P. Chris Hammel

Department of Physics
The Ohio State University

174 West 18^{th} Avenue
Columbus, Ohio 43210-1106

Phone: 505-665-0759
Fax: 665-7652

e-mail: hammel@mps.ohio-state.edu

Education

- B.A. in Physics, University of California, San Diego,
  Magna Cum Laude 1977.
- Ph.D. in Physics, Cornell University 1984,
  Thesis topic: "Magnetic Coupling Across the Liquid ^{3}He-Substrate Interface"
  Advisor: Prof. R.C. Richardson.

Employment and Appointments

- **Professor** and **Ohio Eminent Scholar**, The Ohio State University, June 2002 to present
- **Fellow**, Los Alamos National Laboratory, July 2000 to present
- **Staff member**, Condensed Matter and Thermal Physics Group (MST-10), Los Alamos National Laboratory, October 1989 to present
- **Visiting Associate in Physics**, California Institute of Technology, Pasadena, CA, 1996 to present
- **J. Robert Oppenheimer Fellow**, Los Alamos National Laboratory, October 1986 to October 1989
- **Postdoctoral Fellow**, MIT with Prof. John S. Waugh, January 1984 to October 1986
- **Research Assistant**, Laboratory of Atomic and Solid State Physics, Cornell University, Ithaca, NY, June 1979-January 1984

Research Interests

- Magnetic resonance force microscopy
- Spin electronics and solid state quantum computing
- NMR studies of highly correlated electronic materials
- Ultra-low temperature magnetic resonance

Awards and Honors

- Fellowship at Los Alamos National Laboratory
- Los Alamos National Laboratory Fellows Prize, February 1995.
- Fellow, The American Physical Society.

Professional Activities

- Co-organizer, *International Conference on Experimental Implementation of Quantum Computation*, January 16–19, 2001, Sydney, Australia
- Co-organizer of workshop on *Scanned Probe Microscopy in Biology, Chemistry and Physics* to be held December 9–12, 2001 in Santa Fe, NM.
- Member, Quantum Information Science and Technology Expert Panel, tasked with developing a national quantum information roadmap
- Member, International Advisory Committee, Australian Research Council Special Research Centre for Quantum Computer Technology
- Member, Los Alamos National Laboratory *Nano-Science and Technology Steering Committee*
- Member, Los Alamos National Laboratory *Applied Quantum Technology Steering Committee*
- Member, American Physical Society
- Member, Executive Committee of the *Instrumentation and Measurement Sciences Topical Group* of the American Physical Society
- Organizer of Scanned Probe Journal Club at Los Alamos National Laboratory
- Member, Postdoctoral Research Fellow selection committee, Los Alamos National Laboratory
- Proposal referee, National Science Foundation, the Department of Energy, The Research Foundation and the Petroleum Research Foundation
- Manuscript referee, *Physical Review Letters, Science, Nature, Physical Review B, Applied Physics Letters, Journal of Applied Physics* and *Physica C*

Invited Talks

American Physical Society

1. "^{17}O NMR in $YBa_2Cu_3O_{7-\delta}$," presented at the March Meeting of the American Physical Society, Anaheim, California, March 16–20, 1990.

2. "NMR Studies of $La_2CuO_{4+\delta}$," presented at the March meeting of the American Physical Society, Seattle, Washington, March 22–26, 1993.

3. "NMR/NQR Studies of Oxygen Doped La_2CuO_4: Inhomogeneous Structure and Hole Localization," presented at the March meeting of the American Physical Society, St. Louis, Missouri, March 18–22, 1996.

4. "Ferromagnetic Resonance in Microscopic Magnets Using Magnetic Resonance Force Microscopy," presented by Z. Zhang at the March meeting of the American Physical Society, Kansas City, Missouri, March 17–21, 1997.

5. "Magnetism of Charge-Stripe Ordered 2D Transition Metal Oxides," presented at the March meeting of the American Physical Society, Atlanta, GA, March 21–26, 1999.

6. "Magnetic Resonance Readout in the Silicon-Based Nuclear Spin Quantum Computer," presented at the March meeting of the American Physical Society, Minneapolis, MN, March 20–24, 2000.

7. "Scanning MRFM of Microscopic Ferromagnets" presented at the March meeting of the American Physical Society, Indianapolis, IN, March 18–22, 2002.

Gordon Research Conferences

1. "Anisotropic Knight Shifts and Relaxation Rates in $YBa_2Cu_3O_7$," presented at the *Gordon Research Conference on Magnetic Resonance*, Plymouth NH, June 19–23, 1989.

2. "Phase Separation, Structure and Superconductivity in Oxygen-Annealed $La_2CuO_{4+\delta}$," presented at the *Gordon Research Conference on Superconductivity*, Oxnard, CA, January 4–8, 1993.

3. "Localized Holes in Superconducting Lanthanum Cuprate," presented at the *Gordon Research Conference on Superconductivity*, Ventura, CA, January 12–17, 1997.

4. "Glassy Spin Freezing in Lanthanum Cuprate" presented at the *Gordon Research Conference on Superconductivity*, Oxford, England, September 9–14, 2001.

