

Rensselaer Physics Department Activities

April 2006 – June 2006
(Rensselaer Students are underlined)

HONORS AND AWARDS

T.-M. LU

- Organizer Committee and Session Chair, IITC (International Interconnect Technology Conference), San Francisco, Cal., June 5-7, 2006.
- Patent: "Atomic layer deposition of noble metals", J. Senkevich and T.-M. Lu, US 2006: 0093848-A1

G.-C. WANG

- Received 2006 Wiley Distinguished Faculty Award.

C. WETZEL

- Program Committee Member APOC06: Advanced LED for Solid-State Lighting (Special Symposium) (SPIE), Abstract review April 2006.
- Program Committee Meeting Member Conference on Laser Electro-Optics (CLEO) 2006, Abstract review April 2006.
- Program Committee Member International Symposium on Blue Laser and Light Emitting Diodes, 2006, May 14-19, 2006, Montpellier, France.
- Program Committee Member, Electronic Materials Conference, 2006, Jun 28-30, 2006, College Park, PA.
- Workshop Panelist and Writer, Workshop by Department of Energy / Sandia / Basic Energy Sciences, May 22 – 24, Bethesda, MD.

X.-C ZHANG

- European Patent, EP1281061, titled "Terahertz Transceivers and Methods for Emission and Detection of Terahertz Pulses Using Such Transceivers," validated in France, Germany, Great Britain, and Italy, issued on 03/29/2006.

INVITED TALKS

T.-M. LU

- “Interconnect technology review: US perspectives”, T.-M. Lu, invited talk, International Forum for Semiconductor Technology (IFST), Crystal City, Arlington, VA, May 19, 2006.
- “Novel pore sealing strategies”, T.-M. Lu, invited talk, SRC Workshop on Interconnect Technology, Albany, NY, May 24, 2006.
- “Conductor/barrier materials science and technology”, short course at the International Interconnect Technology Conference, T.-M. Lu, June 4, 2006.

E. F. SCHUBERT

- E. F. Schubert (**Invited plenary short course**) “Light-emitting diodes for solid-state lighting” Spring Meeting of Materials Research Society, MRS, San Francisco CA, April 17–21 (2006)
- E. F. Schubert (**Invited colloquium**) “Innovations in light-emitting diodes for solid-state and smart lighting applications” The Ohio State University, IEEE Distinguished Lecture Series, Columbus OH, April 27 (2006)
- E. F. Schubert (**Invited plenary presentation**) “Solid-state lighting – Opportunities for fundamental innovation” U.S. Department of Energy (DOE), Solid State Lighting Workshop, Bethesda MD, May 21–24 (2006)
- E. F. Schubert (**Invited tutorial**) “Solid-state lighting – Opportunities for fundamental innovation” Conference on Lasers and Electrooptics (CLEO), Long Beach CA, May 22–26 (2006)
- E. F. Schubert (**Invited short course**) “Light-emitting diodes and solid-state lighting” Conference on Lasers and Electrooptics (CLEO), Long Beach CA, May 22–26 (2006)
- E. F. Schubert (**Invited short course**) “Solid-state lighting” Summer Short Course under “2006 Summer @ Rensselaer” program organized by the RPI Outreach Programs Office, Troy, NY, June 7– 8 (2006)
- E. F. Schubert (**Invited short course**) “Light-emitting diodes and solid-state lighting” Short Course under “Chautauqua Program of the National Science Foundation and the RPI Center for Directed Assembly of Nanostructures” Troy, NY, June 12 (2006)

G.-C. WANG

- “THz science and technology – A studio approach”, The NSF annual program directors meeting, May 15, 2006, Arlington, VA.

C. WETZEL

- “Polarization and Piezo-Optoelectronic Phenomena”, **C. Wetzel**, Workshop by Department of Energy / Sandia / Basic Energy Sciences, Bethesda, MD, May 22 – 24, 2006.

M. YAMAGUCHI

- “THz phonon-polariton spectroscopic imaging”, **M.Yamaguchi**, M.Wang, and P.Suarez, SPIE, Defense and Security Symposium, Orlando, FL, 17 April (2006).

