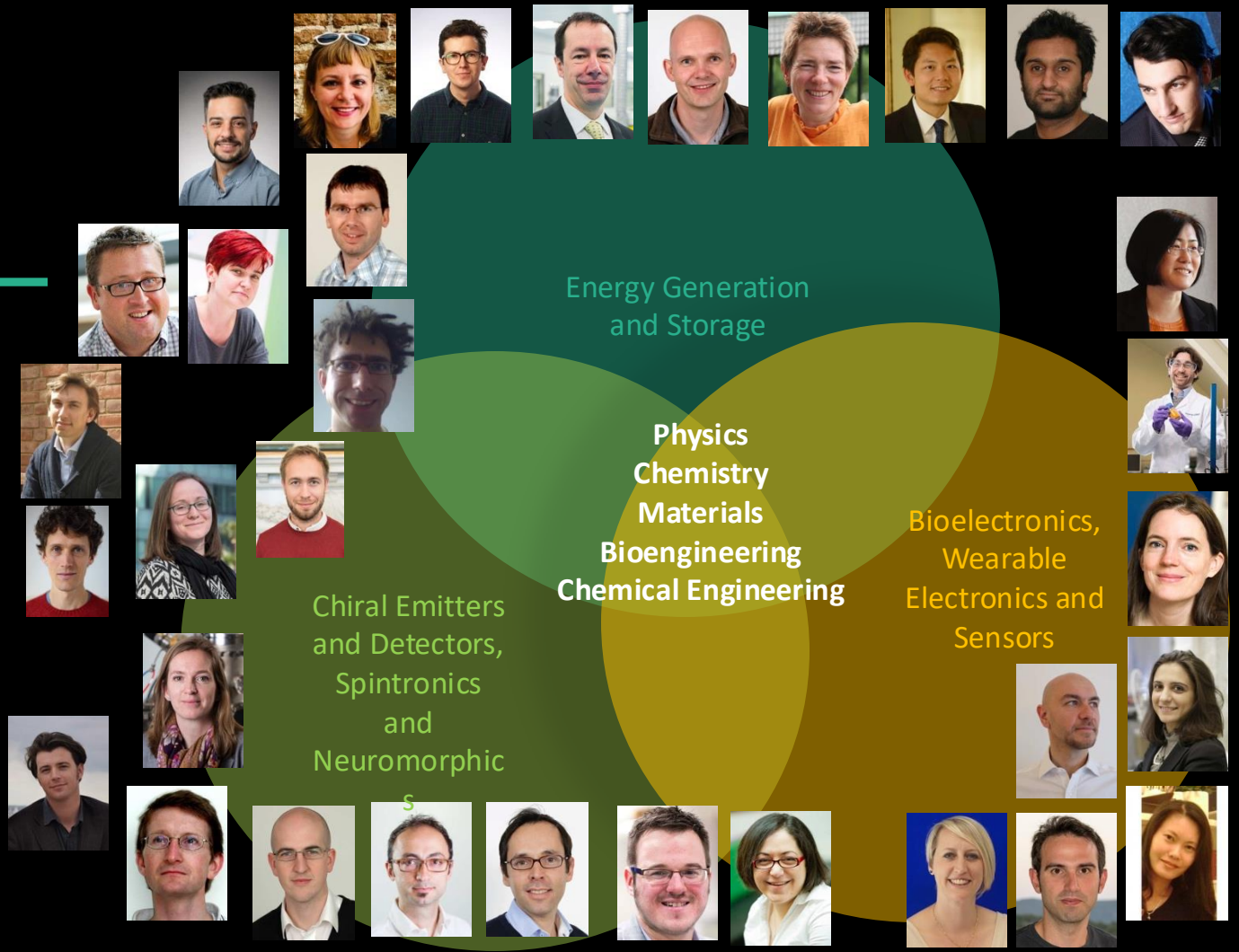


Who Will I Work With on a Project?

PIs from across the Centre for Processable Electronics

>30 members of academic staff

Strong industrial collaborators worldwide

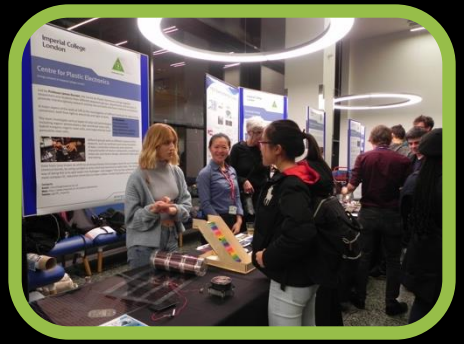


Want to Build a Broader Skill Set?

