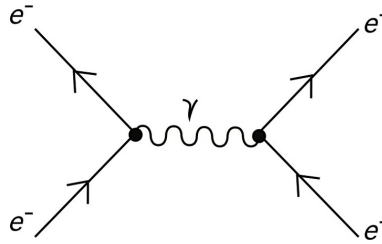


# Quantum Field Theory



## Content

1. Introduction

### Part I: Non-Relativistic Quantum Many-Body Theory

2. Identical Particles
3. Second Quantization
4. Canonical Field Quantization for Bosons
5. Canonical Field Quantization for Fermions
6. Schrödinger propagator

### Part II: Relativistic Fields and Their Quantization

7. Poincaré Group
8. Klein-Gordon Field
9. Noether Theorem
10. Maxwell Field
11. Dirac Field

### Part III: Quantum Electrodynamics

12. Minimal Coupling
13. Dirac Interaction Picture
14. Scattering Operator
15. Møller Cross Section
16. Feynman Diagrams

## References

- F. Dyson, *Quantenfeldtheorie*, Springer, 2014
- L. Edelhäuser und A. Knochel, *Tutorium Quantenfeldtheorie*, Springer, 2016
- J. Gleick, *Genius - The Life and Science of Richard Feynman*, Vintage Books, 1991
- W. Greiner, *Relativistic Quantum Mechanics - Wave Equations*, Springer, 2000
- W. Greiner and J. Reinhardt, *Quantum Electrodynamics*, Springer, 2008
- W. Greiner and J. Reinhardt, *Field Quantization*, Springer, 2008
- H. Kleinert, *Particles and Quantum Fields*, World Scientific, 2016
- M.E. Peskin and D.V. Schröder, *An Introduction to Quantum Field Theory*, Cambridge University Press, 1995
- S. Schweber, *QED and the men who made it - Feynman, Schwinger, and Tomonaga*, Princeton University Press, 1994
- M. Veltman, *Diagrammatica - The Path to Feynman Diagrams*, Cambridge University Press, 1994
- T. Lancaster and S.J. Blundell, *Quantum Field Theory for the Gifted Amateur*, Oxford University Press, 2014

## Organizational Remarks

- 4 hours lectures per week, 2 hours exercises per week
- 6 (8) ECTS credits for elective (in-depth) module
- Certificate for active participation:
  - 50 % points from all points of all exercise sheets
  - five times calculations at the black board / tablet
- Oral module exam possible