Curriculum Vitae

Mark S. Byrd

Business Address:
Physics Department
Southern Illinois University
Carbondale, IL 62901
Phone: 618-453-2271
Fax: 618-453-1056

Home Address:
2120 Pine
Murphysboro, IL 62966
Phone: 618-684-3295
mbyrd@siu.edu
http://www.physics.siu.edu/~byrd

Personal information

Citizenship: United States of America.
Place of Birth: San Antonio, Texas, USA.

Education

Ph.D. Physics, Adviser: E. C. G. Sudarshan, University of Texas at Austin, 1999.

B.S. Physics, B.S. Mathematics, U. T. Austin 1992.

Experience

Associate Professor 2009-Present, Southern Illinois University, Physics Department, Research interests: Quantum Computing, Quantum Error Correction, Quantum Information, Quantum Control and Simulating Quantum Systems with Quantum Systems. **Adjunct Professor of Computer Science 2006-present, Southern Illinois University**. Teaching: Undergraduate Quantum Mechanics, Special Topics: Quantum Computing, Modern Physics, Graduate Mathematical Physics, Developed and taught a new course, PHYS 440: Applications of Quantum Mechanics

Assistant Professor 2003-2009, Southern Illinois University, Physics Department. Teaching: First and Second Semester Graduate Electrodynamics (Jackson), Graduate Quantum Mechanics, University Physics-Mechanics and Electricity/Magnetism.

Postdoctoral Fellow, Harvard University, Division of Engineering and Applied Science 2002-2003. Worked with Navin Khaneja on Quantum Computation, Optimal Quantum Control Theory and Quantum Information Theory.

Postdoctoral Fellow, University of Toronto, Chemistry Department 2000-2002. Worked with Daniel Lidar on Quantum Computation, Quantum Error Correction/Avoidance, Simulating Quantum Systems and Quantum Control Theory.

Visiting Lecturer in Physics at Southern Methodist University. Spring 2000. Taught 2^{nd} semester undergraduate Quantum Mechanics and 2^{nd} semester graduate Quantum Field Theory.

Graduate Research Assistant. Summers 1995-1998. Conducted research in Group Theory, Geometric phases and density matrices for n-state systems.

Assistant Instructor. Department of Physics, U. T. Austin, 1996-1999. Taught Physical Science 304 an introductory course. Topics included Electricity, Magnetism, Light and Optics.

Assistant Instructor. Department of Physics, UT Austin, 1994-1995.
Taught Physical Science 303 an introductory course. Topics included Mechanics and Heat.

Teaching Assistant. Department of Physics, UT Austin, 1993-1994. Taught "Waves" laboratory for Sophomore level Science Majors.

Professional activities

Memberships

Sigma Pi Sigma, American Physical Society (1993-present), American Mathematical Society (1998-2002).

Referee

Physical Review Letters, *Physical Review A*, *Journal of Modern Optics*, *European Journal of Physics B*, *Journal of Physics A: Mathematical and Theoretical Physics*, *New Journal of Physics*, *Journal of Optics B*, IEEE *Transactions on Automatic Control*, *Physics Letters A*, *Journal of Mathematical Physics*, *Optics Communications*, *Quantum Information Processing*, *American Journal of Physics*, *Presentations for QEC11: The International Conference on Quantum Error Correction*, Panelist/Referee for the National Science Foundation.

Masters/Dissertation Committees

Previous (Graduated):

- Aikaterina Mandilara, PhD, (2005) Physics Department, Washington University, St. Louis MO.
- Mohammed Sabra, Physics PhD (2007) SIU (Co-Chair)
- Jeremy Scott, Physics PhD (2012), SIU (Co-Chair)
- C. Allen Bishop, Physics PhD (2012), SIU (Chair)
- Ran Li, Physics PhD (2008) SIU.
- Melique Hoover, Physics Masters (2009) SIU (Chair)
- Tzu-Chieh Chi, Physics Masters (2011) SIU (Chair)
- Nicholas Whiting, Chemistry PhD (2011) SIU
- Michael Skotinoitis, Physics PhD (2012), University of Calgary, Calgary, Alberta, CANADA.

Current Students: C. Allen Bishop (MS 2010, PhD 2012, now researcher at ORNL), Ali Abu-Nada (PhD candidate), Nayeli Zuniga-Hansen (PhD candidate), Siwei Luo (PhD candidate), Sameer Nawaf (Masters candidate), Russell Ceballos (PhD candidate).

