

# *Rensselaer Physics Department*

## *Activities*

***April – June 2005***  
(Rensselaer Students are underlined)

### **HONORS AND AWARDS**

#### **Joel Giedt**

- Chaired one session of: workshop "Continuous Advances in QCD 2008," Fine Theoretical Physics Institute, University of Minnesota, Minneapolis, May 15-18.

#### **Masashi Yamaguchi**

- "Characterization of materials with optically shaped acoustic waveforms", J. Beers, M. Yamaguchi, B. Paxton, T. Fuerer, and K. Nelson, Patent #7,387,027, May 17, Awarded.

#### **Shengbai Zhang**

- Session Chair, The 8<sup>th</sup> Annual Workshop on Carbon Nanostructures, Changchun, China

#### **Xi-Cheng Zhang**

- "Detection of biospecific interactions using amplified differential time domain spectroscopy signal," X.-C. Zhang, M. P. Micken, A. Menikh. US. Patent #7,368,280 May 6, 2008. Awarded.
- Co-Chair, NATO SET129 Specialist Meeting, Bucharest, Romania, May 19-20, 2008.
- Chairman, NATO SET124 Task Group 3<sup>rd</sup> Business Meeting, Bucharest, Romania, May 21, 2008.

### **INVITED TALKS**

#### **Joel Giedt**

- "Domain Wall Fermion Lattice Super-Yang-Mills and Adjoint Walking SU(2)", Yale University (high-energy theory seminar), Apr. 29.
- "Domain Wall Fermion Lattice Super-Yang-Mills," at workshop "Lattice Field Theory for the LHC", Lawrence Livermore National Laboratory, May 2-3.
- "Glueballs Condensing at the CCNI: 4096 CPUs Weigh In", at workshop "Continuous Advances in QCD 2008," Fine Theoretical Physics Institute, University of Minnesota, Minneapolis, May 15-18.
- "Domain Wall Fermion Lattice Super-Yang-Mills," Brookhaven National Laboratory (high-energy theory seminar), June 20.

#### **Heidi Newberg**

- "Making the Sloan Digital Sky Survey," Chinese Academy of Sciences Colloquium Series, Beijing China, June 5, 2008

## **Michael Shur**

- Gave an invited talk on THz nanoelectronics at ISSSR conference in Hoboken, NJ.

## **Gwo-Ching Wang**

- Novel Magnesium Nanostructures for Hydrogen Storage, G.-C. Wang, International MRC, Chongqing, China, June 10, 2008.
- Novel Magnesium Nanostructures for Hydrogen Storage, G.-C. Wang, Taiwan University, Taipei, Taiwan, June 17, 2008.

## **Shengbai Zhang**

- June 6, "Hydrogen interactions and storage in graphitic carbon", **Shengbai Zhang**, Department of Physics, Dalian University of Science and Technology, Dalian, China
- June 13, "Hydrogen interactions and storage in graphitic materials", **Shengbai Zhang**, The 8<sup>th</sup> Annual Workshop on Carbon Nanostructures, Changchun, China
- June 16, "Hydrogen interactions and storage in graphitic carbon", **Shengbai Zhang**, School of Electronic Science and Engineering, Jilin University, Changchun, China
- June 20, "Hydrogen interactions and storage in graphitic carbon", **Shengbai Zhang**, Department of Physics, Tsinghua University, Beijing, China
- June 23, "Theory of defects and doping bottlenecks in semiconductors", **Shengbai Zhang**, School of Applied Chemistry and School of Physics, Nankai University, Tianjin, China
- June 25, "Physics of defect complexes and their nano analogy", **Shengbai Zhang**, Institute of Microstructure and Property of Advanced Materials, Beijing University of Technology, Beijing, China

## **Xi-Cheng Zhang**

- "Recent development of THz wave science and technology," Vilnius University and Institute of Semiconductor, Vilnius, Lithuania, April 16, (2008).
- "Recent development on THz wave science and technology," Keynote, NATO SET129 Specialist Meeting, Bucharest, Romania, May 20, 2008.
- "Recent progress on THz sensing and imaging," Workshop on Terahertz (THz) Science & Technology, Singapore, May 29, 2008.

## **MEETING ATTENDANCE**

### **Theeradetch Detchprohm**

- International Symposium on Semiconductor Light Emitting Devices (ISSLED 2008), April 27 –May 2, 2008, Phoenix, Arizona
- Electronic Materials Conference 2008 (EMC 2008), June 25-27, 2008, Santa Barbara, California.