A Course with More!

Cohort activities, trips and visits, outreach opportunities, presentations

Summer School, Exhibition Road Festival, Annual Symposium, Journal Club, CPE Seminars and Symposia, Transferrable and Advanced Skills Courses, Alumni Talks



Thank You!

For more information:

Visit our website https://www.imperial.ac.uk/plastic-electronics-cdt/mres-in-soft-electronic-materials/

Course Director: Dr Piers Barnes

Centre for Processable Electronics

Imperial College London

Imperial College London

MSc Security and Resilience: Science and Technology

Hosted by DEPARTMENT OF PHYSICS

What is Security and What is Resilience?

Security = preventing events which cause a threat to individuals, organisations and society from occurring.
Resilience = if an event occurs, how to respond immediately, in the medium-term and in the long-term to contain the effect, mitigate the consequences and recover. Use the experience to change and modify security
Threats can be classified into 3 broad areas:

- **Natural** - climate, earthquake, biological, weather, tsunami etc.
- **Accidents** – industrial, domestic, cyber (software updates), personal etc.
- **Deliberate** – criminal activity, political activity, vandalism (physical and cyber), fake news, racial, gender etc.

World View

- We divide the **HUMAN** world into 4 areas
- Need a broad view and technical understanding
- Strong linkages exist between the areas
- Activity in one area affects the others

PEOPLE AND THEIR BEHAVIOUR	**PHYSICAL INFRASTRUCTURE**
PHYSICAL WORLD: PHYSICAL THREATS AND DETECTION	**CYBER WORLD: INTERNET OF THINGS**

The Course has modules to address each

PEOPLE AND THEIR BEHAVIOUR Behavioural Research Methods Behavioural Science and Security	**PHYSICAL INFRASTRUCTURE** Infrastructure and Transport Security
PHYSICAL WORLD: PHYSICAL THREATS AND DETECTION CBRNE: the Physical Threat Space Sensors: Electronic and Natural	**CYBER WORLD: INTERNET OF THINGS** Network and Web Security (Dept of Computing)

The Course has modules which cover all areas

PEOPLE AND THEIR BEHAVIOUR

PHYSICAL INFRASTRUCTURE

Security In Context

Involves active Practioners, industry, govt and academia

Long Research Project

individual theme decided, in part, by you!

PHYSICAL WORLD: PHYSICAL THREATS AND DETECTION

CYBER WORLD: INTERNET OF THINGS

Real World involvement includes Summer Projects

Examples of Industrially linked projects

AWE – Magnetic Imaging Tomography of IEDS – feasibility study

BAE Applied Intelligence – Electronic Identities

SynBioSys – Ballistic Studies for lightweight structural protection

FFI (Norway) – Emerging technologies for point-of-care diagnostics of exposure to organophosphorus nerve agents

Aerospace Corp - Run-Time Hardware Trojan Detection And Response

Support **can** include a stipend, access to executive training courses, offers of internships etc.

Compulsory modules
Security in Context
Behavioural Science and Security
CBRNE: The Physical Threat Space
Infrastructure and Transport Security*
Behavioural Research Methods
Network and Web Security**
Sensors: Electronic and Natural

Long summer research project

Elective modules (x 2)
Global Challenges: Security Entrepreneurship
Introduction to Shock Physics
Electives from other Departments, including Physics, Mathematics, Computing, and Civil and Environmental Engineering (at discretion of the Programme Director).
Short Project

Who do we recruit?

Natural Scientists and Engineers, STEM graduates, high-performing social scientists

- Minimum 2:1 UG degree - Entry requirement

For those with relevant industrial/government experience

- Entry level 2:2 UG degree + experience (interview required)

- **FULL-TIME** (12 months) and **PART-TIME** (24 months) available

Imperial College London

Thank you for listening – on to our Q & A….

1. Physics MSc three streams:
    I. physics MSc
    II. with Quantum Dynamics
    III. with Extended Research (2 x 9 months)
    IV. with Fusion and Plasma Physics (NEW!)
2. MSc Optics & Photonics (O&P) and MRes Photonics
3. MSc Quantum Field & Fundamental Forces (QFFF)
4. MRes Machine Learning & Big Data (MLBD)
5. MRes Soft Electronic Materials (SEM)
6. MSc Security & Resilience: Science & Technology (SRST)