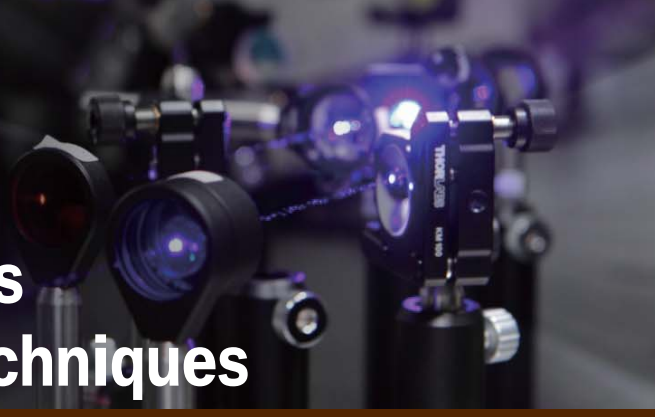

Workshop - Emerging Materials Studied by Ultrafast Optical Techniques

April 8, 2013 (Mon), 14:00—17:40
Location: The auditorium on 1st floor,
Institute of Physics, Academia Sinica
http://www.phys.sinica.edu.tw/emerging_materials/
或至中央研院物理研究所首頁查詢
http://www.phys.sinica.edu.tw

14:00-14:10 Open remark

14:10-14:55 Junichiro Kono
Professor, Department of Electrical & Computer Engineering and Department of Physics & Astronomy Rice University, Houston, TX, USA
High-Field Magneto-optics in Carbon Nanomaterials

14:55-15:40 Matthias Hoffmann
Staff Scientist, LCLS Laser Department, Stanford Linear Accelerator Laboratory, Menlo Park, CA, USA
Inducing and controlling superconductivity with strong THz fields

15:40-16:00 Coffee break

16:00-16:45 Chih-Wei Luo
Associate Professor, Department of Electrophysics, National Chiao Tung University, Hsinchu, Taiwan
Ultrafast dynamics in topological insulators, Fe-based superconductors and multiferroics

16:45-17:30 Keith Nelson
Professor, Department of Chemistry, Massachusetts Institute of Technology, Cambridge, MA, USA
Optical Study and control of advanced materials

17:30-17:40 Close remark

Reference link of Junichiro Kono's talk

http://www.ece.rice.edu/~kono/SasaScience2004.pdf

http://www.ece.rice.edu/~kono/Gordana-PRL2004.pdf

http://www.ece.rice.edu/~kono/Gordana-PRL2005.pdf

http://www.ece.rice.edu/~kono/KonoRoche-MagProp2006.pdf

http://www.ece.rice.edu/~kono/Sasa-PRL2005.pdf

http://www.ece.rice.edu/~kono/cp.pdf

http://www.ece.rice.edu/~kono/Jonah-Rev2007.pdf

http://www.springerlink.com/content/y3627r2384137274/fulltext.pdf

http://www.ece.rice.edu/~kono/Ajit-PRL2008.pdf

http://www.ece.rice.edu/~kono/JiHee-PRL2008.pdf

http://www.ece.rice.edu/~kono/Yoichi-PRL2008.pdf

http://www.ece.rice.edu/~kono/Lei-NL2009.pdf

http://www.ece.rice.edu/~kono/Erik-ACSNano-2010.pdf

http://www.ece.rice.edu/~kono/YongSik-ACSNano2010.pdf

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http://www.ece.rice.edu/~kono/Layla-PRB2011.pdf

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http://www.ece.rice.edu/~kono/Erik-JACS2012.pdf

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http://www.ece.rice.edu/~kono/Erik-NS2013.pdf

http://www.ece.rice.edu/~kono/Seb-2013SREP.pdf

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Light induced Superconductivity in a Stripe-ordered Cuprate
D. Fausti, R.I. Tobey, N. Dean, S. Kaiser, A. Dienst, M.C. Hoffmann, S. Pyon, T. Takayama, H. Takagi and A. Cavalleri
Science, 331, 6014 189-191 (2011)

Bi-directional ultrafast electric-field gating of interlayer charge transport in a cuprate superconductor
A. Dienst, M. C. Hoffmann, D. Fausti, J. C. Petersen, S. Pyon, T. Takayama, H. Takagi and A. Cavalleri
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Optical excitation of Josephson plasma solitons in a cuprate superconductor
A. Dienst, E. Casandruc, D. Fausti, L. Zhang, M. Eckstein, M. Hoffmann, V. Khanna, N. Dean, M. Gensch, S. Winnerl, W. Seidel, S. Pyon, T. Takayama, H. Takagi & A. Cavalleri
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Optical study and control of advanced materials

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Abstract

Methods spanning an extraordinarily wide frequency range have been developed for optical excitation, control, and observation of the various collective degrees of freedom that play key roles in advanced material behavior. The use of optical and terahertz fields to drive thermal, acoustic phonon, optic phonon, and electronic responses and the use of terahertz through x-ray pulses to monitor the responses will be illustrated in order of experimental complexity. First, a simple four-wave mixing or "transient grating" optical measurement of thermal transport, a property of key interest in thermoelectric materials, will be discussed [1]. The results reveal non-diffusive kinetics at small but macroscopic length scales even at room temperature, indicating that the acoustic phonons that carry thermal energy have relatively long mean free paths. Separate experiments aimed at direct measurements of the phonon mean free paths will be mentioned [2,3]. Next, a more advanced form of the four-wave (or higher-order) mixing measurement in which all the light fields are generated by femtosecond pulse shaping, enabling fully phase-coherent control and multidimensional spectroscopic measurement, will be discussed [4]. Results that directly reveal correlations among multiple excitons and exciton-polaritons will be presented [5-7]. Finally, optical generation of intense terahertz (THz) pulses and the use of strong THz fields to drive optic phonon and electronic responses including insulator-metal phase transitions will be discussed [8,9]. Probing of THz-induced responses with THz, optical, and x-ray pulses will be illustrated. Taken together, the results illustrate how increasing capabilities for control and observation of collective degrees of freedom yield new insights and new control possibilities for complex processes that involve those degrees of freedom.

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