Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Implementing quantum gates through scattering between an electron and a magnetic impurity in a graphene nanoribbon GUILLERMO CORDOURIER-MARURI, ROMEO DE COSS, Departamento de Física Aplicada, Cinvestav-Mérida, SOUGATO BOSE, Department of Physics and Astronomy, University College London — We study the feasibility of implementing quantum logic gates and generate entanglement when a ballistic electron is scattered by a magnetic impurity fixed in a graphene nanoribbon. Because electrons in graphene behaves like massless Dirac Fermions, we use the Dirac equation to describe the system. In our model we consider the ballistic electron spin as a relativistic flying qubit and the impurity spin as a static qubit. The interaction between spins is described by a Heisenberg - like operator. The interaction by electron scattering shows the advantage of a low control in the interaction, and the operation success can be measured by means the electron transmition probability. We show that is possible to implement quantum logic gates of the type SWAP, and partial SWAP with a physicaly feasible coupling strenght between spins. We also present the condition to generate states of maximum entanglement. The possible use of the graphene pseudospin as an additional degree of freedom is discussed.

Guillermo Cordourier-Maruri
Departamento de Física Aplicada, Cinvestav-Mérida

Date submitted: 19 Dec 2011 Electronic form version 1.4