

Exam of Advanced Quantum Field Theory

Academic Year 2019-2020

Given the breadth of the course's program, knowledge of all the steps will not be required. The aim of the oral examination is to check the degree of the student's comprehension of the topics covered in the course and his/her ability to expose the arguments with a consequential logic and in a coherent way.

The student can choose to start the exam with a short seminar, typically of 15-20 minutes, concerning the deepening of a topic considered in the course or with a new topic that the student wishes to propose. In the latter case, it is necessary to fix the proposal in advance with the teacher. Those who opt to start the exam with the seminar are encouraged to present a written version of the seminar. Presentations of wider topics can be divided into several students. These contributions can be included in the course notes.

Possible topics for the optional seminar

Here are reported some example of possible topics for the optional seminar. This list will be updated.

1. Rigorous proof of the Coleman-Mandula theorem. Possible reference: S. Weinberg, The Quantum Theory of Fields, III.
2. Renormalizability of Yang-Mills Theories. Possible reference: A. Bilal, Advanced Quantum Field Theory: Renormalization, Non-Abelian Gauge Theories and Anomalies, http://www.solvayinstitutes.be/pdf/doctoral/Adel_Bilal2014.pdf.
3. Homotopy groups. Possible references: Geometry, Topology and Physics, II edition.
4. Solitons, Monopoles and Instantons. Possible references: S. Erik, Weinberg, Classical Solutions in Quantum Field Theory: Solitons and Instantons in High Energy Physics (Cambridge Monographs on Mathematical Physics).
5. Instantons and Seiberg-Witten theory. G. Travaglini, Calcoli istantoni in teorie di gauge supersimmetriche (In Italian), PhD Thesis, [http:](http://)

[//inspirehep.net/record/455054/files/travaglini.pdf](http://inspirehep.net/record/455054/files/travaglini.pdf). J. M. Slater, Instanton effects in supersymmetric $SU(N)$ gauge theories, http://inspirehep.net/record/1253202/files/4812_2281.PDF. V.K. Khoze, M.P. Mattis and M.J. Slater, The Instanton Hunter's Guide to Supersymmetric $SU(N)$ Gauge Theories, <https://arxiv.org/pdf/hep-th/9804009.pdf>.

6. Any other topic related to Seiberg-Witten theory. For example the original paper by Seiberg-Witten or some of the papers mentioned in the references of the course.