

## Andrea G. Markelz

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### Education:

- October 1995      Doctorate: Experimental Condensed Matter Physics  
“Nonlinear Optical and Transport Properties of Quantum Wells at Terahertz  
Frequencies”  
University of California  
Santa Barbara, CA 93106
- December 1989      Master of Science: Applied Physics  
Columbia University  
New York, NY 10027
- May 1987            Bachelor of Arts: Double Major: Applied Math and Physics  
University of California  
Berkeley, CA 94708

### Professional Experience:

- Sept. 2011 – present      Professor, Physics Dept. SUNY Buffalo**
- Jan. 2006 – Aug. 2011      Associate Professor, Physics Dept. SUNY at Buffalo**
- Aug. 2007 – present      Adjunct, Structural Biology Dept. SUNY at Buffalo**
- May 2007 – present      Adjunct, Electrical Engineering Dept. SUNY at Buffalo**
- Jan. 2008 – present      Adjunct, Physiology and Biophysics Dept. SUNY at Buffalo**
- Aug. 1999 – Jan. 2006      Assistant Professor, Physics Dept. SUNY at Buffalo**
- Oct. 1998 – June 1999      NSF GOALI Postdoctoral Fellow**  
University of Maryland, College Park, MD, and Lucent Technologies,  
Murray Hill, NJ. Supervisors: H. D. Drew and B. Batlogg.
- Nov. 1995 – Oct. 1998      National Research Council Postdoctoral Fellow**  
NIST, Gaithersburg, MD. Supervisors: M. P. Cassasa and J. C.  
Stephenson
- May 1991-Oct. 1995      Research Assistant**  
Quantum Institute, University of California, Santa Barbara, CA.  
Supervisors: Dr. E. Gwinn, Dr. M. Sherwin, and Dr. S. J. Allen.

- June 1994 – Sept. 1994**      **Summer Intern Supervisor**  
QUEST, University of California, Santa Barbara, CA.
- Sept. 1990-May 1991**      **Teaching Assistant**  
Physics Dept., University of California, Santa Barbara, CA.  
Supervisors: Dr. J. Richman, Dr. D. Hone, Dr. E. Gwinn. Pre-med physics lab, solid state physics and statistical mechanics.
- Jan. 1990-Sept. 1990**      **Research Assistant**  
Electrical and Computer Engineering, University of California, Santa Barbara, CA. Supervisor: Dr. E. Hu. Assisted construction of an e-beam evaporation system for Y-Ba-Cu-O superconducting thin films. Developed a 1.4K magnetic measurement system (1 Tesla) for high  $T_c$  thin film characterization. R vs. T measurements.
- May 1989-Sept. 1989**      **Research Assistant**  
Morris Research, Berkeley, CA. Supervisor: Dr. D. E. Morris. Determined activation energies for the different oxygen sites in  $YBa_2Cu_3O_{7-\delta}$ . Research in site selective substitution of  $O^{18}$  and  $O^{17}$  in Y123 and Y124 systems. XRD, SEM, magnetic susceptibility measurements, critical current measurements.
- Sept. 1988-May 1989**      **Teaching Assistant**  
Columbia University, New York, NY. Supervisors: Dr. R. Friedman, Dr. I. Herman. Linear algebra and quantum electronics.
- Jan. 1987-Sept. 1989**      **Research Assistant**  
Lawrence Berkeley Laboratory, Berkeley, CA . Supervisor: Dr. D.E. Morris. Conducted oxidation studies on Y-Ba-Cu-O, Bi-Sr-Ca-Cu-O, and Tl-Ca-Ba-Cu-O superconducting systems. TGA, XRD, magnetic susceptibility, SEM.

**Awards:**

- March 1995**      NRC Postdoctoral Fellowship, NIST: “Femtosecond Terahertz Spectroscopy with Applications to III-V Semiconductor Dynamics”
- September 1991**      University of California Doctoral Scholars Fellowship

**Publications: (h index = 21)**

1. “Optical Measurements of Long-Range Protein Vibrations,” Gheorghe Acbas, Katherine A. Niessen, Edward H. Snell and A.G.Markelz, Nature Comm. DOI 10.1038/ncomms4076, 2014.
2. “Photoactive Yellow Protein Terahertz Response: Hydration, Heating and Intermediate States,” D.K. George, J.R. Knab, Y. He, M. Kumauchi, R.R. Birge, W.D. Hoff, A.G. Markelz, IEEE Trans. THz Sci. Tech. **3**, 288 - 294, (2013).
3. “Improved Mode Assignment for Molecular Crystals Through Anisotropic Terahertz Spectroscopy,” Rohit Singh, D. K. George, J. B. Benedict, T. M. Korter and A. G. Markelz, J. Phys. Chem. A **116**, 10359-10364, (2012).

4. "Terahertz Spectroscopic Analysis of Peptides and Proteins," Robert J. Falconer and Andrea G. Markelz, *J. Infrared, Millimeter and THz Waves* **33**, 973-988, (2012).
5. "Terahertz Magneto Optical Polarization Modulation Spectroscopy," D. K. George, A. V. Stier, C. T. Ellis, B. D. McCombe, J. Černe, A. G. Markelz *J of Optical Society of America B* **29**, 1406–1412 (2012).
6. "THz response and colossal Kerr rotation from the surface states of the topological insulator  $\text{Bi}_2\text{Se}_3$ ," R. Valdés Aguilar, A. V. Stier, W. Liu, L. S. Bilbro, D. K. George, N. Bansal, L. Wu, J. Černe, A. G. Markelz, S. Oh, N. P. Armitage *Phys. Rev. Lett.* **108**, 087403 (2012).
7. "Functional State Dependence of Picosecond Protein Dynamics," J.Y. Chen, D.K. George, Yunfen He, J.R. Knab and A. G. Markelz, under revision *Phys. Rev. Lett.* 2012 <http://arxiv.org/0054394>.
8. "Hydration and Temperature Interdependence of Protein Picosecond Dynamics," Seth Levy, Ferdinand Lipps and A. G. Markelz, *Phys. Chem. Chem. Phys.* **14**, 6368 – 6374 (2012). **Highlighted in Noteworthy Chemistry May 14, 2012 ( [portal.acs.org](http://portal.acs.org) )**
9. "Evidence of protein collective motions on the picosecond time scale," Yunfen He, J.-Y. Chen, J. R. Knab, Wenjun Zheng and A. G. Markelz, *Biophysical Journal* **100**, 1058-1065, (2011).
10. "Hydration Effects on Energy Relaxation of Ferric Cytochrome C Films after Soret-band Photoexcitation," Shuji Ye and A. G. Markelz, *J. Phys. Chem. B*, **114**, 15151 (2010).
11. "Hydration Dependence of Picosecond Protein Plasticity," J.-Y. Chen, J. R. Knab and A. G. Markelz, to be submitted to *Physical Review E* 2012.
12. "Why is THz sensitive to protein functional states? Oxidation State of Cytochrome C," Yunfen He, J.-Y. Chen, J.R. Knab, W. Zheng and A.G. Markelz, *International Journal of THz Science and Technology*, **4** (2010)
13. "Protein Dynamical Transition Does Not Require Protein Structure," Yunfen He, Pei I. Ku, J. R. Knab, J.Y. Chen, and A. G. Markelz, *Phys. Rev. Lett.* **101**, 178103 (2008). **Highlighted in the Virtual Journal of Biological Physics. Cited by Faculty of 1000 as an exceptional paper**
14. "Terahertz response of quantum point contacts," J. W. Song, N. A. Kabir, Y. Kawano, K. Ishibashi, G. R. Aizin, L. Mourokh, J. L. Reno, A. G. Markelz, and J. P. Bird, *Appl. Phys. Lett.* **92**, 223115 (2008).
15. "Invited Review: Terahertz Dielectric Sensitivity to Biomolecular Structure and Function," A. G. Markelz, *IEEE Journal of Selected Topics in Quantum Electronics*, **14**, 180 (2008).
16. "Terahertz Spectroscopy of Bacteriorhodopsin and Rhodopsin; Similarities and Differences," R. Balu 1, H. Zhang , E. Zukowski , J.-Y. Chen , A. G. Markelz and Susan K. Gregurick, *Biophysical Journal*, **107**, 105163 (2008).
17. "Observation of Cytochrome C Glass Transition in Terahertz Dielectric Response," J. R. Knab, J.-Y. Chen and A. G. Markelz, *Chem. Phys. Lett.*, **442**, 413 (2007). **Highlighted in the Faculty of 1000.**

