TCM312 Quantum Field Theory II (2020-2023)

HUOM! OPINTOJAKSOJEN TIETOJEN TÄYTTÄMISTÄ KOORDINOIVAT KOULUTUSSUUNNITTELIJAT HANNA-MARI PEURALA JA TIINA HASARI

- 1. Course title
- 2. Course code
- 3. Course status: compulsory or optional
- 4. Course level (first-, second-, third-cycle/EQF levels 6, 7 and 8)
- 5. Recommended time/stage of studies for completion
- 6. Term/teaching period when the course will be offered
- 8. Teacher coordinating the course
- 9. Course learning outcomes
- 10. Course completion methods
- 11. Prerequisites
- 12. Recommended optional studies
- 13. Course content
- 14. Recommended and required literature
- 15. Activities and teaching methods in support of learning
- 16. Assessment practices and criteria, grading scale
- 17. Teaching language

1. Course title

Kvanttikenttäteoria II
Kvantfältteori II
Quantum Field Theory II

2. Course code

TCM312

3. Course status: compulsory or optional

-Which degree programme is responsible for the course?
Master's Programme in Theoretical and Computational Methods

-Which module does the course belong to?
TCM300 Theoretical and Computational Methods, Advanced Studies
PAP3002 Particle Physics and Cosmology, Advanced Studies

-Is the course available to students from other degree programmes?
Yes

4. Course level (first-, second-, third-cycle/EQF levels 6, 7 and 8)

Master's level, degree programmes in medicine, dentistry and veterinary medicine = secondcycle degree/EQF level 7
Doctoral level = third-cycle (doctoral) degree/EQF level 8

-Does the course belong to basic, intermediate or advanced studies (cf. Government Decree on University Degrees)?
Advanced studies

5. Recommended time/stage of studies for completion

After QFT I has been completed

6. Term/teaching period when the course will be offered

Spring term

7. Scope of the course in credits

10 cr

8. Teacher coordinating the course

Prof. Oleg Lebedev

9. Course learning outcomes

Understanding and practice of advanced concepts of quantum field theory such as renormalization, loop expansion, regularization techniques, anomalies, the Standard Model, CP violation. The student is prepared to contribute to original research in particle physics.

10. Course completion methods

Class attendance is strongly encouraged. Homework is assigned once a week and contributes 25% to the final grade, while the final exam contributes 75%. There are bonus points for in-class activities.

11. Prerequisites

QFT I

12. Recommended optional studies

Introductory Particle Physics; Higgs Physics; Supersymmetry; Thermal Field Theory

13. Course content

- Loop calculations and regularizations, renormalization, anomalies
- non-Abelian gauge theories, the Standard Model, CP violation
- effective field theory, flavor and CP problems in the Standard Model
- physics beyond the Standard Model

14. Recommended and required literature

- M. Peskin and D. Schroeder: An Introduction to Quantum Field Theory, Addison-Wesley 1995
- M. Schwartz: Quantum Field Theory and the Standard Model, Cambridge University Press 2014
- original research papers

15. Activities and teaching methods in support of learning

exercise sessions once a week; class activities encouraged with bonus points

16. Assessment practices and criteria, grading scale

1 to 5 (25% homework, 75% final exam, + bonus points)

17. Teaching language

English