

# *Rensselaer Physics Department*

## *Activities*

**OCT 2004 – DEC 2004**  
(Rensselaer Students are underlined)

### **HONORS AND AWARDS**

T.-M. LU

- “7th Annual Topical Research Conference on Reliability”, sponsored by SRC and SEMATECH, Session Chair, October 25-26, 2004.
- Received the Materials Research Society Medal Award at the Annual Materials Research Society Fall Meeting, Boston, MA, December 1, 2004.
- “Fluorine Diffusion Barriers for Fluorinated Dielectrics in Integrated Circuits”, M. Delarosa and T.-M. Lu, US Patent 6,818,990, 2004.

H. NEWBERG

- Accepted to Sigma Xi Honor Society.
- Chaired session on “Canis Major and Constraints on the Galactic Halo”, Basel / Heidelberg workshop on the Structure and Evolution of the Milky Way and Its Surroundings at Ringberg Castle, Bavaria, Germany, December 5-9, 2004.

X.-C. ZHANG

- The Invitation Fellowship for Research in Japan (Short Term), Japan Society for the Promotion of Science, November 10-30, 2004.

### **INVITED TALKS**

J.-Q. LU

- “Dielectric Adhesive Wafer Bonding for Back-End Wafer-Level 3D Hyper-integration”, J.-Q. Lu, T.S. Cale, and R.J. Gutmann, First International Symposium on Dielectrics for Nanosystems: Materials, Science, Processing, Reliability, and Manufacturing, 206th ECS Meeting 2004, Honolulu, Hawaii, October 3-8, 2004.

## T.-M. LU

- “Physical Self-Assembly and 3D Integrated Nanostructures”, seminar, Civil and Mechanical Engineering Department, Columbia University, November 11, 2004.
- “Mechanisms on the Morphology of Thin-Film Growth”, Materials Research Society Medal Award Talk, Boston, MA, December 1, 2004.
- “Physical Self-Assembly and Nano-Patterning”, invited talk, Materials Research Society Fall Meeting, Boston, MA, December 1, 2004.

## H. NEWBERG

- “The SDSS, SEGUE, and the Halo of the Milky Way”, Astrometry in the Age of the Next Generation of Large Telescopes, Lowell Observatory, Flagstaff, AZ, October 19, 2004.
- “Data Mining the Milky Way Halo”, Yale University colloquium, New Haven, CT, November 11, 2004.
- “Galactic Structure with the SDSS”, Basel / Heidelberg workshop on the Structure and Evolution of the Milky Way and Its Surroundings at Ringberg Castle, Bavaria, Germany, December 6, 2004.

## E. F. SCHUBERT

- “Novel Concepts for the Advancement of Solid-State Light Emitters”, seminar, Department of Physics, Applied Physics, and Astronomy, Rensselaer, October 4, 2004.
- “Efficiency limitations of Solid-State Sources Used in General Illumination Applications”, 28th Annual EDS/CAS Activities in Western New York Conference, Rochester, NY, November 3, 2004.
- “Nano-Materials in Optoelectronics”, Nanotechnology – Innovation, Opportunity, and Commercialization, Rensselaer, November 15-16, 2004.
- “Efficiency Limitations in Inorganic Solid-State Sources for Lighting Applications”, Annual Meeting of the American Vacuum Society, Anaheim, CA, November 15-19, 2004.
- “Novel Omnidirectional Reflectors with Unprecedented Performance Characteristics”, 2004 OIDA Annual Forum, Washington, D.C., November 18-19, 2004.
- “High-Reflectivity Omni-Directional Reflectors for Light-Emitting Diodes”, International Electron Devices and Materials Symposium (IEDMS), National Chiao Tung University, Hsin Chu, Taiwan, December 20-23, 2004.

## M. YAMAGUCHI

- “Polariton Based THz Spectroscopy and Its Applications”, Physics Colloquia, Rensselaer, October 6, 2004.

