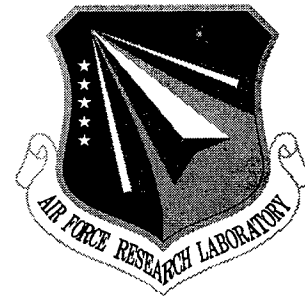AFRL-IF-RS-TR-2001-76 Vol II (of four)
Final Technical Report
May 2001

EXPLORING A THEORY DESCRIBING THE PHYSICS OF INFORMATION SYSTEMS, INFORMATION PHYSICS BIBLIOGRAPHY

Zetetix

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.

AIR FORCE RESEARCH LABORATORY
INFORMATION DIRECTORATE
ROME RESEARCH SITE
ROME, NEW YORK

20010713 055

This report has been reviewed by the Air Force Research Laboratory, Information Directorate, Public Affairs Office (IFOIPA) and is releasable to the National Technical Information Service (NTIS). At NTIS it will be releasable to the general public, including foreign nations.

AFRL-IF-RS-TR-2001-76 Vol. II (of four) has been reviewed and is approved for publication.

APPROVED: *Deborah A. Cerino*

DEBORAH A. CERINO
Project Engineer

FOR THE DIRECTOR: *James A. Collins*

JAMES A. COLLINS, Acting Chief
Information Technology Division
Information Directorate

EXPLORING A THEORY DESCRIBING THE PHYSICS OF INFORMATION SYSTEMS, INFORMATION PHYSICS BIBLIOGRAPHY

Scott Young Harmon

Contractor: Zetetix
Contract Number: F30602-00-C-0104
Effective Date of Contract: 06 April 2000
Contract Expiration Date: 05 October 2000
Short Title of Work: Exploring a Theory Describing the Physics of Information Systems, Information Physics Bibliography
Period of Work Covered: Apr 00 - Oct 00

Principal Investigator: Scott Young Harmon
Phone: (818) 991-0480
AFRL Project Engineer: Deborah A. Cerino
Phone: (315) 330-1445

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	MAY 2001	Final Apr 00 - Oct 00

4. TITLE AND SUBTITLE
EXPLORING A THEORY DESCRIBING THE PHYSICS OF INFORMATION SYSTEMS, INFORMATION PHYSICS BIBLIOGRAPHY

5. FUNDING NUMBERS
C - F30602-00-C-0104
PE - 63760E
PR - IAST
TA - 00
WU - P1

6. AUTHOR(S)
Scott Young Harmon

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Zetetix
PO Box 2640
Agoura CA 91376-2640

8. PERFORMING ORGANIZATION REPORT NUMBER
N/A

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Defense Advanced Research Projects Agency   Air Force Research Laboratory/IFTD
3701 North Fairfax Drive   525 Brooks Road
Arlington VA 22203-1719   Rome New York 13441-4505

10. SPONSORING/MONITORING AGENCY REPORT NUMBER
AFRL-IF-RS-TR-2001-76
Vol II (of four)

11. SUPPLEMENTARY NOTES
Air Force Research Laboratory Project Engineer: Deborah A. Cerino/IFTD/(315) 330-1445

12a. DISTRIBUTION AVAILABILITY STATEMENT
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

This project accomplished all of its objectives: document a theory of information physics, conduct a workshop on planning experiments to test this theory, and design experiments that validate this theory. Information physics proposes quantitative relationships between observable information flows and changes in the content information systems maintain. This theory explains all flows within information systems as either diffusive or force-driven. The forces driving information flows arise from the existence of goal content. The workshop participants discussed various theories and considered experiments that characterize the macroscopic phenomena underlying complex information system behavior. These participants identified experimental opportunities that exploit existing databases, execute simulations and conduct traditional controlled experiments. They recommended that focussed experiments to test theories explaining information system phenomena were feasible today. The experiment plan builds upon the workshop's result and proposes experiments that measure information device energy dissipation, test the independence of symbol execution work from device efficiency, measure information diffusion rates in information systems, and measure force-driven information flows. These experiments are both technically and programmatically feasible. When validated, the proposed theory can guide designers to reliably build more effective, secure and predictable information systems.