18. "Terahertz Dielectric Assay of Solution Phase Protein Binding," Jing-Yin Chen, J. R. Knab, Shuji Ye, Yunfen He and A. G. Markelz, *Appl. Phys. Lett.* **90**, 243901 (2007). **Highlighted in the Virtual Journal of Biological Physics.**
19. "Terahertz Measurements of Protein Relaxational Dynamics," Joseph R. Knab, Jing-Yin Chen, Yunfen He and Andrea G. Markelz, *Proc. IEEE* **95**, 1605 (2007).
20. "Terahertz transmission characteristics of high-mobility GaAs and InAs two-dimensional-electron-gas systems," N. A. Kabir, Y. Yoon, J. R. Knab, J.-Y. Chen, A. G. Markelz, J. L. Reno, Y. Sadofyev, S. Johnson, Y.-H. Zhang, and J. P. Bird, *Appl. Phys. Lett.* **89**, 132109 (2006).
21. "Hydration Dependence of Conformational Dielectric Relaxation of Lysozyme," J. R. Knab, J.-Y. Chen, and A. G. Markelz, *Biophys. J.* **90**, 2576–2581 (2006).
22. "Large oxidation dependence Observed in Terahertz Dielectric Response for Cytochrome C," J.-Y. Chen, J. R. Knab, J. Cerne and A. G. Markelz, *Phys. Rev. E Rapid* **72**, 040901 (2005).
23. "Direct Measurements of Optical Phonons in SrTiO<sub>3</sub> Nanosystems," D. Wolpert, J. Knab, W. Cox, J. Cerne, A. Markelz, T. Zhao, R. Ramesh, and B. Moeckly, *Physica E* **19** 236-9 (2003).
24. "Terahertz Applications to Biomolecular Sensing," A. G. Markelz, S. E. Whitmire, *Intl. J. of High Speed Electronics and Systems* **13** 951-67 (2003).
25. "Protein Flexibility and Conformational State: A comparison of collective vibrational modes of WT and D96N bacteriorhodopsin," S. E. Whitmire, D. Wolpert, A. G. Markelz, J. R. Hillebrecht, J. Galan, and R. R. Birge, *Biophys. J.* **85** 1269-77 (2003).
26. "Terahertz Time Domain Spectroscopy of Biomolecular Conformational Modes," S. Whitmire, A. G. Markelz, J. R. Hillebrecht, and R. Birge, *Phys. Med. Biol.* **21**, 3797-805 (2002).
27. "Pulsed Terahertz Spectroscopy of DNA, Bovine Serum Albumin and Collagen between 0.06 to 2.00 THz," A. G. Markelz, A. Roitberg and E. J. Heilweil, *Chem. Phys. Lett.* **320**, 42-8 (2000). (>200 citations)
28. "High Field Pulsed Terahertz Measurements of Nonlinear Conductivity," A. G. Markelz *Trends in Optics and Photonics* **46** 105-6 (2000).
29. "Temperature Dependent THz Output from Semi-Insulating GaAs Photoconductive Switches," A. G. Markelz and E. J. Heilweil. *Appl. Phys. Lett.* **72**, 2229-31 (1998).
30. "Relaxation times in InAs/Al<sub>1-x</sub>Ga<sub>x</sub>Sb quantum wells," A. G. Markelz, N. G. Asmar, E. G. Gwinn, and Berinder Brar. *Appl. Phys. Lett.* **72**, 2439-41 (1998).
31. "Interband Impact Ionization by Terahertz Illumination of InAs Heterostructures," A. G. Markelz, N. G. Asmar, E. G. Gwinn, and Berinder Brar. *Appl. Phys. Lett.* **69**, 3975-77 (1996).
32. "Charge Density and Intensity dependence of third order susceptibility in Quasi-2D systems," A. G. Markelz and E. G. Gwinn. *J. Appl. Phys.* **80**, 2533-5 (1996).
33. "Temperature of quasi-two-dimensional electrons under steady-state terahertz driving," N. G. Asmar, J. Cerne, A. G. Markelz, E. G. Gwinn, M. S. Sherwin, K. Campman and A. C. Gossard. *Appl. Phys. Lett.* **68**, 829-31 (1996).

34. "Undressing a Collective Excitation Using a Free-Electron Laser," K. Craig, B. Galdrikian, J. N. Heyman, A. G. Markelz, J. Williams, M. S. Sherwin, K. Campman, P. F. Hopkins, and A. C. Gossard, *Phys. Rev. Lett.* **76**, 2382-5 (1996).
35. "Nonlinear Quantum Dynamics in Semiconductor Quantum Wells," M. S. Sherwin, K. Craig, Keith, B. Galdrikian, J. Heyman, A. Markelz, K. Campman, S. Fafard, Simon, P.F. Hopkins, and A. C. Gossard. *Physica D* **83** 229-42 (1995).
36. "Resonant energy relaxation of terahertz-driven two-dimensional electron gases," N. G. Asmar, A. G. Markelz, E. G. Gwinn, J. Cerne, M. S. Sherwin, K. Campman, P. F. Hopkins and A. C. Gossard. *Phys. Rev. B* **51** 18041-4 (1995).
37. "Quenching of excitonic quantum-well photoluminescence by intense far-infrared radiation: carrier heating," J. Cerne, A. G. Markelz, M. S. Sherwin, and S. J. Allen, M. Sundaram, A. C. Gossard, P. S. van Son, and D. Bimberg. *Phys Rev. B* **51** 5253-62 (1995).
38. "Probing terahertz dynamics in semiconductor nanostructures with the UCSB free-electron lasers," S. J. Allen, K. Craig, C. L. Felix, P. Guimaraes, J. N. Heyman, J. P. Kaminski, B. J. Keay, A. G. Markelz, G. Ramian, *J. of Lumin.* **60-61** 250-5 (1994).
39. "Sub-cubic power dependence of third-harmonic generation for in-plane, far infrared excitation of InAs quantum wells," A.G. Markelz, N. G. Asmar, E.G. Gwinn, M. S. Sherwin, C. Nguyen and H. Kroemer. *Semicond. Sci. and Technol.* **9**, 634-7 (1994).
40. "DC Transport in Intense in-plane Terahertz Electric Fields in  $\text{Al}_x\text{Ga}_{1-x}\text{As}$  Heterostructures at 300 K," N.G. Asmar, A. G. Markelz, E.G. Gwinn, P.F. Hopkins and A.C. Gossard. *Solid-State Elec.* **37**, 693-5 (1994).
41. "Giant third-order nonlinear susceptibilities for in-plane far-infrared excitation of single InAs quantum wells," A.G. Markelz, E.G. Gwinn, M. S. Sherwin, C. Nguyen and H. Kroemer. *Solid-State Elec.* **37**, 1243-5 (1994).
42. "Energy relaxation at THz frequencies in  $\text{Al}_x\text{Ga}_{1-x}\text{As}$  heterostructures," N.G. Asmar, A.G. Markelz, E.G. Gwinn, P.F. Hopkins and A.C. Gossard. *Semicond. Sci. and Technol.* **9**, 828-30 (1994).
43. "Far-Infrared Saturation Spectroscopy of Single Wide GaAs/AlGaAs Square Quantum Well," K. Craig, C. Felix, J. Heyman, A. Markelz, M. Sherwin, Ken Campman, A. Gossard, P. Hopkins. *Semicond. Sci. and Technol.*, **9**, 627-629 (1994).
44. "Site-Selective oxygen-isotope substitution in  $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$ ," D. E. Morris, A. G. Markelz, J. Y. T. Wei, C. T. Hultgren, J. H. Nickel, J. C. Hamilton, K. F. McCarty. *Phys. Rev. B* **44**, 9556-61 (1991).
45. "Conversion of 124 into 123 + CuO and 124, 123 and 247 phase regions in YBaCuO system," D.E. Morris, A. G. Markelz, B.Fayn, J. Nickel. *Physica C* **168**, 153-60 (1990).
46. "Eight New Superconductors with 1:2:4 structure," D. E. Morris, J. H. Nickel, J. Y. T. Wei, N. G. Asmar, J. S. Scott, U. M. Scheven, C. T. Hultgren, A. G. Markelz, J. E. Post, P. J. Heaney, D. R. Veblen, R. M. Hazen. *Phys. Rev. B* **37**, 7347-50 (1989).
47. "Oxygen concentration effect of Tc of the Bi-Ca-Sr-Cu-O superconductor," D. E. Morris, C. T. Hultgren, A. G. Markelz, J. Y. T. Wei, N. G. Asmar, J. H. Nickel. *Phys. Rev. B* **39**, 6612-14 (1989).