X.-C ZHANG

- “THz technology and applications,” Short Course, SPIE Photonics and Defense Symposium, Orlando, FL, April 19, 2006.
- “THz wave imaging,” Frontiers in Imaging, International Congress of Imaging Science 2006, Rochester, NY, May 11, 2006.
- “New horizons of sensing and imaging with THz waves,” Keynote presentation, THz System Conference, Washington DC, May 15, 2006.
- “THz technology for defense application,” Navy Yard, Columbia Research Corp., Washington DC, May 17, 2006.
- “THz wave generation, control, enhancement, and detection in laser-induced air plasma,” Jianming Dai, Xu Xie, and X.-C. Zhang, SURA THz Meeting, Washington DC, June 1, 2006.
- “THz photonics in ambient air,” New Scientific Opportunities with High Power THz Source, Runcorn, England, June 30, 2006.

MEETING ATTENDANCE

C. WETZEL

- Meeting with the Middle States Evaluation Team, Apr. 3, 2006, RPI, Troy
- International Symposium on Blue Laser and Light Emitting Diodes, 2006, May 14-19, 2006, Montpellier, France
- 13th International Conference on Metal Organic Vapor Phase Epitaxy (ICMOVPE -XIII) Miyazaki, Japan May 22-26, 2006.
- Workshop by Department of Energy / Sandia / Basic Energy Sciences, May 22 – 24, Bethesda, MD.
- Electronic Materials Conference, 2006, Jun 28-30, 2006, College Park, PA.

M. YAMAGUCHI

- “SURA THz applications symposium”, Washington D.C., 1-2 June (2006)

OTHER PROFESSIONAL TRAVEL

G.-C. WANG

- Attended “A Conference for Physics Department Chairs: Responding to the Gathering Storm” at the American Center for Physics, College Park, MD,

June 9-11, 2006. Discussions on the responses to the report on “Rising above the gathering storm”.

C. WETZEL

- U.S. Department of Energy, National Energy Technology Laboratory, Morgantown, WV, Jun 27, 2006. DOE Program Kick-Off Meeting with M. Pattison

M. YAMAGUCHI

- “NSF site visit CenSSIS Northeastern university-Boston university”, Boston, 4 April (2006).

PRESENTATIONS

T. DETCHPROHM

- “Dislocation Analysis in Homoepitaxial GaInN/GaN Light Emitting Diode Growth”. T. Detchprohm, Y. Xia, Y. Xi, M. Zhu, W. Zhao, Y. Li, E.F. Schubert, L. Liu, D. Tsvetkov, D. Hanser and C. Wetzel. 13th International Conference on Metal Organic Vapor Phase Epitaxy, May 22-26, 2006, Miyazaki, Japan.

C. WETZEL

- Y. Li, W. Zhao, Y. Xia, M. Zhu, T. Detchprohm, E.F. Schubert, and C. Wetzel, Temperature dependence of the quantum efficiency in green and deep green GaInN/GaN light emitting diodes, Electronic Materials Conference, 2006, Jun 28-30, 2006, College Park, PA.
- W. Zhao, Y. Li, T. Detchprohm, and C. Wetzel; The Quantum Efficiency of Green GaInN/GaN Light Emitting Diodes. International Symposium on Blue Laser and Light Emitting Diodes, 2006, May 14-19, 2006, Montpellier, France.
- T. Detchprohm, Y. Xia, Y. Xi, M. Zhu, W. Zhao, Y. Li, E.F. Schubert, L. Liu, D. Tsvetkov, D. Hanser and C. Wetzel; Dislocation Analysis in Homoepitaxial GaInN/GaN Light Emitting Diode Growth, 13th International Conference on Metal Organic Vapor Phase Epitaxy, Miyazaki, Japan May 22-26, 2006.

M. YAMAGUCHI

- “Using air as a nonlinear medium for THz wave generation”, X.Xie, J.Dai, **M.Yamaguchi**, and X.C.Zhang, Orlando, FL, 18 April (2006).

X.-C. ZHANG

- “THz characterization of damage to carbon fiber composites,” Nicholas Karpowicz and X.-C. Zhang, David Dawes and Mark J. Perry, #6212-17, SPIE Photonics and Defense Symposium, Orlando, FL, April 17, 2006.
- “THz standoff detection of explosive-biochemical materials,” H. Zhong, A. Redo, Y. Chen, X.-C. Zhang, #6212-22, SPIE Photonics and Defense Symposium, Orlando, FL, April 18, 2006.
- “Using air as the nonlinear medium for THz wave generation,” Xu Xie, J. Xu, M. Yamaguchi, X.-C. Zhang, #6212-24, SPIE Photonics and Defense Symposium, Orlando, FL, April 18, 2006.
- “THz spectra of 4-NT and 2, 6-DNT,” Yunqing Chen, Haibo Liu, X.-C. Zhang, #6212-26, SPIE Photonics and Defense Symposium, Orlando, FL, April 18, 2006.
- “Detection of explosives and their related compounds by THz wave spectroscopy,” Y.Q. Chen, G. J. Bastiaans, X.-C. Zhang, Technical Support Working Group (TSWG) Explosive Detection Conference, Miami, FL, June 12, 2006.

