

シラバス参照

④ 開講年度/Year	2022
④ 科目名	場の量子論基礎
④ Course	Lecture on Basic Quantum Field Theory
④ 曜日・講時/Day/Period	後期 金曜日 3講時
④ 単位数/Credit(s)	2
④ 担当教員/Instructor	齋藤 理一郎
④ 学期/Semester	後期
④ 科目ナンバリング /Course code/number	SPH-PHY501B
④ 使用言語 /Language Used in Course	2カ国語以上
④ 備考/Notes	

④ 所属講座等	固体統計物理講座 Condensed Matter Theory Group, Department of Physics
④ 授業題目	量子力学の復習と場の量子論の導入 Introduction of quantum field theory
④ Course Title	Basic theory of quantum field theory based on the quantum mechanics.
④ 授業の目的と概要	In this class, we will discuss the quantum field theory in English. The subjects that we discuss in this lecture as examples are taken from subjects of solid-state physics. In order to take this class, students should study quantum mechanics, which is mandatory. In particular, if the students are undergraduate students, the students should pass some preliminary examinations of quantum mechanics. Form solid-state physics, we will introduce some examples that the description of the field theory is useful.
④ Purpose /Abstract	Starting from field quantization in quantum mechanics, we explain field quantization in the field theory. We introduce interactions based on perturbation theory and discuss perturbative calculations in theories in solid-state physics. renormalization procedure. 1. Second quantization in quantum mechanics 2. Some examples in solid-state physics 3. Time evolution in the interaction picture 4. Dyson expansion and Wick theorem 5. Perturbation theory and Feynman diagram
④ 学修の到達目標	本クラスは、留学生が多いことを考慮して、学生のレベルを見てから到達目標を決める。
④ Goal	Since it is for foreign students whose level is not unique, the goal of the class is flexible depending on the level of the students. It does not mean that you can attend this class without knowing any backgrounds.
④ 授業内容・方法と進捗予定	量子力学における場の考え方の導入からはじめ、場の量子化をおこなう。摂動論に基づき相互作用を取り入れ摂動計算を固体物理の問題を中心に議論する。この授業は英語で行われる。英語の質問に対して、英語で答える必要がある。 1. 量子力学における第2量子化 2. 固体物理における例 3. 相互作用表示による時間発展と摂動論 4. 久保公式の場の演算子による記述
④ Contents and progress schedule of the class	We discuss of the concept of field in quantum mechanics. Using the perturbation theory, we discuss how to consider the interaction in the Hamiltonian. In particular, we mainly discuss the problems in solid state physics. 1. Second quantization in quantum mechanics. 2. Introducing the field operator of Fermion and Boson.

	<p>3. Time depending perturbation theory in quantum field theory for solid-state physics.</p> <p>4. Quantum field description for conductivity by the Kubo formula.</p>
成績評価方法	We will give small examinations and some reports every week. Reports that we can use for the future class can be given by the powerpoint file so that we can directly incorporate them into the class note.
Grading	Grading is evaluated by the submitted reports and examinations.
教科書および参考書	The textbooks are specified in the class. The PowerPoint files of the class notes can be downloaded.
Books required /referenced	The textbooks are specified in the class.
授業時間外学修	毎週レポート作成に2-3時間必要です。
Preparation and review	You need to take a couple of hours for making the homework every week.
実務・実践的授業 /Practical business ※〇は、実務・実践的授業であることを示す。 /Note: "〇" Indicates the practical business	
その他	<p>Since it is very advanced class, the contents of the class will be adjusted to the level of students. Nevertheless, you should understand the basic points of quantum mechanics.</p> <p>For any reasons, we will NOT accept the any request of the credit WITHOUT attending the class in order to avoid so-called "duplicated registration of the class at the same time in the same semester".</p>
Remarks	<p>Since it is very advanced class, the contents of the class will be adjusted to the level of students. Nevertheless, you should understand the basic points of quantum mechanics.</p> <p>For any reasons, we will NOT accept the any request of the credit WITHOUT attending the class in order to avoid so-called "duplicated registration of the class at the same time in the same semester".</p>
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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単位の修得に必要な学修時間の目安は、「講義・演習」については15～30時間に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 skill classes, one credit consists of 30-45 hours of class time and 15-0 hours of preparation and review outside of class.