Квантовая теория поля / Quantum Field Theory

Lecturers:
Dmitry Karlovets

Language:
English

Credit points:
3 з.е.

Monitoring type:
Экзамен/Exam

Educational Program:
Advanced Quantum and Nanophotonic Systems
1 and 3 semester

Prerequisites:
Математический анализ
Квантовая механика

Lectures (a.h)*	Practice (a.h)	Labs (a.h)
32		
*1 academic hour = 45 minutes		

Данный курс имеет практическую направленность, чтобы научиться делать все вычисления самостоятельно и осознанно.

This course has a practical focus to learn how to do all the calculations yourself and consciously.

Course content

1 and 3 semester

Квантовая теория поля / Quantum Field Theory

Структура курса

1. Renormalization.

2. Transformations of coordinates and fields. Symmetry. Noether's theorem.

3. Relativistic quantum mechanics. Why can't we do without fields? The evolution operator.

4. The starting model is a system of harmonic oscillators. The benefits of birth/annihilation operators. Quantization. Phonons. Transition to a continuous limit.

5. The S–matrix. The Dyson formula. Wick's theorem. Feynman diagrams. Pulse space for calculations.

6. Quasiparticles. The spectral density of states. The full function of the Green.

7. Canonical quantization of fields. The Hamiltonian in the canonical representation. The normal ordering. Two standard examples are scalar and complex fields.

8, The physical meaning of the S–matrix and its features. Fermi's golden rule.

9. Green's function in quantum mechanics and in field theory. The propagator. Feynman's presentation.

Recommended resources

1. To. Icikson, J.-B. Zuber. "Quantum field theory". In 2 volumes: M., Mir, 1984

2. Общие принципы квантовой теории поля : учебное пособие / Н. Н. Боголюбов, А. А. Логунов, А. И. Оксак, И. Т. Тодоров. — Москва : ФИЗМАТЛИТ, 2006. — 657 с. — ISBN 5-9221-0612-0. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/48239 (дата обращения: 31.08.2024).

Grading Policy

Grades

The knowledge, skills, and abilities of students during intermediate certification in the form of an exam are determined by the following grades:

- "Excellent" – the student has deeply and solidly mastered all the program material, presents it exhaustively, consistently, competently, and logically, does not have difficulty with modified tasks, easily copes with practical tasks, correctly substantiates decisions made, and can independently summarize and present the material without making mistakes.
- "Good" – the student knows the program material well, presents it competently and to the point, does not make significant errors in answering questions, can correctly apply theoretical principles, and possesses the necessary skills for practical tasks.
- "Satisfactory" – the student has mastered only the basic material, but lacks knowledge of certain details, makes errors, provides insufficiently accurate formulations, violates the sequence of presenting the program material, and has difficulties with practical tasks.
- "Unsatisfactory" – the student does not know a significant portion of the program material, makes substantial errors, and experiences great difficulty with practical tasks.