PAPERS PUBLISHED

G. CIOLEK

- "Formation and Collapse of Nonaxisymmetric Protostellar Cores in Planar Magnetic Interstellar Clouds: Formulation of the Problem and Linear Analysis". Glenn E. Ciolek and Shantanu Basu (U. of Western Ontario), submitted to The Astrophysical Journal 25 May 2006.

T.-M. LU

- Breakdown of dynamic scaling in surface growth under shadowing, M. Pelliccione, T. Karabacak, and T.-M. Lu, Phys. Rev. Lett. 96, 146105 (2006).
- “Low Temperature Melting of Copper Nanorod Arrays” Tansel Karabacak, James S. DeLuca, Pei-I Wang, Gregory A. Ten Eyck, Dexian Ye, Gwo-Ching Wang, and Toh-Ming Lu, J. Appl. Phys., J. Appl. Phys. 99, 064304 (2006).
- “Mounds formation in surface growth under shadowing”, M. Pelliccione, T. Karabacak, C. Gaire, G.-C. Wang, and T.-M. Lu, Phys. Rev. B, submitted.
- “Plasma Enhanced Atomic Layer Deposition of Palladium on a Polymer Substrate”, Gregory A. Ten Eyck, Samuk Pimanpang, Jasbir S. Juneja, Hassaram Bakhru, Toh-Ming Lu, and Gwo-Ching Wang, Chem. Vap. Dep., submitted.
- "Instability of metal barrier with porous methyl silsesquioxane films", Pei-I Wang, J.S. Juneja, T.-M. Lu, and Greg S. Spencer, submitted to J. Electrochem. Soc.

- "Enhancement of Cu(hfac)₂ Chemisorption on the Parylene Surface by N₂ Plasma Surface Modification", S. Pimanpang, Pei-I Wang, Dexian Ye, Jasbir S. Juneja, G.-C. Wang, and T.-M. Lu, , submitted to Electrochem. and Solid-State Letters.
- "Direct plating of Cu on Pd Plasma Enhanced Atomic Layer Deposition coated TaN Barrier", Nicole E. Lay, Gregory A. Ten Eyck, David J. Duquette, and Toh-Ming Lu, J. Electrochem. Soc., submitted.
- "Water electrolysis activated by Ru nanorod array electrodes", S.-Y. Kim, T. Karabacak, T.-M. Lu, and Nikhil Koratkar, , Appl. Phys. Lett., submitted.
- "Enhanced Photo-Emission Behavior from Nanostructured Surface Topologies", R. Teki, T. Karabacak, T.-M. Lu, and N. Koratkar, submitted to Advanced Materials.

H. NEWBERG

- A Curious New Milky Way Satellite in Ursa Major, _ Zucker et al., Ap. J. Lett., in press
- New Models for a Triaxial Milky Way Spheroid and Effect on the Microlensing Optical Depth to the Large Magellanic Cloud, _ Savage, C., Newberg, H. J., Freese, K., and Gondolo, P., Journal of Cosmology and Astroparticle Physics, in press
- A New Milky Way Dwarf Satellite in Canes Venatici, _ Zucker et al., Ap. J. Lett., 643, 103, 2006
- The Field of Streams: Sagittarius and Its Siblings, _ Belokurov et al., Ap. J. Lett., 642, 137, 2006

G.-C. WANG

- Low temperature melting of copper nanorod arrays, Tansel karabacak, James DeLuca, Pei-I Wang, Grefory A. Ten Eyck, Dexian Ye, Gwo-Ching Wang, Toh-Ming Lu, J. of Appl. Phys. 99, 064304 (2006).
- Superparamagnetic behavior in ultra thin CoNi layers of electrodeposited CoNi/Cu multilayer nanowires, X.-T. Tang, G.-C. Wang, and M. Shima, Accepted by JAP, 2006.

