

Rensselaer Physics Department

Activities

JUL 2004 – SEPT 2004

(Rensselaer Students are underlined>

HONORS AND AWARDS

T.-M. LU

- “Ultrafast All-Optical Switch Using Carbon Nanotube Polymer Composites”, US Patent #6,782,154, Y.-C. Chen, Y. Zhao, X.-C. Zhang, P.M. Ajayan, T.-M. Lu, G.-C. Wang, and L. Schadler.

X.-C. ZHANG

- Elected Fellow, the World Innovation Foundation (F.W.I.F.), June 8, 2004.
- “Ultrafast All-Optical Switch Using Carbon Nanotube Polymer Composites”, Y. Zhao, Y. Chen, X.-C. Zhang, N.R. Raravikar, P.M. Ajayan, T.-M. Lu, G.-C. Wang, and L.S. Schadler, US Patent No. 6,782,154.
- NRC-CIAR Distinguished Visiting Scientist Program, National Research Council, Ottawa, Canada, August 1-September 30, 2004.

INVITED TALKS

G. KORNISS

- “Extreme Fluctuations in Small Worlds with Relaxational Dynamics”, Third Summer Conference on Statistical Physics of Complex Systems, Center for Nonlinear Studies, Los Alamos National Laboratory, Los Alamos, NM, July 26-August 6, 2004.

J.-Q. LU

- “Wafer-Level 3D Hyper-Integration Processing Technology”, IBM Thomas J. Watson Research Center, Yorktown Heights, NY, July 21, 2004.

T.-M. LU

- “Studio Physics for Student-Centered Learning: Philosophy and Implementation”, Physics Colloquium, University of Toledo, OH, September 2, 2004.

- “Student-Centered Learning: from Introductory to Graduate Classes”, Physics Colloquium, Rensselaer, September 15, 2004.

H. NEWBERG

- “Galactic Structure”, Korean Institute for Advanced Study, Seoul, South Korea, August 20, 2004.

G.-C. WANG

- “Shadowing Growth of Nanostructures and Their Applications”, Physics Department, Fu Jen University, Taipei, Taiwan, Distinguished speaker series, July 22, 2004.
- “Terascale and Terahertz Research at Rensselaer”, Materials Science Department, Tatung University, Taipei, Taiwan, July 27, 2004.
- “Terascale and Terahertz Research at Rensselaer”, Institute of Physics, Academia Sinica, Taipei, Taiwan, July 28, 2004.
- “Shadowing Growth of Nanostructures and Their Applications”, Center for Condensed Matter, National Taiwan University, Taipei, Taiwan, July 30, 2004.
- “Shadowing Growth of Nanostructures and Their Applications”, Physics Department, National Cheng Kung University, Tainan, Taiwan, August 3, 2004.

I. WILKE

- “Broadband Terahertz Radiation Sources and Their Applications, Cornell University, Photonic Seminar, Ithaca, NY, September 29, 2004.

X.-C. ZHANG

- “Sensing and Imaging Explosives and Related Compounds with THz Waves”, J. Xu, Y. Chen, X.-C. Zhang, R. Osiander, and J.B. Spicer, Workshop for Improvised Explosive Device (IED) Locating Through Explosives Detection, the Institute for Defense Analyses building, Arlington, VA, July 1, 2004.
- “Recent Development of THz Wave Science and Technology”, X.-C. Zhang, Institute for Micro-Structural Sciences, Colloquia, NRC, Ottawa, Canada, August 24, 2004.
- “THz Wave Sensing and Imaging Technology”, Monsanto Company, St. Louis, MO, September 21, 2004.
- “THz Technology”, Symposium of Advances in Analytical Techniques for High Throughput Screening Applications, AOAC International 118th Annual Meeting, St. Louis, MO, September 22, 2004.

MEETING ATTENDANCE

J.-Q. LU

- “3D Integration Kickoff Meeting at IBM”, IBM Thomas J. Watson Research Center, Yorktown Heights, NY, July 21, 2004.
- “DARPA 3-D Electronics Kick-off Meeting”, Arlington, VA, July 27, 2004.

OTHER PROFESSIONAL TRAVEL

G.-C. WANG

- Traveled to Taiwan between July 16 and August 9th and met with physics and Rensselaer alumni in Taiwan and reported current status of Rensselaer and studio physics.
- Gave recruiting talks about Rensselaer Sciences to over 150 graduate students and faculty in five universities/Center/Academia Sinica in Taiwan.

