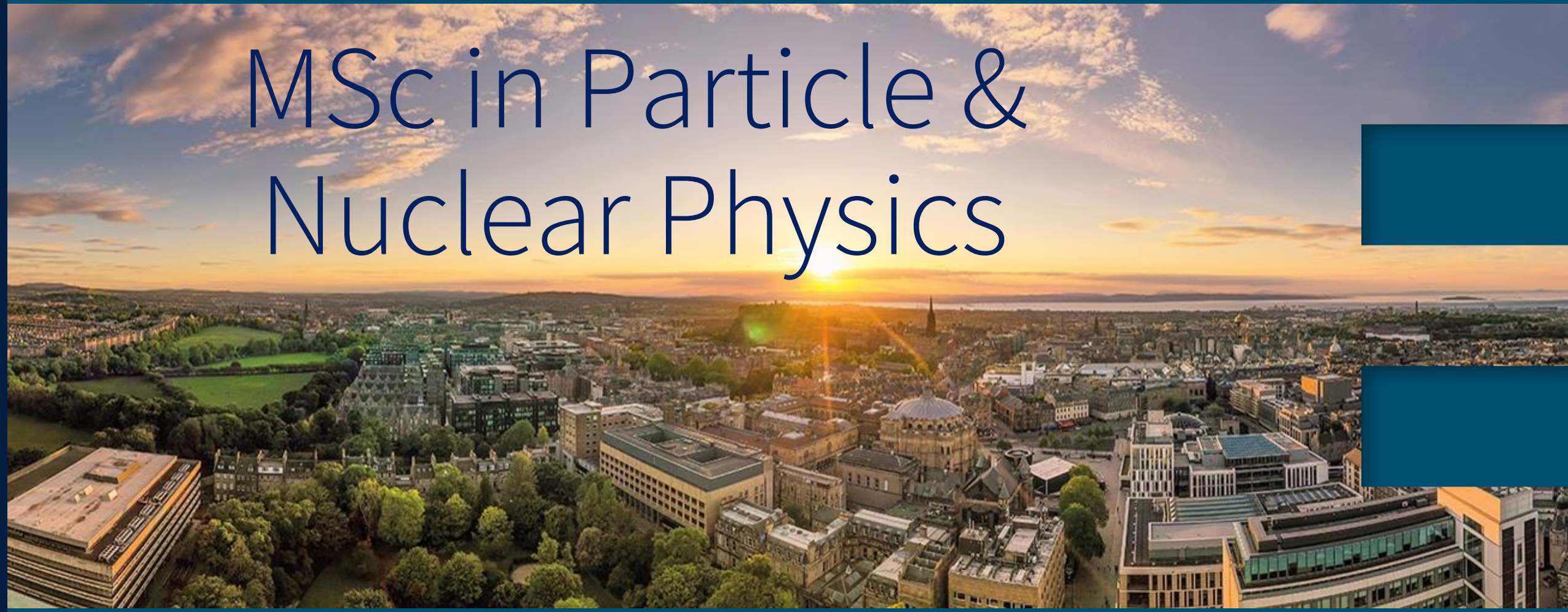
THE UNIVERSITY of EDINBURGH

MSc in Particle & Nuclear Physics



Christos Leonidopoulos | 20 November 2025

EDINBURGH
Extraordinary futures await

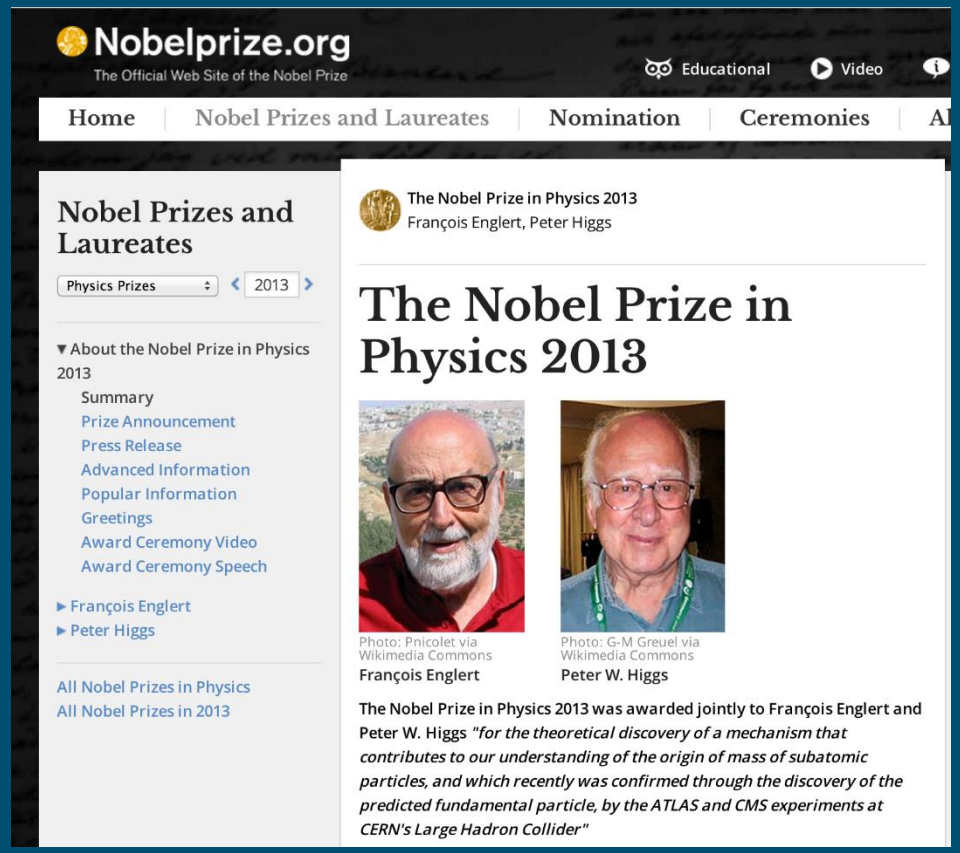
THE UNIVERSITY of EDINBURGH

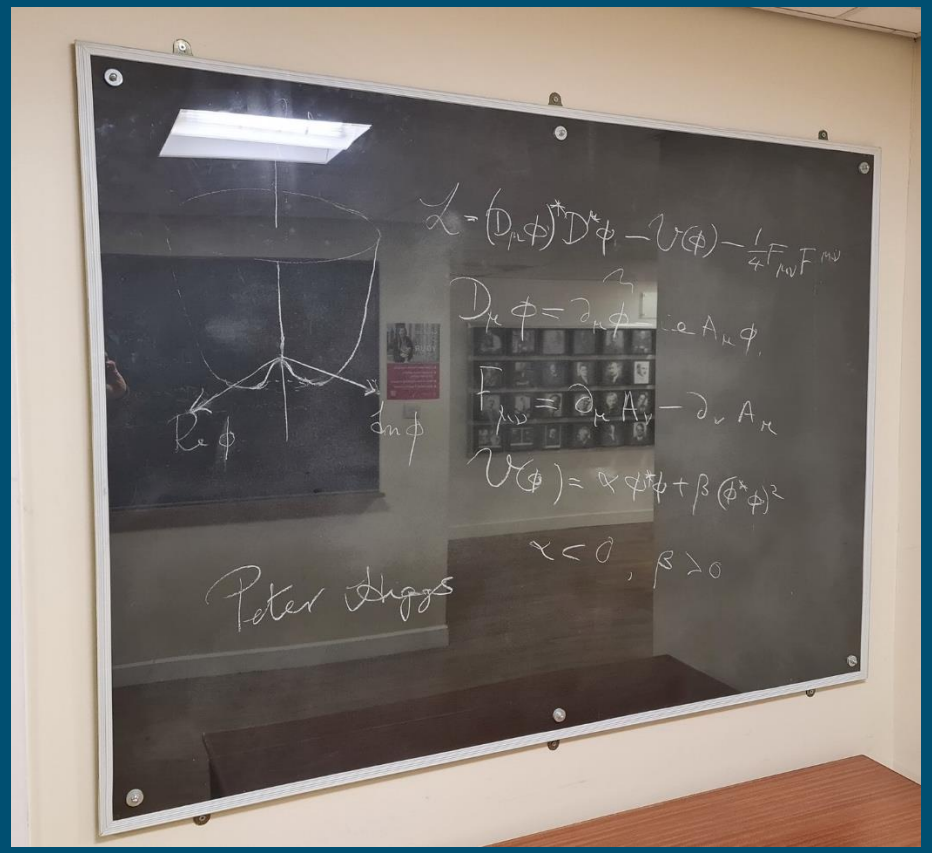
MSc in Particle & Nuclear Physics

EDINBURGH
Extraordinary futures await

Professor Peter Higgs & discovery of Higgs boson