48. "Specific-heat measurements on superconducting Bi-Ca-Sr-Cu and Tl-Ca-Ba-Cu Oxides: Absence of a linear term in the specific heat of Bi-Ca-Sr-Cu oxides," R. A. Fisher, S. Kim, S. E. Lacy, N. E. Phillips, D. E. Morris, A. G. Markelz, J. Y. T. Wei, D. S. Ginley. *Phys. Rev. B* **38**, 11942-5 (1988).
49. "Small Oxygen Isotope Shift in YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7</sub>," D. E. Morris, R. M. Kuroda, A. G. Markelz, J. H. Nickel, J. Y. T. Wei. *Phys Rev. B* **37**, 5936-9 (1988).

**Conference Proceedings (refereed):**

1. "Measuring phonons in protein crystals," Katherine A. Niessen, Edward Snell, A. G. Markelz Proc. SPIE 8623, Ultrafast Phenomena and Nanophotonics XVII, 862305 Photonics West, San Francisco, CA, Feb. 2-7, 2013.
2. "Orientation sensitive Terahertz resonances observed in protein crystals," G. Acbas, E. Snell, A. G. Markelz, 37th International Conference on Infrared, Millimeter, and Terahertz Waves, Wollongong, Australia Sept. 23-28, 2012.
3. "Multi-component response in multilayer graphene revealed through terahertz and infrared magneto-spectroscopy," C.T. Ellis, A.V. Stier, D. George, J.G. Tischler, E.R. Glaser, R.L. Myers-Ward, J.L. Tedesco, C.R. Eddy, D.K. Gaskill, A. Markelz, J. Cerne, 37th International Conference on Infrared, Millimeter, and Terahertz Waves, Wollongong, Australia Sept. 23-28, 2012.
4. "Ultrafast Carriers Dynamics in GaSb/Mn Random Alloys," S. Ye, J. Knab, J.-Y. Chen, S. Wang, M. Cheon, H. Luo and A. Markelz, Proceedings of the 28<sup>th</sup> International Conference on the Physics of Semiconductors, Vienna, Austria July 24-28, 2006.
5. "Using terahertz spectroscopy as a protein binding assay," Jing-Yin Chen, Joseph R. Knab, Shuji Ye, Yunfen He and Andrea G. Markelz, Proc. SPIE Vol. 6080, p. 35-42, Advanced Biomedical and Clinical Diagnostic Systems IV; Gerald E. Cohn, Warren S. Grundfest M.D., David A. Benaron M.D., Tuan Vo-Dinh; Eds.
6. "Critical hydration and temperature effects on terahertz biomolecular sensing," J. R. Knab, Binni Shah, Jing-Yin Chen, Andrea Markelz Proc. SPIE Vol. 5995, p. 208-217, 2005. Chemical and Biological Standoff Detection III; James O. Jensen, Jean-Marc Thriault; Eds.
7. "Terahertz measurements of the Photoactive Protein Bacteriorhodopsin mutant D96N: M and P States," J.-Y. Chen, J. R. Knab, J. Cerne, J. R. Hillebrecht, R. R. Birge and A. G. Markelz, in *Proteins as Materials*, edited by V.P. Conticello, A. Chilkoti, E. Atkins, and D.G. Lynn (Mater. Res. Soc. Symp. Proc. 826E, Warrendale, PA, 2004), V2.6.
8. "Tagless and Universal Biosensor for Point Detection of Pathogens," A.G. Markelz, J. R. Knab, J.-Y. Chen, J. Cerne, and W. A. Cox, Proceedings of the SPIE Security and Defense Symposium, April 12-16, 2004, Orlando, FL.
9. "Measuring Protein Flexibility with Terahertz Spectroscopy: Basic Research and Applications," A. G. Markelz, J.-Y. Chen, J. R. Knab, M. Maeder, Proceedings of the IEEE LEOS Summer Topical Meeting, June 28-30, 2004, San Diego, CA.
10. "Thz Dielectric Response As A Function Of Protein Hydration: Intramolecular Coupling Contribution," A. G. Markelz, J.-Y. Chen, J. R. Knab, M. Maeder, Proceedings of SPIE Optics East, October 25-28, 2004, Philadelphia, PA.

11. "Biosensing with Terahertz Spectroscopy: Ligand Binding Effects," J.-Y. Chen, J. Cerne, and A. G. Markelz. Proceedings of the International Symposium on Spectral Sensing Research 2003, Santa Barbara, CA.
12. "Terahertz Biosensors based on Xerogel Substrates," J. -Y. Chen, W. Cox, F. V. Bright, J. Cerne and A. G. Markelz. Proceedings of the International Symposium on Spectral Sensing Research 2003, Santa Barbara, CA.
13. "Ultrafast THz spectroscopy of photoactive biomolecules," J.-Y. Chen, S. E. Whitmire, A. G. Markelz, J. R. Hillebrecht and R. R. Birge, Ultrafast Phenomena in Semiconductors VII, Jan. 25-31, 2003, San Jose CA. p. 146-153
14. "Finite Size Effects In Ferroelectric Nanosystems: Absence Of Mode Softening," Daniel Wolpert, Joseph Knab, William Cox, John Cerne, Andrea Markelz, Tong Zhao, and R. Ramesh, Technical Proceedings of the 2003 Nanotechnology Conference and Trade Show, Volume 2, San Francisco, CA , Feb. 23-27, 2003. p. 76-81
15. "Terahertz Time domain spectroscopy of the M intermediate state of Bacteriorhodopsin," S. Whitmire, A. G. Markelz, J. R. Hillebrecht, and R. Birge, Proceedings of the 26th International Conference on Infrared and Millimeter Waves, Toulouse, France Sept. 10-14 2001 p. 345-348
16. "Third harmonic generation in a GaAs/AlGaAs Superlattice in the Bloch Oscillator Regime," M. C. Wanke, A. G. Markelz, K. Unterrainer, S. J. Allen and R. Bhatt, Proceedings of the International Conference on Hot Carriers in Semiconductors, Chicago, July 31 – Aug. 4 1995 p. 161-3.
17. "Frequency Dependence of the Third Order Susceptibility of InAs Quantum Wells at Terahertz Frequencies," A. G. Markelz J. Cerne, E. G. Gwinn, M. S. Sherwin, B. Brar, H. Kroemer, Proceedings of the International Conference on the Physics of Semiconductors, Aug. 15-19 1994. p. 1193-6.
18. "Far-infrared harmonic generation from semiconductor heterostructures," A.G. Markelz, E.G. Gwinn, M. S. Sherwin, J. Heyman, C. Nguyen and H. Kroemer. SPIE Proceedings **1854**, 48-55 (1994).
19. "Far-infrared nonlinear response of electrons in semiconductor nanostructures," M. S. Sherwin, N.G. Asmar, W.W. Bewley, K. Craig, C. Felix, B. Galdrikian, E.G.Gwinn, A.G. Markelz, A.C. Gossard, P.F. Hopkins, M. Sundaram, and B. Birnir. SPIE Proceedings **1854**, 36-47 (1993).
20. "Conversion of 124 and 123 + cupric oxide: microstructure and phase diagram," D.E. Morris, J. H. Nickel, A. G. Markelz, R. Gronsky, M. Fendorf, C. P. Burmester, Materials Research Society Symposium Proceedings **169**, 245-8 (1990).

#### **Book Contributions:**

1. "Protein Dielectric Response at Terahertz Frequencies: Correlated and Diffusive Contributions," D.K. George and A.G. Markelz in *Terahertz Biomedical Science and Technology*, edited by Joo Huik Son ( Taylor and Francis 2013).
2. "Spectroscopy of Liquids and Biomolecules," A.G. Markelz and D.K. George, in *Terahertz Spectroscopy: Theory and Applications*, edited by Kai Peiponen, Axel Zeitler, and Makoto Kuwata-Gonokami, (Springer 2012).

3. "Terahertz / Far Infrared Spectroscopy: Protein Dynamics," A.G. Markelz in *Encyclopedia of Biophysics* edited by Gordon C.K.Roberts (Springer, 2012).
4. "Development of Tagless Biosensors for Detecting Pathogen Presence," A. G. Markelz, J. -Y Chen, J. R. Knab, Y. He, and S. Ye. in *Terahertz Frequency Detection and Identification of Materials and Objects* edited by X-C Zhang, R. E. Miles, H. Eisele and A. Krotkus (Springer, Dordrecht, The Netherlands 2007).
5. "Terahertz Applications to Biomolecular Sensing," Scott E. Whitmire and Andrea G. Markelz in *Sensing Science and Electronic Technology at THz Frequencies Vol II Emerging Scientific Applications & Novel Device Concepts*, edited by: D. Woolard, M. S. Shur and W. Leorop (Scientific World Press,Singapore 2003).
6. "Third harmonic generation in a GaAs/AlGaAs superlattice in the Bloch oscillator regime," M. C. Wanke, A. G. Markelz, K. Unterrainer, S. J. Allen, and R. Bhatt, in *Hot Carriers in Semiconductors*, edited by K. Hess, J.-P. Leburton and U.Ravaioli (Plenum Press, 1996).