5. "Scanned Probe Ferromagnetic Resonance Studies of Microscopic Ferromagnets," to be presented at the *Gordon Research Conference on Magnetic Nanostructures*, May 12–17, 2002 in Il Ciocco, Italy.

International Conferences and Workshops

1. "Incommensurate Spin Fluctuations and Oxygen Doping in Super-Oxygenated $La_2CuO_{4+\delta}$," presented at the *Distinguished Visitors Workshop on Spin Effects in High Temperature Superconductors*, University of Illinois at Urbana-Champaign April 2–4, 1992.

2. "Magnetism, Phase Separation, Local Structure and Superconductivity in Super-Oxygenated $La_2CuO_{4+\delta}$," presented at the *International School of Solid State Physics Workshop: Aspects of Phase Separation in Cuprate Superconductors*, May 6–13, 1992, Erice, Sicily.

3. "NMR Study of Local Structural Inhomogeneity in Metallic $La_2CuO_{4+\delta}$," presented at the *International Conference on Strongly Correlated Electron Systems*, August 16–19, 1993, La Jolla, California.

4. "NMR Study of Local Structural Inhomogeneity in Metallic $La_2CuO_{4+\delta}$," presented at the *Second International Workshop on Phase Separation in Cuprate Superconductors*, September 5–10, 1993 in Cottbus, Germany.

5. "Local Structure in Oxygen-Doped $La_2CuO_{4+\delta}$" presented at the *International Workshop on Anharmonic Properties of High-T_c Cuprates*, Bled, Slovenia, September 1–6, 1994.

6. "Sub-surface Imaging with the Magnetic Resonance Force Microscope" presented at the *Symposium on Quantum Fluids & Solids-95*, Cornell University, June 12–17, 1995.

7. "NMR Studies of the Cuprates: Localization of Doped Holes in Metallic $La_2CuO_{4+\delta}$ and An Examination of the Oxygen Relaxation Rate in $YBa_2Cu_3O_7$," presented at the *Third International Workshop on Phase Separation, Electronic Inhomogeneities and Related Mechanisms for High-T_c Superconductors*, Erice, Italy, July 9–15, 1995.

8. "The Magnetic Resonance Force Microscope: Recent Experiments" presented at the *Southeast Magnetic Resonance Conference*, Tallahassee, FL, December 1, 1995.

9. "Localized Holes in Superconducting Lanthanum Cuprate," presented at the *International Conference on Stripes, Lattice Instabilities and High T_c Superconductivity*, Rome, Italy, December 8–12, 1996.

10. "Microscopic Characterization of Magnetic Materials Using Magnetic Resonance Force Microscopy," presented at the *NATO Advanced Study Institute: Frontiers in Magnetism of Reduced Dimension Systems*, Crimea, Ukraine, May 25–June 3, 1997.

11. "Charge Inhomogeneity in Lanthanum Cuprate and Lanthanum Nickelate," presented at the *Workshop on Spin-Charge-Lattice Coupling in Complex Electronic Materials*, Los Alamos, NM, August 12–14, 1997.

12. "Microscopic Characterization of Magnetic Materials Using Magnetic Resonance Force Microscopy," presented at the *4^{th} International Conference on Magnetic Resonance Microscopy and Macroscopy*, Albuquerque, NM, September 21–25, 1997.

13. "Microscopic Characterization of Layered Magnetic Materials Using Magnetic Resonance Force Microscopy," presented at the *25^{th} Conference on the Physics and Chemistry of Semiconductor Interfaces*, Salt Lake City, Utah, 18–22 January 1998.

14. "Charge Inhomogeneity in Transition Metal Oxides," presented at the *Second International Conference on Stripes and High T_c Superconductivity,* Rome, Italy, 2-6 June 1998.

15. "Microscopic Characterization of Magnetic Materials Using Magnetic Resonance Force Microscopy," presented at the *3^{rd} International Symposium on Metallic Multilayers*, Vancouver, British Columbia, Canada, 14–19 June 1998.

16. "Magnetism of Charge-Striped 2D Transition Metal Oxides" presented at the *Colloquium on Magnetic Resonance in High-T_c Superconductors,* Engelberg, Switzerland, 17–21 January 1999.

17. "High Resolution Scanned Probe Magnetic Resonance Microscopy," plenary talk presented at the Swiss-US workshop on *Tools and Simulations in Nanotechnology,* Zürich, Switzerland, 20–21 September 1999.

18. "Inhomogeneous Low Frequency Spin Dynamics in $La_{1.8-x}Eu_{0.2}Sr_xCuO_4$" presented at the Symposium on *Itinerant and Localized States in HTSC* in Klosters, Switzerland, 6–10 April, 2000.

19. "Glassy Spin Freezing in Lanthanum Cuprate," presented at the *Workshop on High Temperature Superconductivity*, Institute for Theoretical Physics, University of California, Santa Barbara, CA, August 14–18, 2000.

20. "Glassy Spin Freezing and Stripe Order in Lanthanum Cuprate," presented at *Stripes 2000* in Rome, Italy, 25–30 September 2000.

21. "The Magnetic Resonance Force Microscope: Readout for a Silicon-Based Nuclear-Spin Quantum Computer," presented at the International Conference on Experimental Implementation of Quantum Computation, Sydney Australia, 16–19 January, 2001.