Nobel Prize in Physics & Higgs Centre

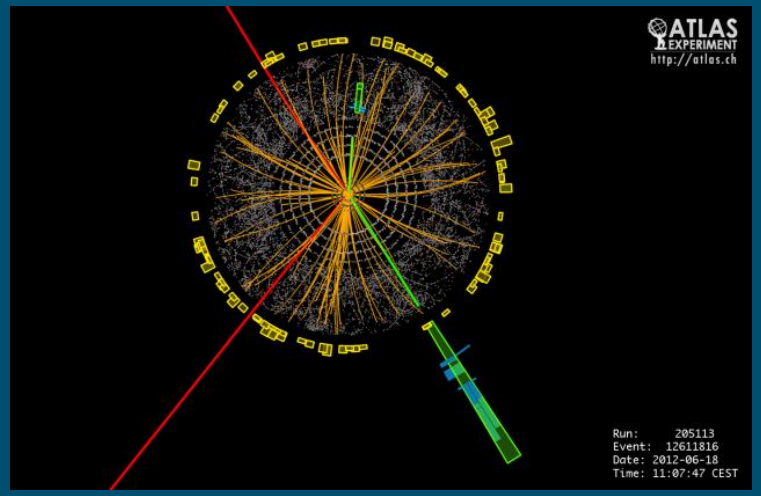




Particle & Nuclear Physics in Edinburgh

Edinburgh has a long tradition in experimental nuclear and particle physics

- Kaon physics with NA-31/48 at CERN in 1980s and 90s
- BaBar at SLAC in 2000s
- UK Dark Matter at Boulby in Yorkshire
- Exotic nuclei and astrophysics
- ATLAS and LHCb at the LHC



