Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Modeling artificial graphene in Si/SiGe hetrostructures LEON MAURER, JOHN KING GAMBLE, JONATHAN MOUSSA, LISA TRACY, Sandia National Laboratories, SHIH-HSIEN HUANG, YEN CHUANG, JIUN-YUN LI, CHIH-WEN LIU, National Taiwan University and National Nano Device Laboratories, TZU-MING LU, Sandia National Laboratories — Artificial graphene is a synthetic material made using a nanostructure with identical 2D potential wells arranged in a honeycomb lattice. Unlike normal graphene, the properties of artificial graphene can be controlled by changing the nanostructure geometry and adjusting applied voltages. We perform a theoretical study of artificial graphene formed from a 2D electron gas (2DEG) in Si/SiGe and Ge/SiGe heterostructures by a metal honeycomb gate and a global top gate. While many models of artificial graphene assume a simple form for the potential landscape in the 2DEG, we instead calculate the potential landscape for actual devices with a range of bias voltages and geometries. This allows us to find the resulting bandstructure and calculate transport parameters, which we compare directly to experimental results. Sandia is a multiprogram laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the US Department of Energys National Nuclear Security Administration under Contract No. DE-AC04-94AL85000. This work was funded by the Laboratory Directed Research and Development Program. The work at NTU was supported by the Ministry of Science and Technology (103-2622-E-002-031 and 103-2112-M- 002-002-MY3).

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Date submitted: 10 Nov 2016 Electronic form version 1.4