#### **Invited Talks (Conferences):**

1. "Measuring phonons in protein crystals," Katherine A. Niessen, Edward Snell, A. G. Markelz Photonics West, San Francisco, CA, Feb. 2-7, 2013.
2. "Orientation sensitive Terahertz resonances observed in protein crystals," G. Acbas, E. Snell, A. G. Markelz, 37th International Conference on Infrared, Millimeter, and Terahertz Waves, Wollongong, Australia Sept. 23-28, 2012.
3. "Anisotropy in Protein Crystals" BioTHz Workshop
4. "Terahertz Anisotropy Measurements of Molecular Crystals," US-UK Workshop in Mid-IR to THz Technology and Applications, Edinburgh, Scotland, Feb. 18-19, 2013.
5. "Methods for Overcoming the Glassy Background in Terahertz Measurements of Correlated Motions in Proteins," Frontiers of THz Science, SLAC National Accelerator Laboratory, Palo Alto, CA Sept. 5-6, 2012.
6. "Detection of Internal Molecular Structural Motions Using Anisotropic Spectroscopy" Protein Dynamics Workshop, Oak Ridge National Laboratory, Oakridge, TN August 27, 2012.
7. "Determination of THz Anisotropic Response in a Glassy Medium," Bio-THz Workshop, Seoul National University, Seoul, Korea, February 7-8, 2012.
8. "Opportunities and Instrumentation Needs for THz Biomolecular Measurements," Jefferson Lab Terahertz Workshop, Newport News, Virginia, July 11, 2011.
9. "Self Assembled Plasmonics At THz Frequencies," Metamaterials and Plasmonics: Novel Materials, Designs, and Applications, University at Buffalo, Buffalo NY May 16-17, 2011.
10. "Evidence of protein collective motions in terahertz response: temperature dependence and hydration dependence," Bio-THz Workshop, Seoul, Korea, January 21-22, 2011.
11. "Evidence Of Correlated Protein Motions In THz Response," International Workshop on Optical Terahertz Science and Technology, Santa Barbara, CA March 13-17, 2011.



12. "Protein Structural Mode Separation with Modulated Orientation Sensitive THz Spectroscopy," Big Light: Applications of Terahertz-to-Infrared Probes in Molecular and Materials Sciences April 14 & 15, 2011, Arlington, VA
13. "Terahertz measurements of the peptide dynamical transition," European Optical Society Annual Meeting, Paris, France, Oct. 26 – 29, 2010.
14. "Size dependence of water-polypeptide interactions: The peptide dynamical transition," Leopoldina Symposium On The Complexity Connecting Biomolecular Structure And Solvation Dynamics, Bochum, Germany, May 24-27, 2010.
15. "Size dependence of water-polypeptide interactions: the peptide dynamical transition ," Bio-THz Workshop, Seoul, Korea, March 9-10, 2010.
16. "Do large scale protein structural vibrations exist? Evidence from Terahertz spectroscopy," Shenzhen International Conference on Advanced Science and Technology, Shenzhen, China, Nov. 16-20, 2009.
17. **Plenary Talk**, "Terahertz Dielectric Response of Proteins: Relaxational and Correlated Motion Contributions," at the International conference on IR, millimeter and THz waves 2009, Busan, Korea, September 21 - 25, 2009.
18. "The role of the protein surface on the local biological water dynamics," SPIE Optics & Photonics, San Diego, CA, August 2-6, 2009.
19. Telluride Science Research Conference "Vibrational Dynamics Workshop" July 20-24, 2009
20. "The Interconnection of Protein and Water Dynamics Picosecond Dynamics," Biodesign Institute ASU: Proteins and Water Workshop, Tempe, AZ, May 10-13, 2009.
21. "The Role of Water Structure in Terahertz Biomaterial Measurements." Materials Research Society Spring 2009 Meeting, San Francisco, CA April 13-17, 2009.
22. "The Other Terahertz-Water problem: How Terahertz dielectric response gives unique insight into biological water dynamics," Osaka University Special THz Symposium, Osaka, Japan, November 25, 2008.
23. "Why is THz sensitive to protein functional states? Oxidation State of Cytochrome C," Spectroscopical Society of Japan, Tohoku University, Sendai, Japan, November 19-21, 2008.
24. "Terahertz Investigations of Biomolecules," The Bernard M. Gordon Center for Subsurface Sensing & Imaging Systems Research & Industrial Collaboration Conference, Northeastern University, Boston, MA, October 29-30, 2008.
25. "Origin of Terahertz Sensitivity To Heme Oxidation State," XXIV Laser Science, Rochester, NY October 19-23, 2008.
26. "The Role of Structure in the Protein Dynamical Transition," International Conference on IR and Millimeter Waves, Pasadena, CA Sept. 15-19, 2008.
27. "What can THz tell us about biological molecules?" Photonics North, Montreal June 2-5, 2008.
28. "Recent Terahertz Measurements on the Protein Dynamical Transition," Telluride Science Research Center Workshop: Protein Dynamics, Telluride CO July 30 – Aug. 3, 2007.

29. "Terahertz Determination of Protein Side Chain Exposure," International Symposium on Topical Problems of Biophotonics, Nizhny Novgorod, Russia Aug. 3 – 10, 2007.
30. "Tertiary Structural Effects on Protein Picosecond Dynamics: Terahertz Dielectric Response," OSA Frontiers in Optics 2007, San Jose, CA Sept 19-20, 2007.
31. "Terahertz Dielectric Response Sensitivity to Protein Oxidation State," IEEE/LEOS 2007 Annual Meeting, Orlando FL Oct. 21-25, 2007.
32. "Evidence of thermally activated relaxational dynamics in proteins," Academy colloquium "TeraHertz Science" Royal Netherlands Academy of Arts and Sciences, Amsterdam June 15-16, 2007.
33. "Insight into origins of protein dynamical transition through THz dielectric spectroscopy," International Bunsen Discussion Meeting, April 1-4, 2007, Physikzentrum Bad Honnef, Germany.
34. Keynote address "Protein Conformational Dynamics Measured With Terahertz Time Domain Spectroscopy," Joseph R. Knab, Jing-Yin Chen Shuji Ye, Yunfen He and Andrea G. Markelz, Joint 31st International Conference on Infrared and Millimeter Waves and 14th International Conference on Terahertz Electronics, Shanghai, China, September 18-22, 2006.
35. "Effects of Hydration and Photointermediate State Occupation on Terahertz Dielectric Response of Photoactive Yellow Protein" NATO ARW Terahertz Frequency Detection and Identification of Materials and Objects, Spiez, Switzerland, July 7-11, 2006.
36. "Biological Photophysics with Small Photons: Terahertz measurements of the protein dynamical Transition," Andrea Markelz, American Physics Society March Meeting 2006, Baltimore, MD.
37. "Using terahertz spectroscopy as a protein binding assay," Jing-Yin Chen, Joseph R. Knab, Shuji Ye, Yunfen He and Andrea G. Markelz, SPIE's Photonics West 2006, 21–26 January, San Jose, California, USA.
38. "Critical hydration and temperature effects on terahertz biomolecular sensing," J. R. Knab, Binni Shah, Jing-Yin Chen, Andrea Markelz Optics East 2005.
39. "Cytochrome C THz Dielectric Response: Relation to Underlying Dynamics," Telluride Science Research Center Protein Dynamics Workshop. July 31 – August 6, Telluride, CO.
40. "Protein Dynamics Studies Using Terahertz Dielectric Response," J. R. Knab, J. Y. Chen and A. G. Markelz. American Chemical Society Meeting. August 28 – September 1, 2005, Washington DC.
41. "Establishing Thz Sensitivity Of Target To Probe Binding For Pathogen Detection," J. R. Knab, J. - Y. Chen, E. Erdemir and A. G. Markelz. Australian Department of Defense Workshop on Terahertz for Defence and Security. December 16-17, 2004, Adelaide, Australia.
42. "Tagless and Universal Biosensor for Point Detection of Pathogens," SPIE Security and Defense Symposium, April 12-16, 2004, Orlando, FL.
43. "Measuring Protein Flexibility with Terahertz Spectroscopy: Basic Research and Applications," IEEE LEOS Summer Topical Meeting, June 28-30, 2004, San Diego, CA.

