

Contact Information

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Current Research

- Noble-gases and alkali-metals for precision measurements, biomagnetism, and navigation systems

Experience

- Physicist, Twinleaf LLC, Princeton, NJ; Jan. 2018-Present
 - DARPA AMBIENT (Atomic Magnetometer for Biological Imaging In Earth's Native Terrain)
 - Research and Develop small, low-power atomic magnetometers and table-top experiments
- Departmental Guest, Department of Physics, Princeton University, Princeton, NJ; Jan. 2018-Present
 - Continuation of dual noble-gas comagnetometer research under ONR grant
- Lecturer, Department of Physics, Princeton University, Princeton, NJ; Jan. 2017-May 2017
 - Lecturer for introductory general physics classes with Investigative Science Learning Environment
- Postdoctoral Research Associate/Associate Research Scholar, Department of Physics, Princeton University, Princeton, NJ; Apr. 2014 –Jan. 2018. PI: Mike Romalis
 - Noble-gas comagnetometry under DARPA C-SCAN for miniature NMR gyro
 - Long-term fundamental efforts included spin-gravity searches under an NSF grant
- Research Assistant, Ph.D. Student, and Postdoctoral Research Associate, Department of Physics and Astronomy, University of Utah, Salt Lake City, UT; 2010-2014. PIs: Brian Saam, Christoph Boehme, Mikhail Raikh, J. Lupton
 - Researched solid and gaseous noble-gas spin relaxation times, and organic semiconductors
 - Mentored undergraduates and high-school students on NMR experiments
 - Made home-built, low-field ODMR/EDMR apparatus under an NSF MRSEC grant
- Teaching Assistant and Ph.D. Student, Department of Physics and Astronomy, University of Utah, Salt Lake City, UT; 2005-2007, 2009-2010
 - TA and course marshal, maintained WebAssign/BlackBoard for entry-level courses
- Adjunct Professor, Life and Natural Sciences Department, Owens Community College, Toledo, OH; 2009
 - General astronomy class and a calculus-based applied physics class
- Teaching Assistant and Ph.D. Student, Department of Mathematics and Statistics, Bowling Green State University, Bowling Green, OH; 2007-2009
 - Teaching assistant for business calculus classes
- Electrical Apprentice, L & B Electric, Grand Rapids, OH; 2006-2009
 - Assistant in the design and implementation of control systems

Education

- Ph.D., Physics – The University of Utah, 2009-2013, Salt Lake City, UT USA
Dissertation Title: *¹²⁹Xe Relaxation and Rabi Oscillations*. Adviser: Brian Saam
- Ph.D. Program, Applied Mathematics – Bowling Green State University, 2007-2009, Bowling Green, OH USA. Adviser: Tong Sun (Masters All but thesis)
- M.Sc., Physics – The University of Utah, 2005-2007, Salt Lake City, UT USA
- B.Sc., Mathematics, Physics – Bowling Green State University, 2002-2005, Bowling Green, OH USA.
Honors Title: *The Multi-Fractal Nature of Dynamical Systems*. Adviser: Haowen Xi

Publications

10. M. E. Limes, N. Dural, M. V. Romalis, E. L. Foley, T. W. Kornack, A. Nelson, L. R. Grisham, J. Vaara, *Dipolar and scalar ^3He - ^{129}Xe frequency shifts in stemless cells*, Phys. Rev. A **100**, 010501 (R) (2019)
9. M. E. Limes, D. Sheng, and M. V. Romalis, *^3He - ^{129}Xe comagnetometry with ^{87}Rb detection and decoupling*, Phys. Rev. Lett. **120**, 033401 (2018).
Editor's Suggestion, Viewpoint: <https://physics.aps.org/articles/v11/5>
8. M. E. Limes, Z. L. Ma, E. G. Sorte, and B. Saam, *Robust solid ^{129}Xe longitudinal relaxation times*, Phys. Rev. B **94**, 094309 (2016).
7. D. P. Waters, G. Joshi, M. Kavand, M. E. Limes, H. Malissa, P. L. Burn, J. M. Lupton, and C. Boehme, *The spin-Dicke effect in OLED magneto-resistance*, Nature Physics **11**, 910-914 (2015).
6. K. J. van Schooten, D. L. Baird, M. E. Limes, J. M. Lupton, and C. Boehme, *Probing carrier-pair spin-spin interactions in a conjugated polymer by detuning of electrically detected spin-beating*, Nature Communications **6**, 6688 (2015).
5. E. F. Thenell, M. E. Limes, E. G. Sorte, Z. V. Vardeny, and B. Saam, *Nuclear relaxation measurements in organic semiconducting polymers for application to organic spintronics*, Phys. Rev. B **91**, 045205 (2015).
4. M. E. Limes, J. Wang, W. J. Baker, S.-Y. Lee, B. Saam, and C. Boehme, *Numerical study of spin-dependent transition rates within pairs of dipolar and exchange coupled spins with $s=1/2$ during magnetic resonant excitation*, Phys. Rev. B **87**, 165204 (2013).
3. R. Glenn, M. E. Limes, B. Saam, C. Boehme, and M. E. Raikh, *Analytical study of spin-dependent transition rates within pairs of dipolar and strongly exchange coupled spins with $s=1/2$ during magnetic resonant excitation*, Phys. Rev. B. **87**, 165205 (2013).
2. R. Glenn, M. E. Limes, B. Pankovich, B. Saam, and M. E. Raikh, *Magnetic resonance in slowly modulated longitudinal field: Modified shape of the Rabi oscillations*, Phys. Rev. B. **87**, 155128 (2013).
1. L. P. Fulcher, R. C. Scherer, A. Melnykov, V. Gateva, and M. E. Limes, *Negative Coulomb damping, limit cycles, and self-oscillation of the vocal folds*, Am. J. Phys. **74**, 386 (2006).

