CRETE CENTER FOR QUANTUM COMPLEXITY AND NANOTECHNOLOGY

UNIVERSITY OF CRETE
DEPARTMENT OF PHYSICS

CAPACITIES

ΓΕΝΙΚΟ ΣΕΜΙΝΑΡΙΟ ΤΜΗΜΑΤΟΣ ΦΥΣΙΚΗΣ

PHYSICS COLLOQUIUM

Thursday, 23 February 2017

17:00 -18:00

3rd Floor Seminar Room

" Chirality and new spin-glass phases, multiple controlled chaos, a bazaar of devil's staircases, and Hollywood goes to statistical mechanics "

Prof. Nihat Berker

Kadir Has University, Turkey

Abstract

Spin-glasses provide both complex and understandable, calculable systems, with ever-increasing new phenomena that are intriguing and visually attractive. After a pedagogical introduction, these new phenomena and (easy) calculations will be presented. Chaos, across different scales or across space at a given scale, is an essential feature of these systems, and used to quantitatively classify spin-glass phases and phase boundaries. In addition to the well-known ferromagnetic and antiferromagnetic interactions, randomly frozen across the system, causing frustration and spin-glass phases, a competition between left- and right-chiral (helical) interactions is introduced, resulting in an explosion of new phenomena. Ising, Potts, and clock models are studied. The new phenomena include spectacular phase diagrams with 5 different ordered phases, including a phase completely composed of a continuum of critical points, microreentrance regions of 4 different ordered phases, and a continuum of devil's staircases. Literally hundreds of different phase diagrams are obtained, so that we have to resort to video movies to show them. Very simple renormalization group methods are used, which are exact for hierarchical lattices and very trustable approximations for hypercubic lattices.