44. "THz Dielectric Response As A Function Of Protein Hydration: Intramolecular Coupling Contribution," SPIE Optics East, October 25-28, 2004, Philadelphia, PA.
45. "Ultrafast THz spectroscopy of photoactive biomolecules," A. G. Markelz, J.-Y. Chen, S. E. Whitmire, J. R. Hillebrecht and R. R. Birge, Photonics West, Jan. 25-31, 2003, San Jose CA.
46. "THz Time Domain Spectroscopy Of Biomolecular Conformational Modes," Andrea Markelz Scott Whitmire, Jay Hillebrecht, and Robert Birge, First International Conference on Biomedical Imaging and Sensing Applications of THz Technology (BISAT2001), Leeds, United Kingdom, 29th November - 1st December 2001
47. "THz Measurements of the M Intermediate State of Bacteriorhodopsin," Andrea G. Markelz, Scott E. Whitmire, J. R. Hillebrecht and Robert Birge, 9th International Conference on Terahertz Electronics 15th - 16th October 2001, Charlottesville, VA.
48. "Terahertz Spectroscopy of Biomolecules," A. G. Markelz and E. J. Heilweil, 23<sup>rd</sup> International Conference on Infrared and Millimeter Wave Spectroscopy, University of Essex, U.K. September 7-11, 1998.
49. "Time-resolved THz spectroscopy of hydrogen bonded systems," A. G. Markelz, V. Kleiman, E. J. Heilweil, Optical Society of America 13<sup>th</sup> Interdisciplinary Laser Science Conference, Long Beach, CA. October 12-17, 1997.
50. "Harmonic Generation at Terahertz Frequencies in InAs-AlSb Quantum Wells," A. G. Markelz, E. Gwinn, M. S. Sherwin, C. Nguyen and H. Kroemer, 6.1 Angstrom Workshop, Santa Barbara, CA. December 2,3 1993

#### **Invited Talks (Universities):**

1. "Terahertz Optical Measurements of Protein Dynamics," OSA Visiting Lecturer, Rice University, Houston, TX March 13, 2013.
2. "Protein Structural Motions Measured by THz Microscopy" Chemistry Department, University of Glasgow, Glasgow, Scotland February 20, 2013.
3. "Anisotropic response in molecular crystals and the development of Modulated Orientation Sensitive Terahertz Spectroscopy (MOSTS)," Case Western Reserve University, March 19, 2012
4. "Correlated motions in biology: THz measurements of picoseconds dynamics of peptides and biological water," University of Missouri, Columbia, MO August 22, 2011
5. "Diffusive Motions in Biological Molecules," University of Science and Technology of China, (USTC), Hefei, China, November 19, 2009.
6. "Correlated Motion And Protein Dynamics: What Terahertz Spectroscopy Tells Us," Physics Colloquium University of Missouri, Rolla, January 15, 2009.
7. "The Role Of Diffusive Motions In Protein Function," Physics Colloquium Macalaster College Sept 11, 2008
8. "Diffusive Dynamics in Proteins," University of Leeds, June 19, 2007.

9. "Terahertz Measurements of Protein Structural Vibrations," Physics Colloquium, Rensselaer Polytechnic Institute, May 2, 2007.
10. "Temperature dependence of protein structural vibrations: insight to solvent interaction," Biophysics Seminar, Columbia University, April 19, 2006.
11. "Are proteins harmonic Solids?" Physics Colloquium, University of Rochester, March 1, 2006.
12. "Protein Dielectric Relaxation at Terahertz Frequencies," Chemistry Seminar, University of Massachusetts, Amherst, September 8, 2005.
13. "Establishing a Measure of Protein Flexibility," Electrical Engineering Seminar, University at Buffalo, October 29, 2004.
14. "THz dielectric response of Proteins: what does it mean?" Physics Seminar, University at Buffalo, Buffalo, NY, March 9, 2004.
15. "Heme Protein Flexibility Dependence on Oxidation State," Physics Colloquium, Brock University, St. Catherine, Ontario, Canada, January 13, 2004.
16. "THz dielectric response of Proteins: what does it mean?" Optics Seminar, University of Toronto, Toronto, Ontario, Canada, January 19, 2004.
17. "Terahertz Spectroscopy Of Heme Proteins: Collective Mode Response As A Function Of Oxidation State," Chemistry Colloquium, Syracuse University, Syracuse, NY, February 23, 2004.
18. "Terahertz Studies of Biomolecular Conformational Flexibility and Change," Chemistry Colloquium, University of Florida, Gainesville, FL, October 21, 2003.
19. "Biomolecular Studies using Terahertz Time Domain Spectroscopy: Fundamental Biophysics and Developmental Biotechnology ," Physics Seminar, University at Buffalo, Buffalo, NY, March 3, 2003
20. "THz spectroscopy of photoactive biomolecules," REU Seminar, Bucknell University, Lewisburg, PA, August 13, 2002.
21. "Temperature Dependent Terahertz Output from Semi-insulating GaAs Photoconductive Switches," Physics Seminar, University at Buffalo, Buffalo, NY, Nov. 9, 2000.
22. "Terahertz Biomolecular Spectroscopy," Electrical Engineering Seminar, University at Buffalo, Buffalo, NY, Oct.10, 2000.
23. "Harmonic Generation from InAs Quantum wells," California Institute of Technology, May 15, 1993.

Refereed Conferences:

Contributed talks:

1. "Correlated Motions In Protein Crystals Measured By THz Microscopy," Katherine A. Niessen, Gheorghe Acbas, Edward Snell, Andrea Markelz, Biophysical Society Annual Meeting, Philadelphia, PA February 2-6, 2013.

2. "Terahertz sensitivity to DNA hybridization: Polynucleotide and Solvent Dynamics," Katherine Niessen, Deepu K. George, Andrea Markelz, *Frontiers in Optics 2012*, Rochester, NY October 14-18, 2012
3. "Large Area Self Assembled Tunable Terahertz Detector, Chejin Bae, Deepu K. George, Rohit Singh, Andrea Markelz, *Frontiers in Optics 2012*, Rochester, NY October 14-18, 2012
4. "MEMS Cell for Dynamical Orientation of Bio Molecules in Solution," Deepu K. George, Byungwook Ahn, Kwang Oh, Andrea Markelz, *Frontiers in Optics 2012*, Rochester, NY October 14-18, 2012
5. "Anisotropy in Molecular Crystals," Rohit Singh, Deepu George and A.G. Markelz, *International Conference on IR, Millimeter and THz Waves*, Houston, TX October 2-7 2011.
6. "Large Area Self Assembled Tunable Terahertz Detector," Che Jin Bae, Deepu K. George, Rohit Singh, and Andrea Markelz, *International Conference on IR, Millimeter and THz Waves*, Houston, TX October 2-7 2011.
7. "Magneto Optical Conductivity Measurements Using THz Polarization Modulation Spectroscopy," A.V. Stier, D.K. George, A.G. Markelz, J. Cerne, R. Valdés Aguilar, W.Liu, L.S. Bilbro, N.P. Armitage, Bansal, S. Oh, *International Conference on IR, Millimeter and THz Waves*, Houston, TX October 2-7 2011.
8. "A Tunable Terahertz Detector Based On Self Assembly Plasmonic Structure On A GaAs 2DEG," Che Jin Bae, Deepu K George, Rohit Singh and Andrea Markelz, *OTST International Workshop on Optical Terahertz Science and Technology*, Santa Barbara, CA March 13-17, 2011.
9. "The Peptide Dynamical Transition," Deepu K. George, and Andrea Markelz, *Frontiers in Optics 2010/Laser Science XXVI*, Rochester, NY, Oct. 24-28, 2010.
10. "Characterization of Phonons in Molecular Crystals," Rohit Singh, Deepu George, A.G. Markelz *IRMMW and THz*, Rome, Italy, September 5-10, 2010.
11. "Abnormal Thz Absorption Behavior Of Interfacial Water," Wei Liang, Yunfen He, D.K. George and A.G. Markelz, *Optical Terahertz Science and Technology*, Santa Barbara, CA March 7-11, 2009.
12. "Spectral and Hydration Dependence of Protein Dynamical Transition," F. Lipps, J.R. Knab, J.Y. Chen, and A.G. Markelz, *63rd OSU International Symposium on Molecular Spectroscopy*, Ohio State University, June 16, 2008.
13. "Biological Water, Protein Structure and Dynamical Transition," Yunfen He and A.G. Markelz, *63rd OSU International Symposium on Molecular Spectroscopy*, Ohio State University, June 16, 2008.
14. "Saturation of the Hydration Dependence of the Terahertz Dielectric Response of Ferri Cytochrome C," J.-Y. Chen, J. R. Knab, A. G. Markelz, S. K. Gregurick, *Optical Terahertz Science and Technology Workshop*, Orlando, FL., March 19 - 21 2007.
15. "Dynamical Transition Observed in Lysozyme Solutions at THz Frequencies," Joseph Knab, Jing-Yin Chen, Yunfen He and Andrea Markelz, *Optical Terahertz Science and Technology Workshop*, Orlando, FL., March 19 - 21 2007.

