P4 (GEP=4)

Scintillation detector development

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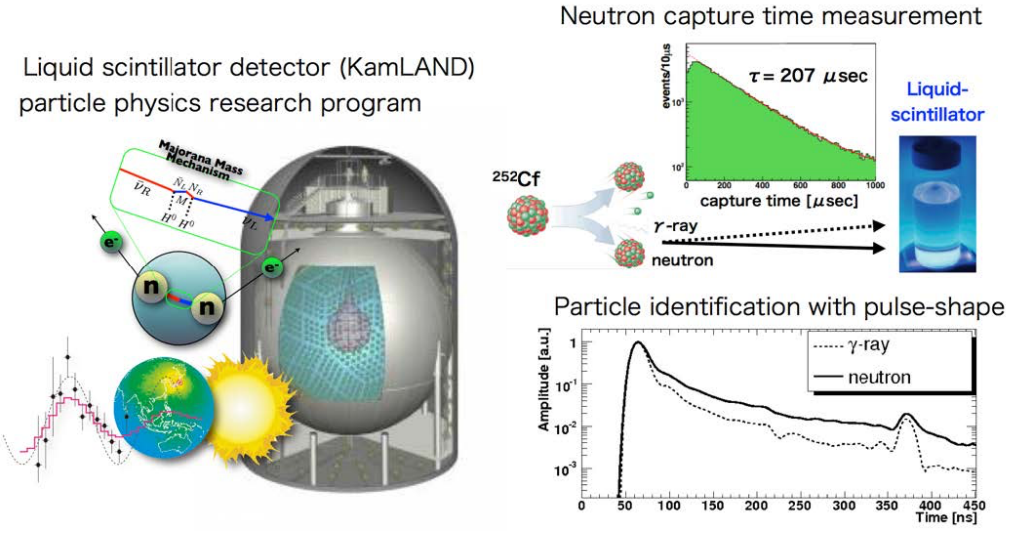
GPPU Experimental Point (GEP): 4

Goal of Study

This course aims to provide broad knowledge and experience of the scintillation detection with fundamental techniques necessary for advanced experiments in particle and nuclear physics research through your work on the liquid scintillator measurement and data analysis.

Contents

The scintillation detection is a widely-used technique in foremost large-scale experiments in the world, relatively cost-effective and multipurpose, so there has been made ongoing efforts on various developments to improve the experimental sensitivities. Actually, a large liquid scintillator detector (KamLAND) has established a new world record in the neutrino mass sensitivity utilizing a unique low-background technique developed in Tohoku University. In this experiment, you will learn the principal and the device design of the scintillation detection in lectures and experiments, and master the practical technique adaptable to the particle and nuclear physics experiments in the future. This course consists of lectures and experiments in 4 days, containing the following items, understanding of light-output and transfer mechanism, particle identification, measurement of neutron capture time, data acquisition and analysis.



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Textbook and References

[1] Measurement principle: Principle of liquid scintillation spectrometry, *National Diagnostics* (2004).

[2] Measurement of time constant, particle identification: Application example for elementary particle experiment: P. Lombardi *et al.*, *Nucl. Inst. Meth. A* **701** 133 (2013).

[3] Application plan for large neutrino experiment: M. Wurm *et al.*, *Astropart. Phys.* **35**, 685 (2012).

Progress Schedule

- Day 1
  Principle of scintillation measurement (lecture)
  Production of liquid scintillator (experiment)
- Day 2
  Design of liquid scintillator detectors (lecture)
  Measurement of light output, light collection efficiency (experiment)
- Days 3-4
  Particle identification, Measurement of neutron capture time (experiment)
  Presentation (measurement results and discussion) and oral test

Other Details

Course Period	Summer in 2022
Place	Research Center for Neutrino Science, room 107
Number of Students	2—4
Evaluation method	Presentation (50%) and oral test (50%) in the last day

In Addition

Some homework for data analysis and consideration will be required on off-duty days.
If the course is hold online, only formal GP-PU doctoral course students are allowed to take it.