Nuclear Physics

Course Code: SM22016 / Google Classroom Code: hek2cde

Year	2021
Course	Lecture on Basic Nuclear Physics
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Day/Period	Fall Semester Fri 3
Credit(s)	2
Instructor	SATOSHI NAKAMURA
Semester	Fall Semester
Course code/number	SPH-PHY505B
Language Used in Course	Two languages or more

Affiliation	Experimental Nuclear Physics Group
Course Title (Japanese)	Basic Nuclear Physics
Course Title (English)	Basic Nuclear Physics
Purpose /Abstract (Japanese)	Modern nuclear physics is study of many-body system interacting by the strong interaction. Based on a picture which treats a nucleus as multi-quark system or hadronic system, basic introduction to the modern nuclear physics will be given. Based on the recent experimental techniques and results, it will be discussed how we understand behavior of materials under extreme conditions like early universe or deep inside of neutron stars.
Purpose /Abstract (English)	Modern nuclear physics is the study of many-body system interacting by the strong interaction. Based on a picture which treats a nucleus as multi-quark system or hadronic system, basic introduction to the modern nuclear physics will be given. Based on the recent experimental techniques and results, it will be discussed how we understand behavior of materials under extreme conditions like early universe or deep inside of neutron stars.
Goal (Japanese)	The goal of this lecture is to learn basic concept of modern nuclear physics and recent research techniques.
Goal (English)	The goal of this lecture is to learn basic concept of modern nuclear physics and recent research techniques.
Contents and progress schedule of the class (Japanese)	Course Outline 01. What is nuclear physics? Definition of nuclear physics in this course and basic terminologies necessary for nuclear physics study will be explained. 02. Mass of nucleus and binding energy of nucleon will be discussed. 03. Lifetime of radio isotopes, radiation and radiation effects to health will be explained. Course participants will discuss about the Fukushima accidents. 04. Iso-spin and charge symmetry of nuclear force will be discussed. 05. Electron scattering experiments and exotic atoms will be discussed. 06. Rosenbluth formula and experiments to measure form factors will be discussed. Relation between the results of those experiment and charge distribution of nucleus will be discussed. 07. Quasi-elastic scattering and nuclear resonances will be discussed. 08. Deep inelastic scattering and structure function will be discussed. 09. Quark model and Baryons will be explained. 10. Baryon magnetic moment and color in QCD will be explained. 11. Nuclear force, Fermi gas model and neutron stars will be discussed.. 12. Shell model and hypernuclei will be discussed. 13. Final Examination

Contents and progress schedule of the class (English)	Course Outline 01. What is nuclear physics? Definition of nuclear physics in this course and basic terminologies necessary for nuclear physics study will be explained. 02. Mass of nucleus and binding energy of nucleon will be discussed. 03. Lifetime of radio isotopes, radiation and radiation effects to health will be explained. Course participants will discuss about the Fukushima accidents. 04. Iso-spin and charge symmetry of nuclear force will be discussed. 05. Electron scattering experiments and exotic atoms will be discussed. 06. Rosenbluth formula and experiments to measure form factors will be discussed. Relation between the results of those experiment and charge distribution of nucleus will be discussed. 07. Quasi-elastic scattering and nuclear resonances will be discussed. 08. Deep inelastic scattering and structure function will be discussed. 09. Quark model and Baryons will be explained. 10. Baryon magnetic moment and color in QCD will be explained. 11. Nuclear force, Fermi gas model and neutron stars will be discussed.. 12. Shell model and hypernuclei will be discussed. 13. Final Examination
Grading(Japanese)	Evaluation will be based on class participation, quiz during each lecture and the final exam (or essay).
Grading (English)	Evaluation will be based on class participation, quiz during each lecture and the final exam (or essay).
Books required /referenced (Japanese)	No textbook will be used. Resumes with necessary information will be given in the course. If you want to study modern nuclear physics more, following reference books are recommended. Bogdan Povh et al. , "Particle and Nuclei", Springer. C.A.Bertulani, "Nuclear Physics in a Nutshell", Princeton U. Press W.R.Leo, "Techniques for Nuclear and Particle Physics Experiments", Springer
Books required /referenced (English)	No textbook will be used. Resumes with necessary information will be given in the course. If you want to study modern nuclear physics more, following reference books are recommended. Bogdan Povh et al. , "Particle and Nuclei", Springer. C.A.Bertulani, "Nuclear Physics in a Nutshell", Princeton U. Press W.R.Leo, "Techniques for Nuclear and Particle Physics Experiments", Springer
Preparation and review (Japanese)	It is recommended to review basic parts of electromagnetism, quantum mechanics, and special relativity.
Preparation and review (English)	It is recommended to review basic parts of electromagnetism, quantum mechanics, and special relativity.
Practical business	
Remarks (Japanese)	The lecture will be given in English.
Remarks (English)	
Last Update	2021/06/23 15:17
	1単位の授業科目は、45時間の学修を必要とする内容をもって構成することを標準としています。1単位の修得に必要となる学修時間の目安は、「講義・演習」については15～30時間の授業および授業時間外学修（予習・復習など）30～15時間、「実験、実習及び実技」については30～45時間の授業および授業時間外学修（予習・復習など）15～0時間です。 One-credit courses require 45 hours of study. In lecture and exercise-based classes, one credit consists of 15-30 hours of class time and 30-15 hours of preparation and review outside of class. In laboratory, practical training, and practical skill classes, one credit consists of 30-45 hours of class time and 15-0 hours of preparation and review outside of class.