

Rensselaer Physics Department

Activities

JUL 2005 – SEPT 2005
(Rensselaer Students are underlined)

HONORS AND AWARDS

T.-M. LU

- Co-organizer and Session Chair, Si Microelectronics Symposium, International Conference on Materials for Advanced Technologies, Singapore, July 4-8, 2005.

X.-C. ZHANG

- Session Chair, International School of Solid State Physics 35th Workshop: Physics and Technology of THz Photonics, Erice, Sicily, Italy, July 22, 2005.
- Organizer and Chair of Symposium on THz Spectroscopy for Analytical Application, American Chemical Society Annual Meeting, Washington, DC, August 28, 2005.

INVITED TALKS

S.-K. EAH

- “Optical Spectroscopy of Single Nanoparticles and Self-Assembled Nanoparticles Superlattice Monolayer”, colloquium, Physics, Applied Physics, and Astronomy, Rensselaer, September 21, 2005.

T.-M. LU

- “Dielectric Barriers, Pore Sealing, and Metallization”, Si Microelectronics Symposium, International Conference on Materials for Advanced Technologies, Singapore, July 4-8, 2005.

H. NEWBERG

- “Creation and Evolution of the Material Universe”, Southern Rensselaer County Rotary Meeting, Rensselaer, NY, September 22, 2005.

- “Creation of the Material Universe”, Glen Eddy Senior Center, Niskayuna, NY, July 8, 2005.
- “Will the Real Stellar Halo Please Stand Up?”, Boston University, Astronomy seminar, Boston, MA, September 13, 2005.

E.F. SCHUBERT

- “AlGaN UV Light-Emitting Diodes Grown by MOVPE”, Crystal IS Corporation, Green Island, NY, July 22, 2005.
- “Enhancement of Light Extraction in GaN Ultraviolet Light-Emitting Diodes by Omni-Directional Reflectors with Nanoporous Low-Index Layer”, J.K. Kim, J.-Q. Xi, H. Luo, and E.F. Schubert, SPIE Annual Meeting, Illumination Engineering, Fifth International Conference on Solid State Lighting, San Diego, CA, August 1-4, 2005.
- “Innovations in Light-Emitting Devices”, University of Delaware, Department of Electrical and Computer Engineering, Newark, DE, September 7, 2005.

X.-C. ZHANG

- “Pulsed Systems, Electro-Optic Detection, and Applications”, tutorial, International School of Solid State Physics 35th Workshop: Physics and Technology of THz Photonics, Erice, Sicily, Italy, July 21, 2005.
- “THz Technology”, The 3rd International Summer School “New Frontiers in Optical Technologies”, August 15, 2005.
- “THz Sensing and Imaging”, Analytical Division, American Chemical Society Annual Meeting, Washington, DC, August 30, 2005.
- “THz Wave Imaging Technology”, Plenary Talk, 4th World Congress on Industrial Process Tomography, Aizu, Japan, September 5, 2005.
- “Explosives Detection by THz Wave”, joint meeting between Energetic & Organic Materials Laboratory Branch, Picatinny Arsenal and Benet Lab, Watervliet, NY, September 22, 2005.

MEETING ATTENDANCE

J.-Q. LU

- “IBM DARPA 3-D Electronics Review Meeting”, Arlington, VA, September 27, 2005.

H. NEWBERG

- NASA Space Grant Affiliate meeting, Ithaca, NY, September 30, 2005.

OTHER PROFESSIONAL TRAVEL

S.-K. EAH

- Visited NSF and met with two program managers, David L. Nelson and Joseph A. Akkara to show the results of “Very Large Two-Dimensional Superlattice of Nanoparticles by Self-Assembly” and discussed funding possibilities, Washington, DC, September 19, 2005.

G.-C. WANG

- Visited Cheng Kung University in Taiwan to publicize RPI's research and to recruit prospective graduates. Met with head of the Office of Research and physics department faculty and students at Cheng Kung University, August 30, 2005.

