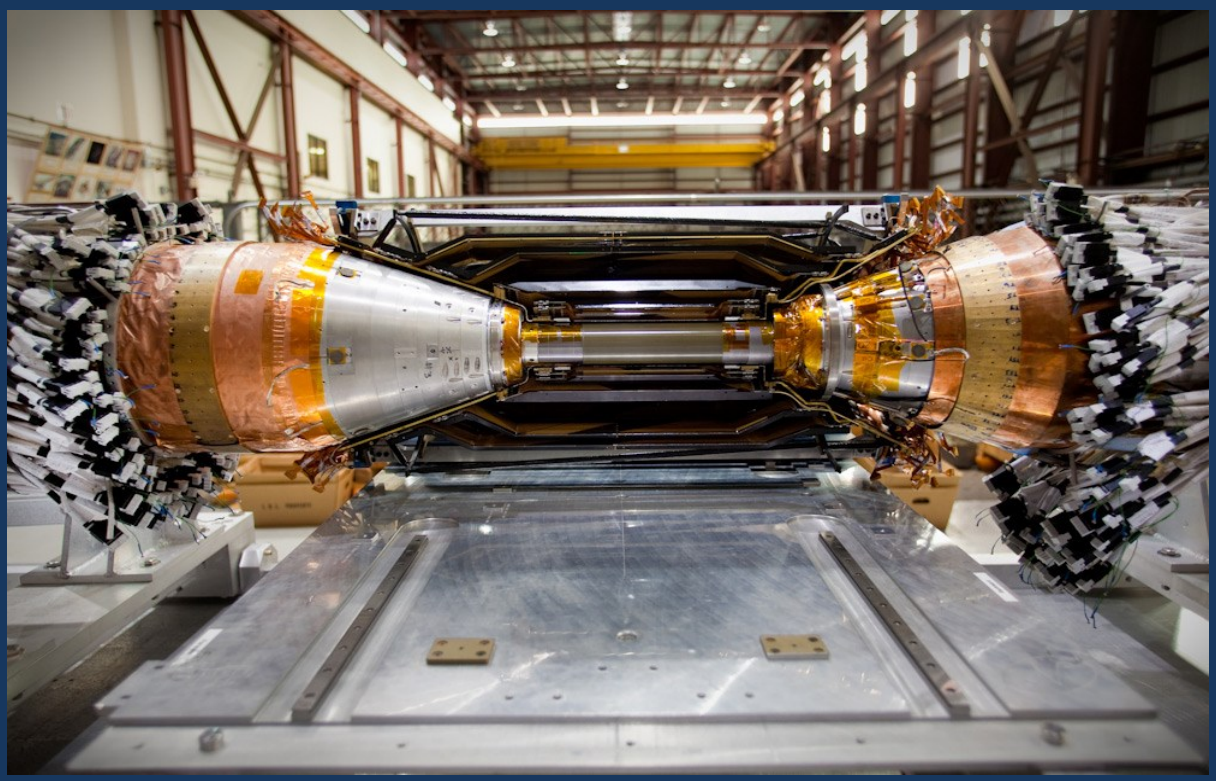
University of Glasgow | School of Physics & Astronomy



PHYS5036 Detection and Analysis of Ionising Radiation

Academic year 2023/2024

1 Course Details

PHYS5036 Detection and Analysis of Ionising Radiation is a level 5 Physics Masters course. It is elective for many physics degree options. It is a Semester 1 laboratory-based course which is made up of 14 sessions.

Laboratory Head: Dr Rachel Montgomery
Room 503, Kelvin Building
Rachel.Montgomery @glasgow.ac.uk

Teaching Staff: Dr Simon Gardner
Mr Gary Penman
Ms Kayleigh Gates

Recommended Text: S. N. Ahmed, Physics and Engineering of Radiation Detection (Elsevier), PDF online through the University library

Laboratory hours: usually Monday and Friday between 14:00 and 17:00, as advertised on the P4/5 timetable

Course notes, laboratory scripts and question sheets are made available on Moodle. Special notice should be taken of the laboratory code of conduct and the instructions on the use of radioactive sources.

2 Assessment

The course will be assessed via oral examination after each experiment (25 % each) and a written individual report on one of the chosen experiments (50 %). The written report should follow the accepted standards of a scientific paper and should not exceed 10 pages. If the course is run in S1, the deadline for submission is usually in the first teaching week of S2.
The course provides 10 M-level credits.