C. WETZEL

- J.-H. Chen, Z.-C. Feng, H.-L. Tsai, J.-R. Yang, P. Li, **C. Wetzel**, T. Detchprohm, J. Nelson; Optical and structural properties of InGaN/GaN multiple quantum well structure grown by metalorganic chemical vapor deposition, Thin Solid Films, 498(1-2), 123-127, (2006).
- A.N. Cartwright, M.C-K. Cheung, F. Shahedipour-Sandvik, J.R. Grandusky, M. Jamil, V. Jindal, S.B. Schujman, L.J. Schowalter, **C. Wetzel**, P. Li, T. Detchprohm, and J.S. Nelson; Ultrafast Carrier Dynamics and Recombination in Green Emitting InGaN MQW LED, Proc. Mat. Res. Soc.

Symp., (The Materials Research Society, Warrendale PA, USA, 2006) Vol 916 (2006) DD-4.10.

- W. Zhao, Y. Li, T. Detchprohm, and **C. Wetzel**; The Quantum Efficiency of Green GaInN/GaN Light Emitting Diodes. *physica status solidi (c)* submitted 2006
- T. Detchprohm, Y. Xia, Y. Xi, M. Zhu, W. Zhao, Y. Li, E.F. Schubert, L. Liu, D. Tsvetkov, D. Hanser and **C. Wetzel**; Dislocation Analysis in Homoepitaxial GaInN/GaN Light Emitting Diode Growth, *J. Crystal Growth* submitted 2006

X.-C. ZHANG

- J.Z. Xu and X.-C. Zhang, "THz wave reciprocal imaging," *Applied Physics Letters*, 88, 151107 (2006).
- Jianming Dai, Xu Xie, and X.-C. Zhang, "Detection of broadband terahertz waves with laser-induced plasma in gases," submitted to *Physics Review Letters*, (2006).
- Lantao Guo, Ying Hu, Yan Zhang, Cunlin Zhang, Yunqing Chen and X.-C. Zhang, "Vibrational spectrum of γ -HNIW investigated using terahertz time-domain spectroscopy," *Optical Express*, 14, 3654, (2006).

PROPOSALS (SUBMITTED or GRANTED)

T.-M. LU

- "Development of carbosilane-based low dielectric constant materials for integrated circuit manufacture", P.I.: Leonard V. Interrante, Co-P.I.s: G. Ramanath and T.-M. Lu, NYSTAR, \$500K, August 1, 2006 --July 31, 2008. Funded.
- "Water Electrolysis using Nanostructured Electrodes- an Efficient Approach to H₂ Production", PI: Nikhil Koratkar, Co-PIs: Toh-Ming Lu, and Glen Eisman, NSF NER, \$100K, Sept 1, 2006—August 31, 2007. Funded.
- "Nanoscale acoustics and thermal conductivity in nanorod/nanotube arrays", PI: M. Yamaguchi, Co-PIs: T.-M. Lu and P. Ajayan, NSF NER, \$120K, Sept 1, 2006—August 31, 2007. Funded.

G.-C. WANG

- A synergistic study of growth front texture evolution using a novel reflection high-energy electron pole figure technique and atomistic simulations, G.-C. Wang, T.-M. Lu, H. Huang, Two-page white proposal submitted to DOE, April 19, 2006. Invited to prepare a full proposal.
- Study of the Chemical Vapor Deposition Reactions on Functionalized Silicon Surface and Low-k Parylene Surface by Specular Reflection THz Spectroscopy, Army Research Office Board Agency Announcement

W911NF-06-R-0005, \$200K, Four-page white proposal, April 27, 2006.
Declined.

- Hands-on physics outside classroom, Gary Bedrosian, Don Millard, Scott Dwyer, G.-C. Wang, NSF CCLI, \$200K, 2 years, submitted May 10, 2006.

C. WETZEL

- A New GaN Scintillator-Based Micro Isotope Power Source, DARPA, subcontract to \$2,709,200 over 2 years (submitted).
- Ultraviolet Source Platform Technology for Water Purification, NYSTAR TTIP granted, 8/2006 – 7/2008, \$652,540

M. YAMAGUCHI

- “Terahertz wave generation in laser induced plasma and sensing of molecular gases, liquids, and solids”, 20 June, \$400K, ARO, submitted.