PRESENTATIONS (presenter in bold)

J.-Q. LU

- “Wafer-Scale Planarization Needs for Wafer-Level Three-Dimensional (3D) ICs”, **R.J. Gutmann**, J.J. McMahon, and J.-Q. Lu, at CAMP's 10th International Symposium on Chemical-Mechanical Planarization, Lake Placid, NY, August 14-17, 2005.
- “Global Planarization Requirements for Wafer-Level Three-Dimensional (3D) ICs”, R.J. Gutmann, **J.J. McMahon**, and J.-Q. Lu, in Technical Track 8: Surface Engineering and Coatings, Session on Chemical Mechanical Polishing (CMP), World Tribology Congress III, Washington Hilton, Washington, DC, September 12-16, 2005.
- “Unit Processes for Cu/BCB Redistribution Layer Bonding for 3D ICs”, **J.J. McMahon**, R.J. Kumar, F. Niklaus, S.H. Lee, J. Yu, J.-Q. Lu, and R.J. Gutmann, 2005 Advanced Metallization Conference (AMC 2005), Colorado Springs, CO, September 27-29, 2005.
- “Thermally Induced Stresses in 3D ICs”, **M. Bloomfield**, D.N. Bentz, J. Zhang, J.-Q. Lu, R.J. Gutmann, and T.S. Cale, 2005 Advanced Metallization Conference (AMC 2005), Colorado Springs, CO, September 27-29, 2005.

H. NEWBERG

- “Your Astronomy Textbook is Wrong about the Milky Way”, Rensselaer REU seminar, Troy, NY, July 5, 2005.
- “Mapping the Milky Way”, Freshman Physics seminar, Troy, NY, September 15, 2005.

G.-C. WANG

- Gave a presentation about THz research for Board of Trustee members on September 9, 2005.
- Gave a presentation about research in nanoscience for Ms. Karolyn Rancourt, US representative of Development Economic Western Switzerland (DEWS) of Switzerland, September 20, 2005.

X.-C. ZHANG

- “Plasma Waves Resonant Detection of Femtosecond Pulsed THz Radiation by Nanometer Field Effect Transistor”, F. Teppe, D. Veksler, V.Yu. Kachorovski, A.P. Dmitriev, X. Xu, X.-C. Zhang, S. Rumyantsev, W. Knap, and M.S. Shur, International School of Solid State Physics 35th Workshop: Physics and Technology of THz Photonics, Erice, Sicily, Italy, July 21, 2005.
- “Continuous-Wave THz Imaging”, N. Karpowicz, H. Zhong, X. Li, A. Redo, and X.-C. Zhang, International School of Solid State Physics 35th Workshop: Physics and Technology of THz Photonics, Erice, Sicily, Italy, July 24, 2005.
- “THz Spectroscopic Investigation of Selected Purines and Amino Acids”, Y. Chen, H. Liu, K. Liu, and X.-C. Zhang, THz/IRMMW 2005, Williamsburg, VA, 2005.
- “Standoff Distance Detection of Explosive Materials with THz Waves”, H. Zhong, A. Redo, Y. Chen, and X.-C. Zhang, THz/IRMMW 2005, Williamsburg, VA, 2005.
- “Continuous-Wave Terahertz Imaging for Non-Destructive Testing Applications”, N. Karpowicz, A. Redo, H. Zhong, X. Li, J. Xu, and X.-C. Zhang, THz/IRMMW 2005, Williamsburg, VA, 2005.
- “Diffuse Fresnel Reflection Spectroscopy of RDX Studied by THz Time-Domain Spectroscopy”, H. Liu, Y. Chen, G.J. Bastiaans, and X.-C. Zhang, THz/IRMMW 2005, Williamsburg, VA, 2005.

PAPERS PUBLISHED

T. KARABACAK and T.-M. LU

- “Atomic Layer Deposition of Pd on TaN for Cu 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, J. Electrochem. Soc. 152, C376, 2005.
- “Shadowing Growth and Physical Self-Assembly”, T. Karabacak and T.-M. Lu, in Handbook of Theoretical and Computational Nanotechnology, edited by M. Rieth and W. Schommers (American Scientific Publishers, 2005), chap. 69.

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

- “Uniform Si Nano-Structures Grown by Oblique Angle Deposition with Substrate Swing Rotation”, D.-X. Ye, T. Karabacak, R.C. Picu, G.-C. Wang, and T.-M. Lu, Nanotechnology 16, 1717, 2005.

