

CURRICULUM VITAE

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Biographical Data

Married to Ginette *née* Brillon, Three Children
U. S. Citizen
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Education

Regis High School, New York City
University of Notre Dame, B. S. 1963
Harvard University, A. M. 1964, Ph. D. 1967

Fellowships

Woodrow Wilson Fellow, Harvard University, 1963-64
National Science Foundation Predoctoral Fellow and
Danforth Fellow, Harvard University, 1963-67
National Academy of Sciences-National Research Council
Resident Research Associate, National Bureau of Standards,
Washington, D.C., 1967-69
Alexander von Humboldt Stiftung, 1978 (declined)
U. S. Department of Energy Outstanding Junior Investigator, 1981-84

Experience

Maître de Conférences Associé, Université de Nice, 1969-70
Assistant Professor, Wesleyan University, 1970-73
Attaché de Recherche, Saclay, 1973-74
Attaché de Recherche, École Polytechnique, 1974-75
Chargé de Recherche, Orsay, 1975-76
Maître de Recherche Associé, Orsay, 1976-77
Visiting Assistant Professor, Louisiana State University, 1977-78
Visiting Associate Professor, Indiana University, 1978-79
Research Associate, Harvard University, 1979-12/1980
Assistant Professor, University of New Mexico, 1/1981-84
Associate Professor, University of New Mexico, 1984-
Visiting Associate Professor and Visiting Scholar, Harvard University, 1987-88
AWU-DOE Faculty Fellow, Lawrence Berkeley Laboratory, Summer 1992
Professor, University of New Mexico, 1994-

Research Interests

“Noncompact” lattice gauge theory, improving the standard model, TeV phenomenology, particle astrophysics, unified gauge theories, supersymmetry, quantum gravity, composite models, strings, and nonperturbative phenomena in field theory; neural networks, genetic algorithms, and machine learning; and biophysics and medicine.

Research Grants

U. S. Department of Energy Outstanding Junior Investigator, 1981–84
Principal Investigator Funded by the Department of Energy, 1981–98
Funding levels: 1981–’82: \$15,000; ’82–’83: \$20,000; ’83–’84: \$25,000; ’84–’85: \$30,000;
’85–’86: \$25,000; ’86–’87: \$28,000; ’87–’88: \$28,000; ’88–’89: \$28,000; ’89–’90: \$29,000;
’90–’91: \$30,000; ’91–’92: \$33,000; ’92–’93: \$51,400; ’93–’94: \$45,000;
’94–’95: \$30,000; ’95–’96: \$28,000; ’96–’97: \$28,000; ’97–’98: \$27,000.
Total 1981–’98: \$500,400.

Courses Taught

Physics for poets, general physics, linear algebra, atomic and nuclear physics, differential equations, mathematical methods, mechanics, statistical mechanics, electrodynamics, quantum mechanics, group theory, quantum field theory, unix, and fortran.

References

Mallinckrodt Professor of Physics Roy J. Glauber
Lyman Laboratory of Physics
Harvard University; Cambridge, MA 02138

Professor Don B. Lichtenberg
Physics Department
Indiana University; Bloomington, IN 47405

Dr. Michael Creutz
Physics Department
Brookhaven National Laboratory; Upton, L.I., NY 11973

Professor Alain Comtet
Division de Physique Théorique
Institut de Physique Nucléaire
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Publications