22. "Glassy Spin Freezing in Lanthanum Cuprate," presented at the *Aspen Winter Physics Conference*, Aspen, CO, January 21–27, 2001.

23. "Probing Materials with Magnetic Resonance," presented at the *The Future of Materials Physics* Workshop in honor of Zachary Fisk, August 13-15, 2001, Los Alamos, NM

24. "Force-Detected Scanned Probe Magnetic Resonance Microscopy," to be presented at the Physical Phenomena at High Magnetic Fields-IV Conference, Santa Fe, New Mexico, October 19–25, 2001

25. "Force Detected Scanned Probe Magnetic Resonance: The Magnetic Resonance Force Microscope," presented at *Physical Properties of Amyloid Diseases Workshop*, the University of California, San Francisco, CA November 29–December 1, 2001

26. "The Silicon-Based Nuclear Spin Quantum Computer," to be presented at the SPIE International Conference "Photonics West", San Jose, CA, Jan 20–25, 2002

27. "The Silicon-Based Quantum Computer," presented at the *3rd Annual Conference of the Southwest Quantum Information and Technology Network*, NIST, Boulder, CO, March 8-10, 2002.

Colloquia and Seminars

1. "Magnetism in $YBa_2Cu_3O_{7-y}$: Insights from NMR" at the Physics and Theoretical Division Colloquium, Los Alamos National Lab, March 1990.

2. "^{139}La Magnetic Resonance Studies of Single Crystal $La_2CuO_{4+\delta}$", Physics Department, Northwestern University, Evanston Illinois, March 18, 1991.

3. "^{139}La Magnetic Resonance Studies of Single Crystal $La_2CuO_{4+\delta}$", Materials Science Division, Argonne National Laboratory, March 19, 1991.

4. "NMR Studies of the High Temperature Superconductors $YBa_2Cu_3O_{7-y}$," Joint Los Alamos National Laboratory and Sandia National Laboratories Office of Basic Energy Sciences Materials Sciences Information and Review Meeting, May 29–30, 1991.

5. "Magnetism, Phase Separation, Local Structure and Superconductivity in Super-Oxygenated $La_2CuO_{4+\delta}$," presented at the Theory Institute of the Swiss Federal Institute of Technology (ETH), Zurich, Switzerland, May 18, 1992.

6. "Magnetism, Phase Separation, Local Structure and Superconductivity in Super-Oxygenated $La_2CuO_{4+\delta}$," presented at the Solid State Physics Laboratory of the University of South Paris, Orsay, France, May 25, 1992.

7. "NMR Study of Local Structure in Metallic $La_2CuO_{4+\delta}$," presented at the University of Köln, September 16, 1993.

8. "NMR Study of Local Structure and Charge Distribution in Metallic $La_2CuO_{4+\delta}$," presented at the Condensed Matter Physics Department, California Institute of Technology, January 11, 1994.

9. "NMR Study of Local Structure and Charge Distribution in Metallic $La_2CuO_{4+\delta}$," presented at the Physics Department, University of California at Riverside, January 13, 1994.

10. "Phase Separation and Local Structure in Oxygen-Doped $La_2CuO_{4+\delta}$," presented to the Physics Department at the University of California at Los Angeles, May 18, 1994.

11. "An Examination of the Oxygen Relaxation Rate in $YBa_2Cu_3O_7$" presented to the Physics Department, University of Florida, Gainesville, FL, November 27, 1995.

12. "The Magnetic Resonance Force Microscope: Recent Experiments" presented to the Physics Department, University of Florida, Gainesville, FL, November 28, 1995.

13. "Localized Holes in Superconducting Lanthanum Cuprate," presented at the Condensed Matter Physics Seminar, Physics Department, University of Illinois at Urbana/Champaign, February 21, 1997.

14. "Doped Holes and Stripes in 2D Cuprates and Nickelates," presented at the Condensed Matter Physics Seminar, Department of Physics, Florida State University and National High Magnetic Field Laboratory, Tallahassee, FL, April 11, 1997.

15. "The Magnetic Resonance Force Microscope: A New Probe of Magnetic Materials," presented at the Condensed Matter Seminar, Department of Physics, The Ohio State University, Columbus, OH, November 12, 1997.

16. "The Magnetic Resonance Force Microscope: A New Probe of Magnetic Materials," presented at the Physics Colloquium, Texas A&M University, College Station, TX, December 4, 1997.

17. "Consequences of Inhomogeneous Charge Structures for Magnetism in 2D Transition Metal Oxides from NMR" presented at the University of Köln, Köln, Germany, May 25, 1998.

18. "Consequences of Inhomogeneous Charge Structures for Magnetism in 2D Transition Metal Oxides from NMR" presented at the University of Augsburg, Augsburg, Germany, May 27, 1998.

19. "The Magnetic Resonance Force Microscope: A New Probe of Magnetic Materials," presented at the University of Zürich, Zürich, Switzerland, May 28, 1998.

20. "The Magnetic Resonance Force Microscope: A New Approach to Microscopic Subsurface Imaging," Physics Department Colloquium presented at the University of California, Davis, February 22, 1999.

21. "Magnetism of Charge-Striped 2D Transition Metal Oxides," presented at the University of California, Riverside, February 23, 1999.