## X.-C. ZHANG

- “Recent Development of THz Wave Science and Technology”, THz Photonic Session, 5th International Workshop on Semiconductor Quantum Structures, Seoul, Korea, October 16, 2004.
- “THz Wave Sensing and Imaging Technology”, Institute of Electronics, Chinese Academy of Sciences, October 22, 2004.
- “Recent Progress of THz Wave Science and Technology”, China Laser Physics, Li Jiang, China, October 25, 2004.
- “THz Wave Technology and Applications”, Coherent, San Jose, CA, November 8, 2004.
- “Pulsed THz Technology”, Photodynamic Center, RIKEN, Sendai, Japan, November 11, 2004.
- “Recent Progress of THz Wave Science and Technology”, Research Institute of Electrical Communication, Tohoku University, Sendai, Japan, November 12, 2004.
- “Recent Progress of THz Wave Science and Technology”, RIKEN, Wako-Shi, Tokyo, Japan, November 15, 2004.
- “Time Domain THz Technology”, Advanced Infrared Spectroscopy Lab., Nishi-Hachioji, Tokyo, Japan, November 16, 2004.
- “Recent Progress of THz Wave Science and Technology”, National Institute of Information and Communications Technology, Tokyo, Japan, November 17, 2004.
- “Recent Progress of THz Wave Science and Technology”, National Institute of Advanced Industrial Science and Technology, Tsukuba Center, Tsukuba, Japan, November 18, 2004.
- “Recent Progress of THz Wave Science and Technology”, Institute of Superconductor Photonics, Osaka University, Osaka, Japan, November 22, 2004.
- “Recent Progress of THz Wave Science and Technology”, Instrumentation Engineering Division, Toyota, Aichi, Japan, November 23, 2004.
- “Recent Progress of THz Wave Science and Technology”, Mitsubishi Electric Research Center, Amagasaki-City, Japan, November 26, 2004.
- “Recent Progress of THz Wave Science and Technology”, Advanced Telecommunications Research Institute International, November 27, 2004.
- “Recent Progress of THz Wave Science and Technology”, Matsushita Electric Industrial Co., Ltd. (Panasonic), November 27, 2004.
- “Sensing and Imaging with THz Waves”, THz System Conference, American Institute of Engineering, Washington D.C., December 7, 2004.
- “THz Science and Technology”, Department of Physics, University of Wollongong, Australia, December 10, 2004.
- “Field Induced THz Wave Emission Microscope with Nanometer Resolution”, Plenary Presentation, SPIE International Symposium, Smart Materials, Nano and Micro-Smart Systems, Sydney, Australia, December 15, 2004.
- “THz Wave Sensing and Imaging for Defense Applications”, Keynote Address, THz for Defense and Security, DSTO Workshop at the frontier of technology, Adelaide, Australia, December 16, 2004.

## **MEETING ATTENDANCE**

### **J.-Q. LU**

- 2004 Annual Review of Interconnect Focus Center for Hyperintegration, Atlanta, GA, October 4, 2004.
- 206th ECS Meeting 2004, Honolulu, Hawaii, October 5-8, 2004.
- “DARPA 3-D Electronics Quarterly Review Meeting”, IBM Thomas J. Watson Research Center, Yorktown Heights, NY, November 4, 2004.
- 2004 MRS Fall Meeting, Boston, MA, November 29-December 3, 2004.

### **H. NEWBERG**

- Annual meeting of the NY/NASA Space Grant Consortium, Ithaca, NY, October 1, 2004.
- Astrometry in the Age of the Next Generation of Large Telescopes, Lowell Observatory, Flagstaff, AZ, October 18-20, 2004.
- Astronomical Society of New York Fall Meeting, Rensselaer, October 23, 2004.
- Basel / Heidelberg workshop on the Structure and Evolution of the Milky Way and Its Surroundings at Ringberg Castle, Bavaria, Germany, December 5-9, 2004.

### **I. WILKE**

- Frontiers in Optics 2004 / Laser Science XX, Rochester, NY, October 10-15, 2004.

### **M. YAMAGUCHI**

- “THz System”, Washington D.C., December 6-7, 2004.

## **OTHER PROFESSIONAL TRAVEL**

### **I. WILKE**

- National Science Foundation, Division of Electrical and Communications Systems Unsolicited Proposal Panel, Arlington, VA, December 16-17, 2004.

### **M. YAMAGUCHI**

- Visited Prof. Korter at Syracuse University for the discussion of amplified laser system for THz spectroscopy, December 8, 2004.

## X.-C. ZHANG

- Traveled to St. Louis on September 19, Karlsruhe, Germany on September 27, Seoul, Korea on October 13, Lijing, China on October 23, Japan on November 9, and Australia on December 15.