### **Joel Giedt**

- "Domain Wall Fermion Lattice Super-Yang-Mills," at workshop "Lattice Field Theory for the LHC", Lawrence Livermore National Laboratory, May 2-3.

- "Glueballs Condensing at the CCNI: 4096 CPUs Weigh In," at workshop "Continuous Advances in QCD 2008," Fine Theoretical Physics Institute, University of Minnesota, Minneapolis, May 15-18.

### **Gwo-Ching Wang**

- Eighth Annual Rensselaer Colloquium on Teaching and learning, Rensselaer, May 12, 2008.

### **Masashi Yamaguchi**

- CenSSIS NSF site visit, Boston, April 16.

## **OTHER PROFESSIONAL TRAVEL**

### **Joel Giedt**

- Apr. 23-24, Visit to Syracuse University to confer with collaborators Simon Catterall and Joseph Schneible on project that is now in its final stages.

### **Heidi Newberg**

- June 1-7, 2008, Chinese Academy of Sciences, Beijing, China, to visit the LAMOST project at the Chinese Academy of Sciences
- June 7-11, 2008, Fermilab, Chicago, IL, collaborate with Brian Yanny on scientific analysis

### **Gwo-Ching Wang**

- Visit college advisor and high school juniors for recruiting at the National Experimental High School, Hsin Chu, Taiwan, June 16, 2008.

## **PRESENTATIONS (presenter in bold)**

### **Theeradetch Detchprohm**

- **T. Detchprohm**, M. Zhu, Y. Li, Y. Xia, W. Zhao, J. Senawiratne, L. Liu, D. Hanser and C. Wetzel, "Enhanced Performance of GaInN Based Green Light Emitting Diodes on Non-Polar GaN", International Symposium on Semiconductor Light Emitting Devices (ISSLED 2008), April 29, 2008, Phoenix, Arizona

### **Sang-Kee Eah**

- Chemical Synthesis and Two-Dimensional Self- Assembly of Monodisperse Gold Nanoparticles, "Sang-Kee Eah" and Matthew N. Martin, The 82nd American Chemical Society Colloid and Surface Science Symposium, Raleigh, NC, July 16-18, 2008.

### **Heidi Newberg**

- "Fitting the Sagittarius Dwarf Tidal Stream Via Maximum Likelihood," Cole, N., Newberg, H. & Magdon-Ismail, M., B.A.A.S., Meeting 212, #18.13
- "The Making of the Milky Way," Heidi Newberg, Rensselaer Polytechnic Institute, class from Catholic Central High School, April 7, 2008

### **Gwo-Ching Wang**

- Education and research at Rensselaer, National Experimental High School, Hsin Chu, Taiwan, June 16, 2008.

### **Xi-Cheng Zhang**

- Albert Redo, Pierre Servais, **X.-C. Zhang**, "Inspection of military protective

equipment with Terahertz imaging,” NATO SET129 Specialist Meeting, Bucharest, Romania, May 20, 2008.

- **J.M. Dai**, J. Liu, J. Chen, X.F. Lu, X.Y. Gou, N. Karpowicz, T. Tongue, X.-C. Zhang, “Toward THz Wave Standoff Detection”, SURA THz Workshop, Washington DC, June 6, 2008.
- **David Brigada**, Brian Schulkin, and X.-C. Zhang, “Chemical Threat Detection Via Portable THz Spectroscopy,” 2008 International Symposium on Spectral Sensing Research, Stevens Institute of Technology, NJ, June 24-25, 2008.
- **Yunqing Chen**, Nick Karpowicz, Xiaofei Lu, Minfeng Wang, Masashi Yamaguchi, X.-C. Zhang, “THz Generation from Inert Gases & Chemical Vapor”, 2008 International Symposium on Spectral Sensing Research, Stevens Institute of Technology, NJ, June 27, 2008.
- **Brian Schulkin** and X.-C Zhang, "Quality Assurance of Real-Time Terahertz Wave Sensing", 2008 International Symposium on Spectral Sensing Research, Stevens Institute of Technology, NJ, June 25, 2008.
- **Brian Schulkin**, Guangyin Zeng, X.-C. Zhang, "Performance of Real-Time Chemical Sensing with a Handheld THz Spectrometer", 2008 International Symposium on Spectral Sensing Research, Stevens Institute of Technology, NJ, June 27, 2008.

## PAPERS PUBLISHED

### Zhongfang Chen

- J. David Zhang, Zhongfang Chen, R. Bruce King, Henry F. Schaefer III  
Comparison of Isoelectronic Heterometallic and Homometallic Binuclear Cyclopentadienylmetal Carbonyls: The Iron-Nickel versus the Dicobalt Systems  
*Eur. J. Inorg. Chem.*, **2008**, 1219.