MSc in Particle & Nuclear Physics

- We started this course to build on these strengths & tradition
- Study of particle and nuclear physics brings together advanced experimental techniques and data science underpinned with theoretical understanding
- Technologies in this area have found a wide range of applications e.g. medical imaging
- Big data sets being collected: advanced computing techniques & machine learning is needed

MSc in PNP: Timeline

Two taught semesters, with examinations at end:

- September – December
- January – May
- **End May – August:** Full time study towards dissertation thesis

In welcome week, you are assigned an academic member of staff as your Academic Advisor; He/she will guide you through academic choices as well as student support team who provide pastoral care

Welcome Week

During welcome week you will get to know the department, your peers, the people involved in the program (cohort leader, student support, academic advisor)

MSc in PNP: Expectations

Applicants for the MSc program come from a wide range of backgrounds.

To get everyone to the same level:

- Suggested reading and python skills development before arrival
- Additional python and coding tutorials during the Research Skills course

Students with limited knowledge of Relativity, Particle or Nuclear Physics have opportunity to take the Relativity, Nuclear & Particle Physics course in Semester 1

- This provides an introduction to these subjects if you haven't studied these before
- During the Welcome Week meeting your Academic Advisor you will discuss what options are best for you

MSc in PNP: Layout

Skills Courses: compulsory

- Research Skills in Particle & Nuclear Physics
- Programming Skills
- Data Analysis Techniques

40 credits

Optional Courses: student chooses 2-5 courses from other physics areas

20-50 credits

Project: a research project on a current experiment or active research project

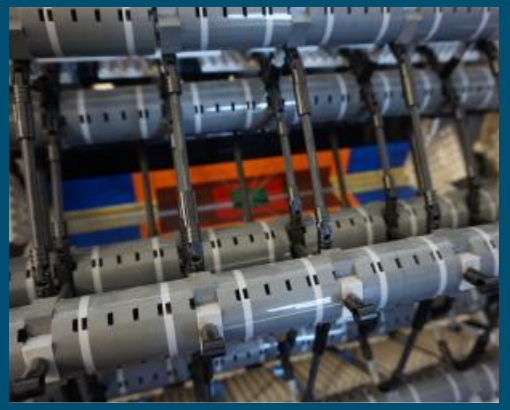
60 credits

Core Courses: student choice of 3-6 of the following courses

- Detectors in Particle & Nuclear Physics
- Medical Physics
- Particle Physics
- Nuclear Physics
- Current Topics in Particle Physics
- Nuclear Astrophysics
- Relativity, Nuclear and Particle Physics (RNP)**

30-60 credits

MSc in PNP: Skills courses



- Compulsory
- Equip you with the skills needed for your dissertation project and beyond
- Research skills: literature study, oral presentation + poster skills, working together as a team
- Data analysis and statistical techniques: Using C++ and python for scientific programming (maximum likelihood fitting, limit setting, machine learning)

MSc in PNP: Core courses

Building skills in nuclear and particle physics together with its applications (detector technology and medical physics). Your Academic Advisor will help guide you through choices

- Detectors in Particle & Nuclear Physics
- Medical Physics
- Particle Physics
- Nuclear Physics
- Nuclear Astrophysics
- Current Topics in Particle Physics

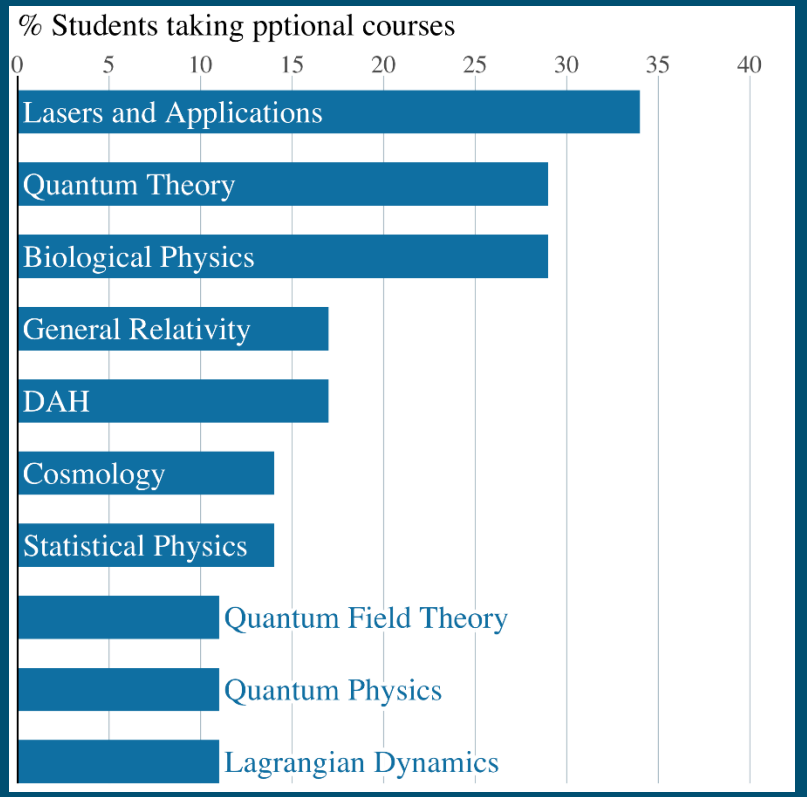
MSc in PNP: Optional courses

Wide range of Scottish SCQF Level 10 & 11 courses open to you (subject to timetabling)