I. WILKE

- Terahertz Workshop, Jefferson Laboratory, Newport News, VA, September 20, 2004.

X.-C. ZHANG

- National Research Council, Ottawa, Canada, August 19-28, 2004.
- Battelle, Columbus, OH, September 16-17, 2004.
- Monsanto Company, St. Louis, MO, September 21, 2004.

PRESENTATIONS (presenter in bold)

J.-Q. LU

- “Wafer-Level 3D Hyper-Integration Processing Technology”, **J.-Q. Lu**, IBM Thomas J. Watson Research Center, Yorktown Heights, NY, July 21, 2004.

I. WILKE

- “Femtosecond Near-Infrared Opto-Injection of Living Cells”, **C. Peng**, I. Wilke, R.E. Palazzo, Rensselaer Biotechnology Symposium - Biological Discoveries that will change the world, September 9, 2004.

M. YAMAGUCHI

- “Ultrahigh Frequency Acoustic Phonon Generation and Spectroscopy with Deathstar Pulse Shaping”, J.D. Beers, **M. Yamaguchi**, T. Feurer, B.J. Paxton, and K.A. Nelson, 14th International Conference on Ultrafast Phenomena, Niigata, Japan, July 25-30, 2004.
- “Phonon-Polariton Based THz Spectroscopy”, B.J.Paxton, **M. Yamaguchi**, and K.A.Nelson, 14th International Conference on Ultrafast Phenomena, Niigata, Japan, July 25-30, 2004.

X.-C. ZHANG

- “Efficient, Wideband THz Emission from Thin Electro-Optic Polymer Films”, L.M. Hayden, A.M. Sinyukov, M.R. Leahy, J. Luo, A.K.-Y. Jena, L.R. Dalton, K. Liu, and X.-C. Zhang, Nonlinear Optics: Materials, Fundamentals and Applications, MC6, Hawaii Island, Hawaii, August 2, 2004.
- “GaSe Crystals for Broadband Terahertz Wave Detection”, K. Liu, J. Xu, and X.-C. Zhang, Nonlinear Optics: Materials, Fundamentals and Applications, MC7, Hawaii Island, Hawaii, August 2, 2004.
- “THz Wave Sensing and Imaging for Defense Applications”, presentation to BAE Systems, September 7, 2004.
- “Broadband THz Detection Using GaSe Crystals”, K. Liu, J. Xu, and X.-C. Zhang, P1.249, Joint 29th IRMMW2004 /12th THz2004, Karlsruhe, Germany, September 28, 2004.
- “Applications of THz-Time Domain Spectroscopy and Far-Infrared Fourier Transform Spectroscopy on Petroleum Products Analysis”, F.M. Al-Douseri, H. Liu, Y.-S. Jin, Y. Chen, and X.-C. Zhang, P1.51, Joint 29th IRMMW2004 /12th THz2004, Karlsruhe, Germany, September 28, 2004.
- “Terahertz Generation from Multiple Transparent Dielectric Coated GaAs Antenna”, J. Xu, W. Shi, L. Hou, W. Jia, K. Liu, X. Xie, and X.-C. Zhang, P1.265, Joint 29th IRMMW2004 /12th THz2004, Karlsruhe, Germany, September 28, 2004.
- “Circular Involute Optical Delay Stage”, J. Xu and X.-C. Zhang, P1.266, Joint 29th IRMMW2004 /12th THz2004, Karlsruhe, Germany, September 28, 2004.
- “Detection of Space Shuttle Insulation Foam Defects by Using a 0.2 THz Gunn Diode Oscillator and Pyroelectric Detector”, H. Zhong, N. Karpowicz, J. Xu, Y. Deng, W. Ussery, M. Shur, and X.-C. Zhang, P2.150, Joint 29th IRMMW2004 /12th THz2004, Karlsruhe, Germany, September 30, 2004.

PAPERS PUBLISHED

G. CIOLEK

- “Multifluid, Magnetohydrodynamic Shock Waves with Grain Dynamics II. Dust, and the Critical Speed for C Shocks”, G.E. Ciolek, W.G. Roberge, and T.Ch. Mouschovias (U. of Illinois), The Astrophysical Journal, Vol. 610, pp. 781-800, August 1, 2004.

T. KARABACAK

- “Formation of Body-Centered Cubic Tantalum on Low-K Dielectrics at Low Temperatures”, D.-L. Bae, T. Karabacak, J.J. Senkevich, and T.S. Cale. Submitted.