3 Required Knowledge

Although there is no specific course which is a prerequisite for Detection and Analysis of Ionising Radiation, students are expected to be familiar the basics of detector operation, radiation interactions with matter and analysis software.

4 Intended Learning Outcomes

By the end of this course students will gain knowledge of different radiation detector technologies and the fundamental particle interactions with matter on which they are based. They should be able to analyse and evaluate data obtained with radiation detectors. They

should also be able to evaluate the operational limits of a selection of relevant detector solutions. Students should be familiar with the utilisation of Monte Carlo methods to simulate particle interactions with matter and detector systems.

5 Course Outline

Students on this course will undertake laboratory work on two of the six advanced experiments listed below. All experiments include the use of data collected from advanced detector systems and/or the latest simulation and data analysis software developed at CERN. The choice of experiment will depend on the number of participants and the equipment available in the laboratory. Working in pairs on the same experiment is permissible, but note is given to the university guidelines on plagiarism and undue collaboration for assessed work. Please contact the lab head in cases of doubt.

5.1 Analysis of dose distributions in radiotherapy

This experiment demonstrates the use of a Monte Carlo simulation to obtain and analyse the radiotherapy dose distributions with gamma-ray, proton and ion beams. Students who undertake this experiment will gain an understanding of the interaction of both gamma-rays and charged particles with matter and the software tools used for simulation and data analysis.

5.2 Absolute determination of source activity

This experiment demonstrates the use of an inorganic scintillation detector system and a Monte Carlo simulation to measure the absolute activity of several radioisotope sources. Students who undertake this experiment will gain an understanding of scintillation detectors, gamma-ray interactions and the software tools used for simulation, data acquisition, calibration and data analysis.

5.3 Attenuation of gamma radiation in matter

This experiment demonstrates the use of an inorganic scintillation detector system and a Monte Carlo simulation to characterise the attenuation of gamma-rays in different materials. Students who undertake this experiment will gain an understanding of scintillation detectors, gamma-ray interactions and the software tools used for simulation, data acquisition, calibration and data analysis.

5.4 High-resolution gamma-ray spectroscopy

This experiment demonstrates the use of a germanium detector system for high-resolution gamma-ray spectroscopy and radioisotope identification in mineral samples. Students who undertake this experiment will gain an understanding of semiconductor detectors, gamma-ray interactions and the software tools used for data acquisition, calibration and data analysis.

5.5 Neptunium lifetime

This experiment demonstrates the use of an organic scintillation detector system and fast digital processing electronics for precision measurements of the lifetime of short-lived nuclear states. Students who undertake this experiment will gain an understanding of fast scintillator detectors, gamma-ray interactions, digital signal processing and the software tools used for data acquisition, calibration and data analysis.

5.6 Gamma-gamma angular correlation

This experiment demonstrates the use of an inorganic scintillation detector system and fast digital processing electronics to measure coincidences between two gamma-rays. Students who undertake this experiment will gain an understanding of fast scintillator detectors, gamma-ray interactions, digital signal processing and the software tools used for data acquisition, calibration and data analysis.

6 Counselling and Disability Services Information

Students can find links to the University of Glasgow's counselling and disability services below.

6.1 Counselling Service

The University of Glasgow Counselling Service supports students to manage their mental health and to build strategies that will help them successfully complete their course of studies.

The Service also offers a series of Wellbeing Masterclasses on topics such as managing stress and overcoming procrastination.

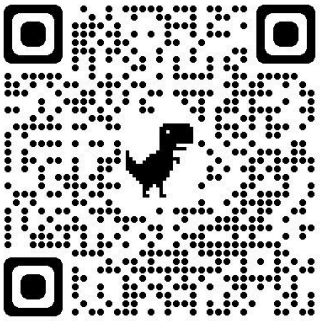
You can find further information, and self-refer, via the QR code below:

https://www.gla.ac.uk/myglasgow/counselling/

6.2 Disability Service

The University of Glasgow Disability Service supports students with disabilities, long-term health and mental health conditions or learning differences, such as dyslexia, to reach their academic potential and experience in full all that the University has to offer.

You can find further information, and self-refer, via the QR code below:



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