

## Examination topics

### Mathematical Introduction to QFT Winter Semester 2017/18

1. Advanced/retarded Green's function of the KG equation
2. Positive/negative frequency solution of the KG equation
3. Feynman propagator of the KG equation
4. Space of solutions of the KG equation as a symplectic space
5. Initial value problem for the KG equation and the Pauli-Jordan function
6. Lagrangian formalism for the KG equation and the stress-energy tensor
7. Diagonalization of the Hamiltonian and the momentum with help of normal modes
8. Hilbert space of positive frequency solutions of the KG equation
9. Quantization of scalar fields
10. Time-ordered and non-time-ordered 2-point function of the scalar field
11.  $*$ -algebras as a description of quantum systems, superselection sectors
12. Mathematical description of the Poincaré invariance of a quantum theory, the Hamiltonian and the momentum operator
13. Haag-Kastler axioms
14. Wightman axioms
15. Time-dependent Hamiltonians—general formalism
16. Scalar fields with a time-independent linear current.
17. Scalar fields with a time-dependent linear current and their S matrix
18. Infrared problem for massless scalar fields.
19. Representations of Canonical Commutation Relations—definition, examples
20. Stone-von-Neumann Theorem about the uniqueness of representations of CCR for a finite number of degrees of freedom