### Glenn Ciolek

- "Nonlinear Evolution of Gravitational Fragmentation Regulated by Magnetic Fields and Ambipolar Diffusion", by Shantanu Basu (U. Western Ontario), Glenn E Ciolek (RPI); James Wurster (U. Western Ontario) Submitted to *New Astronomy*

### Theeradetch Detchprohm

- T. Detchprohm, M. Zhu, Y. Li, Y. Xia, C. Wetzel, E. A. Preble, L. Liu, T. Paskova, and D. Hanser, “Green Light Emitting Diodes on *a*-Plane GaN Bulk Substrates”, *Appl. Phys. Lett.* 92,241109(2008).

### Joel Giedt

- Made available on high-energy preprint server, [xxx.arxiv.org/abs/hep-lat/0806.0013](http://xxx.arxiv.org/abs/hep-lat/0806.0013): J. Elliott, J. Giedt, G. Moore, "Lattice N=4 SYM is Practical," submitted to *Physical Review Letters*.

### Toh-Ming Lu

- “Low temperature synthesis of single crystalline ZnO nanorods by oblique angle deposition”, Ranganath Teki , Thomas C. Parker, Huafang Li, Nikhil Koratkar, Toh-Ming Lu, and Sabrina Lee, *Thin Solid Films* 516, 4993 (2008).
- “Shadowing growth of three-dimensional nanostructures on finite size seeds”, D.-X. Ye, C. L. Ellison, B.-K. Lim, and T.-M. Lu, *J. Appl. Phys.* 103, 103531

- (2008).
- “Influence of Nanotips on the Hydrophilicity of Metallic Nanorod Surfaces”, D.-X. Ye and T.-M. Lu, *Phys. Rev. Lett.* 100, 256102 (2008).
  - “Mechanical properties of porous methyl silsesquioxane and nanoclustered silica films using atomic force microscope”, C. Gaire, Y. Ou, R. C. Picu, G.-C. Wang, and T.-M. Lu, submitted to *J. Electrochem. Soc.*
  - “Effects of annealing on metal ion drift in porous methyl silsesquioxane low-K dielectrics”, Ya Ou, Pei-I Wang, and T.-M. Lu, submitted to *J. Electrochem. Soc.*
  - “Microfluidic Mixing System for Time Resolved Cryo Electron Microscopy Imaging”, Zonghuan Lu, Jay McMahon, Hisham Mohamed, David Barnard, Tanvir R. Shaikh, Carmen A. Mannella, Terence Wagenknecht, and Toh-Ming Lu, Lab on a Chip, submitted.

### Heidi Newberg

- “Maximum Likelihood Fitting of Tidal Streams With Application to the Sagittarius Dwarf Tidal Tails,” Cole, N., Newberg, H.J., Magdon-Ismael, M., Desell, T., Dawsey, K., Hayashi, W., Liu, X., Purnell, J., Szymanski, B., Varela, C., Willett, B., Wisniewski, J., *Ap.J.*, in press, astro-ph:0805.2121
- “Improved Cosmological Constraints from New, Old and Combined Supernova Datasets,” Kowalski, M., et al., *Ap.J.*, in press, astro-ph:0804.4142
- “The Milky Way Tomography with SDSS: II. Stellar Metallicity,” Ivezić et al., *Ap.J.*, in press, astro-ph:0804.3850
- “The Milky Way's Rotation Curve to 60 kpc and an Estimate of the Dark Matter Halo Mass from Kinematics of ~2500 SDSS Blue Horizontal Branch Stars,” Xue, X.-X., et al. *Ap. J.*, in press, astro-ph:0801.1232

### Gwo-Ching Wang

- “Magnetoresistance of oblique angle deposited multilayered Co/Cu nanocolumns measured by scanning tunneling microscope”, P. Morrow, X.-T. Tang, T.C. Parker, M. Shima, and G.-C. Wang, *Nanotechnology* 19, 065712 (2008).

