Modules:

physics700 **Elective Advanced Lectures**
physics730 **Theoretical Physics**

Course: Quantum Field Theory for Condensed Matter Physics (T)

Course No.: physics759

Category	Type	Language	Teaching hours	CP	Semester
Elective	Lecture with exercises	English	2+1	5	WT/ST

Requirements:
Quantum mechanics I (physik421)

Preparation:
Quantum mechanics II (physics606), Thermodynamics and statistical physics (physik521)
Can be heard in parallel to physics617: "Theoretical Condensed Matter Physics"

Form of Testing and Examination:
Requirements for the examination (written or oral): attendance of and successful work with the exercises

Length of Course:
1 semester

Aims of the Course:
Knowledge of quantum field theory of interacting many-body systems at finite temperature
Knowledge of quantum field theory for non-equilibrium systems
Ability to construct and evaluate perturbation theory using Feynman diagram

Contents of the Course:
Fock space and occupation number representation for bosons and fermions
Green's functions: analytical properties and their relation to observable quantities
Elementary linear response theory
Equations of motion
Perturbation theory in thermodynamic equilibrium: Feynman diagrams, Matsubara technique
Perturbation theory away from equilibrium: Keldysh technique
Infinite resummations of perturbation expansions
Exemplary application to model system

Recommended Literature:
W. Nolting, Grundkurs Theoretische Physik 7: Vielteilchen-Theorie (Springer, Heidelberg 2009)
A. A. Abrikosov, L. P. Gorkov, I. E. Dzyaloshinskii, Methods of Quantum Field Theory in Statistical Physics (Dover, New York 1975 and later editions)
Xiao-Gang Wen, Quantum Field Theory of Many-Body Systems, Oxford Graduate Texts (Oxford University Press, Oxford 2004)
A. Altland and B. Simons, Condensed Matter Field Theory (Cambridge University Press, Cambridge 2006)