14. SUBJECT TERMS
Information Physics, Physics of Computation, Information Theory, Thermodynamics

15. NUMBER OF PAGES
60

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL

The bibliography presented below was collected to explore the prior work related to information physics. This bibliography includes references from the fields of complexity theory, the theory of computation, computational complexity, the physics of computation, thermodynamics, information theory, reversible computation, and quantum computation among others. Regrettably, the coverage of these fields is largely incomplete, especially in the areas of complexity theory, information theory and quantum computation, all of which contain vast bodies of knowledge in themselves. However, the purpose of this bibliography was not to provide complete coverage of all possible sources of information but more to collect possible pointers into the fields that contain knowledge relevant to information physics. Particular effort was spent in collecting the references related to the physics of computation so any bias resides in that direction.

As with all bibliographies of dynamic fields of study, this one represents a snapshot of the field as of October 2000. Many of the entries contained herein are incomplete, some more than others. The contents of this bibliography reside in a bibliographic database and will be updated as periodically as possible. The author invites comments, corrections and additions to this bibliography and may be contacted through the information presented on the cover page.

(1)   H. Abelson & P. Andrae, "Information Transfer and Area-Time Tradeoffs for VLSI Multiplication," Comm. of the ACM, 1980, np.

(2)   C. Adami & N.J. Cerf, "Complexity, Computation, and Measurement," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 7-11.

(3)   C. Adami & N.J. Cerf, "von Neumann Capacity of Noisy Quantum Channels," Physical Review A, 56, 1997, pp 3470-.

(4)   R.L. Adler, A.G. Konheim & M.H. McAndrew, "Topological Entropy," Trans. Am. Mathematical Soc., 114, 1965, pp 309-319.

(5)   R. Agelink & N. van der Heijden, "Information in Social Systems: Implications for Steering and Regulation," Proc. 1st Conf. on the Foundations of Information Science, Madrid, Spain, 1994, np.

(6)   A. Aggarwal, A. Chandra & P. Raghavan, "Energy Consumption in VLSI Circuits," Proc. 20th ACM Symp. on the Theory of Computing, Chicago, IL, USA, 1988, ACM Press, New York, NY, USA, pp 205-216.

(7)   M. Agu & M. Yamada, "Short-Time Information Entropy as a Complexity Measure," Japanese J. of Applied Physics, 37 (11B), 1998, pp L1415-L1417.

(8)   A. Aho, J.D. Ullman & M. Yannakakis, "On Notions of Information Transfer in VLSI Circuits," Proc. 15th ACM Symp. on the Theory of Computing, 1983, ACM Press, New York, NY, USA, pp 133-139.

(9)   D.Z. Albert, "The Quantum Mechanics of Self-Measurement," Complexity, Entropy and the Physics of Information, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 471-476.

(10)   A.E. Allahverdyan & D.B. Saakian, "Strengthened Lindblad inequality: Applications in nonequilibrium thermodynamics and quantum information theory," Physical Review E, 58 (1), 1998, pp 1148-1151.

(11)   R.L. Amoroso, "Engineering a Conscious Computer," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 12-16.

(12) M.P. Anantram & V. Roychowdhury, "Can Metastable States Affect Ground State Computing?," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 17-21.

(13) V.S. Anishchenko, W. Ebeling & A.B. Neiman, "Power Law Distributions of Spectral Density and Higher Order Entropy," Chaos, Solitons & Fractals, 4, 1994, pp 69-81.

(14) R. Ansorge & T. Sonar, "Information Theory, Abstract Entropy and the Mathematical Description of the Second Law of Thermodynamics," Zeits. fur Angewandte Mathematik & Mechanik, 77 (11), 1997, pp 803-821.

(15) H. Araki & E.H. Lieb, "Entropy Inequalities," Comm. of Mathematical Physics, 18, 1970, pp 160-170.

(16) P. Århem, "Vertical Information Flow in the Brain: On Neuronal Micro Events and Consciousness," Proc. 1st Conf. on the Foundations of Information Science, Madrid, Spain, 1994, np.

