UCLouvain

lphys2316

2023

Advanced mathematical physics

5.00 credits	30.0 h	Q1

Teacher(s)	Ruelle Philippe ;Walmsley Hagendorf Christian ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Prerequisites	LPHYS2113. Having followed LPHYS2132et LPHYS2215 is an asset.
Main themes	The teaching unitwill attempt to answer the following general question: why and how is a statistical model near a critical point described by a quantum field theory? The first part will examine the Ising model in details: duality; spectrum of the transfer matrix and relationswith a theory of free fermions; the free fermionas a conformal theory; identification of its operator contentfrom lattice observables via a scaling limit. The second part will generalise these concepts and introduce the minimal conformal theories. The following topics will be addressed: the conformal Ward identity, primary operators and descendants, the Virasoro Algebra andits representations, the Kac determinant and the operator content of minimal models, correlation functions and fusion rules.
Learning outcomes	**At the end of this learning unit, the student is able to :** **a. Contribution of the teaching unit to the learning outcomes of the programme (PHYS2M and PHYS2M1)** 1.1, 1.2, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 5.4. 1 **b. Specific learning outcomes of the teaching unit** At the end of this teaching unit, the student will have : ' acquired a basic working knowledge of conformal field theories in two dimensions.
Evaluation methods	The exam will consist of an oral presentation on a topic selected in advance (and approved by the instructors). Within presentation, the student will discuss an in-depth exploration of a physics or mathematical problem related to the course material. This assesses the student's knowledge and understanding of the concepts covered in the course, their ability to apply them to a new problem, and their capacity to present it coherently through an oral presentation.
Teaching methods	The learning activity consists of lectures. They aim at introducing the fundamental concepts and, by establishing results, at showing their reciprocal links and relations with other courses of the Master of Physical Sciences programme. The activity is given in class.
Content	This year, the course will be dedicated to the study of integrable (or exactly solvable) systems. The following topics will be addressed and illustrated (depending on the available time): the dimer model - the two-dimensional Ising model - the Bethe ansatz - spin chains, vertex models, and related models - the Yang-Baxter equation - algebraic methods.
Inline resources	https://moodle.uclouvain.be/course/view.php?id=2936
Bibliography	Une bibliographie détaillée est fournie sur le site Moodle de LPHYS2316. - A detailed bibliography is provided on the Moodle website of LPHYS2316.
Faculty or entity in charge	PHYS

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Physics	PHYS2M	5		🔍