- “Physical Self-Assembly and Nanopatterning”, T.-M. Lu, D.-X. Ye, T. Karabacak, and G.-C. Wang, *Mat. Res. Soc. Symp. Proc.* 849, KK8.4, 2005.
- “AFM, SEM and In Situ RHEED 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*, 72, 035430, 2005.
- “Stress Reduction in Sputter Deposited Films Using Nanostructured Compliant Layers by High Working-Gas Pressures”, T. Karabacak, J.J. Senkevich, G.-C. Wang, and T.-M. Lu, *J. Vac. Sci. Technol. A* 23, 986, 2005.
- “Texture Evolution During Shadowing Growth of Isolated Ru Columns”, F. Tang, T. Karabacak, P. Morrow, C. Gaire, G.-C. Wang, and T.-M. Lu, *Phys. Rev. B* 72, 2005.

J.-Q. LU

- “Multiscale Planarity Characterization of Chemical-Mechanically Polished Copper/Benzocyclobutene Surfaces for Three-Dimensional Integration Applications”, J.J. McMahon, S. Rao, J.-Q. Lu, and R.J. Gutmann, *Tribology Letters*, July, 2005. Submitted.
- “Wafer-Level Three-Dimensional Hyper-Integration Technology Using Dielectric Adhesive Wafer Bonding”, J.-Q. Lu, T.S. Cale, and R.J. Gutmann, Book Chapter in “Materials for Information Technology: Devices, Interconnects and Packaging”, Eds. E. Zschech, C. Whelan, and T. Mikolajick, pp. 386 – 397, Springer-Verlag (London) Ltd, August, 2005.
- “Aligned Wafer Bonding - The Technology Platform for 3D Interconnect”, J.-Q. Lu, R.J. Gutmann, T. Matthias, and P. Lindner, *Semiconductor International (Trade Journal)*, pp. SP.4-8, August, 2005.
- “Global Planarization Requirements for Wafer-Level Three-Dimensional (3D) ICs”, R.J. Gutmann, J. McMahon, and J.-Q. Lu, in Technical Track 8: Surface Engineering and Coatings, Session on Chemical Mechanical Polishing (CMP), World Tribology Congress III, Washington Hilton, Washington, DC, September 12-16, 2005.
- “Thermally Induced Stresses in 3D ICs”, M.O. Bloomfield, D.N. Bentz, J. Zhang, J.-Q. Lu, R.J. Gutmann, and T.S. Cale, 2005 Advanced Metallization Conference (AMC 2005), Colorado Springs, CO, September 27-29, 2005.
- “Unit Processes for Cu/BCB Redistribution Layer Bonding for 3D ICs”, J.J. McMahon, R.J. Kumar, F. Niklaus, S.H. Lee, J. Yu, J.-Q. Lu, and R.J. Gutmann, 2005 Advanced Metallization Conference (AMC 2005), Colorado Springs, CO, September 27-29, 2005.
- “Thermal Stresses in 3D Inter-Wafer Interconnects”, J. Zhang, M.O. Bloomfield, J.-Q. Lu, R.J. Gutmann, and T.S. Cale, accepted to *Microelectronic Engineering*, 2005. In press.
- “Bond Strength of Benzocyclobutene (BCB)-Bonded Wafers”, Y. Kwon, J.-Q. Lu, T.S. Cale, and R.J. Gutmann, accepted to *Journal of The Electrochemical Society*, 2005. In press.
- “Wafer-Level 3D Integration of Cache Memory for High-Performance Microprocessors”, A.Y. Zeng, J.-Q. Lu, K. Rose, and R.J. Gutmann, accepted to *IEEE Design & Test of Computers*, 2005. In press.

T.-M. LU

- “Effects of Substrate Temperature on Properties of Pulsed dc Reactively Sputtered Tantalum Oxide Films”, P. Jain, J.S. Juneja, V. Bhagwat, E.J. Rymaszewski, T.-M. Lu, and T.S. Cale, *J. Vac. Sci. Technol. A*23, 512, 2005.

