NST1-004

# Pseudo-electromagnetism in graphene

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In this talk, I will discuss roles of pseudo vector and scalar potential in changing physical properties of graphene systems. First, graphene under small uniaxial strain is shown to be described by the generalized Weyl's Hamiltonian with inclusion of pseudo vector and scalar potential simultaneously [1]. Thus, strained graphene is predicted to exhibit velocity anisotropy as well as work function enhancement without any gap. Second, if homogeneous strains with different strengths are applied to each layer of bilayer graphene, transverse electric fields across the two layers can be generated without any external electronic sources, thereby opening an energy gap [2]. This phenomenon is made possible by generation of inequivalent pseudo scalar potentials in the two graphene layers. Third, when very tiny lateral interlayer shift occurs in bilayer graphene, the Fermi surfaces of the system are shown to undergo Lifshitz transition [3]. We will show that this unexpected hypersensitive electronic topological transition is caused by a unique interplay between the effective non-Abelian vector potential generated by sliding motions and Berry’s phases associated with massless Dirac electrons.

**References**

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**Keywords:** graphene