22. "Magnetism of Charge-Stripe Ordered Transition Metal Oxides," presented at Solid State Sciences Seminar, Caltech, Pasadena, CA May 25, 1999.

23. "High Resolution Scanned Probe Magnetic Resonance Microscopy," Physics Colloquium, The Ohio State University, Columbus, OH, November 2, 1999.

24. "Inhomogeneous Low Frequency Spin Dynamics in $La_{1.8-x}Eu_{0.2}Sr_xCuO_4$," Physics Colloquium, University of California, San Diego, 8 March, 2000.

25. "The Silicon-Based Nuclear Spin Quantum Computer," presented at the Physics Colloquium, Boston College, April 26, 2000.

26. "Glassy Spin Freezing and Stripe Order in Lanthanum Cuprate," presented at the UCLA Solid State Seminar, May 10, 2000.

27. "Glassy Spin Freezing in Lanthanum Cuprate," presented at the University of Köln, Köln, Germany, October 2, 2000.

28. "Magnetic Resonance Readout in the Silicon-Based Nuclear Spin Quantum Computer," presented at the University of Stuttgart, Stuttgart, Germany October 4, 2000.

29. "Glassy Spin Freezing in Lanthanum Cuprate," presented at the Max Planck Institute, Stuttgart, Germany, October 5, 2000.

30. "The Magnetic Resonance Force Microscope: Imaging Magnetic Materials," presented at the Ohio State University, November 20, 2000.

31. "Glassy Spin Freezing in Lanthanum Cuprate," presented to the Applied Physics Department, Stanford University, November 30, 2000.

32. "Magnetic Resonance Readout in the Silicon-Based Nuclear Spin Quantum Computer," presented at the University of California, San Diego, La Jolla, CA, February 14, 2001.

33. "High Resolution Scanned Probe Magnetic Resonance," presented to the Department of Radiology, The Ohio State University, Columbus, OH, May 29, 2001.

34. "Force Detected Scanned Probe Magnetic Resonance: The Magnetic Resonance Force Microscope," presented at the University of California, Santa Barbara, May 25, 2001.

35. "Force-Detected Scanned Probe Magnetic Resonance Microscopy," presented at the University of Illinois at Urbana/Champaign on October 29, 2001, Urbana, Illinois.

36. "Force-Detected Scanned Probe Magnetic Resonance Microscopy: The Magnetic Resonance Force Microscope," presented at Cornell University on December 18, 2001, Ithaca, NY.

Publications

Average citation rate for ten most-cited papers: **>130 citations/paper**. Total citations: > 1700.

1. "Spin aligned hydrogen: Some considerations for ESR vs. NMR experiments and preliminary observation of H↑ at low temperature," B. Yurke, D. Igner, E. Smith, B. Johnson, J. Denker, C. Hammel, D. Lee and J. Freed, *Journal de Physique (Paris) Colloque* **41**, C7-177 (1980).

2. "Fabrication of 0.25 μm metal particles," P. Chris Hammel and Robert C. Richardson, *Physica* **107**B, 611 (1981).

3. "Magnetic coupling between ^{3}He and ^{19}F at low temperatures," P.C. Hammel, M.L. Roukes, Y. Hu, T.J. Gramila, T. Mamiya and R.C. Richardson, *Phys. Rev. Lett.* **51**, 2124 (1983).

4. "Relaxation as an interface probe in ^{3}He-substrate systems," P.C. Hammel, T.J. Gramila, Y. Hu and R.C. Richardson, Proc. of the *17$^{\text{th}}$ International Conference on Low Temperature Physics* (North-Holland, Amsterdam, 1984), p. 753.

5. "Surface relaxation of ^{3}He on CaF_2," T.J. Gramila, Y. Hu, P.C. Hammel, and R.C. Richardson, *ibid*, p. 755.

6. "Relaxation of nuclear magnetization of liquid ^{3}He-substrate systems," P.C. Hammel and R.C. Richardson, *Phys. Rev. Lett.* **52**, 1441 (1984).

7. "^{19}F nuclear relaxation at the interface between liquid ^{3}He and a solid substrate at high field and low temperature," P.C. Hammel, P.L. Kuhns, O. Gonen and J.S. Waugh, *Phys. Rev.* B **34**, 6453 (1986).

8. "Unexpectedly rapid ^{19}F spin-lattice relaxation in CaF_2 below 1K," P.L. Kuhns, P.C. Hammel, O. Gonen, and J.S. Waugh, *Phys. Rev.* B **35**, 4591 (1987).

9. "Nuclear spin lattice relaxation in ^{3}He-^{4}He mixtures," Mary Lowe, P.C. Hammel, R.E. Ecke, K. Bedell and M. Takigawa, *Phys. Rev.* B **37**, 2281 (1988).

10. "Copper nuclear quadrupole resonance in $GdBa_2Cu_3O_7$: Determination of Site Assignment," P.C. Hammel, M. Takigawa, R.H. Heffner and Z. Fisk, *Phys. Rev.* B **38**, 2832 (1989).