16. "Quantum Dot Array Based Terahertz Detectors," N. Kabir, A. Sergeev, V. Mitin, A.G. Markelz and J. Bird 14th International Conference on Nonequilibrium Carrier Dynamics in Semiconductors (HCIS-14) Chicago, July 24-29, 2005
17. "Biosensing with Terahertz Spectroscopy: Ligand Binding Effects," J.-Y. Chen, J. Cerne, and A. G. Markelz. International Symposium on Spectral Sensing Research 2003, Santa Barbara, CA, June 2-6, 2003.
18. "Finite Size Effects In SrTiO<sub>3</sub> Nanosystems: Appearance of new GHz absorption below T<sub>c</sub>," D. Wolpert, J. Knab, W. Cox, J. Cerne, A. Markelz, T. Zhao, and R. Ramesh, NanoMes 2003, Tempe, AZ, Feb. 17-21, 2003.
19. "THz Measurements Of Intermediate States Of Bacteriorhodopsin," Andrea Markelz, Scott Whitmire, J. R. Hillebrecht and Robert Birge, 26th International Conference on Infrared and Millimeter Waves, Toulouse, France Sept. 10-14 2001.
20. "Direct Measurement of Transport Lifetimes in Cuprate Metals," A. G. Markelz, E. J. Heilweil, and H. D. Drew, 1998 Annual Meeting/14<sup>th</sup> Interdisciplinary Laser Science Conference, Baltimore, MD. Oct. 12-16, 1998.
21. "Frequency dependence of Third Harmonic Response of InAs quantum wells and bulk InAs in the Far-Infrared," A. G. Markelz, J. Cerne, N.G. Asmar, E.G. Gwinn, M.S. Sherwin, C. Nguyen, and H. Kroemer. 185th Meeting of the Electrochemical Society, San Fransisco, CA. May 22-27, 1994.
22. "Far-infrared harmonic generation from semiconductor heterostructures," A. G. Markelz, E. G. Gwinn, M. S. Sherwin, J. Heyman, C. Nguyen, H. Kroemer, P. F. Hopkins and A. C. Gossard. OE/LASE '93: International Society of Optical Engineering, Los Angeles, CA. January 23-29, 1993.

Contributed Posters:

1. "Development Of Modulated Orientation Sensitive Terahertz Spectroscopy," Rohit Singh, Deepu George and Andrea Markelz, OTST International Workshop on Optical Terahertz Science and Technology, Santa Barbara, CA March 13-17, 2011.
2. "THz Measurements Of Molecular Solution Phase Dynamical Alignment," Deepu George, Rohit Singh, Chejin Bae, A. G. Markelz, Byungwook Ahn and Kwang Oh, International Workshop on Optical Terahertz Science and Technology, Santa Barbara, CA March 13-17, 2011.
3. "Dynamical Alignment Of Solution Phase Proteins For Structural Measurements," Deepu K. George, Rohit Singh, Chejin Bae, Byungwook Ahn, Kwang Oh, Andrea Markelz, Biophysical Society Meeting 2011, Baltimore, MD March 5-9, 2011.
4. "Protein Structural Mode Separation With Modulated Orientation Sensitive Terahertz Spectroscopy," Rohit Singh, Deepu K. George, and Andrea Markelz, Biophysical Society Meeting 2011, Baltimore, MD March 5-9, 2011.
5. "Characterization of Phonons in Molecular Crystals," Rohit Singh, Deepu George, and A.G. Markelz, Frontiers in Optics 2010/Laser Science XXVI, Rochester, NY, Oct. 24-28, 2010.
6. "Correlated Structural Motions in Proteins: Dynamically Aligned Far IR Spectroscopy," Deepu George, Yunfen He, Rohit Singh, Gottfried Strasser and Andrea Markelz, Kwang Oh, Edward

Snell. 2nd Integrated Nanostructured Systems Workshop Nanotechnology in Biology and Medicine, University at Buffalo, NY, May 13, 2009

7. "Developing spectral terahertz imaging microscopy (STIM) to study protein crystals," Rohit Singh, Deepu George, Yunfen He, Wei Liang and Andrea Markelz, Edward Snell. 2nd Integrated Nanostructured Systems Workshop Nanotechnology in Biology and Medicine, University at Buffalo, NY, May 13, 2009
8. "Picosecond Dynamics Evolution During Function For Photoactive Yellow Protein," D. K. George, J. R. Knab, Yunfen He, Wei Liang, A. G. Markelz, Miwa Hara and Wouter Hoff, Optical Terahertz Science and Technology, Santa Barbara, CA March 7-11, 2009.
9. "Picosecond Dynamics Of Surface Water As A Function Of Hydrophobicity," Wei Liang, Yunfen He, Deepu George, Andrea G. Markelz, Biophysical Society Meeting, Boston, MA, March 1 – 4, 2009.
10. "Picosecond Dynamics Evolution During Function For Photoactive Yellow Protein," D. K. George, J.R. Knab, Yunfen He, Wei Liang, A. G. Markelz, Miwa Hara and Wouter Hoff, Biophysical Society Meeting, Boston, MA, March 1 – 4, 2009.
11. "Nanostructure components for terahertz spectroscopy on a chip," 2008 NSF Nanoscale Science and Engineering Grantees Conference, Arlington, VA. Dec. 3-5, 2008.
12. "Minimum Structure Necessary for Protein Dynamical Transition," Yunfen He and A.G. Markelz, Biophysical Society Meeting, Long Beach, CA, March 3 – 7, 2008. (**Ms. Yunfen He Tascione Travel Award winner**)
13. "Confined Plasmons in Quantum Dot Arrays," Kabir N. A., Song J. W., Morimoto T., Aoki N., Ochiai Y., Aizin G., Markelz A. G., Bird J. P., July 23-27, 2007, Tokyo, Japan
14. "Is The Protein Dynamical Transition Dependent On Tertiary Structure?," Yunfen He, J.R. Knab, J.Y Chen and A.G Markelz, Biophysical Society Meeting, Baltimore, MD, March 3 – 7, 2007.
15. "Ultrafast Carriers Dynamics in GaSb/Mn Random Alloys," S. Ye, J. Knab, J.-Y. Chen, S. Wang, M. Cheon, H. Luo and A. Markelz, 28<sup>th</sup> International Conference on the Physics of Semiconductors, Vienna, Austria July 24-28, 2006.
16. "Effects of Hydration and Photointermediate State Occupation on Terahertz Dielectric Response of Photoactive Yellow Protein," J. R. Knab, J.-Y. Chen, W. Hoff and A. G. Markelz, NATO ARW Terahertz Frequency Detection and Identification of Materials and Objects, Spiez, Switzerland, July 7-11, 2006.
17. "Terahertz Measurements Of The Evolution Of Photoactive Yellow Protein Conformational Modes During Photocycle," Joseph Knab, Jing-Yin Chen, Wouter Hoff and Andrea Markelz, Biophysical Society Annual Meeting, February 18-22, 2006, Salt Lake City, Utah.
18. "First Observation of the Protein "Glass" Transition at Terahertz Frequencies," J.-Y. Chen, J. R. Knab and A.G. Markelz, Biophysical Society Annual Meeting, February 18-22, 2006, Salt Lake City, Utah. (**Ms. Chen BPS Travel Award Winner**)
19. "Frequency dependent momentum relaxation rates in 2D systems," N. Kabir, J. R. Knab, Y. Yoon, A. G. Markelz, J. Bird The 12th International Conference on Modulated Semiconductor Structures (MSS 12) Albuquerque, New Mexico, July 10-15, 2005.