These were the top 10 picks of the students over the last four years to give you a flavour

35 different options in total were taken

Now added three options for School of Informatics (Quantum Computing, Categories And Quantum Informatics, Quantum Cyber Computing



MSc in PNP: Flavours

With the choice in the MSc, you can choose to focus on

- Data Analysis
- Detector Development
- Medical Applications
- Computing
- A mix of the above…
- Or something different

You will also obtain skills in organising research and presenting your work to a wider audience

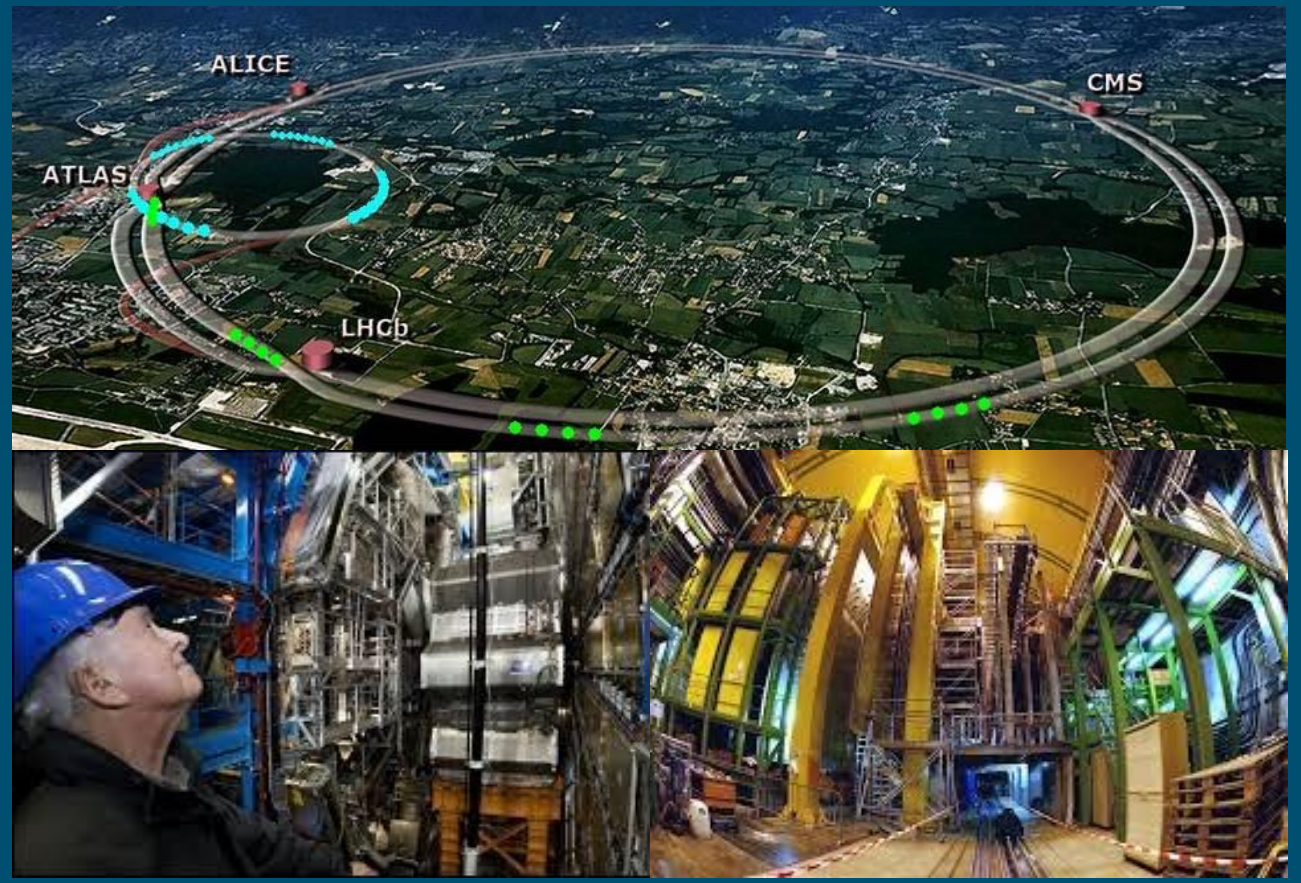
MSc in PNP: Dissertation

- During Semester 1 you will choose a project for the summer and start to work on it
- Three months dedicated to a research on your project from May - mid August
- You will write a dissertation and present your work to your peers
- Wide range of project will be available on topics related to particle and nuclear physics research being carried out in our group
- Some projects will be data analysis orientated; others will be focussed on detector development.
- All will be at the cutting edge of science – e.g. utilizing data from the LHC or the latest developments in single photon detection