11. "Anisotropic Cu Knight shift and magnetic susceptibility in the normal state of $YBa_2Cu_3O_7$," M. Takigawa, P.C. Hammel, R.H. Heffner, Z. Fisk, J.L. Smith, and R.B. Schwarz, *Phys. Rev.* B **39**, 300 (1989).

12. "Spin susceptibility in superconducting $YBa_2Cu_3O_7$ from ^{63}Cu Knight shift," by M. Takigawa, P.C. Hammel, R.H. Heffner and Z. Fisk, *Phys. Rev.* B **39**, 7371 (1989).

13. "Anomalous temperature dependence of Cu NMR line width and magnetization in $YBa_2Cu_3O_{7-\delta}$," M. Takigawa, P.C. Hammel, R.H. Heffner, Z. Fisk, J.D. Thompson and M. Maley, *Physica C* **162–164**, 175 (1989).

14. "NMR relaxation rates at copper and oxygen sites in $YBa_2Cu_3O_7$," P.C. Hammel, M. Takigawa, R.H. Heffner, Z. Fisk and K.C. Ott, *Physica C* **162–164**, 177 (1989).

15. " NMR study of $YBa_2Cu_3O_{7-\delta}$," M. Takigawa, P.C. Hammel, R.H. Heffner, Z. Fisk, K.C. Ott, and J.D. Thompson, *Physica C* **162–164**, 853 (1989).

16. "^{17}O NMR study of local spin susceptibility in aligned $YBa_2Cu_3O_7$ powder," M. Takigawa, P.C. Hammel, R.H. Heffner, Z. Fisk, K.C. Ott and J.D. Thompson, *Phys. Rev. Lett.* **63**, 1865 (1989).

17. "Spin dynamics at oxygen sites in $YBa_2Cu_3O_7$," P.C. Hammel, M. Takigawa, R.H. Heffner, Z. Fisk and K.C. Ott, *Phys. Rev. Lett.* **63**, 1992 (1989).

18. "Observation of Cu NMR in Antiferromagnetic $PrBa_2Cu_3O_7$: Evidence for Hole-Band Filling," A.P. Reyes, D.E. MacLaughlin, M. Takigawa, P.C. Hammel, R.H. Heffner, J.D. Thompson, J.E. Crow, A. Kebede, T. Mihalisin, J. Schwegler, *Phys. Rev.* B **42**, 2688 (1990).

19. "Normal state ^{63}Cu Knight Shift and Hole-band Modification in $Y_{1-x}Pr_xBa_2Cu_3O_7$," A.P. Reyes, D.E. MacLaughlin, M. Takigawa, P.C. Hammel, R.H. Heffner, J.D. Thompson, J.E. Crow, A . Kebede, T. Mihalisin, and J. Schwegler, *J. Appl. Phys.* **67**, 5032 (1990).

20. "^{139}La NMR study of Phase Separation in Single Crystal $La_2CuO_{4.032}$," P.C. Hammel, A.P. Reyes, Z. Fisk, M. Takigawa, J.D. Thompson, R.H. Heffner, S-W. Cheong and J.E. Schirber, *Phys. Rev.* B **42**, 6781 (1990).

21. "A Low Temperature NMR Probe for Use in a Dilution Refrigerator," P.L. Kuhns, S-H Lee, C. Coretsopoulos, P.C. Hammel, O. Gonen, and J.S. Waugh, *Rev. Sci. Instr.* **62**, 2159 (1991).

22. "^{63}Cu NMR and Hole Depletion in the Normal State of Yttrium Rich $PrBa_2Cu_3O_7$," A.P. Reyes, D.E. MacLaughlin, M. Takigawa, P.C. Hammel, R.H. Heffner, J.D. Thompson and J.E. Crow, *Phys. Rev.* B **43**, 2989 (1991).

23. "Cu and O NMR Studies of the Magnetic Properties of $YBa_2Cu_3O_{6.63}$," M. Takigawa, A.P. Reyes, P.C. Hammel, J.D. Thompson, R.H. Heffner, Z. Fisk, K.C. Ott, *Phys. Rev.* B **43**, 247 (1991).

24. "^{139}La NMR and NQR Study of the Temperature Dependent Structure of $La_2CuO_{4+\delta}$," P.C. Hammel, E.T. Ahrens, A.P. Reyes, R.H. Heffner, P.C. Canfield, S-W. Cheong and Z. Fisk, and J.E. Schirber, *Physica C* **185–189**, 1095 (1991).

25. Comment on "Order-Disorder Structural Phase Transition in $La_{2-x}Sr_xCu\ O_{4+\delta}$ at 150 K," by D.E. MacLaughlin, P.C. Hammel, J.P. Vithayathil, P.C. Canfield, Z. Fisk, R.H. Heffner, A.P. Reyes, J.D. Thompson, and S-W. Cheong, *Phys. Rev. Lett.* **67**, 525, (1991).

26. "Phase Separation, Structure and Superconductivity in Oxygen-Annealed $La_2CuO_{4+\delta}$," P.C. Hammel, E.T. Ahrens, A.P. Reyes, J.D. Thompson, D.E. MacLaughlin, Z. Fisk, P.C. Canfield, and J.E. Schirber, in *Phase Separation in Cuprate Superconductors*, edited by K. Alex Müller and G. Benedek, p. 139 (World Scientific Publishing, Singapore, 1993).

