DEPARTMENT OF PHYSICS AND ASTRONOMY

CONDENSED MATTER SEMINAR

Monday April 3, 2017
3:30 PM, Physics, Room 203
(Refreshments 3:00 PM, Physics, Room 242)

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Terahertz Devices Based on 2D Electron Systems

In two-dimensional electron systems with electron mobility on the order of 1,000 – 10,000 cm^2/Vs, the electron scattering time is about 1 ps, and 1/ps = 1 THz. In the electromagnetic window of 0.3 – 3 THz, the THz photon energy is in the neighborhood of 1 meV, substantially smaller than the optical phonon energy of solids, about 30-160 meV, where these 2D electron systems resides. These properties make the 2D electron systems interesting as a platform to realize THz devices. In this talk, I will review 3 approaches investigated in the past few years in my group toward THz devices. The first approach is the conventional high electron mobility transistor based on GaN toward THz amplifiers [1]. The second approach is to employ the tunable intraband absorption in 2D electron systems to realize THz modulators, where I will use graphene as a model material system [2]. The third approach is to exploit plasma wave in these 2D electron systems that can be coupled with a negative differential conductance element for THz amplifiers sources/detectors [3].

[1] B. Song et al, IEEE TED 61, 747 (2014). [2] Berardi Sensale-Rodriguez et al, Nat. Comm. (2012) doi:10.1038/ncomms1787. [3] Berardi Sensale-Rodriguez et al, IEEE Trans. THz Sci. Tech. 3, 200 (2013); J. Encomendero et al, arXiv:1606.08100

Huili Grace Xing is currently a Richard Lunquist Sesquicentennial Professor of Electrical and Computer Engineering, Materials Science and Engineering at Cornell University. She was with the University of Notre Dame from 2004 to 2014. She obtained B.S. in physics from Peking University (1996), M.S. in Material Science from Lehigh University (1998) and Ph.D. in Electrical Engineering from University of California, Santa Barbara (2003), respectively. Her research focuses on development of III-V nitride and 2-D crystal semiconductor growth, electronic and optoelectronic devices, especially the interplay between material properties and device development as well as high performance devices, including RF/THz devices, tunnel field effect transistors, power electronics and DUV emitters. She is a recipient of AFOSR Young Investigator Award, NSF CAREER Award and ISCS Young Scientist Award.