Quantum Field Theory for Condensed Matter Physics (T) - physics759

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)

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