清华大学高等研究院

Institute for Advanced Study, Tsinghua University

学术报告

Title: **Strong Correlation Effects in Silicene and Germanene**

Speaker: **Prof. G Baskaran**

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The Institute of Mathematical Sciences, India

Time: **3:00pm, Monday, June 9, 2014**

Venue: **Conference Hall 322, Science Building, Tsinghua University**

Abstract

Combining theoretical considerations and certain striking phenomenology we predict silicene and germanene to be narrow gap Mott insulators and abode of quantum spin liquids and unconventional superconductivity. A weaker pi-bond, because of a 60 % bond stretching, from ~ 1.4 Au in graphene to ~ 2.3 Au in silicene renders Mott localization. A supporting theoretical analysis is presented. Recent experimental results are invoked to provide additional support for our Mott insulator modeling: i) a narrow band of width ~ 1 eV lying below K points in ARPES of silicene on ZrB2, ii) a superconducting gap seen below 35 K with a large 2Delta/kBTc ~ 20 in silicene on Ag, ii) emergence of electron like pockets at M points on electron doping by Na adsorbents and iii) absence of Landau level splitting up to 7 Tesla and v) superstructures, not common in graphene but ubiquitous in silicene. A synthesis of the above results using theory of Mott insulator, with and without doping, is attempted. We surmise that if competing orders are taken care of and optimal doping achieved, superconductivity in silicene and germanene could reach room temperature scales [1], as our estimates of tJ model parameters, t and J ~ 1 eV, are encouragingly high.

[1] G. Baskaran, arXiv:1309.2242