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ACADEMIC DEGREES

Ph.D.   1991, The University of Texas at Austin
             Mathematics
             Speciality: non-commutative ring theory
             Thesis: Extension and Contraction Properties of Dubrovin Valuation
             Rings

B.A.   1980, Rice University
             Mathematics and Economics
             Honors: Magna cum Laude

PRESENT POSITION

9/03 –Present   **Professor**; Department of Mathematics and Computer Science, Denison
                    University, Granville, Ohio, 43023.

PREVIOUS POSITIONS

8/96 – 8/03   **Associate Professor**; Department of Mathematics and Computer Science,
                    Denison University, Granville, Ohio, 43023.

8/90 – 7/96   **Assistant Professor**; Department of Mathematics and Computer Science,
                    Denison University, Granville, Ohio, 43023.

1/90 – 7-90   **Instructor**; Department of Mathematics and Computer Science,
                    Denison University, Granville, Ohio, 43023.

8/88 – 12/89   Austin Community College

8/89 – 12/89   **Learning Specialist**; Learning Skills Center; The University of Texas at
                    Austin, Austin, Texas, 78701.

8/87 – 5/89   **Assistant Instructor**; Department of Mathematics; The University
                    of Texas at Austin, Austin, Texas, 78701.

1/87 – 5/87	**Research Assistant**; Department of Mathematics; The University of Texas at Austin, Austin, Texas, 78701.
9/83 – 8/87	**Teaching Assistant**; Department of Mathematics; The University of Texas at Austin, Austin, Texas, 78701.
1/84 – 8/86	**Bank Consultant**; Independent consultant to C.E.O. of Guaranty National Bank, Austin, Texas.
10/81 – 5/83	**Vice-President/Controller**; InterFirst Bank – Post Oak, Houston, Texas.
5/79 – 10/81	**Investment Analyst**; Republic of Texas Savings, Houston, Texas.

JOURNAL ARTICLES

Schumacher, B., & Westmoreland, M. (in press). "Reverend Bayes takes the Unexpected Examination." *Math Horizons*.

Schumacher, B., & Westmoreland, M. (2006, October). "Quantum one-time keypad," *Physical Review A*, 74, No. 4.

Fressola, A., Krone, J., Paunov, S., & Westmoreland, M. (2006, January). "Characterization of Boolean Topological Logics." *Journal of Multiple - Valued Logic*.

Linden, N., Popescu, S., Schumacher, B., & Westmoreland, M. (2005, August). "Reversibility of local transformations of multiparty entanglement." *Journal of Quantum Information Processing*, 4, 241-250.

Schumacher, B., & Westmoreland, M. (2005, February). "Locality and information transfer in quantum operations." *Journal of Quantum Information Processing*, 4, 13-34.

Schumacher, B., & Westmoreland, M. (2002, April). "Approximate quantum error correction." *Journal of Quantum Information Processing*, 1, 5-12.

Schumacher, B., & Westmoreland, M. (2002, September). "Entanglement measures and quantum channels." Special issue on quantum information theory, *Journal of Mathematical Physics,* 43, Number 9, 4279-4285.

Schumacher, B., & Westmoreland, M. (2002). "Relative entropy in quantum information theory." *American Mathematical Society Contemporary Mathematics Series: Quantum Information and Quantum Computation"*, 305, American Mathematical Society, Providence.

Krone, J., & Westmoreland, M. (2002). "Implication in twin open set logic." *Collision-Based Computing, Lecture Notes in Computer Science*. Andrew Adamatzky (Editor), Springer Verlag, New York.

Schumacher, B., & Westmoreland, M. (2001, September). "Indeterminate length quantum coding." *Physical Review A*, 64, 042304.

Schumacher, B., & Westmoreland, M. (2001, February). "Optimal signal ensembles." *Physical Review A*, 63, 022308.

Krone, J., & Westmoreland, M. (2001). "Collision models for multiple-value logic gates." *Journal of Multiple Valued Logic*, 6, 405-421.

Schumacher, B., & Westmoreland, M. (1999, September). "Characterizations of Classical and Quantum Communications Processes." *Chaos, Solitons & Fractals*, 10, 1719-1736.

Schumacher, B., & Westmoreland, M. (1998). "Classical Capacity of Quantum Channels, Coherent Quantum Information and Quantum Privacy." *Proceedings of the 1998 IEEE International Symposium on Information Theory*.

Schumacher, B., & Westmoreland, M. (1999). "Capacities of Quantum Channels and Quantum Coherent Information." *Quantum Computing and Quantum Communicaitons, Lecture Notes in Computer Science 1509.* Springer Verlag, New York.

Schumacher, B., & Westmoreland, M. (1998, June). "Coherent information and quantum cryptography." *Physical Review Letters,* 80, 5695-5697.

Krone, J., Schumacher, B., & Westmoreland, M. (1998, September). "Analysis of billiard ball computation using phase space logics." *Physica D*, 120, 236-252.

Schumacher, B., & Westmoreland, M. (1997, July). "Sending classical information via noisy quantum channels." *Physical Review A*, 56, 131-138.

Schumacher, B., Westmoreland, M., & Wootters, W. (1996, April). "Limitation of the amount of accessible information in a quantum channel." *Physical Review Letters*, 76, 3452.