H. NEWBERG

- “Spectroscopic Study of the Ancient Milky Way: F- and G-Type Stars in the Third Data Release of the Sloan Digital Sky Survey”, C. Allende Prieto, T.C. Beers, R. Wilhelm, H.J. Newberg, C.M. Rockosi, B. Yanny, and Y.S. Lee, *The Astrophysical Journal*. In press.
- “The Metallicity Distribution Function of the Halo of the Milky Way”, T.C. Beers, N. Christlieb, J.E. Norris, M.S. Bessell, R. Wilhelm, C. Allende Prieto, B. Yanny, C. Rockosi, H.J. Newberg, S. Rossi, T.S. Lee, in *From Lithium to Uranium: Elemental Tracers of Early Cosmic Evolution*, IAU Symposium 228, V. Hill, P. Francois & F. Primas, eds. In press.
- “The Milky Way's Stellar Halo - Lumpy or Triaxial?”, H.J. Newberg, and B. Yanny, in *Physics at the end of the Galactic Cosmic Ray Spectrum*, *Journal of Physics: Conf. series*, eds. G. Thomson and P. Sokolsky. In press.
- “Spectroscopic Observations and Analysis of the Unusual Type Ia SN 1999ac”, *Supernova Cosmology Project*: G. Garvanini, et al., *The Astronomical Journal*. In press.
- “The Halo of the Milky Way”, H.J. Newberg and B. Yanny, in *Astrometry in the Age of the Next Generation of Large Telescopes*, *ASP Conf. Ser.* 338, 210, 2005.
- “Metallicity of the Monoceros Stream from A/F-Type Stars”, R. Wilhelm, T.C. Beers, C. Allende-Prieto, H.J. Newberg, and B. Yanny, in *COSMIC ABUNDANCES as Records of Stellar Evolution and Nucleosynthesis in honor of David L. Lambert*, *ASP Conf. Ser.* 336, 371, 2005.
- “The Milky Way as Seen from Apache Point”, C. Allende-Prieto, T.C. Beers, R. Wilhelm, H.J. Newberg, and B. Yanny, in *COSMIC ABUNDANCES as Records of Stellar Evolution and Nucleosynthesis in honor of David L. Lambert*, *ASP Conf. Ser.* 336, 301, 2005.
- “The Sloan Digital Sky Survey Quasar Catalog. III. Third Data Release”, D.P. Schneider, et al., *The Astronomical Journal*, 130, 367, 2005.

P. PERSANS

- “Fabrication of Micromirrors with Self-Aligned Metallization Using Silicon Back-End-of-the-Line Processes”, S.S. Ponoth, N.T. Agarwal, P.D. Persans, and J.L. Plawsky, *Thin Solid Films*, v 472, 169-79, 2005.
- “On-Wafer Optical Interconnectivity Using 3D Integration of Optical and Electronic ICs”, P.D. Persans, J.Q. Lu, R. Gutmann, S. Ponoth, R. Garrelts, and A. Gennett, *VMIC Conference*, October, 2005. Submitted.

E.F. SCHUBERT

- “Silica Nanorod-Array Films with Very Low Refractive Indices”, J.-Q. Xi, J.K. Kim, and E.F. Schubert, *Nano Letters* 5, 1385, July 2005.
- “Light-Emitting Diodes”, E.F. Schubert, J.K. Kim, and T. Gessmann, *Kirk Othmer Encyclopedia of Chemical Technology*; on-line access at < www.mrw.interscience.wiley.com/kirk/ > (John Wiley and Sons and Wiley Inter-Science, New York, NY, July 2005).
- “Internal High-Reflectivity Omni-Directional Reflectors”, J.-Q. Xi, M. Ojha, J.L. Plawsky, W.N. Gill, J.K. Kim, and E.F. Schubert, *Applied Physics Letters* 87, 031111, July, 2005.

M. YAMAGUCHI

- “Generation of Ultrahigh-Frequency Tunable Acoustic Waves”, J.D. Choi, T. Feurer, M. Yamaguchi, B. Paxton, and K.A. Nelson, *Appl. Phys. Lett.*, 87, 081907, 2005.