Departmental/Committee Service

2012:

- Undergraduate Advisor (2011-present), Duties include advising students, evaluating transfer credit, meeting with prospective students, serving on the undergraduate committee.
- Seed grant committee (University committee)
- Strategic Planning committee
- Qualifying Exam committee
- Judged presentations at Research Fair, April 2012
- Chair of the faculty search committee
- External Examiner Michael Skotinoitis, PhD Physics, University of Calgary, Calgary, Alberta, CANADA.
- Course modification/development: PHYS 500, Graduate Mathematical Methods for Physcists.
- New course development: PHYS 440, "Quantum Mechanics II: Applications of Quantum Mechanics," Spring 2012. First time this course was taught at SIUC.
- Attended APS March meeting and funded one student to attend and present. Boston, MA.
- Attended invitation-only, "Multi-qubit Coherence Quantum Operations (MQCO)" workshop, Minneapolis, MN, May 2012.
- Year-end Grant evaluation, "Quantum Computer Science Program," Princeton, New Jersey, July 16-17.
- Referee for NSF, PRL, PRA, ...
- Will again be a workshop leader for EYH.
- Visiting Fellow, Mcquarie University, Sydney, Australia, August 2-August 31, 2012.

2011:

- Expanding Your Horizons (EYH) workshop leader. EYH is a STEM workshop for female students 5th-9th grades. Performed demonstrations.
- Murphysboro John A. Logan Elemenatary's Science Night: Physics Demonstrations
- Advisor for the following students: C. Allen Bishop (PhD candidate), Nayeli Zuniga-Hansen (PhD candidate), Yu-Chieh Chi (Master's recipient in 2011), Russell Ceballos (Undergraduate), Samuel Tempel (undergraduate), Timothy Jones (PhD candidate)

- Undergraduate Advisor
- Chair of the Faculty Search Committee
- Attended, presented at, American Physical Society's March meeting. Funded two students and a postdoc to also attend and present.
- SABBATICAL in Spring 2011, Mostly completed the Wikibook "Quantum Computation and Quantum Error Prevention"
  `http://qunet.physics.siu.edu/wiki`
  This book, written by me, is free to read and has many unique characteristics such as linked references, linked equations and tables, linked index entries, glossary, and linked table of contents.
- Co-organizer of the International Conference on Quantum Error Correction, USC, Los Angeles, CA. A week-long conference devoted to quantum error correction. Obtained grant funding, chose speakers, chaired session, organized and moderated a panel discussion with theorists and experimentalists on the collaborations between them.
- Attended workshop at LSU: QuaF, a workshop for quantum information science.

2010:

- Attended ORAU (Oak Ridge Associated Universities) graduate student recruitment fair. (**One student is now in Physics!** This is the only one known to be recruited to SIU.)
- Ph.D. committee Nicholas Whiting, Chemistry. Advisor: Boyd Goodson
- Expanding Your Horizons (EYH) workshop leader. EYH is a STEM workshop for female students 5th-9th grades. Performed demonstrations.
- Served as Assistant Chair to the Department of Physics. (Numerous duties, including helping with TA schedules, acting as a student liason, coordinating outreach, aided with lab coordination, acted as chair in the chair's absence, attended graduations (Summ09, FA10), Presented Scholarships on Honors day 2010, etc.)
- Member of the undergraduate committtee. With the aid of Tom Masden, undergraduate advisor, filled out numerous Form 90s, wrote letters to various departments for our revamped undergraduate curriculum which now includes three new specializations, rewrote undergraduate cataloge. The specializations were written by Samir Aouadi, Mark Byrd, Andrei Kolmakov, Leo Silbert, Saikat Talapatra, and Mesfin Tsige.)
- Attended the SIUC Job Fair - All Majors
- Advisor for the following students: C. Allen Bishop (PhD candidate), Nayeli Zuniga-Hansen (PhD candidate), Yu-Chieh Chi (Master's candidate), Melique Hoover (Masters recipient 2010), Kevin Reuter (Undergraduate), Russell Ceballos (Undergraduate).
- College of Science LLC speaker, November 18, "Where can teleportation take you?"

