THE UNIVERSITY OF HONG KONG

COLLOQUIUM SERIES IN PHYSICS DEPARTMENT

# Scanning Tunneling Spectroscopic Studies of Dirac Fermions in Graphene and Topological Insulators


## Prof. Nai-Chang Yeh

*California Institute of Technology, Pasadena*


**Time:** Wednesday, July 2, 2014, 4:00 p.m.

**Venue:** Lecture Theatre T3, Meng Wah Complex, HKU


**Abstract:**

**The investigation and classification of topological materials have become a new frontier in condensed matter physics. One of the novel properties associated with the topological states of these materials is the presence of a Dirac spectrum of chiral low-energy excitations, which is a salient feature of the so-called Dirac materials. More generally, "Dirac materials" refer to a class of matter that exploits the mapping of electronic band structures and an embedded spin or pseudo-spin degree of freedom onto the relativistic Dirac equation. These materials have provided an arena in condensed matter for investigating the topological phases of massless and massive Dirac fermions.**

**In this talk I'll present our scanning tunneling spectroscopic (STS) studies of two exemplifying Dirac materials: graphene and the surface state (SS) of three-dimensional (3D) topological insulators (TIs). In the case of graphene, I'll discuss the manifestation of strain-induced gauge potentials and spontaneous time-reversal symmetry breaking. A new breakthrough in one-step growth of large-area excellent-quality graphene at much reduced temperature will also be reported. In the case of 3D-TIs, I'll present direct empirical evidences for topological protection and preservation of spin textures in the SS of MBE-grown $Bi_2Se_3$ and their heterostructures. In addition, I'll describe our observation of magnetism-induced massive Dirac spectra and topological defects. Finally, the implication of these findings on applications to spintronics and quantum information technology will be discussed.**


## About the Speaker:

**N. C. Yeh is a professor of Physics at Cal Tech. She received BSc from National Taiwan University and obtained her PhD from MIT. She is mainly interested in fundamental physical properties of strongly correlated electronic systems, and is best known in superconductvity, magnetic materials, and superconductor /ferromagnet heterostructures. She is a Fellow of a number of professional associations, including American Association for the Advancement of Science, American Physical Society. She is the President of International Organization of Chinese Physicists and Astronomers (OCPA).**

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**Physics colloquium series is organized to introduce cutting edge researches and new development in physics, designed to be *suitable to graduate and undergraduate students, and also to scientists working on different fields*. Each colloquium will generally start with an extensive introduction of the background of the field, followed by forefront research topics and results. The colloquium will serve as an education forum for students and laymen alike, and also serve as a platform for exchange and update their knowledge of various branches of physics among academic staff members.**

*Coffee and tea will be served 20 minutes prior to the colloquium*

***Anyone interested is welcome to attend***


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