## PRESENTATIONS (presenter in bold)

### J.-Q. LU

- “Dielectric Adhesive Wafer Bonding for Back-End Wafer-Level 3D Hyperintegration”, **J.-Q. Lu**, T.S. Cale, and R.J. Gutmann, First International Symposium on Dielectrics for Nanosystems: Materials, Science, Processing, Reliability, and Manufacturing, 206th ECS Meeting 2004, Honolulu, Hawaii, October 3-8, 2004.
- “Exploratory 3D Integration Technologies”, **J.- Q. Lu**, J. Yu, J.J. McMahon, R.J. Kumar, A. Tran, T.S. Cale, and R.J. Gutmann, 2004 Annual Review of Interconnect Focus Center for Hyperintegration, Atlanta, GA, October 4, 2004.
- “Processes and Evaluation for a Wafer-Level 3D Technology Platform”, **J.- Q. Lu**, Y. Kwon, J. Yu, J.J. McMahon, R. Kumar, A. Tran, T.S. Cale, and R.J. Gutmann, 2004 Annual Review of Interconnect Focus Center for Hyperintegration, Atlanta, GA, October 4, 2004.
- “Optical Waveguide Vias and Optical Beam Vias for Three-Dimensional Optical Interconnectivity”, **R. Kumar**, P.D. Persans, M. Ojha, R.J. Gutmann, J.-Q. Lu, A. Filin, and J. Plawsky, 2004 Annual Review of Interconnect Focus Center for Hyperintegration, Atlanta, GA, October 4, 2004.
- “Performance Prediction for Memory-Intensive ICs: Comparison of 2D and 3D Implementations”, **A. Zeng**, K. Rose, J.-Q. Lu, and R. J. Gutmann, 2004 Annual Review of Interconnect Focus Center for Hyperintegration, Atlanta, GA, October 4, 2004.
- “Power Delivery to High Performance ICs using a Three-Dimensional IC Technology Platform”, **D. Giuliano**, A. Sinkar, J. Sun, J.-Q. Lu, T.P. Chow, and R.J. Gutmann, 2004 Annual Review of Interconnect Focus Center for Hyperintegration, Atlanta, GA, October 4, 2004.
- “Die-on-Wafer and Wafer-Level Three-Dimensional (3D) Integration of Heterogeneous IC Technologies for RF-Microwave-Millimeter Applications”, **J.-Q. Lu**, S. Devarajan, A.Y. Zeng, K. Rose, and R.J. Gutmann, MRS Fall Meeting 2004, Symposium G: Materials, Integration, and Packaging Issues for High-Frequency Devices II, Boston, MA, November 29-December 3, 2004.
- “200mm Silicon Wafer-to-Wafer Bonding with Thin Ti Intermediate under BEOL-Compatible Process Conditions”, **J. Yu**, J.J. McMahon, J.-Q. Lu, and R.J. Gutmann, MRS Fall Meeting 2004, Symposium T: Surface Engineering – Fundamentals and Applications, Boston, MA, November 29-December 3, 2004.

## E. F. SCHUBERT

- “Junction Temperature Measurements in Deep-UV Light-Emitting Diodes”, **Y. Xi**, J.-Q. Xi, Th. Gessmann, J.M. Shah, J.K. Kim, E.F. Schubert, A.J. Fischer, M.H. Crawford, K.H.A. Bogart, and A.A. Allerman, MRS Fall Meeting, Boston, MA, November 29-December 3, 2004.
- “Enhancement of Light Extraction Efficiency of GaInN LEDs by Omni-Directional Diffuse Reflectors”, **J.K. Kim**, H. Luo, Y. Xi, J.M. Shah, Th. Gessmann, and E.F. Schubert, MRS Fall Meeting, Boston, MA, November 29-December 3, 2004.

## I. WILKE

- “Terahertz Emission by InN”, **I. Wilke**, Condensed Matter Seminar, Department of Physics, Applied Physics, and Astronomy, Rensselaer, December 6, 2004.
- “Microinjection by Femtosecond Near-Infrared Laser Pulses”, C. Peng, **I. Wilke**, and R. Palazzo, Frontiers in Optics 2004, Rochester, NY, October 13, 2004.

## X.-C. ZHANG

- “Towards the Realization of Three-Dimensional THz Inspection Systems”, B. Ferguson, S. Wang, D. Gary, X.-C. Zhang, and D. Abbott, THz for Defense and Security, DSTO Workshop at the frontier of technology, Adelaide, Australia, December 16, 2004.

