

# Quantum Field Theory 2

## Fall 2022

Contact information

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This course is a synchronous class. It carries 3 credit.

Lectures: MW Period 8&9 (15:00 - 16:15 AM)

Office hours: Wednesday 16:15 - 17:00 PM or by appointment.

Prerequisites: QFT 1

Welcome to QFT 2 (PHY7669).

Course Description: Introduce the gauge theory and Standard Model to students.

Course Goals and Objectives: the course will tell students how to do path integral and solve RG equation, what is the Standard Model.

The books that I recommended are

- 1) Quantum Field Theory and the Standard Model
- 2) The Quantum Theory of Fields I & II by S. Weinberg

1. Introduction to Standard Model
2. Path Integral
  - 2.1 Path Integral and quantum mechanics
  - 2.2 Generating functions and S-matrix
  - 2.3 Feynman rules
  - 2.4 Semi-classical expansions
  - 2.5  $i\epsilon$
  - 2.6 Derivative interactions
  - 2.7 Fermionic path integral
  - 2.8 Gauge field functional integral
  - 2.9 Quantum effective action
  - 2.10 Symmetry and Ward identity
3. Renormalization and Renormalization Group
  - 3.1 Casimir force

- 3.2 Scalar field examples
- 3.3 Vacuum polarization
- 3.4 Anomalous magnetic moment
- 3.5 Mass renormalization
- 3.6 Renormalized perturbation theory
- 3.7 Infrared divergences
- 3.8 Renormalizability
- 3.9 Non-renormalizable theories
- 3.10 Renormalization group
  
- 4. Yang-Mills Theories
  - 4.1 Gauge fields
  - 4.2 Quantum gauge fields
  - 4.3 Quantum Chromodynamics
  - 4.4 beta function
  
- 5. Spontaneous and Explicit Global Symmetry Breaking
  
- 6. Higgs Mechanism
  
- 7. Standard Electroweak Theory
  
- 8. Anomalies

The homework will contribute 80% towards the final grade, while the final exam will count for 20%. You may refer to the Physics Department policy on incomplete grades. For additional details regarding grading policies, see the university website: [catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/](http://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/)

A guaranteed grading scale has been announced:

A: 90% A-: 85% B+: 80% B: 75% B-: 70% C+: 66% C: 62% C-: 58% D+: 54% D: 50%  
D-: 46%

These thresholds may be lowered if appropriate but they will not be raised.

### Accommodations for Students with Disabilities

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, [www.dso.ufl.edu/drc/](http://www.dso.ufl.edu/drc/)) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation.

Students with disabilities should follow this procedure as early as possible in the semester.

### Academic Honesty

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<http://www.dso.ufl.edu/sccr/process/student-conduct-honorcode/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.”

### Online Evaluations

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

### Advising and Counseling

Due to the nature of the environment at the university, it is not uncommon for students to experience stressful situations, and “study harder” sometimes does not seem to work. If you find yourself in this situation, you are encouraged to seek confidential counseling, see: <http://www.counseling.ufl.edu/cwc/>.

### Zoom Code of Conduct

The UF Student Honor Code and Student Conduct Code continue to apply to online behavior. You are expected to be professional and respectful while attending class on Zoom, if we ever need to switch to an online mode of instruction.

### Health & safety

In response to COVID-19, the following recommendations are in place to maintain your learning environment, to enhance the safety of our in-classroom interactions, and to further the health and safety of ourselves, our neighbors, and our loved ones.

- If you are not vaccinated, get vaccinated. Vaccines are readily available and have been demonstrated to be safe and effective against the COVID-19 virus. Visit [one.ufl.edu](http://one.ufl.edu) for screening / testing and vaccination opportunities.

- If you are sick, stay home. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 to be evaluated.
- As with any excused absence, you will be given a reasonable amount of time to make up missed work.
- Masks are always welcome within our classroom, regardless of your vaccination status.