MSc in PNP projects: LHC physics

Group has long and big involvement with ATLAS and LHCb experiments at the LHC

Studies of physics at the energy and precision frontier

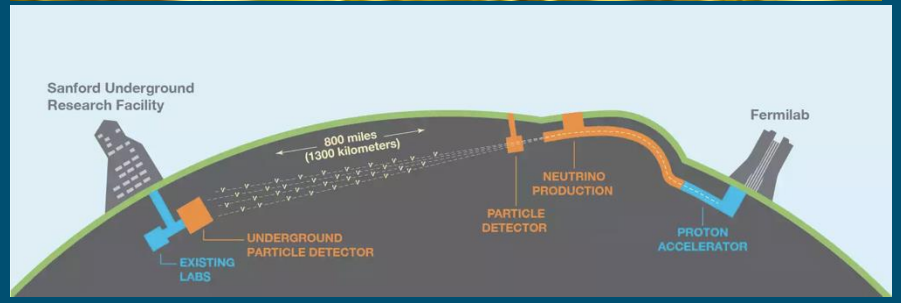


MSc in PNP projects: neutrino physics

Running experiments:

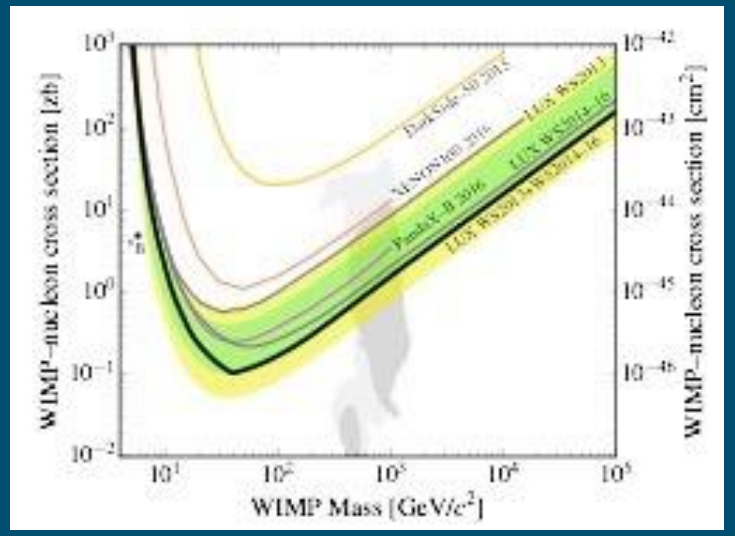
- MicroBoone + SBND (short-baseline)
- Super-NEMO (neutrinoless double β-decay)

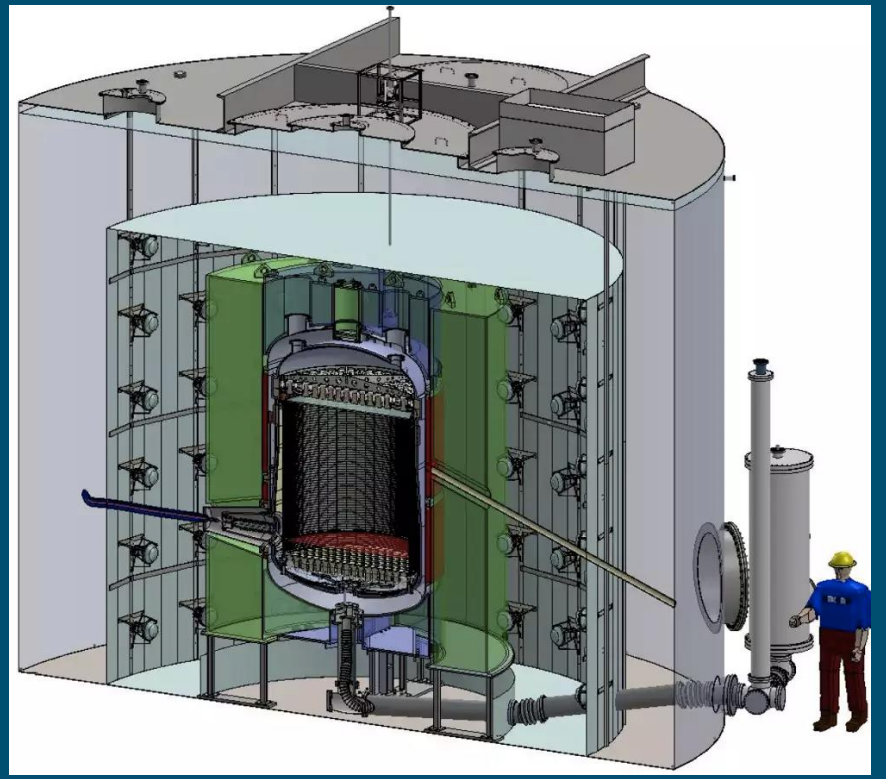
Next generation long-baseline experiments: DUNE



