Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Strain and defect induced enhancement of Young's modulus of graphene GUILLERMO LOPEZ-POLIN, CRISTINA GOMEZ-NAVARRO, MIRIAM JAAFAR, JULIO GOMEZ-HERRERO, Universidad Autonoma de Madrid, VINCENZO PARENTE, RAFAEL ROLDAN, Instituto de Ciencia de Materiales de Madrid, MIKHAIL KATSNELSON, Radboud University, FRANCESC PEREZ MURANO, Instituto de Microelectrónica de Barcelona, FRANCISCO GUINEA, Instituto de Ciencia de Materiales de Madrid — Graphene, due to its extremely high in plane stiffness and low bending rigidity, presents important out of plane thermal fluctuations crucial for the understanding of its mechanical properties. In this work we measure the variation of the stiffness of graphene with induced vacancy density using AFM nanoindentations. Unlike predicted, we find that the stiffness of graphene increases with defect content until a vacancy density of 0.2 percent, where it doubles its initial value. For higher defect density the elastic modulus exhibits a decreasing tendency. We attribute the initial increase in stiffness to the quenching of the out of plane oscillations of graphene due to defects [1]. In order to validate this interpretation we also study the dependence of the elastic modulus with strain. We observe an increase of the Young's modulus at pre-strains higher than 0.5 percent where it again doubles its initial value.

[1] Nature Physics accepted.

Guillermo Lopez-Polin
Universidad Autonoma de Madrid

Date submitted: 12 Nov 2014 Electronic form version 1.4