- Open house: SIUC visit by Benton High School Students. Performed Physics Demonstrations.
- Murphysboro John A. Logan Elemenatary's Science Night: Physics Demonstrations
- Served on an NSF panel in Arlington, VA.
- Invited Participant, "Control and Optimization of Open Quantum Systems for Information Processing," American Institute of Mathematics, June 21-25, 2010, Paulo Alto, CA.
- Seed Grant Commitee, SIUC

2009:

- Undergraduate committee: Helped institute changes to undergraduate curriculum including three new specializations; Biomedical Physics, Computational Physics, and Materials/Nano- Physics.
- Served on the Departmental Review Committee.
- Co-advised (with Leo Silbert) Max Herlache for SIU's Research Rookies Program.
- Panel participation: Morris Library's Open Access Forum.
- Served on an NSF panel in Arlington, VA.
- Advisor for the following students: Zhao-Ming Wang (graduated with PhD), C. Allen Bishop (PhD candidate), Yu-Chieh Chi (Master's candidate).
- Participated in Open Access Forum at Morris Library, November 19.
- Attended the ORAU Graduate Recruitment in Oak Ridge, TN in August.

2008:

- Performed Physics Demonstrations at Murphysboro Elementary as part of "Science Night," Oct. 2008.
- Chaired Masters Committee for C. Allen Bishop (Graduated).
- Primary invited speaker ORDA workshop: applying for CAREER awards

2007:

- Served on an NSF panel in Arlington, VA.
- Performed Physics Demonstrations at Murphysboro Elementary as part of "Science Night," Oct. 2007.
- Performed Physics Demonstrations at Murphysboro Elementary as part of "Science Night," Feb. 2007.
- Served on the PhD Dissertation Committee of Ran Li (Physics).
- Served on the PhD Dissertation Committee of Jennifer Shapiro (Chemistry).
- Served as co-chair of PhD Dissertation Committee of Mohammad S. Sabra (Physics).

2006:

- Supervised Masters Degree candidate C. Allen Bishop.

- Participated in Nova Science Cafe.

2005:

- Faculty search committee: two experimental searches, one theory search.
- Physics Demonstrations at Murphysboro Elementary
- Served on the PhD Dissertation Committee of Aikaterina Mandilara, Physics Department, Washington University, St. Louis MO.

2004:

- Faculty search committee: theory search.
- Web site revision committee.
- New Student Orientation Physics Department representative, Fall 2004.
- Reader, College of Science, Dec. Graduation Ceremonies.
- Community Service: Attend Buddy Walk in support of children with Down's Syndrome (every year). Contribute time and monetary support to Down's Syndrome Community groups. Attend Spring Picnic fund raiser for DSAGSL.

Selected Presentations

"Positive but not completely positive maps and how they arise in experiment," Fudan University, Shanghai, China, June 15, 2012.

"Error prevention and quantum control using decoherence-free and noiseless subsystems," Shanghai University, Shanghai, China, June 14, 2012.

"Fault-tolerant quantum computation, quantum control, and quantum error correction," QCS Workshop, Minneapolis, MN, May 21, 2012.

Panelist, "Fault-Tolerant Quantum Computation," QCS Workshop, Minneapolis, MN, May 22, 2012.

"Quantum Error Prevention and Quantum Control," Washington University, St. Louis, MO., May 18, 2012.

"Theory Meets Experiment," Panel Moderator at QEC11, the International Conference on Quantum Error Correction, Dec. 8, 2011.

"SU(p,q), negative probabilities, and quantum computation," Math Department, Southern Illinois University, May 5, 2011.

Southwest QUantum INformation and Technology (SQUINT), Feb. 19, 2011. "Compatible Gating Operations for Universal Quantum Computing on a Noiseless Subsystem Encoding." Also chaired a session Feb. 21, 2011.

"Control and Error Prevention in Quantum Computing Devices," Octorber 20, 2010, Institute for Quantum Information Science, Calgary, Alberta.

Quantum Information and Quantum Computing Workshop, "Quantum Error Prevention and Decoherence-Free Subsystems, Quantum Computing and Control," Sept. 16, 2010, Bilbao, Spain.

Southwest QUantum INformation and Technology (SQUINT), "Robust and Reliable Transformation of Quantum States Through a Spin Chain," Feb 21, 2009

Science Applications International Corporation (SAIC), "Quantum Error Prevention Methods," Washington, D.C., Feb. 13, 2009.

"Robust Simulation of Quantum Systems," QEC07, USC, Los Angelos, CA, December 2007.

"Preventing Errors in Quantum Computing Devices, Especially Quantum Dots," HRL laboratories, LLC, Malibu, CA, Sept. 26, 2007.