- [1] “Coherent-State Representations for the Photon Density Operator,” *Phys. Rev.* 138, B1566 (1965).
- [2] “Ordered Expansions in Boson Amplitude Operators,” with R. J. Glauber, *Phys. Rev.* 177, 1857 (1969).
- [3] “Density Operators and Quasiprobability Distributions,” with R. J. Glauber, *Phys. Rev.* 177, 1882 (1969).
- [4] “Pure States and the P Representation,” *Phys. Rev.* 180, 1239 (1969).
- [5] “Regularization of the P Representation,” *Phys. Rev.* 180, 1244 (1969).
- [6] “A Basic Discontinuity Equation,” with H. P. Stapp, *Phys. Rev.* D6, 1007 (1972).
- [7] “Generalized Optical Theorems and Steinmann Relations,” with H. P. Stapp, *Phys. Rev.* D8, 2714 (1973).
- [8] “Optical Theorems for General Collisions,” *Lett. Nuovo Cimento* 10, 577 (1974).
- [9] “Optical Theorems and Steinmann Relations,” with H. P. Stapp, *Ann. Phys. (N.Y.)* 90, 438 (1975).
- [10] “Generalized Optical Theorems,” in *Structural Analysis of Collision Amplitudes (Les Houches 1975)*, eds. R. Balian and D. Iagolnitzer, North Holland, 1976), p. 137.
- [11] “Multiple Discontinuities for 2-to-4 Processes,” with H. P. Stapp, *Ann. Inst. Henri Poincaré*, A26, 193 (1977).
- [12] “Extended Particles and Solitons,” *Phys. Lett.* 53B, 174 (1974) and reprinted in *Coherent States* (eds. J. R. Klauder and B.-S. Skagerstam, World Scientific, 1985), p. 877.
- [13] “Extended Particles and Polarons,” *Phys. Lett.* 56B, 275 (1975).
- [14] “Solitons,” in *VIIe Journées d’Études (Méribel, IPN Orsay, 1976)*, Chapter XV.
- [15] “Mass Formulas for Static Solitons,” with A. Comtet and R. J. Glauber, *Phys. Lett.* 64B, 283 (1976).
- [16] “The Subsidiary Condition in Quantum Electrodynamics,” *Lett. Nuovo Cimento* 20, 232 (1977).
- [17] “Scalar-Vector Instantons in n Dimensions: Surface Terms,” with A. Comtet, *J. Math. Phys.* 19, 758 (1978).
- [18] “Topological Cohesion,” with N. Stoltzfus, *J. Math. Phys.* 19, 1381 (1978).

- [19] “Example of Color Screening,” *Phys. Rev. Letters* 41, 599 (1978).
- [20] “General Internal Gauge Symmetry,” *Phys. Rev.* D18, 2930 (1978).
- [21] “Soliton-Generating Differential Equations in 3 + 1 Dimensions,” with R. G. Newton, *Physica Scripta* 20, 502 (1979).
- [22] “Gauge Invariance and the Quark-Antiquark Static Potential,” with D. Stump, *Phys. Rev.* D20, 540 (1979).
- [23] “Comment on the Wilson-Loop Formula,” with D. Stump, *Phys. Rev.* D20, 2096 (1979).
- [24] “Soluble Gauge Theory of a Non-Compact Group,” *Phys. Rev.* D20, 2636 (1979).
- [25] “Nonlinear Internal Symmetry,” *J. Math. Phys.* 21, 2676 (1980).
- [26] “Statistical Enhancement of Gauge Invariance,” with P. Denes, *Lett. Nuovo Cimento* 33, 184 (1982).
- [27] “On the Unification of the Gravitational and Electronuclear Interactions,” *Phys. Rev.* D26, 1916 (1982).
- [28] “Unitary Gauge Theories of Noncompact Groups,” with S. Özenli, *Phys. Rev.* D27, 1396 (1983).
- [29] “Energy Loss by Slow Magnetic Monopoles,” with J. Gea-Banacloche, A. Comtet, and D. Rossbach, *Lett. Nuovo Cimento* 37, 145 (1983).
- [30] “Tetrads, Broken Symmetries, and the Gravitational Constant,” *Z. Phys.* C23, 353 (1984).
- [31] “The Gravitational Constant,” *Lett. Nuovo Cimento* 39, 181 (1984), selected for Honorable Mention in the 1983 competition of the Gravity Research Foundation.
- [32] “Nuclear Proton Decay,” *Phys. Rev. Letters* 51, 1600 (1983).
- [33] “Path Integrals Without Lattices,” with R. Reeder, *Phys. Lett.* 136B, 77 (1984).
- [34] “Path Integrals Without Lattices for QED_2 ,” with R. Reeder and S. Prasad, *Phys. Lett.* B143, 213 (1984).
- [35] “Simplicial Interpolations for Path Integrals,” with R. Reeder and S. Prasad, *Phys. Lett.* B149, 377 (1984).
- [36] “Using MACSYMA to Write Long FORTRAN Codes for Simplicial-Interpolative Lattice Gauge Theory,” with R. Reeder, in *Advances in Lattice Gauge Theory* (D. W. Duke and J. F. Owens, eds., World Scientific, 1985), p. 424.