Hausladen, P., Schumacher, B., Westmoreland, M., & Wootters, W. (1996, September). "Classical information capacity of a quantum channel." *Physical Review A*, 54, 1869-1876.

Bailey, S., Schumacher, B., & Westmoreland, M. (1996, January). "Three-valued logics for classical phase spaces." *International Journal of Theoretical Physics*, 35, Number 1, 31-62.

Hausladen, P., Schumacher, B., Westmoreland, M., & Wootters, W. (1995)."Sending classical bits via quantum its." *Fundamental Problems in Quantum Mechanics*, D. Greenberger & A. Zeilinger, Editors, New York Academy of Sciences.

Schumacher, B., & Westmoreland, M. (1994, June). "Zeno's arrow and classical phase space logics." *Foundations of Physics Letters*, 7, Number 3, 259-271.

Schumacher, B., & Westmoreland, M. (1993, August). "Non-Boolean derived logics for classical systems." *Physical Review A*, 48, Number 2, 977-985.

WORK IN PROGRESS

Schumacher, B., & Westmoreland, M. "Thermodynamic Cost of Communication."

Khoury, M., Schumacher, B., & Westmoreland, M. "Transmitted Pure States in Quantum Channels."

PRESENTATIONS

"Quantum Mutual Information and the One-Time Pad." International Conference on Quantum Information; Rochester, New York, June 15, 2007.

"Bayesian Analysis of a Paradox of Induction." Susquehanna Mathematics Colloquium; Selinsgrove, Pennsylvania, March, 2006.

"Reverend Bayes Takes the Unexpected Examination." College of Wooster Mathematics Colloquium; Wooster, Ohio, November, 2005.

"Topological Logics for Classical Mechancial Systems." Summer Conference on Topology and its Applications; Denison University, Granville, Ohio, July, 2005.

"Is the Holevo capacity additive?" Institute for Quantum Information Seminar; California Institute of Technology, Pasadena, California, March 12, 2003.

"Approximate quantum error correction." 2002 Special session on quantum information at the Fall 2002 Eastern Section Meeting of the American Mathematical Society at Northeastern University, October, 2002.

"Perfect and Approximate Quantum Error Correction." Feynman Festival; University of Maryland, College Park, Maryland, August, 2002.

With B. Schumacher, *"Entanglement measures and quantum channels."* 2001 International Conference on Quantum Information; University of Rochester, Rochester, New York, June, 2001.

"Thermodynamic Cost of Quantum Communication." Special session on quantum information theory at the Spring 2000 Meeting of the Eastern Section of the American Mathematical Society, Lowell, Massachusetts, April, 2000.

"Relative Entropy and Multiparty Entanglement." Special session on quantum information theory at the annual meeting of the American Mathematical Society in Washington, D.C., January, 2000.

"Optimal Signal Ensembles." 1999 Colloquium on the Foundations of Quantum Mechanics; University of Maryland Baltimore County, August, 1999.

"Classical Capacity of Quantum Channels, Coherent Quantum Information and Quantum Privacy." 1998 IEEE International Symposium on Information Theory; Massachusetts Institute of Technology, August, 1998.

"Quantum Entanglement: The Weirdest Thing we do not Know." Ohio Colleges Speaker's Circuit; Kenyon College, Gambier, Ohio, March 17, 1998.

"The Weirdest Thing we do not Know: Quantum Entanglement." Denison Faculty Luncheon; Denison University, Granville, Ohio, March 3, 1998.

"Capacities of Quantum Channels and Quantum Coherent Information." NASA International Conference on Quantum Computing and Quantum Communications; Palm Springs, California, February, 1998.

"Quantum Coherent Information and Quantum Privacy." Ohio Section of the American Physical Society; Miami, Ohio, October, 1997.

"An Information Theoretic Interpretation of von Neumann Entropy." PhysComp 1996 meeting; Boston, Massachusetts, November, 1996.

"Classical Information Capacity of a Quantum Channel." Special session on quantum information theory at the annual meeting of the American Mathematical Society; Orlando, Florida, January, 1996.

"Three-valued Logics and Zeno's Arrow." Ohio College Speaker's Circuit; Ohio Wesleyan University, Delaware, Ohio, April, 1995.

"Quantum Information Theory." Undergraduate Physics Colloquium; Denison University, Granville, Ohio, March, 1995.

"Three-valued Subversive Thoughts about Logic." Denison Scientific Association; Denison University, Granville, Ohio, February, 1995.

"Nonstandard Logics and Zeno's Arrow." Undergraduate Physics Colloquium; Denison University, Granville, Ohio, February, 1993.

"Nonclassical Logics for Classical Mechanics." Ohio College Speaker's Circuit; Wooster College, Wooster, Ohio, November, 1992.

"Non-Euclidean Geometry." Denison Honors Program Chowder Hour; Denison University, Granville, Ohio, November, 1991.

"Quantum Logic." Denison Scientific Association; Denison University, Granville, Ohio, November, 1991.

"Subversive Thoughts about Logic." Ohio College Speaker's Circuit; Kenyon College, Gambier, Ohio, February, 1991 and Oberlin College, November, 1991.

AFFILIATIONS

The American Mathematical Society (AMS)

The American Physical Society (APS)

Sigma Pi Sigma (Physics Honorary Society)

Pi Mu Epsilon (Mathematics Honorary Society)

Sigma Xi (Scientific Research Honorary Society)

Institute of Electronic and Electrical Engineers