

PHYS 7147 Syllabus

Quantum Field Theory, Phys 7147

Fall 2026

Instruction Information

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General Course Information

Description

This course is an introduction to Quantum Field Theory, a subject that is useful for the understanding of fundamental phenomena in high energy, particle, condensed matter and many-particle physics. A **strong** background in Linear Algebra, Quantum Mechanics, Calculus and Partial Differential Equations is necessary to succeed in this class. In addition, a **solid** background in Advanced Quantum Mechanics and Advanced Classical Mechanics (Lagrangian, Hamiltonian, and Classical Fields) is essential to appreciate Quantum Field Theory and to do well on it. Some knowledge of Group Theory and Lie Algebras is desirable but not required. Lecture topics include symmetry groups, canonical quantization, conservation laws, symmetry breaking, the CPT theorem, the Dirac equation, quantum electrodynamics, non-Abelian gauge theories, electroweak interactions, and the standard model.

Course Learning Outcomes

At the end of this course, students should be able to explain why symmetry plays an important role in quantum field theory, use canonical quantization to quantize classical field theories, understand that conservation laws are consequences of symmetries, explain what spontaneous symmetry breaking is, appreciate the importance of the CPT theorem, interpret the meaning of the Klein-Gordon and Dirac equations, analyze basic elements of quantum electrodynamics, apply concepts of non-Abelian gauge theories, make connections between electromagnetic and weak forces, describe the essence of the standard model of particle physics and what is beyond it.

Required Course Materials

Lecture notes containing material from various sources will be provided. **There is no required textbook in this course.** Here are some classical Quantum Field Theory textbooks that can be used as supplementary material:

- *An Introduction to Quantum Field Theory*, by Michael E. Peskin and Daniel V. Schroeder, Addison Wesley.
- *Field Theory - A Modern Primer*, by Pierre Ramond, Frontiers in Physics, Benjamin/Cummings.
- *The Quantum Theory of Fields*, by Steven Weinberg, Vols. I and II, Cambridge University Press.
- *Quantum Field Theory*, by Claude Itzykson and Jean-Bernard Zuber, McGraw Hill.

Grading Policy

Letter Grade: **A** = 90 to 100%; **B** = 80 to 89%; **C** = 70 to 79%; **D** = 60 to 69%; **F** = 0 to 59%

Assignments

- Homework 60%
- Term Paper 20%
- Oral Presentation 20%

Description of Graded Components

Homework assignments are given periodically. There are no midterm or final exams. Grades will be given based on homework assignments, a term paper and an oral presentation.

Course Policies

Attendance and/or Participation

This will be an engaging class, where students are expected to participate. Therefore, attendance and participation are considered in determining final grades.

Academic Integrity

The foundations of the Georgia Tech community are based on honor, trust and academic integrity. Students are expected to behave according to the highest ethical standards outlined in the Georgia Tech's Honor Code (<https://policylibrary.gatech.edu/student-life/academic-honor-code>) and the Student Code of Conduct (<https://policylibrary.gatech.edu/student-life/student-code-conduct>).

Students suspected of plagiarism or cheating on assignments, quizzes or exams will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Core IMPACTS

Not Applicable

Accommodation for Students with Disabilities

Students with learning needs that require special accommodation should contact the Office of Disability Services (<https://disabilityservices.gatech.edu/>, Phone: 404 894-2563) as soon as possible to make an appointment and to obtain a letter of accommodation. Students should feel free to contact the course instructor to discuss their learning needs.

Student-Faculty Expectations Agreement

At Georgia Tech, it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. Read the student-faculty expectations (<https://catalog.gatech.edu/rules/22/>), where the basic principles are articulated. Hard work, respect for knowledge, and cordial interactions will go a long way in building a healthy academic environment.

Pre- &/or Co-Requisites

- Phys 6106 (Quantum Mechanics II)

Collaboration, Group Work, and Use of Generative AI

Students are permitted to consult with one another and to seek other resources to solve homework problems **excluding prior-year solutions or AI based software**, but each student must turn in their **own** original work. The term paper and the oral presentation should be prepared by the students without the use of **AI-based software**.

Extensions, Late Assignments, & Re-Scheduled/Missed Exams

Penalties are given for late homework without justification. The submission of late homework requires documentation, and is allowed in cases of illness, religious observances or approved Institute activities. Additional accommodation can be made for students whose presence elsewhere is required by law, or for whom a special request is made by the Office of the Dean of Students.