Module Name
Information Theory and Statistical Physics

Type of Module	Module Code
Advanced Module	AM-InfTheo

Identification Number	Workload	Credit Points	Term	Offered Every	Start	Duration
MN-CS-InfTheo	180 h	6 CP	1. – 3. Semester	variable	both	1 Semester

1	Course Types		Contact Time	Private Study	Planned Group Size
	a) Lecture		45 h	60 h	30 Students
	b) Exercise		15 h	60 h	

2	Module Objectives and Skills to be Acquired
	This lecture course gives an introduction to information theory and statistical inference from the perspective of statistical physics.

3	Module Content
	• introduction to probability and information theory
	• information theory and the foundations of statistical physics, the principle of maximum entropy
	• Maxwell's demon and Szilard's engine: physics of information processing
	• typical and rare events, the source coding theorem
	• statistical inference
	• inverse problems, the inverse Ising problem
	• information processing in biology: sequence analysis, molecular structure prediction, regulation of gene expression

4	Teaching Methods
	Lectures and Exercises

5	Prerequisites (for the Module)
	Formal: None
	Regarding the Contents: Statistical Mechanics on the bachelor level

6	Type of Examination
	Oral Examination or Term Paper

7	Credits Awarded
	The module is passed and credit points are awarded if the 30-45-minute oral final exam is passed or the term paper is passed.

8	Compatibility with other Curricula
	The course is part of the Master of Science Physics

9	Proportion of Final Grade
	6/114

10	**Module Coordinator**
	J. Berg
11	**Further Information**
	Recommended literature: T. Cover and J. Thomas, Elements of Information Theory (Wiley, 1991) D. MacKay, Information theory, Inference and Learning Algorithms (CUP, 2003) M. Mézard and A. Montanari, Information, Physics, and Computation (OUP, 2009)