- [37] “The Strong CP Problem in a Compact Robertson-Walker Universe,” *Z. Phys.* C29, 537 (1985). This essay was selected for Honorable Mention in the 1985 competition of the Gravity Research Foundation.
- [38] “Comparison of the Simplicial Method with Wilson’s Lattice Gauge Theory for $U(1)_3$,” with R. Reeder, *Phys. Lett.* B168, 381 (1986).
- [39] “A Better Lattice Gauge Theory?,” with R. Reeder, in “*Coherence, Cooperation, and Fluctuations*,” (F. Haake, L. M. Narducci, and D. Walls, eds., Cambridge Univ. Press, 1986), p. 67.
- [40] “Testing Two Versions of Lattice Gauge Theory: Creutz Ratios in $U(1)_3$,” with R. Reeder, *J. Stat. Phys.* 43, 1043 (1986).
- [41] “Noncompact Simulations of $SU(2)_3$,” with S. Prasad, R. Reeder, and B. Richert, *Phys. Lett.* B181, 333 (1986).
- [42] “Lattice Artifacts and $SU(2)_3$ Simulations,” with M. Hebert and S. Prasad, *Phys. Lett.* B210, 198 (1988).
- [43] “Wilson Loops in Three Dimensions,” with S. Prasad, *Phys. Rev.* D40, 1274 (1989).
- [44] “Noncompact Simulations of $SU(2)$,” *Nucl. Phys. B (Proc. Suppl.)* 9, 529 (1989).
- [45] “Does Pure $SU(2)$ Gauge Theory Confine?,” *Phys. Lett.* B231, 294 (1989).
- [46] “How to Use MACSYMA to Write Long FORTRAN Codes,” *Comput. Phys.* 4, 159 (1990).
- [47] “Noncompact Simulations of $SU(2)$ at Strong Coupling,” *Proceedings of the Rice Meeting* (H. E. Miettinen, ed., World Scientific, 1990), p. 797.
- [48] “Noncompact Simulations of $SU(2)$ Gauge Theory at Strong Coupling,” *Nucl. Phys. B (Proc. Suppl.)* 20, 240 (1991).
- [49] “The Masses of the Lighter Quarks,” *J. Phys.* G 17, 1059 (1991).
- [50] “Symmetry Breaking by Fermions,” *Phys. Lett.* B269 (1991) 129.
- [51] “Report of the Subgroup on the Top Quark,” with R. M. Barnett, A. Bay, P. Bhat, A. Barbaro-Galtieri, W. Giele, J. F. Gunion, H. E. Haber, I. Hinchliffe, B. Hubbard, R. Kauffman, S. Klein, H. Ma, B. Margolis, L. Nodulman, F. Paige, A. Palounek, A. Para, R. Partridge, R. Thun, H.-J. Trost, H. Trotter, K. Wacker, C.-P. Yuan, in *Research Directions for the Decade – Proceedings of the 1990 Summer Study on High-Energy Physics*, edited by E. L. Berger (World Scientific, River Edge, NJ, 1992) p. 354.

- [52] “Why Is There Mass?”, in *The Vancouver Meeting* edited by D. Axen, D. Bryman, and M. Comyn (World Scientific, River Edge, NJ, 1992), p. 847.
- [53] “Static Forces in Noncompact SU(2),” *Nucl. Phys. B (Proc. Suppl.)* 26 (1992) 453.
- [54] “A More Effective Potential,” in *Proceedings of the XXVIth International Conference on High-Energy Physics*, edited by J. Sanford (American Institute of Physics Conference Proceedings No. 272, 1993), Vol. 2, p. 1461 and eprint hep-ph/9210273.
- [55] “Inflation Pressures,” with Jiří Podolský, in *The Fermilab Meeting, DPF '92* edited by C. H. Albright, P. H. Kasper, R. Raja, and J. Yoh (World Scientific Publishing Co. Pte. Ltd., 1993), Vol. 2, p. 1418, selected for Honorable Mention in the 1992 competition of the Gravity Research Foundation.
- [56] “A High-Statistics Simulation of SU(2) Gauge Theory,” in *The Fermilab Meeting, DPF '92* edited by C. H. Albright, P. H. Kasper, R. Raja, and J. Yoh (World Scientific Publishing Co. Pte. Ltd., 1993), Vol. 2, p. 1468.
- [57] “A Really Effective Potential,” in *The Fermilab Meeting, DPF '92* edited by C. H. Albright, P. H. Kasper, R. Raja, and J. Yoh (World Scientific Publishing Co. Pte. Ltd., 1993), Vol. 2, p. 1519.
- [58] “Noncompact Lattice Simulations of SU(2) Gauge Theory,” eprint hep-lat/9301010 and *Phys. Lett. B*304 (1993) 307.
- [59] “The Fourth Root of Gravity,” preprint UNM-frg and eprint gr-qc/9304014.
- [60] “Geometrical Representations of Gauge Fields,” with S. Raghavan, *J. Phys. A* 26 (1993) 7213.
- [61] “Inflation Pressures,” with Jiří Podolský, *J. Phys. G* 20 (1994) 571.
- [62] “Gauge Invariance and Confinement in Noncompact Simulations of SU(2),” *Nucl. Phys. B (Proc. Suppl.)* 34 (1994) 231 and eprint hep-lat/9312077.
- [63] “Noncompact Gauge-Invariant Lattice Simulations,” with G. Herling, hep-lat/9408022 and in *The Albuquerque Meeting, DPF '94* edited by S. Seidel, (World Scientific Publishing Co. Pte. Ltd., 1995), p. 1715.
- [64] “An Application of a More-Effective Potential,” in *The Albuquerque Meeting, DPF '94* edited by S. Seidel, (World Scientific Publishing Co. Pte. Ltd., 1995), p. 1361.
- [65] “Chameleonic Chirality,” with L. Crowell and D. Khetselius, in *The Albuquerque Meeting, DPF '94* edited by S. Seidel, (World Scientific Publishing Co. Pte. Ltd., 1995),