MSc in PNP projects: Dark Matter searches

Next-generation LZ experiment



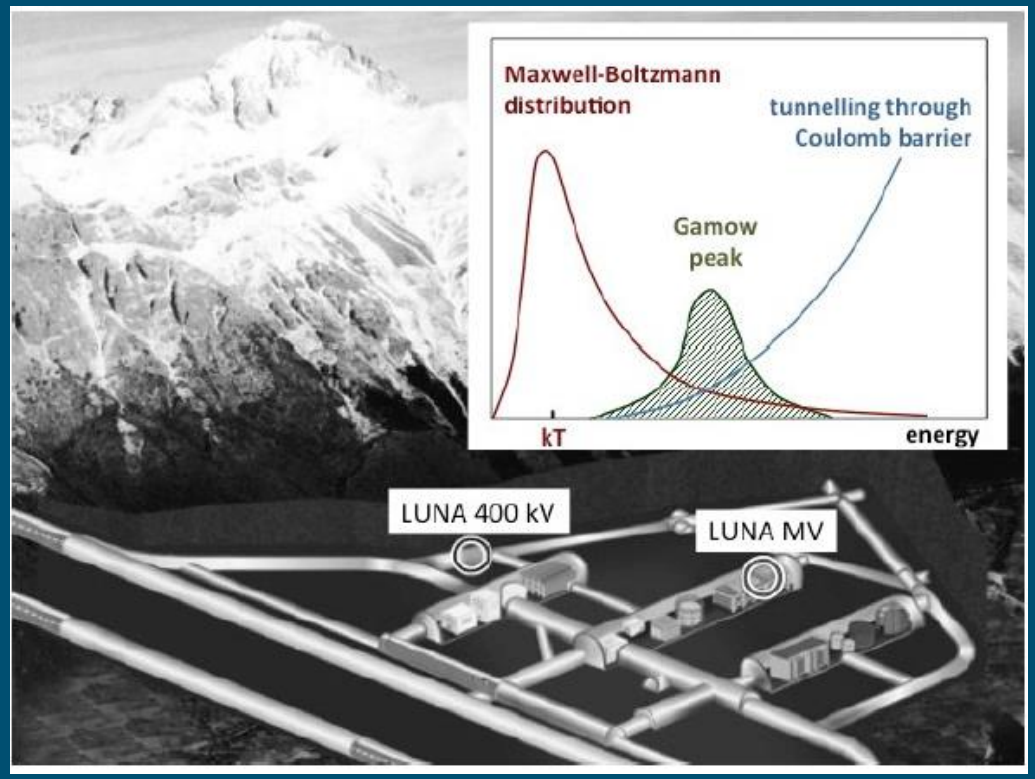


MSc in PNP projects: nuclear physics

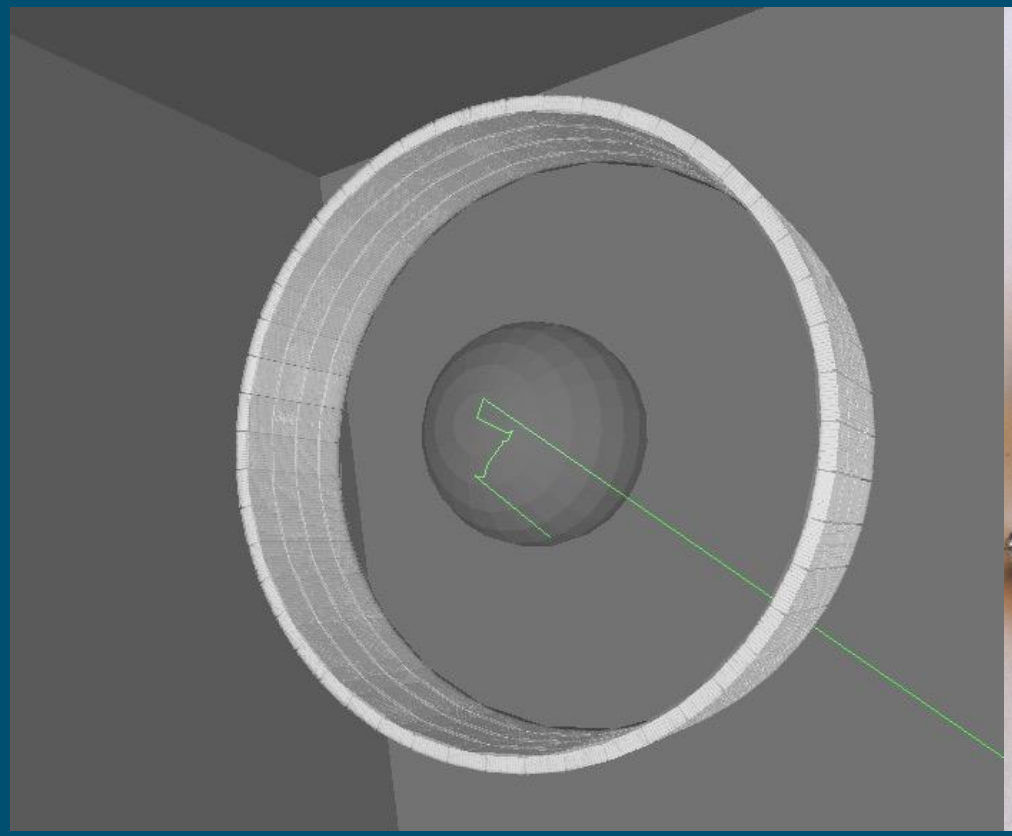
Astrophysical processes in the laboratory LUNA Facility in Gran Sasso, Italy