T. KARABACAK and T.-M. LU

- “Enhanced Step Coverage by Oblique Angle Physical Vapor Deposition”, T. Karabacak and T.-M. Lu. Submitted.
- “Pd on TaN Substrate by Atomic Layer Deposition and Cu Fill-Up of the Damascene Structure Using Electroless Deposition”, Y.-S. Kim, G.A. Ten Eyck, D.-X. Ye, C. Jezewski, T. Karabacak, H.-S Shin, J.J. Senkevich, and T.-M. Lu. Submitted.
- “Enhanced Photoluminescence of PPV Thin Film Coated on the Nano-Structured Substrate by Glancing Angle Deposition”, T. Karabacak, C. Wiegand, D. Jia, J.J. Senkevich, and T.-M. Lu, *Electrochemical and Solid-State Letters* 7, H36, 2004.
- “Photoluminescence of PPV Thin Film Coated on Tungsten Nano-Rods”, D. Jia, F. Fernandez, T. Karabacak, C. Weigand, J.J. Senkevich, and T.-M. Lu, *J. Appl. Phys.*, 2004. Submitted.

T. KARABACAK, T.-M. LU and G.-C. WANG

- “Growth of Uniformly Aligned Nanorod Arrays by Oblique Angle Deposition with Two-Phase Substrate Rotation”, D.-X. Ye, T. Karabacak, B.K. Lim, G.-C. Wang, and T.-M. Lu, *Nanotechnology* 15, 817, 2004.
- “Physical Self-Assembly and the Nucleation of 3D Nanostructures by Oblique Angle Deposition”, T. Karabacak, G.-C. Wang, and T.-M. Lu, *J. Vac. Sci. Technol. A* 22, 1778, 2004.
- “Field Ionization of Argon Using β -Phase W Nanorods”, J.P. Singh, T. Karabacak, T.-M. Lu, G.-C. Wang, and N. Koratkar, *Appl. Phys. Letters*. In press.
- “Enhanced Cold Field Emission from $\langle 100 \rangle$ Oriented β -W Nanoemitters”, J.P. Singh, F. Tang, T. Karabacak, T.-M. Lu, and G.-C. Wang, *J. Vac. Sci. Technol. B* 22, 1048, 2004.
- “Growth of Single Crystal Tungsten Nanorods by Oblique Angle Sputter Deposition”, T. Karabacak, P.-I. Wang, G.-C. Wang, and T.-M. Lu, *Mat. Res. Soc. Symp. Proc.* 788, 75, 2004.
- “Plasma-Assisted Atomic Layer Deposition of Palladium”, G.A. Ten Eyck, J.J. Senkevich, F. Tang, D. Liu, S. Pimanpang, T. Karabacak, G.-C. Wang, and T.-M. Lu, *Chemistry Vapor Deposition*, 2004. Submitted.
- “Stress Reduction in Tungsten Films Using Nanostructured Compliant Layers by Oblique Angle Sputter Deposition”, T. Karabacak, J.J. Senkevich, G.-C. Wang, and T.-M. Lu, *J. Appl. Physics*. Submitted.

J.-Q. LU

- “Raman and XRD Strain Analysis of 3D Bonded and Thinned SOI Wafers”, S. Pozder, M. Canonico, S. Zollner, R. Liu, K. Yu, and J.-Q. Lu, 27th International Conference on the Physics of Semiconductors (ICPS'04), Flagstaff, AZ, July 26-30, 2004.
- “Wafer-Level Three-Dimensional Monolithic Integration for Heterogeneous Silicon ICs”, R.J. Gutmann, J.-Q. Lu, A.Y. Zeng, S. Devarajan, and K. Rose, the 5th topic meeting on Silicon Monolithic Integrated Circuits in RF Systems (SiRF 2004), Atlanta, GA, September 8-10, 2004.
- “Wafer-Level Three-Dimensional Monolithic Integration for Intelligent Wireless Terminals”, R.J. Gutmann, A.Y. Zeng, S. Devarajan, J.-Q. Lu, and K. Rose, Journal of Semiconductor Technology and Science, Special Issue on System Integration Technologies for Wireless Terminals, Vol.4, No.3, pp. 193-200, September, 2004.
- “A Wafer Bonding Approach for 3D Processor Memory Chip-Stacks”, J.F. McDonald, R.P. Kraft, P. Belemjian, O. Erdogan, J.-Q. Lu, A.Y. Zeng, K. Rose, and R.J. Gutmann, (invited) 21st International VLSI Multilevel Interconnection Conference (VMIC 2004), Hawaii, September 30, 2004.