"Preventing Errors in Solid-State Quantum Computing Devices," 30th Annual Workshop on Condensed Matter Theories, Dresden, Germany, June 10, 2006.

"Preventing Errors in Quantum Computers," Washington University, St. Louis, MO, Dec. 15, 2005.

"Decoherence-free Subsystems Constructed from N-state Systems," Madereira Math Encounters XXIX, University of Madeira, Funchal, Madeira, Portugal, Aug. 2, 2005.

"Quantum Error Prevention and Leakage Elimination," National Institute for Science and Technology, Gaithersburg, Maryland June 2, 2005.

"Quantum Control and Simulating Quantum Systems with Quantum Systems," 28th Annual workshop on Condensed Matter Theories, St. Louis, MO, Sept. 27-Oct. 2, 2004.

"Preventing Errors in Quantum Computing Devices and Leakage Elimination," 34th Winter Colloquium on the Physics of Quantum Electronics, Snowbird, Utah Jan. 4-8, 2004.

"Practical Schemes for Quantum Error Prevention," University of Southern Illinois at Carbondale, Carbondale, Illinois, April 23, 2003.

"Practical Quantum Error Correction/Avoidance," National Institute for Science and Technology, Gaithersburg, Maryland December 11, 2002.

"Quantum Computing and Error Prevention, Fantasy and Myth," National Institute for Science and Technology, Gaithersburg, Maryland December 10, 2002.

"Combining Quantum Error Correction/Avoidance Techniques," ARO Sponsored Quantum Control Workshop, MIT, Cambridge, Massachusetts, October 15, 2002.

"Tailored Quantum Error Correction," University of Texas at Austin, Austin, Texas, Jan. 18, 2002.

"Combining Error Correction/Avoidance Techniques in the Geometric Setting," Texas A&M University, College Station, Texas, Jan. 16, 2002.

"Bang-Bang Operations for Quantum Error Suppression From a Geometric Perspective," Physics of Quantum Electronics Conference, Snowbird, Utah January 6-10, 2002.

"Quantum Bang-Bang Operations for Quantum Error Suppression," Harvard University, Cambridge, Massachusetts, December 13, 2001.

"Bang-Bang Operations from a Geometric Perspective," Fields Institute, Toronto, Ontario, September 28, 2001.

"Entanglement and the Structure of Density Matrices," University of New Mexico, Albuquerque, New Mexico, June 26, 2000.

"Introduction to Quantum Computation and Information," Southern Methodist University, Dallas, Texas, March 8, 2000.

Publications

"Effects of Noise, Correlations and Errors in the Preparation of Initial States in Quantum Simulation," *arXiv preprint:*1202.6337, Nayeli Zuniga-Hansen, Yu-Chieh Chi, Mark S. Byrd

"Geometric phases for Dressed-State Quantum Computation," Lian-Ao Wu, C. Allen Bishop, and Mark S. Byrd *Phys. Rev. A* **84**, 022341 (2011).

QUNET: Wikibook "Quantum Computation and Quantum Error Prevention"
`http://qunet.physics.siu.edu/wiki`
This book, written by me, is free to read and has many unique characteristics such as linked references, linked equations and tables, linked index entries, glossary, and linked table of contents. (2011).

"General open-system quantum evolution in terms of affine maps of the polarization vector," Mark S. Byrd, C. Allen Bishop, and Yong-Cheng Ou *Phys. Rev. A* **83**, 012301 (2011). *arXiv preprint:* arXiv:1010.2274.

"Casimir Invariants for Systems Undergoing Collective Motion", C. Allen Bishop, Mark Byrd, and Lian-Ao Wu, *Phys. Rev. A* **83**, 062327 (2011), *arXiv preprint:* arXiv:1001.3578.

"Computable constraints on entanglement-sharing of multipartite quantum states," Yong-Cheng Ou and Mark Byrd, *Quantum Information & Computation*, Vol. 10, No.3&4(2010) 0223-0233 *arXiv preprint:* arXiv:1004.5148.

"All maps equivalent to a given map, completely positive or not," Yong-Cheng Ou and Mark Byrd, *Phys. Rev A.* **82**. 022325 (2010) *arXiv preprint:* arXiv:1004.0951

"Perfect Function Transfer in two- and three- dimensions without initialization," Lian-Ao Wu, Mark Byrd, Z. D. Wang, Bin Shao, *Phys. Rev. A* **82**, 052339 (2010)*arXiv preprint:* arXiv:1004.0010.