27. "Pressure Effects on NQR Parameters in Oxygen-deficient $YBa_2Cu_3O_{6.62}$," A.P. Reyes, E.T. Ahrens, P.C. Hammel, R.H. Heffner and M. Takigawa, in *Lattice Effects in High-T_c Superconductors*, edited by Y. Bar-Yamm, T. Egami, J. Mustre-de Leon and A.R. Bishop, p. 143 (World Scientific Publishing, Singapore, 1993).

28. "NQR Study of Local Structure and Cooling Rate Dependent Superconductivity in $La_2CuO_{4+\delta}$," A.P. Reyes, E.T. Ahrens, P.C. Hammel, J.D. Thompson, P.C. Canfield, Z. Fisk, and J.E. Schirber, *J. Appl. Phys.* **73**, 6323 (1993).

29. "Thermal History Dependent Superconductivity and Local Structure in $La_2CuO_{4+\delta}$," E.T. Ahrens, A.P. Reyes, P.C. Hammel, J.D. Thompson, P.C. Canfield, Z. Fisk, J.E. Schirber, *Physica C* **212**, 317 (1993).

30. "NMR Determination of the B substitutional site in $U(Be_{1-x}B_x)_{13}$," E.T. Ahrens, P.C. Hammel, R.H. Heffner, A.P. Reyes, J.L. Smith and W.G. Clark, *Phys. Rev.* B **48**, 6691 (1993).

31. "NMR Study of Local Structure in Metallic $La_2CuO_{4+\delta}$," P.C. Hammel, A.P. Reyes, S-W. Cheong, Z. Fisk and J.E. Schirber, *Phys. Rev. Lett.* **71**, 440 (1993).

32. "Phase Separation and Superconductivity in $La_2CuO_{4+\delta}$: Effects of Oxygen Diffusion," A.P. Reyes, P.C. Hammel, E.T. Ahrens, J.D. Thompson, P.C. Canfield, Z. Fisk, and J.E. Schirber, *J. Phys. Chem. Solids* **54**, 1393 (1993).

33. "NMR Study of Oxygen-Doped $La_2CuO_{4+\delta}$," P.C. Hammel, A.P. Reyes, E.T. Ahrens, D.E. MacLaughlin, J.D. Thompson, Z. Fisk, P.C. Canfield, S-W. Cheong, J.E. Schirber, *Physica B* **199** & **200**, 235 (1994).

34. "Abrupt but Continuous Antiferromagnetic Transition in Nearly Stoichiometric $La_2CuO_{4+\delta}$," D.E. MacLaughlin, J.P. Vithayathil, H.B. Brom and J.C.J.M. de Rooy, P.C. Hammel, P.C. Canfield, A.P. Reyes, J.D. Thompson, and S-W. Cheong, *Phys. Rev. Lett.* **72**, 760-763 (1994).

35. "Microscopic Study of Local Structure and Charge Distribution in Metallic $La_2CuO_{4+\delta}$," P.C. Hammel, A.P. Reyes, E.T. Ahrens, Z. Fisk, P.C. Canfield, and J.D. Thompson, in *Phase Separation in Cuprate Superconductors*, edited by E. Sigmund and K. Alex Müller, (Springer-Verlag, Berlin, Heidelberg 1994).

36. "Observation of Vortex-Lattice Melting by NMR Spin-Lattice Relaxation in the Mixed-State," L.N. Bulaevskii, P.C. Hammel, and V.M. Vinokur, *Phys. Rev.* B **51**, 15355 (1995).

37. "Spin Susceptibility and Low-Lying Excitations in the Haldane-Gap Compound $YBaNi_2O_5$," T. Shimizu, D.E. MacLaughlin, P.C. Hammel, J.D. Thompson, and S-W. Cheong, *Phys. Rev.* B **52**, R9835 (1995).

38. "Oxygen Ordering and Phase Separation in $La_2CuO_{4+\delta}$," B.W. Statt, P.C. Hammel, Z. Fisk, S-W. Cheong, F.C. Chou, and D.C. Johnston, and J.E. Schirber, *Phys. Rev.* B **52**, 15575 (1995).

39. "Sub-surface imaging with the Magnetic Resonance Force Microscope," P.C. Hammel, Z. Zhang, G.J. Moore and M.L. Roukes, *Jour. of Low Temp. Phys.* **101**, 59 (1995).

40. "^{9}Be and ^{11}B NMR Study of Superconductivity in Boron Doped UBe_{13}," E.T. Ahrens, R.H. Heffner, P.C. Hammel, A.P. Reyes, J.L. Smith, and W.G. Clark, *Physica B* **206** & **207**, 589 (1995).

41. "Observation of Ferromagnetic Resonance in a Microscopic Sample Using Magnetic Resonance Force Microscopy," Z. Zhang, P.E. Wigen and P.C. Hammel, *Appl. Phys. Lett.* **68**, 2005 (1996).

42. "Sensitivity and Spatial Resolution in Magnetic Resonance Force Microscopy," Z. Zhang, M.L. Roukes and P.C. Hammel, *J. Appl. Phys.* **80**, 6931 (1996).

