Graduate Program in Spintronics Seminar GP Spin

"OPTICAL PROBE OF COHERENT PHENOMENA IN MULTI-FUNCTIONAL MATERIALS"

Professor. **Giti KHODAPARAST**

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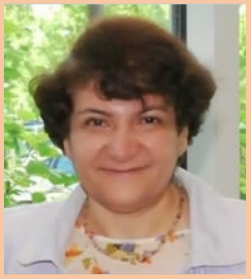

Time : 2:00pm-4:00pm

Date : Friday,

January 11, 2019

Venue: Seminar Room 2 :407

Education and Research Building,
Materials Science and Materials Processing,
Graduate School of Engineering

Materials Science and Engineering
Education and Research Building (B01)

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Optical Probe of Coherent Phenomena in Multi-Functional Materials

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Intense laser pulses can generate carriers, spins, phonons, and magnons ***far from equilibrium states***. Information about the dynamical behavior of these nonequilibrium states can be elucidated by: **1)** the electronic structure, **2)** carrier scattering and relaxation mechanisms, including carrier-phonon and carrier-carrier scattering, **3)** spin and magnetization dynamics, and **4)** dynamical many-body interactions. For example, coherent acoustic phonons which are ultrasonic strain pulses can result in a broad optical spectrum from GHz up to THz [1,2,3,4] The possibility of manipulating Coherent Phonons (CP) could lead to develop new techniques such acoustic imaging as well as better understanding and control of electronic and optical properties in devices. Exploring the interaction of CP with carriers, magnetic impurities, and photons can open new prospective of phononics on nanoscale. For example, the manipulation of spins in semiconductors without the application of magnetic fields opens the door to the next generation of devices, where the electronic computation and magnetic memory can be performed on the same chip. In this talk, I will present several time resolved studies including CP generation and control in multifunctional materials such as ferromagnetic semiconductors and mutliferroics [1,5].

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[1] B. A. Magill, K-D Park, Y. Zhou, A. Chopra, Maurya, S. Priya, M. B. Raschke, A. Belyanin, C. J. Stanton, G. A. Khodaparast ,"Ultrafast Anisotropic Optical Response and Coherent Acoustic Phonon Generation in Polycrystalline $BaTiO_3$-$BiFeO_3$", Energy Harvesting and Systems. Volume 3, Issue 3, 229, April (2016).

[2] M. P. Hasselbeck, D. Stalnaker, L. Schlie, A. Stintz, and T. J. Rotter, "Fress space radiation of coherent, coupled plasmon-phonon modes from InAs," Physica B 314, 158 (2002).

[3] M. P. Hasselbeck, D. Stalnaker, L. Schlie, A. Stintz, T. J. Rotter, and M. Sheik-Bahae, "Emission of terahertz radiation from coupled plasmon-phonon modes in InAs," Phys. Rev. B 65, 233203 (2002).

[4] C. K. Sun, J. C. Liang, C. J. Stanton, A. Abare, L. Coldren, and S. P. DenBars, "Large coherent acoustic-phonon oscillation observed in InGaN/GaN multiple-quantum wells," Appl. Phys. Lett. 75, 1249 (1999).

[5] B. Madon, H. Byul Kang, M. Gyu Kang, D. Maurya, B. Magill, M. Alves, J.-E. Wegrowe, H.-J. Drouhin, S. Priya, and G. A. khodaparast, "Room Temperature Ferromagnetic Resonance in Hetero-Epitaxial BTO-BFO/LSMO Magnetoelectric Composite", AIP Advances 8 (10), 105034 (2018). **Editor's Pick.**

Short Bio:

Professor Giti Khodaparast research activities at Virginia Tech have been focused to utilize and enhance the importance and power of magneto-optical spectroscopy to explore quantum coherence, correlations, and many-body effects in several materials systems that can play important roles in developing concepts for the next generation of devices or shed lights on the underlying interactions at the nanoscale. She has established modern experimental techniques including femtosecond time resolved optical, magneto-optical, and nonlinear spectroscopy at the physics department. In addition, she has established strong national and international collaborations with large research facilities including the National High Magnetic Field Laboratory in Florida, and the Megagauss Laboratory in Kashiwa, Japan. She is the recipient of both the NSF career and the AFOSR young investigator awards.