"High Fidelity State Transfer Over an Unmodulated Linear XY Spin Chain" C. Allen Bishop, Yong-Cheng Ou, Zhao-Ming Wang, Mark Byrd *Phys. Rev. A* **81**, 042313 (2010), *arXiv preprint:* arXiv: 0910.1829.

"Robust and Reliable Transfer of a Quantum State Through a Spin Chain", Zhao-Ming Wang, C. Allen Bishop, Mark Byrd, Bin Shao, Jian Zou *Phys. Rev. A* **80**, 022330 (2009), *arXiv preprint:* arXiv:0812.4578.

"Quantum communication through anisotropic Heisenberg XY spin chains," Z.-M. Wang, M. Byrd, B. Shao, J. Zou. *Phys. Lett. A*, Volume **373**, Issue 6, Pages 636-643, (2009).

"Compatible transformations for a qudit decoherence-free/noiseless encoding," C Allen Bishop and M. Byrd, *J. Phys. A: Math. Theor.* **42**, 055301 (2009).

"Self-Protected Quantum Algorithms Based on Quantum State Tomography," Lian-Ao Wu and Mark Byrd, *Qu. Info. Proc.* **8**, page 1 (2009). *arXiv preprint:* quant-ph/0702047.

"Methods for Producing Decoherence-Free States and Noiseless Subsystems Using Photonic Qutrits," C. Allen Bishop and Mark Byrd, *Phys. Rev. A* **77**, 012314 (2008). *arXiv preprint:* quant-ph/0709.0021.

"General depolarized pure states: Identification and properties," Mark Byrd and Gavin K. Brennen, *Physics Letters A*, Volume **372**, Issue 11, Pages 1770-1782 (2008). *arXiv preprint:* quant-ph/0706.2000.

"Decoherence-free/Noiselss Subsystems for Qudits," Mark Byrd and C. Allen Bishop, In Proceedings of the 8th International Conference on Quantum Communication, Measurement and Computing, 28th November-3rd December, 2006, Tsukuba, Japan, Eds. O. Hirota, J.H. Shapiro and M. Sasaki, NICT Press, pg. 85.

"Geometry of d-state Systems, Pure and Mixed," Mark Byrd, Luis J. Boya, Mark Mims, and E.C.G. Sudarshan. Proceedings of the International Conference on Particles and Fields, Jaca, Spain, J. Phys.: Conf. Ser. 87 012006 doi:10.1088/1742-6596/87/1/012006.

"Control and Error Prevention in Condensed Matter Quantum Computing Devices," Mark Byrd and Lian-Ao Wu, Int. J. Mod. Phys. B, Vol. 21, Nos. 13-14 (2007) 2505-2516.

"Implications of Qudit Superselection Rules for the Theory of Decoherence-free Subsystems," Mark Byrd, *Physical Review A*, **73**, 032330 (2006).

"Elliptical orbits in the Bloch sphere," with Aikaterina Mandilara, John W. Clark, and Mark Byrd *Journal of Optics B*, **7**, S1 (2005).

"Pairing Model Simulation on a Quantum Computer," Lian-Ao Wu, Mark Byrd, and Daniel A. Lidar. *Condensed Matter Theories* vol 20, (2005).

"Generalized Leakage Elimination for Physical and Encoded Qubits," M. Byrd, D.A. Lidar, L.-A. Wu and P. Zanardi. *Phys. Rev. A* **71**, 052301 (2005).

"Overview of Quantum Error Prevention and Leakage Elimination," M. Byrd, L.-A. Wu and D.A. Lidar, *Journal of Modern Optics* **51**, 2449 (2004).

"Characterization of the Positivity of the Density Matrix in Terms of the Coherence Vector Representation," Mark Byrd and Navin Khaneja, *Phys. Rev. A* **68**, 062322 (2003).

Reply to: "Comment on 'Polynomial-Time Simulation of Pairing Models on a Quantum Computer, "' M. Byrd, L.-A Wu and D.A. Lidar, *Phys. Rev. Lett* 90, 249804, (2003), `quant-ph/0305159`.

"An Empirical Approach to Dynamical Decoupling Operations," M. Byrd and D.A. Lidar, *Phys. Rev. A*, **67**, 012324 (2003), `quant-ph/0205156`.

"Efficient Leakage Error Elimination for Physical and Encoded Qubits," L.-A. Wu, M. Byrd, and D.A. Lidar, *Phys. Rev. Lett.* 89, 127901 (2002), `quant-ph/0202168`.