T.-M. LU

- “Effective Pore Sealing of Ultralow-K Dielectrics”, C. Jezewski, W.A. Lanford, C.J. Wiegand, J.J. Senkevich, and T-M Lu, J. of Semiconductor International, Vol. 27, (5) pp 56-59, 2004.
- “Continuum Model for Nanocolumn Growth During Oblique Angle Deposition”, E. Main, T. Karabacak, and T. M. Lu, J. Appl. Phys. 95, 8, 4346, April 15, 2004.
- “Novel Epoxy Siloxane Polymer as Low K Dielectrics”, P.-I. Wang, J.S. Juneja, S. Murarka, T.-M. Lu, and R. Ghoshal, Mat. Res. Soc. Proc. 812, 31, 2004.
- “Inductively Coupled Hydrogen Plasma-Assisted Cu Atomic Layer Deposition on Metallic and Dielectric Surfaces”, C. Jezewski,* W.A. Lanford,* C.J. Wiegand, J.P. Singh, P.-I. Wang J.J. Senkevich, and T.-M. Lu, J. Electrochem. Society. Submitted.
- “Effects of Substrate/Film Temperature on Properties of Reactively Sputtered Tantalum Oxide Films”, P. Jain, J.S. Juneja, V. Bhagwat, E.J. Rymaszewski, T.-M. Lu, and T. Cale, J. Appl. Physics. Submitted.

T.-M. LU and G.-C. WANG

- “Molecular Caulk: A Pore Sealing Technology for Ultra-Low K Dielectrics”, J.J. Senkevich, C. Jezewski, D. Liu, W.A. Lanford, G.-C. Wang, and T.-M. Lu, Mat. Res. Soc. Proc. 812, 1, 2004.
- “Direct Copper Electroless Deposition on Tungsten Barrier Layer for Ultra-Large Scale Integration”, Y.-S. Kim, D.-I. Bae, H. Yang, H.-S. Shin, G.-C. Wang, J.J. Senkevich, and T.-M. Lu, J. Electrochem. Society. Submitted.
- “Real Time Observation of Initial Stages of Copper Film Growth on Silicon Oxide Using Reflection High-Energy Electron Diffraction”, J. Drotar, T.-M. Lu, and G.-C. Wang, J. Appl. Physics. Submitted.

- “Size Effect and Strain Rate Sensitivity in Benzocyclobutene (BCB) Film”, D.-L. Liu, T.-M. Lu, G.-C. Wang, and R.C. Picu, Applied Physics Letters. Submitted.
- “Size Effect and Strain Rate Sensitivity in Benzocyclobutene (BCB) Film”, D.-L. Liu, T.-M. Lu, R.C. Picu, and G.-C. Wang, Applied Physics Letters 85, accepted and to appear in October 11, 2004.

H. NEWBERG

- “Type Ia Supernova Rate at a Redshift of ~ 0.1 ”, G. Blanc et al., Astronomy and Astrophysics, v.423, p.881-894, 2004.
- “The Mass of the Galaxy from Large Samples of Field Horizontal-Branch Stars in the SDSS Early Data Release”, T.C. Beers et al., International Astronomical Union Symposium no. 220, held July 21-25, 2004 in Sydney, Australia. Eds: S. D. Ryder, D.J. Pisano, M.A. Walker, and K.C. Freeman. San Francisco: Astronomical Society of the Pacific., p.195, 2004.
- “The Second Data Release of the Sloan Digital Sky Survey”, K. Abazajian et al., The Astronomical Journal, Volume 128, Issue 1, pp. 502-512, 2004.
- “Spectroscopic Observations and Analysis of the Peculiar SN 1999aa”, G. Garavini et al., The Astronomical Journal, Volume 128, Issue 1, pp. 387-404, 2004.

