Statistical and Biological Physics

Module No.: MN-P-SP-StatBio, MN-P-PN-StatBio, MN-P-WaMa   Version: 05.06.2015 HK

Course: Information Theory and Statistical Physics

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Category	Type	Language	Teaching Hours	CP	Semester
Specialized Course	Lecture	English	3+1	6	WiSe

Requirements for participation:

Statistical Mechanics on the bachelor level

Type of module examinations:

Oral Examination or Term Paper and one oral examination at the end of the module

Duration of the course:

1 semester

Aims of the course:

This lecture course gives an introduction to information theory and statistical inference from the perspective of statistical physics.

Contents of the course:

- 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

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)