

PHYS-452

**Radiation detection**

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Cursus	Sem.	Type
Ing.-phys	MA1, MA3	Opt.
Nuclear engineering	MA1	Opt.
Physicien	MA1, MA3	Opt.

Language of teaching	English
Credits	3
Session	Winter
Semester	Fall
Exam	Oral
Workload	90h
Weeks	14
<b>Hours</b>	<b>3 weekly</b>
Lecture	2 weekly
Exercises	1 weekly
<b>Number of positions</b>	

**Summary**

The course presents the detection of ionizing radiation in the keV and MeV energy ranges. Physical processes of radiation/matter interaction are introduced. All steps of detection are covered, as well as detectors, instrumentations and measurements methods commonly used in the nuclear field.

**Content**

- **Interaction of radiation with matter at low energies:** X-rays/gammas, charged particles and neutrons up to MeV range, ionisation, nuclear cross sections.
- **Characteristics and types of detectors:** gas detectors, semiconductor detectors, scintillators and optical fibers, fission chambers, meshed and pixel detectors
- **Signal processing and analysis:** types of electronics, signal collection and amplification, particle discrimination, spatial and time resolution
- **Nuclear instrumentation and measurements:** principle of measurements, spectrometry, common detection instrumentations, applications in nuclear engineering and R&D.

**Keywords**

radiation detection; radiation-matter interaction; ionizing radiation; detector; signal processing; nuclear instrumentation; measurement methods

**Learning Outcomes**

By the end of the course, the student must be able to:

- Explain interaction processes of ionising radiation and matter
- Describe the production of a detection signal and its processing
- Explain the operation of all types of commonly used detectors
- Assess / Evaluate the detection system and method required for a specific measurement

**Transversal skills**

- Communicate effectively with professionals from other disciplines.

**Teaching methods**

Lectures, exercises, presentations, practice.

**Expected student activities**

Attendance at lectures and exercises, short presentations.

**Assessment methods**

Oral exam

**Supervision**

Assistants                      Yes

**Resources****Bibliography**

Radiation detection and measurement, Glenn F. Knoll. Wiley 2010  
Practical Gamma-Ray Spectrometry, Gordon R. Gilmore, Wiley & Sons 2008

**Ressources en bibliothèque**

- [Radiation detection and measurement, Glenn F. Knoll](#)
- [Practical Gamma-Ray Spectrometry, Gordon R. Gilmore](#)

**Moodle Link**

- <https://go.epfl.ch/PHYS-452>