X.-C. ZHANG

- “GaSe Crystals for Broadband Terahertz Wave Detection”, K. Liu, J. Xu, and X.-C. Zhang, Appl. Phys. Letts., 85, 863, 2004.
- “Circular Involute Stage”, J. Xu and X.-C. Zhang, Optics Letters, 2004. In press.
- “Terahertz Radiation from Large Aperture Bulk Semi-Insulating GaAs Photoconductive Dipole Antenna”, W. Shi, W.-L. Jia, L. Hou, J. Xu, and X.-C. Zhang, Chin. Phys. Lett., 21, 1842, 2004.
- “Efficient, Wideband THz Emission from Thin Electro-Optic Polymer Films”, L.M. Hayden, A.M. Sinyukov, M.R. Leahy, J. Luo, A.K-Y. Jena, L.R. Dalton, K. Liu, and X.-C. Zhang, Nonlinear Optics: Materials, Fundamentals and Applications on CDROM, MC6, Optical Society of America, Washington, DC, 2004.
- “GaSe Crystals for Broadband Terahertz Wave Detection”, K. Liu, J. Xu, and X.-C. Zhang, in Nonlinear Optics: Materials, Fundamentals and Applications on CDROM, MC7, Optical Society of America, Washington, DC, 2004.
- “Low Noise Laser-Based T-Ray Spectroscopy of Liquids Using Double-Modulated Differential Time-Domain Spectroscopy”, S.P. Micken, R. Shvartsman, J. Munch, X.-C. Zhang, and D. Abbott, J. Opt. B: Quantum Semiclass. Opt. 6 (2004) S786–S795 PII: S1464-4266(04)73533-8, 2004.

PROPOSALS (SUBMITTED or GRANTED)

G. KORNISS

- National Science Foundation, Division of Materials Research, “ITR: Non-Equilibrium Surface Growth and the Scalability of Parallel Discrete-Event

Simulations for Large Asynchronous Systems”, PI: G. Korniss; collaboration involves Rensselaer, Mississippi State, and Los Alamos, \$550,000, September 1, 2004-August 31, 2007.

J.-Q. LU

- NASA, “Self-Reconfigurable Analog/Mixed-Signal Electronics for Extreme Environments”, \$25,000 seed fund in collaboration with JPL and ISMT. Granted.

T.-M. LU

- “Novel Routes to the Destruction of Organophosphate Molecules at Low Thermal Budgets: Field-Induced Nanocatalysis”, with J. Kelber (UT Texas), ARO, three years, \$150K/year. Submitted.
- “Novel Pore Sealing Techniques for Ultra-Low K Materials”, with H. Bakhru, SRC, three years, \$150K. Submitted.

G.-C. WANG

- REU site in physics at Rensselaer, NSF, 3 years, \$210K, August 16, 2004. Submitted.
- Faculty development pre-proposal to NYSTAR, \$750,000, pre-proposal submitted on July 22, 2004. Full proposal submitted on August 19, 2004.

I. WILKE

- “CAREER: Transient Pore Creation in Membranes of Living Cells by Femtosecond Laser Pulses”, July 22, 2004, \$550,000. Submitted.
- “Physical Mechanisms of Indium Nitride Based Terahertz Devices, September 1, 2004, \$70,000. Submitted.

X.-C. ZHANG

- Corning Corp., 6 months, \$25,000, 2004. Granted.
- “Development of Portable Terahertz System and Millimeter Wave Detection”, Lockheed Martin, supplemental grant, one year, \$50,000, 2004. Granted.
- INEEL, 3 months, \$4,000, 2004. Granted.

VISITORS TO RENSSELAER

I. WILKE

- Professor Shinho Sho, Silla University, Korea, August 15-September 1, 2004, visiting scientist.
- Noboru Hasegawa, Nippon Steel, Japan, August 30-September 4, 2004, research collaboration.

X.-C. ZHANG

- Carlo Williams, Richard Fox, Matt Whiting, Boh Ruffin, and Qi (Chris) Wu, (RPI Alum), Corning, began laying a foundation towards working with RPI that will be beneficial for the technology, Corning and RPI, July 15, 2004.
- James Walker, Linda Clark, Frank Hepburn, Bill Winfree, and Eric Madaras from NASA, and Lee Klynn and Warren Ussery from Lockheed Martin, observed a demonstration of the Gunn diode THz system and discussed an approach for implementation, observed and discussed the small fiber laser based THz system, July 16, 2004.
- Glenn Benecke, Alex Majewski, Jeffrey Grotts, and Rene Abreu, Goodrich, July 28, 2004.
- Tim White, Idaho National Engineering and Environmental Laboratory (INEEL), discuss theory and application of THz imaging, and Explore RPI - INEEL Collaboration, July 29, 2004.
- Minh Le, Vitesse Semiconductor Corp. , September 7, 2004.
- P.C. Chao, John Windyka, Frank Stroili, and Rick Thompson, BAE Systems, Exchange RPI and BAE's interest in THz imaging program, especially on possible DARPA's SWIFT program and Explore possibility of RPI – BAE Collaboration, September 7, 2004.

OTHER

H. NEWBERG

- August 2004, segments of previous interviews were included in two part "To the Best of Our Knowledge", NPR program on women in science.