PHYSICS DEPARTMENT

# SEMINAR

**Thursday, December 21, 14:00-15:00**

Physics Department- H Block Seminar Hall (Tea & coffee at 13:45)

## Statistical Physics, Phase transitions, and Anomalous diffusion. Application to Science, Engineering, and Technology

Beyond their contributions to strengthening our scientific knowledge, the current advances in physics have been widely applied to the development of many devices and methods, among which we can cite tunnel and laser diodes, echography, radiography, magnetic sensors, thermocouples, and thermal radiators. In this seminar, we focus on three concepts of physics: Statistical physics (particularly Boltzmann, Bose-Einstein, and Fermi-Dirac distributions), Phase transitions (percolation theory), and Anomalous diffusion/relaxation processes that are present in most of the topics of materials science as well as other fields like epidemics, forest fires, and even social science. In the first part of the seminar, these concepts are briefly described, and some known applications in different fields of science are presented. The second part will be devoted to the application of these concepts to propose three developments in engineering: i) the first concerns a new method for the estimation of the critical heat flux for ignition using the universal law describing phase transitions, ii) the second concerns a new formula based on percolation theory which relates electrical conductivity to moisture content for woody (or generally porous materials) at saturation, and iii) the third concerns modeling fire spread by using anomalous diffusion.

**Keywords:** phase transitions, percolation theory, anomalous diffusion and relaxation, fire ignition, fire spread, conductivity in porous media

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He obtained his PhD in 1988 in Particles Physics from University of Savoie in France. He has been working at University USTO as a professor since 1998. He is still working as the Director of Laboratoire d'Etude Physique des Matériaux (LEPM) USTO.

His research interest includes "Modeling fire spread and behavior, Analysis of fire risk", "Modelling virus spread and epidemics", "Dielectric and Optical Properties of Composite and Granular Materials", "Disordered Systems, Transport Properties, Low Dimensional Systems, Statistical Physics".