Presentations

30. W. Lee, V.G. Lucivero, M. E. Limes, E. Foley, T. Kornack, M. V. Romalis, *Heading error analysis of a pulsed ^{87}Rb magnetometer at geomagnetic fields*, Poster
2019 APS DAMOP Meeting, 05/2019, Milwaukee, WI
29. V.G. Lucivero, W. Lee, M. V. Romalis, M. E. Limes, E. Foley, T. Kornack, *A femtotesla quantum-noise-limited pulsed gradiometer at Earth's magnetic fields*, Poster
2019 APS DAMOP Meeting, 05/2019, Milwaukee, WI
28. V.G. Lucivero, W. Lee, M. V. Romalis, M. E. Limes, E. Foley, T. Kornack *A femtotesla quantum-noise-limited pulsed gradiometer at finite fields*, Conference Paper, <https://doi.org/10.1364/QIM.2019.T3C.3>
Quantum Information and Measurement (QIM) V: Quantum Technologies, 04/2019, Rome, Italy
27. A. Braun, S. McBride, S. Caliga, T. Kornack, E. Foley, M. E. Limes, V. G. Lucivero, W. Lee, M. V. Romalis, *Pulsed Intrinsic Gradiometer for Magnetometry in Earth's Native Terrain (PIGMENT)*
2019 DARPA AMBIIENT Meeting, 01/2019, Anaheim, CA
26. M. E. Limes, T. Kornack, E. Foley, *High-sensitivity pulsed magnetometer*, Contributed talk
2018 Workshop on Optically-Pumped Magnetometers, 08/2018, Philadelphia, PA

25. T. Kornack, E. Foley, L. Grisham, D. Newby, M. E. Limes, *Applications of Twinleaf microfabricated alkali vapor cells*, Contributed talk
2018 Workshop on Optically-Pumped Magnetometers, 08/2018, Philadelphia, PA
24. K. Zhao, A. Almasi, M. E. Limes, M. V. Romalis, *Suppressing Rubidium back-polarization in nuclear spin comagnetometer by radiation trapping assisted depolarization pumping*, Poster
2018 APS DAMOP meeting, 05/2018, Ft. Lauderdale, FL
23. M. E. Limes, N. Dural, M. V. Romalis, E. L. Foley, T. W. Kornack, A. Nelson, L. R. Grisham *Dipolar and scalar ^3He and ^{129}Xe frequency shifts in mm-sized cells*, Contributed Talk
2018 APS DAMOP meeting, 05/2018, Ft. Lauderdale, FL
22. A. Braun, S. McBride, S. Caliga, T. Kornack, E. Foley, M. E. Limes, M. V. Romalis, *Pulsed Intrinsic Gradiometer for Magnetometry in Earth's Native Terrain (PIGMENT)*
2018 DARPA AMBIIENT kickoff meeting, 03/2018, Washington DC
21. M. E. Limes, M. V. Romalis, *^3He - ^{129}Xe Comagnetometry with ^{87}Rb Pulse-train Detection & Decoupling*, Contributed Talk
2017 APS DAMOP meeting, 06/2017, Sacramento, CA
20. M. E. Limes, D. Sheng, M. V. Romalis, *A ^3He - ^{129}Xe co-magnetometer with ^{87}Rb magnetometry*, Poster
2016 APS DAMOP meeting, 05/2016, Providence, RI
19. M. V. Romalis, M. E. Limes, D. Sheng, A. Kabcenell, N. Dural, T. Kornack, J. Foley, D. Newby, N. Ford, M. Rizzo, A. Nelson, D. Murray, *^3He - ^{129}Xe Nuclear Spin Gyro*, Poster
2016 Spring microPNT Program Review, 04/2016, Atlanta, GA
18. M. E. Limes, M. V. Romalis, *^3He - ^{129}Xe NMR Gyro with ^{87}Rb decoupled SERF detection*, Poster
2016 Experimental Nuclear Magnetic Resonance Conference (ENC), 04/2016, Pittsburg, PA
17. H. Malissa, D. P. Waters, G. Joshi, M. Kavand, M. E. Limes, P. L. Burn, J. M. Lupton, C. Boehme, *Magnetoresistance detected spin collectivity in organic light emitting diodes*, Contributed Talk
2016 APS March Meeting, 03/2016, Baltimore, MD
16. K. J. van Schooten, D. Baird, M. E. Limes, John Lupton, Christoph Boehme, *Probing carrier-pair spin-spin interactions in a conjugated polymer by detuning of electrically detected beating of Rabi oscillations*, Contributed Talk
2015 Joint Fall Meeting of the APS and AAPT New England Sections, 11/2015, Hanover, NH
15. M. V. Romalis, M. E. Limes, D. Sheng, A. Kabcenell, N. Dural, T. Kornack, J. Foley, D. Newby, N. Ford, M. Rizzo, A. Nelson, D. Murray, *^3He - ^{129}Xe Nuclear Spin Gyro*, Poster
2015 Fall microPNT Program Review, 10/2015, San Diego, CA
14. M. E. Limes, D. Sheng, M. V. Romalis, *Progress on a ^3He - ^{129}Xe co-magnetometer*, Poster
2015 APS DAMOP meeting, 06/2015, Columbus, OH
13. M. V. Romalis, M. E. Limes, D. Sheng, A. Kabcenell, N. Dural, T. Kornack, J. Foley, *^3He - ^{129}Xe Nuclear Spin Gyro*, Poster
2015 Spring microPNT Program Review, 04/2015, Pittsburg, PA
12. M. V. Romalis, M. E. Limes, D. Sheng, A. Kabcenell, N. Dural, T. Kornack, J. Foley, *^3He - ^{129}Xe Nuclear Spin Gyro*, Poster
2014 Fall microPNT Program Review, 11/2014, San Antonio, TX
11. Z. L. Ma, K. Jeong, E. Houghtby, T. Paskvan, M. E. Limes, and B. Saam, *Noble gas polarimetry using Rb EPR frequency shifts*, Poster

