**ΠΑΝΕΠΙΣΤΗΜΙΟ ΚΡΗΤΗΣ**

**ΤΜΗΜΑ ΦΥΣΙΚΗΣ**

# ΓΕΝΙΚΟ ΣΕΜΙΝΑΡΙΟ ΤΜΗΜΑΤΟΣ ΦΥΣΙΚΗΣ

# PHYSICS COLLOQUIUM

**Thursday, 26 May 2011**

**17:00 -18:00**

**3rd Floor Seminar Room**

## "Physics and mechanics of single- and multi-layer layer graphenes"

**K. Papagelis**

Department of Materials Science, University of Patras, 26504 Patras, Greece

Institute of Chemical Engineering and High Temperature Chemical Processes - Foundation of Research and Technology Hellas, 26504 Patras, Greece

## Abstract

Graphene is the thinnest known elastic material, exhibiting exceptional mechanical and electronic properties. Because graphene is a single-layer membrane, it is also amenable to external perturbations, including mechanical loading. A promising approach to develop graphene-based electronic devices is by engineering local strain profiles obtained by means of a controlled mechanical or thermal deformation of the substrate or by applying appropriate geometrical patterns in a substrate.

In this work, single- and multi-layers graphene flakes have been subjected to a uniaxial tension/compression using the polymer cantilever beam technique. In all cases the mechanical response was monitored by simultaneous Raman measurements using various excitation wavelengths. The results have significant implications for the use of graphene as reinforcement in composites since it is important to know how effectively the external stress is transferred, under both tension and compression, to the nanoinclusions. On the other hand, uniaxial tensile strain softens the frequency of the optical-phonon branches, and reduces the hexagonal symmetry of the system. Very recent experiments under tension have shown a splitting of the 2D mode in two distinct components depending on the excitation wavelength, the direction of the applied strain relative to graphene's crystallographic orientation and the polarization of the incident and scattered light. An in-depth theoretical analysis of the aforementioned splitting gives new insight into the origin of the 2D band.