## PAPERS PUBLISHED

### J.-Q. LU

- “Wafer-Level Three-Dimensional ICs: A Better Solution than SoCs and SiPs?”, R.J. Gutmann, J.-Q. Lu, and T.S. Cale, The First Annual International Wafer Level Packaging Congress (IWLPC), San Jose, CA, October 10-12, 2004.
- “Dielectric Adhesive Wafer Bonding for Back-End Wafer-Level 3D Hyper-integration”, J.-Q. Lu, T.S. Cale, and R.J. Gutmann, in Dielectrics for Nanosystems: Materials, Science, Processing, Reliability, and Manufacturing, edited by R. Singh, H. Iwai, R.R. Tummala, and S.C. Sun, ECS PV 2004-04, 2004, pp. 312-323.

### T.-M. LU

- “Copper Drift in High Dielectric Constant Tantalum Oxide Thin Films”, P. Jain, J.S. Juneja, A. Mallikarjunan, E.J. Rymaszewski, and T.-M. Lu, Appl. Phys. Letters. 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. Landford, G.-C. Wang, and T.-M. Lu, *Mat. Res. Soc. Symp. Proc.*, 812, F1.2, 2004.
- “Molecular Caulking: A Pore Sealing Chemical Vapor Deposited Polymer for Ultra-Low K Dielectrics”, C. Jezewski, W.A. Lanford, J.J. Senkevich, C.J. Wiegand, A. Mallikarjunan, D. Lu, G.-C. Wang, T.-M. Lu, and C. Jin, *Journal of the Electrochemical Society*, 151(7) F157-161, 2004.
- “Stress Reduction in Tungsten Films Using Nanostructured Compliant Layers by Oblique Angle Sputter Deposition”, T. Karabacak, C.R. Picu, J.J. Senkevich, G.-C. Wang, and T.-M. Lu, *J. Appl. Phys.* 96, 5740, 2004.
- “Size Effect and Strain Rate Sensitivity in Benzocyclobutene Film”, D.-L. Liu, T.-M. Lu, G.-C. Wang, and R.C. Picu, *Appl. Phys. Lett.* 85, 3053, 2004.
- “In-Situ Reflection High-Energy Electron Diffraction Study of Cu Texture Evolution on Amorphous Carbon by Oblique Angle Vapor Deposition”, F. Tang, C. Gaire, D.-X. Ye, T. Karabacak, T.-M. Lu, and G.-C. Wang, *Phys. Rev. B*. Submitted.
- “Low Temperature Chemical Vapor Deposition of Co Thin Films from  $\text{Co}_2(\text{CO})_8$ ”, D.-X. Ye, S. Pimanpong, C. Jezewski, F. Tang, J.J. Senkevich, G.-C. Wang, and T.-M. Lu, *Thin Solid Films*. Submitted.

## M. YAMAGUCHI

- “High Pressure Studies of Optical Dephasing in Polymer Glasses”, M.J. McIntire, M. Yamaguchi, M.A. Kol’chenko, Y.G. Vainer, and E.L. Chronister, *Journal of Physical Chemistry*. Submitted.

## X.-C. ZHANG

- “Terahertz Radiation from InAlAs and GaAs SIN+ Structures and the Critical Electric Fields of Semiconductors”, J.-S. Hwang, H.-C. Lin, K.-I. Lin, C.-C. Chang, and X.-C. Zhang, *Japan Journal of Applied Physics*, 2004. Accepted.
- “Compact Involute Optical Delay Line”, J. Xu, Z. Lu, and X.-C. Zhang, *Electronics Letters*, 40, 1218, 2004.
- “THz Spectroscopic Investigation of 2,4-Dinitrotoluene”, Y. Chen, H. Liu, Y. Deng, D. Schauki, M.J. Fitch, R. Osiander, C. Dodson, J.B. Spicer, M. Shur, and X. -C. Zhang, *Chemical Physics Letters*, 400, 358, 2004.

## PROPOSALS (SUBMITTED or GRANTED)

### T.-M. LU

- “Novel Pore Sealing Techniques for Ultra-Low K Materials”, T.-M. Lu and H. Bakhru, SRC, \$330K/3 years. Granted.