43. "Application of a Novel rf Coil Design to the Magnetic Resonance Force Microscope," Z. Zhang, P.C. Hammel and G.J. Moore, *Rev. Sci. Instr.* **67**, 3307 (1996).

44. "Local microstructure and the cuprate spin gap puzzle," P.C. Hammel and D.J. Scalapino, *Phil. Mag. B* **74**, 523 (1996).

45. "Oxygen nuclear magnetic resonance on the 90 K plateau of $YBa_2Cu_3O_{7-\delta}$," J. A. Martindale and P.C. Hammel, *Phil. Mag. B* **74**, 573 (1996).

46. "Magnetic Excitations of the Doped-Hole State in Diamagnetic $La_2Cu_{0.5}$ $Li_{0.5}O_4$," Y. Yoshinari, P.C. Hammel, J.A. Martindale, E. Moshopoulou, J.D. Thompson, J.L. Sarrao and Z. Fisk, *Phys. Rev. Lett.* **77**, 2069 (1996).

47. "Properties of Li-doped La_2CuO_4," J.L. Sarrao, D.P. Young, Z. Fisk, P.C. Hammel, Y. Yoshinari, and J.D. Thompson, *Proceedings of the 10th Anniversary HTS Workshop on Physics, Materials, and Applications,* ed. C.W. Chu and K.A. Müller (World Scientific, Singapore, 1997) p. 107.

48. "Vortex Melting in Polycrystalline $YBa_2Cu_3O_7$ from ^{17}O NMR," A.P. Reyes, X.P. Tang, H.N. Bachman, W.P. Halperin, J.A. Martindale, P.C. Hammel, *Phys. Rev.* B **55**, 14737 (1997).

49. "Magnetic Resonance Force Microscopy with a Permanent Magnet on the Cantilever," Z. Zhang and P.C. Hammel, *IEEE Trans. Magn.* **33**, 4047 (1997).

50. "Localized Holes in Superconducting Lanthanum Cuprate," P.C. Hammel, B.W. Statt, R.L. Martin, S-W. Cheong, F.C. Chou, and D.C. Johnston, *Phys. Rev.* B **57**, R712 (1998).

51. "Temperature Dependence of the Anisotropic Planar Oxygen Nuclear Spin-Lattice Relaxation Rate in $YBa_2Cu_3O_{7-\delta}$," J.A. Martindale, P.C. Hammel, W.L. Hults and J.L. Smith, *Phys. Rev.* B **57**, 11769 (1998).

52. "Towards a Magnetic Resonance Force Microscope Employing a Ferromagnetic Probe Mounted on the Force Detector," Z. Zhang and P.C. Hammel, *Solid State Nuclear Magnetic Resonance* **11**, 65 (1998).

53. "The Magnetic Resonance Force Microscope: A New Microscopic Probe of Magnetic Materials," P. C. Hammel, Z. Zhang, M. Midzor, M. L. Roukes, P. E. Wigen and J. R. Childress, *Frontiers in Reduced Dimensional Magnetism,* edited by V. G. Bar'yakthar, P. E. Wigen and N. A. Lesnik, Kluwer Academic Publishers (Dordrecht), p. 441 (1998).

54. "Suppression of Antiferromagnetic Order by Light Hole Doping in $La_2Cu_{1-x}Li_xO_4$: A ^{139}La NQR Study," B.J. Suh, P.C. Hammel, Y. Yoshinari, J.D. Thompson, J.L. Sarrao, and Z. Fisk, *Phys. Rev. Lett.* **81**, 2791 (1998).

55. "Ferromagnetic Resonance Imaging of Co Films Using Magnetic Resonance Force Microscopy," B. J. Suh, P. C. Hammel, Z. Zhang, M. M. Midzor, M. L. Roukes, and J. R. Childress, *J. Vac. Sci. Tech. B* **16**, 2275 (1998).

56. "Ferromagnetic Resonance Force Microscopy on Microscopic Co Single Layer Films," Z. Zhang, P. C. Hammel, M. Midzor, M. L. Roukes, and J. R. Childress, *Appl. Phys. Lett.* **73**, 2036 (1998).

57. "Magnetic field independence of the spin gap in $YBa_2Cu_3O_{7-\delta}$," K. Gorny, O. M. Vyaselev, J. A. Martindale, C. H. Pennington, P. C. Hammel, W. L. Hults, J. L. Smith, P. L. Kuhns, A. P. Reyes, and W. G. Moulton, *Phys. Rev. Lett.* **82**, 177 (1999).

58. "Nuclear Magnetic Resonance Study of $U(Be, B)_{13}$ in the Normal and Superconducting States," E. T. Ahrens, R. H. Heffner, P. C. Hammel, A. P. Reyes, J. D. Thompson, J. L. Smith, and W. G. Clark, *Phys. Rev. B* **59**, 1432 (1999).

59. "Local Magnetic and Structural Properties of the LTO $\rightarrow$ LTT Transition: A ^{139}La NQR Study in Lightly Hole-Doped $La_{1.8-x}Eu_{0.2}Sr_xCuO_4$," B. J. Suh, P. C. Hammel, M. Hücker and B. Büchner, *Phys. Rev.* B **59**, R3952 (1999).

