Module Name

Computational Many-Body Physics

Type of Module	**Module Code**
Basic Module	BM-CMBP

Identification Number	**Workload**	**Credit Points**	**Term**	**Offered Every**	**Start**	**Duration**
MN-CS-CMBP	180 Hours	6 CP	1. – 3. Semester	SuSe	Summer Term Only	1 Semester

1	**Course Types**	**Contact Time**	**Private Study**	**Planned Group Size**
	a) Lecture	45 h	60 h	Students
	b) Problem Class	15 h	60 h	

2 Module Objectives and Skills to be Acquired

This course provides an overview of elementary numerical approaches to study many-body systems, both classical and quantum.

3 Module Content

The lecture will provide an overview of modern numerical approaches to many-body systems, both classical and quantum. The in-depth introduction of elementary algorithms will be complemented by application of these methods to fundamental models and phenomena, mostly arising in the context of condensed matter physics.

A typical list of topics includes

· percolation

· phase transitions

· finite-size scaling

· Monte Carlo sampling

· extended ensemble techniques

· molecular dynamics

· Hartree-Fock / density-functional methods

· exact diagonalization

· quantum Monte Carlo

· series expansions

· numerical renormalization group

· density matrix renormalization group

4 Teaching Methods

The module consists of a lecture course, supplemented by a problem class.

5 Prerequisites (for the Module)

Formally: none

Regarding the Contents: Training in theoretical physics at the B.Sc. level, experimental solid state physics

6 Type of Examination

Written or oral examination

7	**Credits Awarded** The module is passed by passing the examination. The grade given for the module is equal to the grade of the examination.
8	**Compatibility with other Curricula** The module is part of the Master of Science in Physics.
9	**Proportion of Final Grade** 6/114
10	**Module Coordinator** S. Trebst, R. Bulla
11	**Further Information** Literature: J.M. Thijssen, Computational Physics, Cambridge University Press (2007) Tao Pang, An Introduction to Computational Physics, Cambridge University Press (2006) Werner Krauth, Statistical Mechanics: Algorithms and Computation, Oxford University Press (2006)