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

- GOALI: “Novel High Performance Polymer with Strong Metal Adhesion”, T.-M. Lu, G.-C. Wang, S. Murarka, and R. Ghoshal, Polyset Inc., NSF, \$300K/3 years, October 29, 2004. Submitted.
- “Synergistic Investigation of In-Situ Diffraction and Atomic Simulations of Texture Evolution in Film Growth by Shadowing”, G.-C. Wang, T.-M. Lu, and H.C. Huang, NSF, \$430K/3 years, October 29, 2004. Submitted.
- NIRT: “Study of Electro- and Magneto-Mechanical Nano-Assemblies”, T.-M. Lu, G.-C. Wang, M. Shima, N.A. Karatkar, and T. Borca-Tasciuc, NSF, \$1.55M/3 years, November 12, 2004. Submitted.

## H. NEWBERG

- Collaborative Research: A Wholistic Approach to Galactic Structure (The WAGS Collaboration) – Research and Education, NSF, \$99,925, November 15, 2004. Submitted.
- Collaborative Research: Identifying Candidate Companion Stars to Type Ia Supernova Progenitors, NSF, \$70,161, November 15, 2004. Submitted.
- Proposal to present a one day astronomy workshop for middle school teachers, NASA/NY Space Grant Consortium, \$1928, November, 2004. Submitted.
- Collaborative Research: Improved Undergraduate Astronomy Laboratories and Public Outreach with a Modernized Hirsch Observatory Control System, NSF, \$72,911, December 2, 2004. Submitted.
- NASA/NY Space Grant Fellowship, NASA/NY Space Grant Consortium, \$10,000, December 2, 2004. Submitted.

## E. F. SCHUBERT

- New Samsung contract will start December 20, 2004.

## I. WILKE

- NIRT: Silicon Nanotechnologies for THz Devices, PI: F. Rana (Cornell), Co-PI: E. Kan (Cornell), A. Ibitayo (MIT), I. Wilke, NSF, \$2,000,000, November, 2004. Submitted.

## M. YAMAGUCHI

- “Terahertz Dynamics in Photoinduced Structural Change”, NSF-DMR, \$450K, 3 years, November 10, 2004. Submitted.
- “Synthetic Aperture GHz-THz Acoustic Microscopy”, M. Yamaguchi, M. Cheney, and C. Wetzel, \$40K, 1 year, RPI seed funding, November 22, 2004. Submitted.

## X.-C. ZHANG

- “THz Spectroscopy for the Detection of Hidden Explosives and Weapons”, Intelligent Optical Systems, \$20,000, 9 months, 2005. Granted.
- Corning Corp. \$5,000, 6 months, 2005. Granted.

## VISITORS TO RENSSELAER

### E. F. SCHUBERT

- Dr. Hans-Joachim L. Gossmann, Axcelis Technologies, Beverly, MA, visited December 10 and gave a talk entitled: “Junction Formation in Advanced Planar and Vertical Devices”.

### X.-C. ZHANG

- Dr. I. Brener, Sandia National Laboratories, establish research collaboration with RPI on THz biophotonics for integrated devices (THz on chip) project, October 11, 2004.
- Dr. J.P. Spoonhower, Director, Strategic Technology Initiatives, Eastman Kodak, October 11, 2004.
- Dr. J. Ambroseo, President, Mark Gitin, VP for Marketing, Coherent Laser Company, October 11, 2004.
- Dr. P. Vold, Business Development Lead, Honeywell ACS Advanced Technology Lab., October 25, 2004.

## IMPORTANT ACTIVITIES OF STUDENTS

### D. LIU

- Deli Liu received her PhD on October 22, 2004. (G.-C. Wang)

### D. LIU and X. TANG

- Deli Liu and Xueti Tang presented posters at the 2004 NY-Nanotech Symp., U.-Albany College of Nanoscale Science and Engineering, Albany, NY, October 7, 2004. (G.-C. Wang)

## OTHER

### J. LAGRAFF

- The second edition of a book with co-author D. Sangeeta entitled “Inorganic Materials Chemistry: Desk Reference” (CRC Press), December, 2004.

## E. F. SCHUBERT

- “Light-Emitting Diodes and Solid-State Lighting”, featured as module in the web-based IEEE Xplore-Enabled Learning Library (IEEE XELL). The module was delivered to IEEE in October, 2004.
- “Research in the Future Chips Constellation”, J.Q. Kim, T. Gessmann, S. Chhaged, J.-L. Li, H. Luo, F. Mont, C. Shah, J. Shah, J.Q. Xi, Y. Xi, S. Lin, C. Wetzel, J. Plawsky, W. Gill, and R. Siegel, General Electric Corporation, Schenectady, NY, October 26, 2004.