20. "Collective Dynamics Transition with Solvation of Lysozyme," J. R. Knab, J.-Y. Chen and A. G. Markelz. American Chemical Society Spring Meeting 2005, March 13-17 2005, San Diego, CA.
21. "Comparison of Protein Hydration Dynamics of ferri and ferro Cytochrome C," J.Y. Chen, J.R. Knab, R. Glasglow, A. G. Markelz. Biophysical Society Annual Meeting, February 13-16, 2005, Long Beach, CA.
22. "Hydration Transition Observed in Terahertz Dielectric Response of Lysozyme," Joseph Knab, Jing-Yin Chen and Andrea Markelz. Biophysical Society Annual Meeting, February 13-16, 2005, Long Beach, CA.
23. "Detection of Protein-Ligand Binding By THz Spectroscopy," Joseph Knab, Jing-Yin Chen, Marisa Mäeder, Andrea Markelz, Biophysical Society Meeting, February 15 - 18, 2004, Baltimore, MD.
24. "Terahertz Biosensors based on Xerogel Substrates," J. -Y. Chen, W. Cox, E. Tehan, F. V. Bright, J. Cerne and A. G. Markelz. International Symposium on Spectral Sensing Research 2003, Santa Barbara, CA. June 2-6, 2003.
25. "Finite Size Effects In Ferroelectric Nanosystems: Absence Of Mode Softening," Daniel Wolpert, Joseph Knab, William Cox, John Cerne, Andrea Markelz, Tong Zhao, and R. Ramesh, Proceedings of Nanotech 2003, San Fransisco, CA , Feb. 23-27, 2003.
26. "High Field Pulsed Terahertz Measurements of Nonlinear Conductivity," International Terahertz Workshop 2000, Sandbjerg, Denmark. September 17-19, 2000.
27. "High Field Pulsed Terahertz Measurements of Nonlinear Conductivity," 2000 Nonlinear Optics: Materials, Fundamentals and Applications, Kauai, HI. August 6-10, 2000.
28. "Absence of Low Frequency Roll of in the Third Order Susceptibility of InAs Quantum Wells," A. G. Markelz. FEL Users Workshop, Standford University, Palo Alto, CA. August 28-29 1994.
29. "Frequency Dependence of the Third Order Susceptibility of InAs Quantum Wells at Terahertz Frequencies," A. G. Markelz, J. Cerne, N. G. Asmar, E. G. Gwinn, M. S. Sherwin, B. Brar, C. Nguyen, H. Kroemer. 22nd International Conference on the Physics of Semiconductors, Vancouver, Canada, Aug. 15-19, 1994.
30. "Giant third-order nonlinear susceptibilities for in-plane far-infrared excitation of single InAs quantum wells," A. G. Markelz, E. G. Gwinn, M. S. Sherwin, C. Nguyen, H. Kroemer. Sixth International Conference on Modulated Semiconductor Structures, Garmisch -Partenkirchen, Germany, 23-27 Aug. 1993.
31. "Subcubic power dependence of third-harmonic generation for in-plane, far infrared excitation of InAs quantum wells," A. G. Markelz, N. G. Asmar, E. G. Gwinn, M. S. Sherwin, C. Nguyen, H. Kroemer. The Eighth International Conference on Hot Carriers in Semiconductors, Oxford, England. August 16-20 1993.

**General Conferences:**

Contributed Talks:



1. "THz Microscopy of Anisotropy and Correlated Motions in Protein Crystals," Katherine Niessen, Gheorghe Acbas, Edward Snell, Andrea Markelz, APS March Meeting, March 18-22, Baltimore, MD.
2. "A Tunable Terahertz Detector Based On Self Assembled Plasmonic Structure on a GaAs 2DEG," Chejin Bae, Deepu George, Rohit Singh, Andrea Markelz, APS March Meeting, March 18-22, Baltimore, MD.
3. "The Dynamical Transition and DNA hybridization," Deepu George, Katherine Niessen, Andrea Markelz, APS March Meeting, March 18-22, Baltimore, MD.
4. "Near-Field Orientation Sensitive Terahertz Micro-Spectroscopy of Single Crystals," Gheorghe Acbas, Rohit Singh, Edward Snell, Andrea Markelz, American Physics Society March Meeting, Feb 27 - March 2, 2012, Boston, MA.
5. "Polarization Modulation THz TDS of Topological Insulators," Deepu George, Chase Ellis, Tobias Kiessling, John Cerne, Andrea Markelz, American Physics Society March Meeting, Feb 27 - March 2, 2012, Boston, MA.
6. "A Tunable Terahertz Detector Based On Self Assembled Plasmonic Structure on a GaAs 2DEG," Chejin Bae, Deepu George, Rohit Singh, Andrea Markelz. American Physics Society March Meeting, Feb 27 - March 2, 2012, Boston, MA.
7. "Detection of internal molecular structural motions using anisotropic spectroscopy," Rohit Singh, Deepu George, Timothy Korter, Andrea Markelz, American Physics Society March Meeting, Feb 27 - March 2, 2012, Boston, MA.
8. "A Tunable Terahertz Detector Based On Self Assembled Plasmonic Structure on a GaAs 2DEG," Che Jin Bae, Deepu K George, Rohit Singh and Andrea Markelz, American Physics Society March Meeting, March 21-25, 2011, Dallas, TX.
9. "Size dependence of water-polypeptide interactions: the peptide dynamical transition," Andrea Markelz, Rohit Singh, Deepu George, American Physics Society March Meeting, March 14-19, 2010, Portland, OR.
10. "Characterization of molecular crystal phonons," Andrea Markelz, Rohit Singh, Deepu George, American Physics Society March Meeting, March 14-19, 2010, Portland, OR.
11. "Terahertz Dielectric Response for Cytochrome C," Yunfen He, Jing-Yin Chen, Wenjun Zheng, and A.G. Markelz, American Physics Society March Meeting, March 16-20, 2009, Pittsburgh, PA (**Ms. Yunfen He APS Division of Biological Physics Travel Award winner**)
12. "Dynamical Transition in polypeptides," Yunfen He and Andrea G. Markelz, American Physics Society March Meeting, March 10-14, 2008, New Orleans, Louisiana.

13. "Spectral and Hydration Dependence of Protein Dynamical Transition," Ferdinand Lipps, J. R. Knab, Jing Yin Chen, Yunfen He and A.G. Markelz, American Physics Society March Meeting, March 10–14, 2008, New Orleans, Louisiana.
14. "The protein hydration transition," Yunfen He, J.R. Knab, J.Y. Chen and A.G. Markelz, American Physics Society March Meeting, March 13 - 17, 2007, Denver, CO.
15. "Terahertz dielectric response dependence on protein melting and hydration," Y. He, J. R. Knab, B. Shah and A. Markelz, American Physics Society March Meeting, March 13 - 17, 2006, Baltimore, MD.
16. "Hydration Dependence of Energy Relaxation Time in Cytochrome C Film," Shuji Ye, Jing-Yin Chen, Joseph Knab and Andrea Markelz, American Physics Society March Meeting, March 13 - 17, 2006, Baltimore, MD.
17. "Dynamical Transition of the Protein Observed in Terahertz Dielectric Response," J.-Y. Chen, J. R. Knab and A.G. Markelz, American Physics Society March Meeting, March 13 - 17, 2006, Baltimore, MD.
18. "Terahertz Dielectric Response of Photoactive Yellow Protein (PYP): Influence of Conformational-Vibrational State during Photocycle and Hydration Effects," Joseph Knab, Jing-Yin Chen, Wouter Hoff and Andrea Markelz, American Physics Society March Meeting, March 13 - 17, 2006, Baltimore, MD.
19. "Terahertz Dielectric Response Measurements of the Protein Glass Transition," Rachael Kao, J. Y. Chen, J. R. Knab and A. G. Markelz. American Physical Society March Meeting 2005. March 21-25, 2005, Los Angeles, CA.
20. "Mid-Infrared Hall effect in  $\text{Ca}_x\text{Sr}_{1-x}\text{RuO}_3$ , A. Stephens, A. Arroyo, S.R. Cho, A. Markelz, J. Cerne, I. Ohkubo, H. Christen, P. Khalifah, and D. Mandrus," American Physical Society March Meeting, Los Angeles, March 21-25, 2005.
21. "Mid-Infrared magneto-optical properties of diluted magnetic semiconductors, V. Patel, K. Smith, S.R. Cho, S. Wang, M. Cheon, H. Luo, A. Markelz, J. Cerne, J. Sinova, X. Liu, Y. Sasaki, and J. Furdyna," American Physical Society March Meeting, Los Angeles, March 21-25, 2005.
22. "Sensitivity of Terahertz dielectric response to heme protein oxidation state," Jing-Yin Chen, Joe Knab, John Cerne, Andrea Markelz, American Physical Society March Meeting, March 22-26, 2004, Montreal, Quebec, Canada
23. "Protein-Ligand Binding Detected by Terahertz Spectroscopy," J. Knab, J.Y. Chen, M. Mader, A. Markelz, American Physical Society March Meeting, March 22-26, 2004, Montreal, Quebec, Canada
24. "Mid-Infrared Hall effect in  $\text{Ca}_x\text{Sr}_{1-x}\text{RuO}_3$ ," Anthony Stephens, A. Arroyo, S.R. Cho, Andrea Markelz, John Cerne, I. Ohkubo, H. Christen, P. Khalifah, D. Mandrus, American Physical Society March Meeting, March 22-26, 2004, Montreal, Quebec, Canada