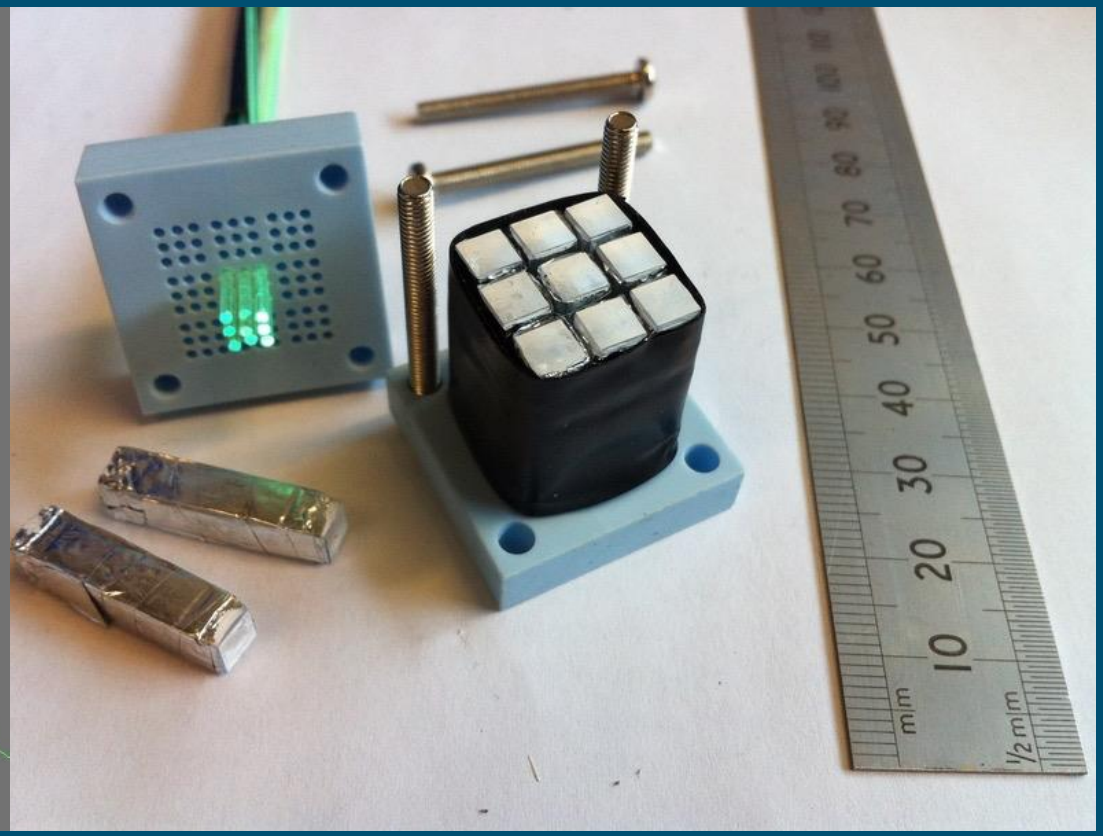
e.g. Studying reaction of Oxygen-17 + Hydrogen to understand dust in nebulae

Understanding of processes involved in novae and supernovae, Big Bang nuclear synthesis at ISOLDE, n_tof at CERN, RIKEN



MSc in PNP projects: Medical Imaging





MSc in PNP: Dissertation projects

We aim to provide self-contained projects that allow you to research and contribute to scientific knowledge

- Chance to interact with the big data sets being collected at the LHC and elsewhere
- Chance to do something/ see something no one has seen before
- Not uncommon for good projects to lead to a publication

MSc in PNP: Dissertation projects

2023-24 project list for illustration

- Further developments towards advanced time-of-flight mass-spectrometry - supervised by Moritz Pascal Reiter
- SuperNEMO: can we create matter without antimatter? - supervised by Dr Cheryl Patrick
- e4nu: Demystifying neutrino interactions with electrons - supervised by Dr Cheryl Patrick
- Developments towards the study of Radioactive Molecules - supervised by Moritz Pascal Reiter
- Total Body PET Imaging - supervised by Matthew Needham
- Developing a world leading alpha particle counter for particle astrophysics and industry. - supervised by Prof Alex Murphy
- What's going on with Scintillation Light in liquid argon neutrino detectors? - supervised by Dr Andrzej Szelc
- Energy calibration of a particle accelerator: Why do we care? - supervised by Marialuisa Aliota, Tom Davinson & Ragandeep Singh Sidhu
- Neutron Signals in the LZ Dark Matter Experiment - supervised by Dr Sally Shaw
- The search for rare and exotic nuclear decay modes - supervised by Moritz Pascal Reiter
- Student Proposed Project - supervised by TBC
- What can the structure of the proton tell us about the Higgs boson? - supervised by Liza Mijovic
- Developing cutting-edge silicon sensors with ultra-precise timing - supervised by Mark Williams
- Photon detectors with fast timing - supervised by Prof Franz Muheim, Dr Federica Oliva, Dr Silvia Gambetta

