Controlling atomic scale magnetism on graphene using hydrogen atoms

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Abstract

Isolated hydrogen atoms adsorbed on graphene are predicted to induce magnetic moments. Direct observation of these magnetic moments and their interactions as well as their manipulation still remains a major experimental challenge. Here [1] we demonstrate that the adsorption of a single hydrogen atom on graphene induces a magnetic moment characterized by a 20 meV spin-split state at the Fermi energy. Our scanning tunneling microscopy (STM) experiments, complemented by first-principles calculations, show that such a spin-polarized state is essentially localized on the carbon sublattice complementary to the one where the H atom is chemisorbed. This atomically modulated spin-texture, which extends several nanometers away from the H atom, drives the direct coupling between the magnetic moments at unusually long distances. The magnetic nature of the H induced graphene state is confirmed by external electronic doping. Using the STM tip to manipulate H atoms with atomic precision, we demonstrate the possibility to tailor the magnetism of selected graphene regions.

References

[1] H. Gonzalez-Herrero, J. M. Gomez-Rodriguez, P. Mallet, M. Moaied, J. J. Palacios, C. Salgado, M. M. Ugeda, J.Y. Veuillen, F. Yndurain and I. Brihuega, Science (in press).