### Shengbai Zhang

- The adsorption of O<sub>2</sub> on Pb films and the effect of quantum modulation: A first-principles prediction Yang Y, Zhou G, Wu J, Duan WH, Xue QK, Gu BL, Jiang P, Ma XC, Zhang SB *JOURNAL OF CHEMICAL PHYSICS* **128**, 164705 (2008)
- Response to "Comment on 'Characterization of As-doped, p-type ZnO by x-ray absorption near-edge structure spectroscopy: Theory' " [*Appl. Phys. Lett.* 92, 236101 (2008)] Limpijumnong S, Smith MF, Zhang SB *APPLIED PHYSICS LETTERS* **92**, 236102 (2008)
- Dislocation network at InN/GaN interface revealed by scanning tunneling microscopy Y. Liu, Y. Cai, L. Zhang, M. H. Xie, N. Wang, S. B. Zhang, and H. S. Wu *APPLIED PHYSICS LETTERS* **92**, 231907 (2008)

### Xi-Cheng Zhang

- N.E. Karpowicz, J. Chen, T. Tongue and X.-C. Zhang, “Coherent millimetre wave to mid-infrared measurements with continuous bandwidth reaching 40 THz,” *Electronics Letters*, **44** April (2008).
- Y. Zhang , X.-H. Peng , Y. Chen, J. Chen, A. Curioni, W. Andreoni, S.K. Nayak, X.-C. Zhang, “A first principle study of terahertz (THz) spectra of acephate,”

- Chemical Physics Letters **452** 59 (2008).
- G.M. Png, J.W. Choi, B.W.-H. Ng, S.P. Micken, D. Abbott, and X.-C. Zhang, “The impact of hydration changes in fresh bio-tissue on THz spectroscopic measurements,” *Physics in Medicine and Biology*, **53** 3501–3517(2008).
  - Hua Zhong, Cunlin Zhang, Liangliang Zhang, Yuejin Zhao, and X.-C. Zhang, “A phase feature extraction technique for terahertz reflection spectroscopy,” *Appl. Phys. Lett.* **92** 221106 (2008).

## **PROPOSALS (SUBMITTED or GRANTED)**

### **Toh-Ming Lu**

- “Realization of Photonic Band gap Materials and Photonic Heterostructures by Innovative Material Growth”, S.Y. Lin and T.-M. Lu, NSF, \$376K, June 15, 2008- June 14, 2011, granted.

### **Heidi Newberg**

- “REU Supplement: Revealing the Structure of the Galactic Halo through Statistical Analysis – Middle School Teacher Training,” March 2008, \$13,056, NSF, granted
- “REU Supplement: SEI(AST): A Dynamic Grid for Astroinformatics: Data-Driven Discovery of the Milky Way Origin and Evolution from the Sloan Digital Sky Survey,” Magon-Ismail, Szymanski, Varela, and Newberg, April 2008, \$22,500, granted
- “Semantically Enabling Earth and Space Science Informatics,” Newberg and McGuinness, New York Space Grant Consortium, Cornell University, Sept. 2008 to Aug. 2008, \$20,000, submitted
- “Generalized Maximum Likelihood Evaluation Framework for Astroinformatics,” Magdon-Ismail, Szymanski, Varela, and Newberg, NSF CDI, \$612,102, submitted

### **Gwo-Ching Wang**

- Real-time label-free ultrasensitive PSA sensor based on nanostructured microcantilevers, G.-C. Wang, C. Picu (RPI MANE), Eric Klein (Cleveland Clinic), Derek Raghavan (Cleveland Clinic), DOD, \$547 K, submitted on June 10, 2008.

### **Masashi Yamaguchi**

- “Magneto and thermally processed polymer nanocomposites for high thermal conductivity interface materials, PI: G.Ramanath, co-PI: T.Borca-Tasciuc, M.Yamaguchi, J.Plawsky, P.Keblinski, and G.Pethuraja, DARPA, BAA-0842 June 2008, white paper submitted.
- “Science of broadband THz wave photonics: generation and detection with gases”, PI: X.C.Zhang, Co-PIs: J.Dai, E.Gagnon, and M. Yamaguchi, DTRA, HDTRA1-08-10-BRCWMD, June 2008, white paper submitted.

### **Shengbai Zhang**

- PI, “Theoretical Modeling of van der Waals Interactions”, NREL subcontract/Department of Energy, June 30, 2008, \$250,000, granted
- Team member, “Computational materials science network: Predictive modeling of the growth and properties of energy-relevant thin films and nanostructures”, Iowa State University/DOE, RPI gets half postdoc support for two years. granted
- Co-PI, “DEVELOPMENT OF MULTISCALE MODELS FOR DEFECTS IN

NUCLEAR REACTOR AND FUEL MATERIALS”, full proposal submitted to DOE, June 10, 2008, \$200,000, submitted

- Co-PI, “Advanced Waste Forms for Long-lived Fission Products”, full proposal submitted to DOE, June 10, 2008, \$220,000, submitted
- PI, “Simulation of strained silicon by using the high computer power at the RPI-IBM center for computational nanotechnology innovations (CCNI)”, white paper submitted to Semiconductor Research Consortium, June 15, 2008, \$525,000, submitted