"SU(4) Euler Angle Parameterization and Bipartite Density Matrices," Todd Tilma, E. C. G. Sudarshan, and Mark Byrd *J. Phys. A: Math. Gen.* 35 (2002) 10445.

"Combined Error Correction Techniques for Quantum Computing Architectures," Mark Byrd and Daniel Lidar *J. Mod. Opt.*, **50**, (No.8) 1285 (2002), `quant-ph/0210072`.

"Combined encoding, recoupling, and decoupling solution to problems of decoherence and design in solid-state quantum computing," Mark Byrd, D.A. Lidar, *Phys. Rev. Lett.* 89, 047901 (2002), `quant-ph/0112054`.

"Tailored Quantum Error Correction: Theory and Experiment," Mark Byrd, D.A. Lidar and Aephraim Steinberg. *Proceedings of the Dallas Nov. 26-29, DARPA-QuIST Meeting on Quantum Computing* (2001).

"Bang-Bang Operations from a Geometric Perspective," Mark Byrd and D.A. Lidar, *Quantum Information Processing*, Vol. 1, No. 1-2, page 19, (2002). `quant-ph/0110121`

"Testing Pairing Models on a Quantum Computer," L.-A. Wu, Mark Byrd, and D.A. Lidar, *Phys. Rev. Lett.* 89, 057904 (2002), `quant-ph/0108110`

"Empirical Determination of Bang-Bang Operations," Mark Byrd and Daniel Lidar, *Proceedings of the International Conference on Quantum Information*, (ICQI-01) Rochester, NY.

"Bures Measures over the Spaces of Two and Three-Dimensional Density Matrices," Mark Byrd and Paul B. Slater, *Phys. Lett. A* **283**, 3-4, (2001) 152-156. `quant-ph/0004055`.

"Geometric Phases for Three-State Systems," Mark Byrd.arXiv:quant-ph/9902061

"Clifford Periodicity from Finite Groups," Luis J. Boya and Mark Byrd `math-ph/9902013`. *J. Phys. A* **32** Issue 18, L201-L205 (1999).

"$SU(3)$ Revisited," with E. C. G. Sudarshan.
J. Phys. A **31** (1998) 9255-9268.

"Differential geometry on $SU(3)$ with applications to 3-state systems,"
J. Math. Phys. **39** (11) (1998) 6125-6136.

Grants

ARO, $18,000, for QEC11, the International Conference on Quantum Error Correction, Co-PIs and Co-organizers: Daniel Lidar and Todd Brun.

IARPA, "Quantum Information Science," (Large collaborative grant involving Telcordia (Lead) Penn State, University of Massachusetts, Louisiana State University, and Southern Illinois University.) Amount: $689,079 (my part), Duration: 4 years, Began August 2011.

NSF: Southern Illinois HPC Infrastructure (SIHPCI): Amount $370,000, Co-PI (PI: Shaikh Ahmed, EE)

National Science Foundation, CISE CAREER Award, "Practical Quantum Error Prevention Protocols Involving Quantum Systems With More Than Two Orthogonal States," Amount: $400,000, Duration: June 2006 - May 2011.

Southern Illinois University Office of Research and Development Seed Grant, "Identifying and Using Entangled Quantum States in Quantum Computing and Quantum Cryptography," Amount: $13,918, Duration: 2004-2005 Academic Year.

References

E. C. G. Sudarshan
Department of Physics
University of Texas at Austin
Austin TX 78712-1081
Phone: (512) 471-5229
Email: sudarshan@physics.utexas.edu

Daniel Lidar
Departments of Physics, Chemistry, and Electrical Engineering
University of Southern California
Los Angeles, CA 90089-1062
Phone: (213) 740-0198
Email: lidar@usc.edu

Lian-Ao Wu
Department of Theoretical Physics and History of Science
The Basque Country University (EHU/UPV)
Ikerbasque Foundation
48080 Bilbao, Spain
Phone: 946-015-395 (O)
Email: lianao_wu@ehu.es

Samir Aouadi
Physics Department
Southern Illinois University
Carbondale, IL 62901
Phone: (618) 453-3659
Email: saouadi@physics.siu.edu

Tom Chapuran
Senior Scientist
Applied Communications Sciences
One Telcordia Drive
Piscataway, NJ 08854-4151
Email: tchapuran@appcomsci.com

Other references are available upon request.