Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Edges states and anomalous Aharonov-Bohm-type oscillation in anti-dot lattice graphenes formed by nanoporous alumina template mask J. HARUYAMA, T. SHIMIZU, J. NAKAMURA, Aoyama Gakuin University, T. MATSUI, H. FUKUYAMA, Tokyo University — Edge states of graphene with a zigzag structure theoretically have extremely high electronic density of states (EDOS), electron localization, and polarized spin transport as well [1]. However, few studies have reported on the experimental observation of edge states and related quantum phenomena. Here, we report on the nonlithographic and low-damage fabrication of honeycomb-like nanopore arrays (anti-dot lattice) on thin multilayered graphenes utilizing nanoporous alumina template masks [2]. We confirm the presence of high EDOS at the edges of the nanopores using STM observation. We find periodic magnetoresistance oscillations with two different periods over a wide magnetic field range (anomalous Aharonov-Bohm-type effect [3]) (e.g., high fields at where the diameter of cyclotron-motion electrons is smaller than diameter of the nanopore). These findings clearly suggest the presence of localized electrons and edge states at the nanopore edges of graphene.

[1] K. Nakada, G. Dresselhaus, M. S. Dresselhaus et al., Phys. Rev. B 54, 17954 (1996).
[2]T. Shimizu, J. Haruyama et al., To be published on Phys. Rev. Lett.
[3] D. Weiss, K.von Klitzing et al., Phys. Rev. Lett. 70, 4118 (1993).

J. Haruyama
Aoyama Gakuin University

Date submitted: 23 Dec 2010 Electronic form version 1.4