### **Xi-Cheng Zhang**

- “Phase and polarization controller for remote intense terahertz wave generation in laser-induced air plasma”, X.-C. Zhang and J.M. Dai, PTAP program, Optoelectronics Industry Development Association. \$17,000, awarded.
- “Fast dual line-scan system for continuous-wave terahertz inspection”, Albert Redo, PTAP program, Optoelectronics Industry Development Association. \$10,000, awarded.
- “High speed THz balanced detector” for a contingency award, X.-C. Zhang, and Brian Schulkin, PTAP program, Optoelectronics Industry Development Association. \$10,000, conditionally awarded.
- “Inspection of defects in fiberglass tanks and corrosion evaluation in under-insulation metal piping with terahertz wave imaging,” Materials Technology Institute. \$100,000 to Zomega THz Corp. Rensselaer’s share is \$30,000. PIs: X.-C. Zhang, A. Redo. One year. 2008. Awarded.
- “Intense and broadband THz source using laser-induced gas plasma” AFOSR-STTR Phase I, Zomega Terahertz Corp., \$100,000. Rensselaer’s share is \$30,000. PIs: Jianming Dai and X.-C. Zhang, Six months. 2008. Awarded.
- “Miniaturized terahertz spectrometer” Navy Surface Warfare Center (Crane Division) SBIR Phase II, Zomega Terahertz Corp, \$750,000. Rensselaer’s share is \$250,000. Two years. 2008. Awarded.
- “THz wave emission apertures” ARO, \$50,000. One year. 2008. Awarded.
- “Terahertz (THz) Technology and Applications Center (THz-TAC)” NSF Industry/University Cooperative Research Centers Program Planning Grant. \$20,000. Rensselaer Polytechnic Institute/Oklahoma State University (\$10k each), 9 months. 2008-2009. Awarded.

## **VISITORS TO RENSSELAER**

### **Joel Giedt**

- Simon Catterall, Prof., Syracuse University visited June 12, to collaborate on the Walking Adjoint SU(2) project.

### **Heidi Newberg**

- Natalia Connolly, Hamilton College, 4/17/2008, Gave astrophysics seminar, and discussed possible future collaboration
- Brian Yanny, Fermilab, 5/12/2008 – 5/15/2008, collaborated on scientific analysis

## Shengbai Zhang

- Dr. Zhigen Yu, Institute of High Performance Computing, Singapore, April 19-May 10, for scientific collaborations.

## Xi-Cheng Zhang

- Dr. Emory A. Ford, Associate Director, Materials Technology Institute. Research and collaboration, April 11,
- Roland Kersting, May 10 to May 29. Research collaboration.
- John Mackay, Coherent Laser Co., April 24.
- He Mingxia, Huang Zhanhua, and Yu Daoyin, Tianjin University, April 28 Visit.
- Aaron LaPointe, Army Night Vision Lab., Site visit. June 12
- Dr. David Nelson, Navy Indian Head, Site visit and quarterly review, June 24
- Mr. Lei Hou, Xian Polytechnic Institute, visiting scholar, one year, July 2

## IMPORTANT ACTIVITIES OF STUDENTS

### Heidi Newberg

- Nate Cole (graduate student) had a first author paper accepted to The Astrophysical Journal. Seven of the twelve authors are current or former students of Prof. Newberg. Nate also presented a poster of his research results at the American Astronomical Society Meeting in St. Louis, MO, June 2008.

### Gwo-Ching Wang

- Paul Morrow successfully defend his PhD thesis on May 30, 2008. He will start as an NRC postdoc at NIST Washington DC.

## OTHER

### Xi-Cheng Zhang

- An article in *Science Magazine*, entitled **New Efforts to Detect Explosives Require Advances on Many Fronts** featured our THz group activities at Rensselaer on June 13, 2008.

Another approach to finding explosions is to pick out their molecular signatures from afar. **Xi-Cheng Zhang, an electrical engineer at Rensselaer Polytechnic Institute** in Troy, New York, thinks that terahertz (THz) beams might be the answer. THz radiation lies between the infrared and microwave parts of the electromagnetic spectrum and can pass through barriers such as clothing and plastic without being a health hazard. In recent years, some airports have begun testing THz imaging systems to look for concealed weapons on airline passengers. Researchers have also found that most explosive molecules absorb THz radiation at frequencies between 0.5 to 1.0 THz, so explosives stand out in reflected THz beams. Zhang and his colleagues, including Northeastern's Silevitch, are hoping to exploit this property to detect explosives from distances of 100 meters or more.

Read the [story](#).