2014 APS DAMOP meeting, 06/2014, Madison, WI

10. M. E. Limes, *¹²⁹Xe Relaxation and Rabi Oscillations*, Invited Talk
Pines Lab Seminar, 12/2013, UC Berkeley, CA
9. E. Thenell, M. E. Limes, E. G. Sorte, and B. Saam, *Relaxation measurements in organic semiconducting polymers for applications to organic spintronics*, Poster
2013 Experimental Nuclear Magnetic Resonance Conference, 04/2013, Asilomar, CA
8. M. E. Limes, R. Glenn, B. Pankovich, M. E. Raikh, and B. Saam, *Low-frequency modulation of the longitudinal field: modified Rabi envelopes*, Poster
2013 Experimental Nuclear Magnetic Resonance Conference, 04/2013, Asilomar, CA
7. M. E. Limes, J. Wang, W. J. Baker, S.-Y. Lee, B. Saam, and C. Boehme, *Numerical study of spin-dependent transition rates within pairs of dipolar and exchange coupled spins with $s=1/2$ during magnetic resonant excitation*, Contributed Talk
2013 APS March Meeting, 03/2013, Baltimore, MD
6. M. E. Limes, Z. L. Ma, and B. Saam, *Longitudinal relaxation of solid ¹²⁹Xe*, Poster
2012 Rocky Mountain Conference on Magnetic Resonance, Solid State NMR Symposium
06/2012, Copper Mountain, CO
5. M. E. Limes, J. Wang, W. J. Baker, S.-Y. Lee, B. Saam, and C. Boehme, *Numerical study of spin-dependent electronic transition rates between two dipolar and exchange coupled paramagnetic ($S=1/2$) states during coherent excitation by magnetic resonance*, Poster
2012 Rocky Mountain Conference on Magnetic Resonance, EPR Symposium, 06/2012, Copper Mountain, CO.
4. M. E. Limes, Z. L. Ma, E. G. Sorte, H. Emerson, L. Hales, B. Thapa, O. Jeong, T. van Hook, and B. Saam, *Crystallite morphology and longitudinal relaxation in solid ¹²⁹Xe*, Poster
2012 XeMat Conference, 05/2012, Dublin, Ireland
3. M. E. Limes, Z. L. Ma, and B. Saam, *Altered states of solid xenon*, Poster
2012 DAMOP Meeting, 05/2012, Orange County, CA
2. M. E. Limes and B. Saam, *Relaxation of low-field gas-phase ¹²⁹Xe*, Contributed Talk
2010 APS/Four Corners Meeting, 10/2010, Ogden, UT
1. M. Randles, M. E. Limes, E. Ondieki, and H. Rajaei, *Distributed simulation of particle physics*, Poster,
2005 Spring Symposium on Undergraduate Research, 04/2005, Bowling Green, OH

Honors/Academic Service

- James Robert and Gretchen Overman Undergraduate Physics Scholarship, 2004
- Phi Beta Kappa Society, Xi of Ohio, 2005
- Kappa Mu Epsilon National Mathematics Honors Society, Ohio Alpha, 2005
- Physics Graduate Student Advisory Council President, 2010
- J. Irvin and Norma K. Swigart Outstanding Graduate Student, 2013
- Referee: Physical Review B, IEEE Photonics Technology Letters, Journal of Magnetic Resonance, IEEE Sensors, Physical Review Letters, Physical Review Applied