25. "Mid-Infrared magneto-optical properties of diluted magnetic semiconductors," V. Patel, K. Smith, S.R. Cho, S. Wang, M. Cheong, H. Luo, A. Markelz, J. Cerne, J. Sinova, X. Liu, Y. Sasaki, J. Furdyna, American Physical Society March Meeting, March 22-26, 2004, Montreal, Quebec, Canada
26. "Infrared studies of SrTiO<sub>3</sub> thin films using pulsed terahertz and FTIR spectroscopy," American Physical Society March Meeting, Austin, TX, March 3 - 7, 2003.
27. "Finite size effects for phonon mode softening in ferroelectric thin films," American Physical Society March Meeting, Austin, TX, March 3 - 7, 2003.
28. "Protein Conformational State Observed through Terahertz Spectroscopy," J.Y. Chen, S. E. Whitmire, D. Wolpert, A. G. Markelz, J. R. Hillebrecht, J. Galan, R. R. Birge. American Physical Society March Meeting Austin, TX. March 3-7, 2003.
29. "Towards Biosensing With Terahertz Spectroscopy: Ligand Binding Effects," J. Y. Chen, J. Cerne, A. G. Markelz, Biophysical Society Annual Meeting, San Antonio, TX March 1-5, 2003.
30. "Terahertz Determination of Conformational Flexibility of Photonic Proteins," Scott Whitmire, A. G. Markelz, Jay Hillebrecht and Robert Birge. American Physical Society March Meeting Indianapolis, IN. March 18-22, 2002.
31. "AC conductivity characterization of InAs/Mn and GaSb/Mn digital alloys," Stefan Feigh, Kevin Mooney, S. Wang, M. Cheon, X. Chen, H. Luo, A. G. Markelz, X. Liu, Y. Sasaki, T. Wojtowicz, and J. K. Furdyna, Dept. of Physics. American Physical Society March Meeting Indianapolis, IN. March 18-22, 2002.
32. "Terahertz Spectroscopy of Digital III-Mn-V Alloys," S. Feigh, K. Mooney, J. Knab, K. Korolev, M. Na, G. Kim, S. Wang, M. Cheong, X. Chen, H. Luo, A.G. Markelz, X. Liu, Y. Sasaki, T. Wojtowicz and J. K Furdyna, DARPA SPINS Workshop, Feb. 22-23, 2002.
33. "Temperature Dependent Studies of Conformational Vibrational Modes of Biological Molecules," A. G. Markelz and A. Pawar. American Physical Society March Meeting Seattle, WA. March 12-16, 2001.
34. "Hydration and Conformation Dependence of FIR Collective Mode Spectroscopy," A. G. Markelz. American Physical Society March Meeting Atlanta, GA. March 20-26, 1999.
35. "Pulsed Terahertz Output Dependence on Substrate Properties," A. G. Markelz and E. J. Heilweil. American Physical Society March Meeting Kansas City, MO. March 17-21, 1997.
36. "Impact Ionization by Subterahertz Illumination in InAs quantum wells," A. G. Markelz, N. G. Asmar, E.G. Gwinn, B. Brar, and H. Kroemer. American Physical Society March Meeting St. Louis, MO. March 18-22, 1996.
37. "Second Order Susceptibility of a Bimetallic Junction," A.G. Markelz, E. G. Gwinn, C. Felix, K. Campman, A.C. Gossard. American Physical Society March Meeting San Jose, CA. March 20-24, 1995.
38. "Third Harmonic Response of InAs quantum wells and bulk InAs in the Far-Infrared," A. G. Markelz, J. Cerne, N. G. Asmar, E.G. Gwinn, M. S. Sherwin, C. Nguyen, and H. Kroemer. American Physical Society March Meeting Pittsburgh, PA. March 21-25, 1994.

39. "Far Infrared Second Harmonic Generation from GaAs-AlGaAs Heterostructures Using a Prism Coupler," A. G. Markelz, K. C. Craig, E. G. Gwinn, M. S. Sherwin, P.F. Hopkins. American Physical Society March Meeting Indianapolis, IN. March 16-20, 1992.

### **Professional/Public Service**

- Executive Committee Member, Biological Physics Division, American Physical Society, 3/2002-3/2005
- Webmaster, Division of Biological Physics, American Physical Society, 3/2004- 2006
- Invited participant, presentation chair and panel member of "DOE-NSF-NIH Workshop on Opportunities in THz Science," February 12-14, 2004 Arlington, VA
- Exhibitor at American Physical Society Division of Biological Physics Workshop, "Opportunities in Biology for Physicists," Boston, MA, October 2002
- Member, Forum on Industrial and Applied Physics, American Physical Society
- American Chemical Society
- Sigma Xi
- Optical Society of America
- American Women In Science
- American Chemical Society
- Biophysical Society
- Journal Referee: Physical Review Letters, Physical Review B, Physical Review E, Physica E, Applied Physics Letters, Biophysical Journal, Journal of Physical Chemistry B, Europhysics Letters, Science, Chemical Physics Letters, JACS, IEEE Quantum Electronics
- Proposal Referee: NSF, NIH and EU funding agencies
- NSF Panel member service 2002 - present
- Program Committee, OSA workshop: Optical Terahertz Science and Technology 2007
- Session Chair for APS March Meeting: 2006, 2007, 2008
- Session Chair for IEEE/LEOS Annual meeting: 2007
- Session Chair for International Conference on IR, Millimeter and THz Waves: 2009,2010,2011, 2012
- Organizing Committee, Telluride Research Science Conference: Protein Dynamics 2007
- International Program Committee International conference on IR, millimeter and THz waves, standing member 2009 - present
- External Advisory Committee for Center for THz-Bio Application Systems and Department of Physics and Astronomy, Seoul National University, Korea 2009 – present.
- Editor: Virtual Journal of Terahertz Science and Technology, 2008 - 2011
- Associate Editor: Journal of IR, millimeter and THz Waves (Springer), 2009 – present
- Organizing Chair, International Optical Terahertz Science and Technology Workshop 2009, Santa Barbara, CA (200 + participant/10 vendor international conference)
- CLEO Science & Innovation: Terahertz Technologies and Applications: program committee: 2012, 2013

### **University Service**

#### **General University Service**

- Rehabilitated the CAPEM clean room facilities for research use in 2001.

- Faculty Senator, alternate 2001
- Organized public presentation: Physics is Phun, (see community service) April 2001
- Member of Institute for Lasers, Photonics, and Biophotonics since January 2000
- Organizer of Institute for Lasers, Photonics and Biophotonics Winter Workshop 2002, Jan. 16, 2002
- Member of the University at Buffalo Nanotechnology Group 2002-2003
- Organizer (with H. Suga and M. Swihart): Nanotechnology Workshop, Center for the Arts, University at Buffalo, Buffalo, NY, May 30, 2003.
- Chair Session for DURINT Kickoff Meeting 2001, December, 2001.
- Interim Senator 12/04-5/05
- Presentation for CAS102, “Biophysics Research” March 9, 2004
- UB2020 Participant: Nanomaterials Retreat and Biomolecular Recognition Retreat
- Member of Steering Committee of IRWEG 2004-20013
- Presentation for IRWEG Career Workshop, “Post doc and beyond: Things I wish I had known...” 4/1/05
- 2003-present Biological Chemistry and Physics Fellowship Committee
- 2005 -2007 Faculty senator
- 2006-2007 CAS Dean’s search committee
- 2006-2007 Postdoctoral Scholar committee
- Fall 2006 AGEF presentation
- 2008-present member of the Committee of Academic Excellence and Equity (CAEE)
- 2010-2011 CAS Dean’s search committee
- Judge 2011 UB Post Doc Research Symposium
- Manager INSIF FTIR facility September 2010 - present