60. "Magnetism of Stripe-Ordered $La_{5/3}Sr_{1/3}NiO_4$," Y. Yoshinari, P. C. Hammel and S-W. Cheong, *Phys. Rev. Lett.* **82**, 3536 (1999).

61. "Spin freezing and recovery of sublattice magnetization in lightly doped lanthanum cuprate," B. J. Suh, P. C. Hammel, J. L. Sarrao, J. D. Thompson, Z. Fisk, M. Hücker and B. Büchner, in *Physical Phenomena at High Magnetic Fields,* Z. Fisk, L. Gor'kov, J.R. Schrieffer, eds., World Scientific Publishing Co. Pte. Ltd., (Singapore) p. 336 (1999).

62. "^{139}La NMR evidence for sensitivity of local structure to magnetic field in $La_{0.5}Ca_{0.5}MnO_3$" Y. Yoshinari, P.C. Hammel, J.D. Thompson and S-W. Cheong, *Phys. Rev. B* **60**, 9275 (1999).

63. "Mobile Anti-phase Domains in Lightly Doped Lanthanum Cuprate," P. C. Hammel, B. J. Suh and J. L. Sarrao, and Z. Fisk, *Stripes and Related Phenomena,* , edited by A. Bianconi and N. Saini (Kluwer Academic/Plenum Publishers, New York, 2000) p. 295.

64. "Spin Dynamics in the LTT Phase of $\cong$ 1/8 Doped Single Crystal $La_{1.67}Eu_{0.2}Sr_{0.13}CuO_4$," B. J. Suh, P. C. Hammel, M. Hücker, B. Büchner, U. Ammerahl, and A. Revcolevschi, *Phys. Rev. B* **61**, R9265 (2000).

65. "Imaging Mechanism of Force Detected FMR Microscopy," M.M. Midzor, P.E. Wigen, D. Pelekhov, W. Chen, P.C. Hammel and M.L. Roukes, *J. Appl. Phys.* **87**, 6493 (2000)

66. "The Cu NMR echo decay in stripe ordered $La_{1.65}Eu_{0.2}Sr_{0.15}CuO_4$," N.J. Curro and P.C. Hammel, Physica C **341**, 1797 (2000).

67. "La-139 NQR and NMR studies of the structural phase transitions in $La_{1.8-x}Eu_{0.2}Sr_xCuO_4$," B.J. Suh and P.C. Hammel, Physica C **341**, 2127 (2000).

68. "Solid-state nuclear-spin quantum computer based on magnetic resonance force microscopy," G.P. Berman, G.D. Doolen, P.C. Hammel, and V.I. Tsifrinovich, *Phys. Rev. B* **61**, 14694 (2000)

69. "Inhomogeneous Low Frequency Spin Dynamics in $La_{1.65}Eu_{0.2}Sr_{0.15}CuO_4$," N.J. Curro, P.C. Hammel, B.J. Suh, M. Hücker, B. Büchner, U. Ammerahl, and A. Revcolevschi, *Phys. Rev. Lett.* **85**, 642 (2000).

70. "Evidence for Spiral Magnetic Order in the Heavy Fermion Material $CeRhIn_5$," N. J. Curro, P. C. Hammel, P. G. Pagliuso, J. L. Sarrao, J. D. Thompson and Z. Fisk, *Phys. Rev. B* **62**, R6100 (2000).

71. "Magnetic field independence of Cu(2) NMR spin-lattice relaxation rate in the normal state of optimally doped $YBa_2Cu_3O_{7-\delta}$, " K.R. Gorny, O.M. Vyaselev, C.H. Pennington, P.C. Hammel, W.L. Hults, J.L. Smith, J. Baumgartner, T.R. Lemberger, P. Klamut, B. Dabrowski, *Phys. Rev. B* **63**, 4513 (2001), article no. 064513.

72. "Magnetic resonance force microscopy quantum computer with tellurium," G.P. Berman, G.D. Doolen, P.C. Hammel, V.I. Tsifrinovich, *Phys. Rev. Lett.* **86**, 2894 (2001).

73. "Anomalous Magnetic NMR Shifts in $CeCoIn_5$," N.J. Curro, B. Simovic, P.C. Hammel, P.G. Pagliuso, J.L. Sarrao, J.D. Thompson, *Phys. Rev. B Rapid Communications* **6418**, 0514 (2001).

74. "Superconductivity and magnetism in a new class of heavy-fermion materials," J.D. Thompson, R. Movshovich, Z. Fisk, F. Bouquet, N.J. Curro, R.A. Fisher, P.C. Hammel, H. Hegger, M.F. Hundley, M. Jaime, P.G. Pagliuso, C. Petrovic, N.E. Phillips and J.L. Sarrao, *J. Magn. Magn. Mat.* **226**, 5 (2001).

75. "Static Stern-Gerlach effect in magnetic force microscopy" G.P. Berman, G.D. Doolen, P.C. Hammel and V.I. Tsifrinovich, *Phys. Rev. A* **6503**, 2311 (2002)

76. "Probe-Sample Coupling in the Magnetic Resonance Force Microscope," A. Suter, D.V. Pelekhov, M.L. Roukes and P.C. Hammel, *Journal of Magnetic Resonance* **154**, 210 (2002).