p. 1213.

- [66] “Noncompact Gauge-Invariant Simulations of $U(1)$, $SU(2)$, and $SU(3)$,” with G. Herling, *Nucl. Phys. B (Proc. Suppl.)* 42 (1995) 858 and hep-lat/9412113.
- [67] “An Effective Potential That Is Real,” LBL-32679, hep-ph/9301294, and *Phys. Rev. D* 52 (1995) 4704.
- [68] “Noncompact, Gauge-Invariant Simulations of $U(1)$, $SU(2)$, and $SU(3)$,” with G. Herling, *Phys. Lett. B* 365 (1996) 239.
- [69] “Lattice Fermions without Doublers,” hep-lat/9508013.
- [70] “Random Gauge Transformations in Noncompact $SU(2)$ Lattice Simulations,” *J. Phys. G* 22 (1996) 1373 and hep-lat/9406001.
- [71] “Better Actions,” with G. Herling, *Nucl. Phys. B (Proc. Suppl.)* 53 (1997) 787.
- [72] “Confinement Artifacts in the $U(1)$ and $SU(2)$ Compact Lattice Gauge Theories,” with G. Herling, hep-lat/9801009.
- [73] “Density Operators for Fermions,” with R. J. Glauber, *Phys. Rev. A* 59 (1999) 1538 and physics/9808029.
- [74] “Lattice Effective Actions and Light-Quark Confinement,” with G. Herling, *Nucl. Phys. B (Proc. Suppl.)* 73 (1999) 886 and hep-lat/9809149.
- [75] “Neutrinos Are Nearly Dirac Fermions,” hep-ph/9912416, selected by Maury Goodman as a “notable new reference” in the August 2000 issue of his *Long-Baseline Neutrino Oscillation Newsletter* (<http://gate.hep.anl.gov/ndk/longbnews/0008.html>).
- [76] “Elements of Supersymmetry,” hep-ph/9907295.
- [77] “Simulations of Protein Folding,” with M. Cahill and M. Fleharty, *Nucl. Phys. B (Proc. Suppl.)* 83-84 (2000) 929 and hep-lat/9909080.
- [78] “Toward a Neutrino Mass Matrix,” *Int. J. Mod. Phys. A* 16 (2001) 712 and hep-ph/0011022.
- [79] “Supersymmetry without Grassmann Variables,” *J. High Energy Phys.* 06(2001)002 and hep-th/0102058.
- [80] “Proteins Wriggle,” with M. Cahill and S. Cahill, *Biophys. J.* 82(#5)2665-2670(2002) and cond-mat/0108218.
- [81] “The Kinematics of Protein Folding,” with S. Cahill and M. Cahill, *J. Comput. Chem.* 24(#11): 1364-1370 (2003) and physics/0205043.

- [82] “Riemannian Gauge Theory and Charge Quantization,” with M. Serna, *J. High Energy Physics* JHEP 10 (2003) 054 and hep-th/0205250.