(17) W.R. Ashby, "Some Peculiarities of Complex Systems," Cybernetic Medicine, 9, 1973, pp 1-7.

(18) W.C. Athas, J.G. Koller & L.J. Svensson, "An Energy-Efficient CMOS Line Driver Using Adiabatic Switching," Proc. 4th IEEE Symp. on VLSI Design, 1994, IEEE Press, Piscataway, NJ, USA, pp 159-164.

(19) W.C. Athas & L.J. Svensson, "Reversible Logic Issues in Adiabatic CMOS," Proc. 3rd IEEE Workshop on Physics & Computation, Dallas, TX, 1994, IEEE Computer Society Press, Los Alamitos, CA, pp 111-118.

(20) W.C. Athas, L.J. Svensson, J.G. Koller, N. Tzartzanis & E.Y.-C. Chou, "Low-Power Digital Systems Based on Adiabatic-Switching Principles," IEEE Trans. on VLSI Systems, 2 (4), 1994, pp 398-407.

(21) G. Ausiello, "Abstract Computational Complexity and Cycling Computations," J. of Computer & System Sciences, 5, 1971, pp 118-128.

(22) N. Baas, "Higher Order Cognitive Processes," Toward a Scientific Basis for Consciousness: An Interdisciplinary Conference, Tucson, AZ, 1994, np.

(23) P.F. Bagwell & M.A. Alam, "Entropy Flow in a Mesoscopic Conductor and the Entropy of Erasure," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 271-275.

(24) P.A. Ballonoff, "Comparison of Rule Bound Systems Theory to Traditional Systems Theory," Cybernetics & Systems, 27 (4), 1996, pp 317-326.

(25) M. Ban, "State Reduction, Information and Antropy in Quantum Measurement Processes," J. of Physics A, 32 (9), 1999, pp 1643-1665.

(26) W. Banzhaf, "Competition as an Organizational Principle for Massively Parallel Computers?," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 229-231.

(27) X. Bar-Hillel, Y. Kasher & E. Shamir, "Measures of Syntactic Complexity," Machine Translation, A.D. Booth, ed., North-Holland, Amsterdam, The Netherlands, 1967, pp 30-50.

(28) A. Barenco, C.H. Bennett, R. Cleve, D.P. DiVincenzo, N.H. Margolus, P.W. Shor, T. Sleator, J.A. Smolin & H. Weinfurter, "Report on New Gate

Constructions for Quantum Computation," <u>Physical Review A</u>, **52**, 1995, pp 3457-3467.

(29) A. Barenco, C.H. Bennett, R. Cleve, D.P. DiVincenzo, N.H. Margolus, P.W. Shor, T. Sleator, J.A. Smolin & H. Weinfurter, "Elementary Gates for Quantum Computation," <u>Physical Review A</u>, **52** (5), 1995, pp 3457-3467.

(30) A. Barenco, D. Deutsch & A.K. Ekert, "Conditional Quantum Dynamics and Logic Gates," <u>Physical Review Lett.</u>, **74**, 1995, pp 4083-4086.

(31) J. Barham, "A Dynamical Model of the Meaning of Information," <u>Proc. 1st Conf. on the Foundations of Information Science</u>, Madrid, Spain, 1994, np.

(32) H. Barnum, C.M. Caves, C.A. Fuchs, R. Jozsa & B. Schumacher, "Noncommuting States Cannot Be Broadcast," <u>Physical Review Lett.</u>, **76** (15), 1996, pp 2818-2821.

(33) H. Barnum, C.A. Fuchs, R. Jozsa & B. Schumacher, "General Fidelity Limit for Quantum Channels," <u>Physical Review A</u>, **54**, 1996, pp 4707-4711.

(34) J.W. Barrett, "Quantum Mechanics and Algorithmic Complexity," <u>Complexity, Entropy and the Physics of Information</u>, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 375-380.

(35) H.B. Barrow, "The Absolute Efficiency of Perceptual Decision," <u>Trans. Royal Soc. London B</u>, **290**, 1980, pp 71-.