X.-C. ZHANG

- “Terahertz Radiation from InAlAs and GaAs Surface Intrinsic-N+ Structures and the Critical Electric Fields of Semiconductors”, J.S. Hwang, H.C. Lin, K.I. Lin, and X.-C. Zhang, *Appl. Phys. Letts.*, 87, 110287, 2005.
- “Plasma Wave Resonant Detection of Femtosecond Pulsed Terahertz Radiation by a Nanometer Field-Effect Transistor”, F. Tepea, D. Veksler, V.Y. Kachorovski, A.P. Dmitriev, X. Xu, X.-C. Zhang, S. Romyantsev, W. Knap, and M.S. Shur, *Appl. Phys. Lett.*, 87, 022102, 2005.
- “Terahertz Generation from CdTe Crystal Characterized by Excitation Frequency”, X. Xie, J. Xu, and X.-C. Zhang, *APL*, 2005. Submitted.
- “Detection of RDX by Back Scattered THz Waves”, H. Liu, Y. Chen, G.J. Bastiaans, and X.-C. Zhang, *Optical Express*, 2005. Submitted.
- “THz Radiation from InAs Induced by Carrier Diffusion and Drift”, K. Liu, J. Xu, T. Yuan, and X.-C. Zhang, *PR B*, 2005. Submitted.

PROPOSALS (SUBMITTED or GRANTED)

S. LIN and T.-M. LU

- “Investigation of Metallic Photonic-Crystals for the Modification of Thermal Emission”, S.-Y. Lin, T.-M. Lu, and K.M. Ho, DOE, \$600K, 2006-2009. Submitted.

J.-Q. LU

- Proposal white paper title: ““Chip-Scale Tunnel Junction MOS and SOS Silicon Lasers”, Co-PI, with S.-Y. Lin (PI at RPI) & K.-M. Ho (Co-PI at Iowa State University), submitted to AFOSR under the ONR BAA Announcement Number 05-017 for the FY06 MURI - Topic 14 “Silicon-Based Lasers and Nanophotonics”, August 9, 2005.

T.-M. LU

- “Commercialization of Patented Epoxy Siloxane Materials for Disruptive Micro-and Nano-Lithography and Electronic Packaging Applications”, PI: T.-M. Lu, Co-PIs: O. Nalamasu, A. Tran, NYSTAR, \$500K, October 2005-October 2007. Granted.

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

- “NIRT: Study of Electro- and Magneto-Mechanical Nano-Assemblies”, Physics faculty, T.-M. Lu, G.-C. Wang, MANE faculty, N. Koratkar, T. Borca-Tasciuc, and Materials Science and Engineering faculty M. Shima, \$1.15M NSF NIRT. Granted.

H. NEWBERG

- “NASA/NY Space Grant Graduate Fellowship”, 2/2006-1/2007, \$10,000, NASA/NY Space Grant. Submitted.

G.-C. WANG

- “Novel Spin-Controlled Thermoelectric Nano-Valves”, G.-C. Wang, T. Borca-Tasciuc, and M. Shima, CIMAT preproposal, September 2005. Submitted.

M. YAMAGUCHI

- “Thermal Conductivity in Nanotube and Nanowire Arrays”, SRC Interconnect focus center, white paper, July 13, 2005. Submitted.
- “CAREER: Nonequilibrium Terahertz Dynamics in Photoinduced Structural Change”, NSF DMR, \$607K, July 27, 2005. Submitted.
- “Polariton Based THz Spectroscopic Imaging for Chemical Detection”, ARO DSSI-THz program, white paper, August 1, 2005. Submitted.
- “Great Distance Explosive Detection (>100m) by THz Spectroscopy with Air as THz Emitter and Detector”, BAA Counter Improvised Explosive Device Basic Research, ONR, white paper, September 1, 2005. Submitted.

- “BomDetec-Wide Area Surveillance and Suicide Bomber Detection at >10M”, BAA Prototypes and Technology for Improvised Explosives Devices Detection, Department of Homeland Security, \$3.9M (PI-Micheal Shilevich Northeastern University), September 16, 2005. Submitted.
- “Optimization of Thermal Properties and Non-Contact Thermal Conductivity Measurement at Nanowire/Nanorod Interconnects”, Cross-disciplinary semiconductor research, SRC, white paper, September 23, 2005. Submitted.

