DAY 2 (24 June): 10:50 – 11:30

Controlling the electronic valley degree of freedom in graphene systems

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The band structure of graphene has energetically degenerate valleys at the two nonequivalent corners of the Brillouin zone. Because of their large separation in momentum space, inter-valley scattering is strongly suppressed, implying the potential use of valley degree of freedom (valley index) in a manner similar to the use of spin in spintronics applications. Interesting valley dependent phenomena and their possible applications, dubbed as 'valleytronics', are being actively explored. Recently, we discovered a general scheme to generate and detect valley polarization (difference in electron concentrations in the two valleys) in graphene systems with broken inversion symmetry, which occur in epitaxially grown graphene and in biased graphene bilayers. Here I report a systematic study of magnetic, electrical and optical control on the valley degree of freedom of electrons in such graphene systems.