X.-C. ZHANG

- Idaho National Lab., “Stand-off detection of explosive materials using THz spectroscopy and imaging,” Vance Deason (INL), C. Miller, J. Partin (INL), X.C. Zhang (RPI), INL, \$600,000, three years. Rensselaer’s share is \$300,000. (2006). Submitted.
- Army Benet Lab., “Terahertz-wave imaging technology” \$106k for 9 months. (2006). Awarded.
- ARO STTR, “Orthogonal Spectroscopic Technologies for the Detection of Hazardous Substances,” 6 months. (2006). Zomega THz Corp. \$100k, Rensselaer’s share is \$30k. Awarded.
- OSD/Navy, SBIR Phase I, “Miniature THz Spectrometer,” 6 months. (2006). Rensselaer’s share is \$20k. Zomega THz Corp. \$100k, awarded.
- AFOSR, NATO Advanced Research Workshop Terahertz Frequency Detection and Identification of Materials and Objects, \$10,000, awarded.
- AFOSR, NATO Research and Technology Office, THz exploratory team meeting, \$4000, awarded.

SIGNIFICANT RESULTS OBTAINED OR NEW RESEARCH AFFILIATES

VISITORS TO RENSSELAER

G. CIOLEK

- Hosted Prof. Shantanu Basu and Dr. Eduard Vorobyov (Dept. of Physics and Astronomy, U. of Western Ontario) April 11 and 12. Dr. Vorobyov gave a special astrophysics seminar on "Episodic Accretion and Luminosity Outbursts in the Early Stages of Star Formation: A New Explanation for the FU Ori Eruptions".

H. NEWBERG

- Brian Yanny from Fermi National Accelerator Laboratory came to collaborate on a project to measure the shape of the Milky Way halo, May 22-24, 2006.
- Peter Mack, from ACE, came to Rensselaer on June 28, 2006. He expects to finish the refurbishing of the 16_ B&C telescope that is the centerpiece of the Hirsch Observatory by July 16.

C. WETZEL

- Dr. Martin Yeh, LandMark Optoelectronics, Tainan, Taiwan, Installation of MOVPE equipment. Apr 30 – June 7, 2006.

X.-C. ZHANG

- April 12-14, Roel Stolper, Technical Specialist, Centre for Integrated Sensing Systems, CSIR, South-Africa
- May 4-5, Michael Bruke, LLNL

NON-PROFESSIONAL ACTIVITIES

IMPORTANT ACTIVITIES OF STUDENTS

S.-K EAH

- Paul Chando (freshman majoring chemical engineering) got an award of summer URP (Undergraduate Research Program) for working with me on "Chemical synthesis of monodisperse silver nanoparticles" during the summer.
- James Basham (junior in Physics) was selected as one of the 8 REU (Research Experience for Undergraduate) Program students for working with me on "Chemical synthesis of monodisperse gold nanoparticles" during the summer.

H. NEWBERG

- Gigi Nevils, an undergraduate REU student from Sam Houston State University, gave a presentation entitled *_SEGUE Target Selection, Kinematics and Distribution of Blue Horizontal Branch Stars in the Galactic Halo_* at the joint meeting of the Texas Sections of AAPT and APS, as well as Zone 13 of SPS, March 24, 2006 at the SEGUE meeting in Santa Fe, NM.

G.-C. WANG

- Mechanical testing of slanted and isolated copper nanorods using Atomic Force Microscope, C. Gaire, D.-X. Ye, T.-M. Lu, G.-C. Wang, C. R. Picu, APS March Meeting, Marcy 13, 2006, Baltimore, MD. Presentation by graduate student C. Gaire.
- Enhanced Chemisorption of Cu(hfac)₂ on Parylene Surface by N₂ Plasma Treatment S. Pimanpang, P.-I Wang, D.-X. Ye, J. S. Juneja, G.-C. Wang, T.-M. Lu, APS March Meeting, Marcy 16, 2006, Baltimore, MD. Presentation by graduate student S. Pimanpang.
- The Magnetics Society of the IEEE granted graduate student Xueti Tang a US \$750 travel grant to attend the May 2006 Intermag Conference in San Diego, California, May 8 – May 12, 2006. He presented a poster.
- Samuk Pimanpang defended his PhD thesis entitled “Chemical Modification of Polymeric Surfaces to Promote Wettability and Reactivity” on June 20, 2006.

X.-C. ZHANG

- Laser Focus World featured our research on THz wave generation and detection in ambient air in the News Breaks session in its April issue, 2006.

OTHER