(36) S. Barta, "Relation between Information and Thermodynamic Entropy," <u>J. of Electrical Engineering</u>, **48** (7-8), 1997, pp 169-174.

(37) J. Barwise, D. Gabbay & C. Hartonas, <u>On the Logic of Information Flow,</u>,, 1995.

(38) J. Barwise & J. Seligman, "Imperfect Information Flow," <u>Proc. 8th IEEE Symp. on Logic in Computer Science</u>, 1993, pp 252-260.

(39) Y.M. Barzdin, "Algorithmic Information Theory," <u>Encyclopedia of Mathematics</u>, D. Reidel, ed., Kluwer Academic Publishers, 1988, Vol. 1, pp 140-142.

(40) J.E. Bates & H.K. Shepard, "Measuring Complexity Using Information Fluctuation," <u>Physics Lett. A</u>, **172**, 1993, pp 416-425.

(41) E.C. Behrman, J. Niemal, J.E. Steck & S.R. Skinner, "A Quantum-Dot Neural Network," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 22-24.

(42) J.D. Bekenstein, "Entropy Content and Information Flow in Systems with Limited Energy," <u>Physical Review D</u>, **30**, 1984, pp 1669-1679.

(43) P.A. Benioff, "The Computer as a Physical System: A Microscopic Quantum Mechanical Hamiltonian Model of Computers as Represented By Turing Machines," <u>J. of Statistical Physics</u>, **22**, 1980, pp 563-591.

(44) P.A. Benioff, "Quantum Mechanical Hamiltonian Models of Discrete Processes that Erase Their Own Histories: Application to Turing Machines," <u>Int. J. of Theoretical Physics</u>, **21** (3/4), 1982, pp 177-202.

(45) P.A. Benioff, "Quantum Mechanical Hamiltonian Models of Turing Machines," <u>J. of Statistical Physics</u>, **29**, 1982, pp 515-546.

(46) P.A. Benioff, "Quantum Mechanical Models of Turing Machines that Dissipate No Energy," <u>Physical Review Lett.</u>, **48**, 1982, pp 1581-1585.

(47) P.A. Benioff, "Quantum Mechanical Hamiltonian Models of Computers," <u>Annals of the New York Academy of Sciences</u>, **480**, 1986, pp 475-486.

(48) P.A. Benioff, <u>Review of Quantum Computation</u>, 1995.

(49) P.A. Benioff, "Unitary Dilation Models of Turing Machines in Quantum Mechanics," <u>Physical Review A</u>, **51**, 1995, pp 3513-3524.

(50) P.A. Benioff, "Hamiltonian Models of Quantum Computers which Evolve Quantum Ballistically," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 25-27.

(51) P.A. Benioff, "Transmission and Spectral Aspects of Tight-Binding Hamiltonians for the Counting Quantum Turing Machine," <u>Physical Review B</u>, **55**, 1997, pp 9482-9494.

(52) P.A. Benioff, "The Landauer Resistance and Band Spectra for the Counting Quantum Turing Machine," <u>Physica D</u>, **120** (1-2), 1998, pp 12-29.

(53) P.A. Benioff, "Simple Example of Definitions of Truth, Validity, Consistency, and Completeness in Quantum Mechanics," <u>Physical Review A</u>, **59**, 1999, pp 4223-4237.

(54) C.H. Bennett, "Logical Reversibility of Computation," <u>IBM J. of Research & Development</u>, **17**, 1973, pp 525-532.

(55) C.H. Bennett, "Dissipation-Error Tradeoff in Proofreading," <u>BioSystems</u>, **11**, 1979, pp 85-91.

(56) C.H. Bennett, "The Thermodynamics of Computation - A Review," <u>Int. J. of Theoretical Physics</u>, **21** (12), 1982, pp 905-940.

(57) C.H. Bennett, "On the Nature and Origin of Complexity in Discrete, Homogenous, Locally-Interacting Systems," <u>Foundations of Physics</u>, **16**, 1986, pp 585-592.