X.-C. ZHANG

- “New and Additional Nondestructive Evaluation (NDE) Methods for the External Tank (ET) Spray-on-Foam Insulation (SOFI)”, Phase III grant, NASA Langley Research Center, \$25,000 for 90 days, 2005. Granted.
- “A Scanning Stage for THz Imaging System”, NASA Langley Research Center, \$25,000 for 90 days, 2005. Granted.
- “Analysis of Terahertz Wave Technology for Standoff Detection of Explosives”, Sub-contract through Battelle. This grant supports my chairmanship for the NATO THz Exploratory Team, ARO-STAS, \$35,000, 2005-2006. Granted.
- “THz Nanoscope”, DuPont, seed grant \$20k, committed for funding.
- Monsanto, with Ingrid Wilke, \$50,000, committed for funding.
- “Multi-Scalable THz Technology: from Meso-, Micro-, Nano-Scale to Atomic Scale”, ARO, Director Research Initiative Program, \$350k, white paper. Submitted.
- “Terahertz-Wave Emission Apparatus”, ARO-DSSI, \$40k, white paper. Submitted.

VISITORS TO RENSSELAER

J.-Q. LU

- Dr. Bob Markunas, SoCit LLC, working on the 3D integration roadmap on behalf of SEMATECH, August 8, 2005.
- Drs. John Warlaumont, Gomba, Kimmel, Liebmann, and Varanasi, all from IBM, discussion of lithography research challenges and opportunities, August 29, 2005.
- Kabir Mupuri, McGill University, staff candidate interview, September 29-30, 2005.
- Dr. Ed Eegal’61, Chairman of the Board of Directors of SEMI, September 30, 2005.

H. NEWBERG

- Allan Weatherwax and Darren Broder, Siena College, collaboration in astronomy education research, August 5, 2005.
- Sebastien Lepine, American Museum of Natural History, Astro seminar speaker, September 1, 2005.

- Rose Finn, Siena College, Astro seminar speaker, September 22, 2005.
- Kathryn Johnston, Wesleyan University, Astro seminar speaker, September 29, 2005.

G.-C. WANG

- Sandy Thomas from IGERT national recruiting program visited G.-C. Wang, director of IGERT program in THz Science and Technology and students. Sandy shared many recruiting strategies with us, September 19, 2005.
- Prof. Willie Rockward, Morehouse College, Atlanta, GA, sponsored by IGERT program spent three weeks at RPI THz Center. He will recruit students from Morehouse for Rensselaer.

X.-C. ZHANG

- Prof. Yoshizumi Yasuoka, Vice President of Japan National Defense Academy, Professor Emeritus, July 8, 2005.
- Prof. Jin Wook Choi, MD, Korea, THz wave interaction with tissues, August 22 to present.
- Prof. Peter Jepsen, Technical University of Denmark, August 25, 2005.
- Prof. Guozhong Zhao, Physics Department, Capital Normal University of Beijing, China, September 1-30, 2005.
- Prof. Taiichi Otsuji, Ultra-broadband Signal Processing, Broadband Engineering Division, Research Institute of Electrical Communication, Tohoku University, Japan, September 12, 2005.
- Dr. Tani and Dr. Yamamoto, Osaka University, Japan, September 16-18, 2005.
- Dr. Fang Li, Institute of Electronics, Chinese Academy of Science, Beijing, China, September 25-26, 2005.
- Dr. Toshihiko Ouchi, Chief, Terahertz Project, Canon Research Center, Canon Inc., 30-2, Shimomaruko 3-chome, Ohata-ku, Tokyo 146-8501, Japan and THz Biological Sensing Research Lab. RIKEN, Japan, September 26, 2005.
- Dr. Prashanth Upadhy, University of Leeds, UK, September 26, 2005.
- Prof. Jingling Shen, Physics Department, Capital Normal University of Beijing, China, September 27-28, 2005.
- Dr. Mark Johnson, Dr. Jeff Warrender, and Dr. Moayyed Hussain, Army Benet Laboratory, September 28, 2005.

NON-PROFESSIONAL ACTIVITIES

H. NEWBERG

- Elected to Board of Trustees, First Unitarian Universalist Society of Albany.

IMPORTANT ACTIVITIES OF STUDENTS

F. TANG

- Won the 2005 American Vacuum Society (AVS) graduate research award (GRA) and AVS Thin Film Division Award. Fu Tang could only accept one award. (G.-C. WANG)

OTHER

G.-C. WANG

- IGERT and GAANN fellows had summer poster presentations on August 4, 2005.
- REU students had the end of program poster presentations on August 9, 2005.