CBC SEMINAR ANNOUNCEMENT

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Toward Ultrafast and Ultrasmall: Femtosecond Transient Absorption Imaging of Single Nanostructures

I will present our recent work on transient absorption microscopy (TAM) as a novel tool to image carrier and phonon dynamics in single nanostructures with simultaneously high spatial (~ 200 nm) and temporal resolution (~ 200 fs). Until now, the majority of dynamical measurements on single nanostructures are based on photoluminescence (PL). Transient absorption imaging approach offers two key advantages over PL based methods: 1) A time resolution of ~ 200 fs. This fast time resolution is important because many critical events such as electron-phonon coupling occur on such sub-picosecond time scales. 2) The measured signal is based on absorption, which means we can also study samples with low or even zero fluorescence quantum yield.

I will discuss two examples of such transient absorption microscopic studies. Femtosecond transient absorption microscopy was employed to study the excited-state dynamics of *individual* semiconducting single wall carbon nanotubes (SWNTs). This unique experimental approach removes sample heterogeneity in ultrafast measurements of these complex materials. Transient absorption spectra of the individual SWNTs were obtained by recording transient absorption images at different probe wavelengths. These measurements provide new information about the origin of the photoinduced absorption features of SWNTs. Transient absorption dynamics traces were also collected for individual SWNTs. The dynamics show a fast ~ 1 ps decay for all the semiconducting nanotubes studied. We attributed this fast relaxation to coupling between the excitons created by the pump laser pulse and the substrate.

Recent success in fabricating graphene has inspired researchers to search for semiconducting analogues of graphene in hopes to retain 2D crystallinity while providing a bandgap. In particular, monolayer MoS_2 has recently emerged as a promising candidate. The second study I will present is the investigation of exciton dynamics in atomically thin and semiconducting MoS_2 crystals. By controlling the dielectric environment around monolayers of MoS_2 crystals, our measurements provide a comprehensive understanding on intrinsic exciton dynamics, quantum confinement effect, exciton-phonon coupling, as well as how the dielectric environment alters optical properties and energy relaxation processes in these novel 2D crystals.

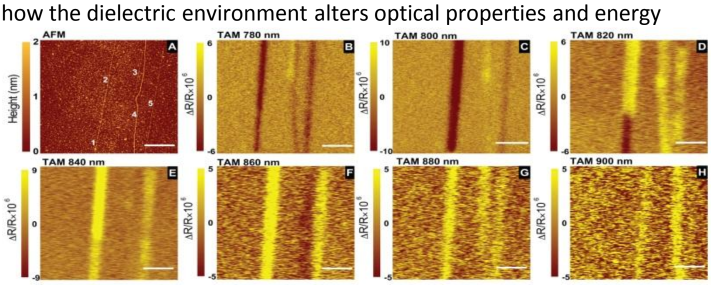

Figure 1. (A) Tapping mode AFM height image of the SWNT-1, -2, -3, -4 and -5. (B) to (H) TAM images with pump/probe wavelength of 390/780 nm, 400/800 nm, 410/820 nm, 420/840 nm, 430/860 nm, 440/880 nm and 450/900 nm respectively. All TAM images were collected at a pump-probe delay of 0 ps. Scale bars are 2 μm in all images.

Date:	**18th July 2012 (Wednesday)**
Time:	**11am – 12.30pm**
Venue:	**NTU SPMS CBC Building Level 2, Conference Room**
Host:	**Asst Professor Chen Gang**