- Understanding the behaviour of TPB thin-films in liquid argon - supervised by Andrzej Szelc, Miquel Nebot-Guinot and Alice Hamer
- Matter-antimatter asymmetry in charm decays D0 - supervised by Mark Williams
- Search for New Physics in Radiative B meson decays with the LHCb experiment - supervised by William Barter and Lais Lavra
- Towards an Improved Determination of Matter/Antimatter Differences - supervised by William Barter and Federico Betti
- HV-CMOS Pixel detector R&D - supervised by Yanyan Gao
- Preparing for Commissioning of the DarkSide - supervised by Andrzej Szelc
- Electron-Yukawa coupling at the Future Circular Collider - supervised by Prof Victoria Martin
- Anomaly Detection: New Physics searches at LHC - supervised by Christos Leonidopoulos
- Studies of b-hadron decay modes with LHCb - supervised by Matthew Needham
- Neutron Induced Reactions in Astrophysics - supervised by Claudia Lederer-Woods
- Characterisation of sodium solid targets for nuclear astrophysics at LUNA - supervised by Dr Carlo Bruno
- Analysis of first nuclear physics data from CARME - supervised by Dr Carlo Bruno

MSc in PNP: A sense of community

Community is an important part of the program

- Welcome Week events
- Festival of Physics
- Quiz nights
- Film screenings
- Pizza nights
- …

Beyond your MSc in PNP

A PhD in particle or nuclear physics

- in Edinburgh … in the UK … worldwide!

Using your skills in a workplace…

- Data science skills
- Detector development skills
- Medical physics application skills
- Problem solving and analytic skills
- Computing skills

Higgs Scholarships

The School of Physics and Astronomy are offering twelve scholarships to applicants who have applied to study full-time on either the MSc Astrobiology and Planetary Sciences, MSc Mathematical Physics, MSc Particle and Nuclear Physics or MSc Theoretical Physics programmes of study for the 2024-2025 academic session

Each scholarship award is £10,000, deducted from the tuition fee

Scholarships awarded on the basis of academic merit and/or financial need

https://www.ed.ac.uk/student-funding/postgraduate/international/science-engineering/physics/higgs

Next steps…

https://virtualvisits.ed.ac.uk/pg

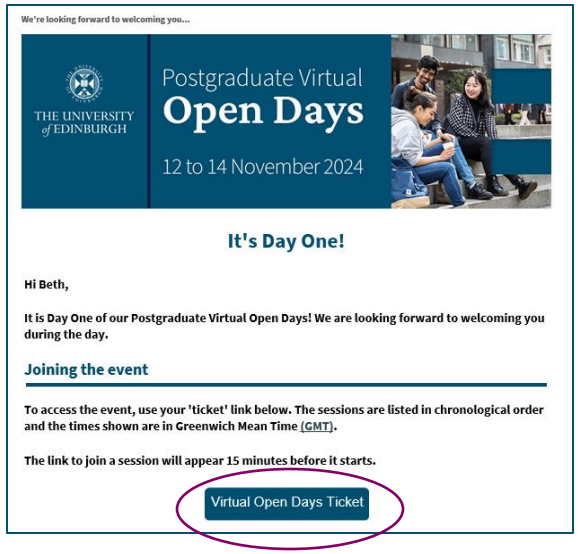
https://edin.ac/student-chat-pg

Contact details for follow-up questions

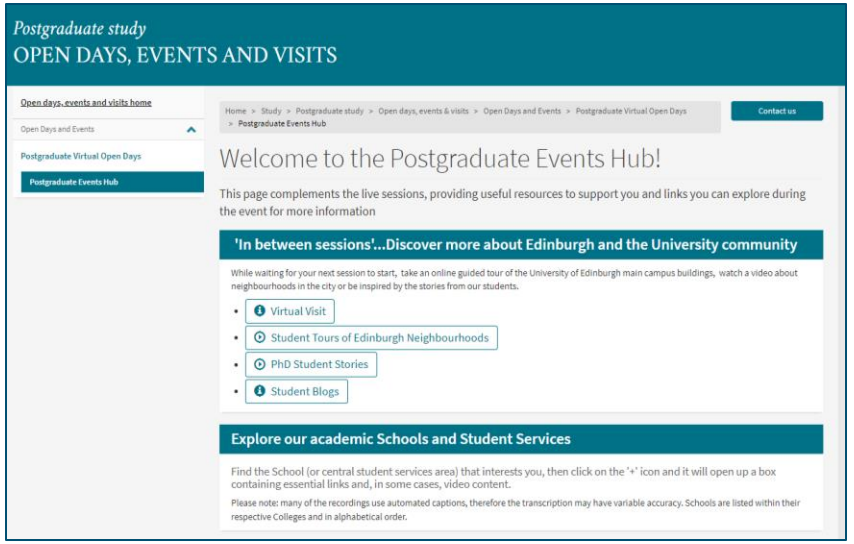
- We apologise if we did not get through all of your questions in the time allotted for this session. If you have further questions that have not been answered, please email: futurestudents@ed.ac.uk
- Or, feel free to contact me: Christos.Leonidopoulos@ed.ac.uk

Thank you – click ‘Leave’ when the session ends

- Return to your ‘e-ticket’ to find and attend other sessions you’ve booked – by clicking on the button in the email we sent you…



- …and visit the events hub:
- https://edin.ac/4gZuP3G



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Thank you

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