Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

The Magnetic effect of Nonmagnetic Defect on Graphene HIDEKI KUMAZAKI, DAI HIRASHIMA, Nagoya University — We study the effect of a nonmagnetic defect on magnetism of graphene. Magnetism in carbon-based materials has been a controversial problem. Apart from magnetic defects, the nonmagnetic-defect-induced mechanism is the most probable mechanism in those materials. In this presentation, we focus on vacancy-induced magnetism. Electrons in graphene can be described with a half-filled Hubbard model on a honeycomb lattice. We then introduce a vacancy as a short-range strong scattering potential on a lattice point. Resorting to a mean field approximation and diagonalizing the approximated Hamiltonian, we can determine the electron number and spin densities at each lattice point. We then find that a vacancy induces short-range ferrimagnetic order around itself. This order is caused by a quasilocalized vacancy state induced by a strong potential. In cases with extended vacancies, the moment formation depends on the geometrical structure and the difference in the numbers of vacancies on two sublattices. The magnetic moment is necessarily induced when the number of vacancies on one sublattice is unequal to that on the other sublattice, in accordance with Lieb's theorem. We further discuss the possible magnetic moment formation on realistic edges in graphene.

Hideki Kumazaki
Nagoya University

Date submitted: 27 Nov 2007 Electronic form version 1.4