

MAR11-2010-000940

Abstract for an Invited Paper
for the MAR11 Meeting of
the American Physical Society

Missing atom as a source of carbon magnetism

IVAN BRIHUEGA, Dept. Física de la Materia Condensada. Universidad Autónoma de Madrid

Introducing vacancies in graphene-like systems by irradiation has been shown to be an efficient method to vary its mechanical behavior, tune its electronic properties and even to induce magnetism in otherwise non-magnetic samples [1-2]. While the role played by these vacancies as single entities has been extensively addressed by theory [3-6], experimental data available refer to statistical properties of the whole heterogeneous collection of vacancies generated in the irradiation process. Here, by artificially generating isolated vacancies on a graphite surface and measuring their local density of states on the atomic scale, we have shown how single vacancies modify the electronic properties of this graphene-like system [7]. Our scanning tunneling microscopy experiments, complemented by tight binding calculations, reveal the presence of a sharp electronic resonance at the Fermi energy around each single graphite vacancy, which implies a dramatic reduction of the charge carriers' mobility and can be associated with the formation of local magnetic moments. Finally, we have extended our investigations to other graphene systems.

- [1] P. Esquinazi, D. Spemann, R. Höhne, A. Setzer, K.-H. Han and T. Butz, *Phys. Rev. Lett.* **91**, 227201 (2003).
- [2] A. V. Krasheninnikov and F. Banhart, *Nature Materials* **6**, 723 (2007)
- [3] V. M. Pereira, F. Guinea, J. M. Lopes dos Santos, N. M. R. Peres and A. H. Castro Neto, *Phys. Rev. Lett.* **96**, 036801 (2006)
- [4] P. O. Lehtinen, A. S. Foster, Y. C. Ma, A. V. Krasheninnikov and R. M. Nieminen, *Phys. Rev. Lett.* **93**, 187202 (2004).
- [5] J. J. Palacios, J. Fernández-Rossier and L. Brey, *Phys Rev. B* **77**, 195428 (2008)
- [6] O. V. Yazyev, *Phys. Rev. Lett.* **101**, 037203 (2008).
- [7] M. M. Ugeda I. Brihuega, F. Guinea and J. M. Gómez Rodríguez, *Phys. Rev. Lett* **104**, 096804 (2010)