(58) C.H. Bennett, "On the Nature and Origin of Complexity in Discrete, Homogeneous, Locally-Interacting Systems," <u>Foundations of Physics</u>, **16**, 1986, pp 585-592.

(59) C.H. Bennett, "Information, Dissipation, and the Definition of Organization," <u>Emerging Syntheses in Science</u>, D. Pines, ed., Addison-Wesley, Reading, MA, 1987, pp 297-313.

(60) C.H. Bennett, "Demons, Engines, and the Second Law," <u>Scientific American</u>, **257** (5), 1987, pp 108-116.

(61) C.H. Bennett, "Logical Depth and Physical Complexity," <u>The Universal Turing Machine - A Half-Century Survey</u>, R. Herken, ed., Oxford University Press, Oxford, UK, 1988, Vol. 1, pp 227-258.

(62) C.H. Bennett, "Notes on the History of Reversible Computation," <u>IBM J. of Research & Development</u>, **32** (1), 1988, pp 16-24.

(63) C.H. Bennett, "Dissipation, Information, Computational Complexity and the Definition of Organization," <u>Emerging Synthesis in Science</u>, D. Pines, ed., Addison-Wesley, Reading, MA, 1988, pp 215-231.

(64) C.H. Bennett, "Quantum Information," <u>Physica Scripta</u>, **T76**, 1988, pp 210-217.

(65) C.H. Bennett, "Time-Space Trade-Offs for Reversible Computation," <u>SIAM J. on Computing</u>, **18** (4), 1989, pp 766-776.

(66) C.H. Bennett, "Computational Measures of Physical Complexity," Lectures in the Sciences of Complexity, D.L. Stein, ed., Addison-Wesley, 1989, pp 787-798.

(67) C.H. Bennett, "How to Define Complexity in Physics, and Why," Complexity, Entropy and the Physics of Information, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 137-148.

(68) C.H. Bennett, "Dissipation, Anisotropy, and the Stabilization of Computationally Complex States of Homogeneous Media," Physica A, 163, 1990, pp 393-397.

(69) C.H. Bennett, "Logical Depth and Other Algorithmically Defined Properties of Finite Objects," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 75-77.

(70) C.H. Bennett, "Certainty from Uncertainty," Nature, 362, 1993, pp 694-695.

(71) C.H. Bennett, "Complexity in the Universe," Physical Origins of Time Asymmetry, J.J. Halliwell, J. Perez-Mercader & W.H. Zurek, eds., Cambridge University Press, Cambridge, UK, 1994, pp 33-46.

(72) C.H. Bennett, "Night Thoughts, Dark Sight," Nature, 371, 1994, pp 479-480.

(73) C.H. Bennett, "Quantum Information and Computation," Physics Today, 48 (10), 1995, pp 24-30.

(74) C.H. Bennett, "Classical and Quantum Information Transmission and Interactions," Quantum Comminication, Computing, and Measurement, O. Hirota, A.S. Holevo & C.M. Caves, eds., Plenum Press, New York, NY, 1997, pp 25-40.

(75) C.H. Bennett, "Information Physics in Cartoons," Superlattices & Microstructures, 23 (3-4), 1998, pp 367-372.

(76) C.H. Bennett, "Classical and Quantum Information: Similarities and Differences," Frontiers in Quantum Physics, S.C. Lim, R. Abd-Shukor & K.H. Kwek, eds., Springer-Verlag, Singapore, 1998, pp 24-37.

(77) C.H. Bennett, "Future Directions for Quantum Information Theory," Introduction to Quantum Computation and Information, H.-K. Lo, T. Spiller & S. Popescu, eds., World Scientific Publishers, Singapore, 1998.

(78) C.H. Bennett, "Quantum Information Theory," Feynman and Computation: Exploring the Limits of Computers, A.J.G. Hey, ed., Perseus Books, Reading, MA, 1999, pp 177-190.

(79) C.H. Bennett, E. Bernstein, G. Brassard & U. Vazirani, "Strengths and Weaknesses of Quantum Computing," SIAM J. on Computing, 26, 1997, pp 1510-1523.

(80) C.H. Bennett, F. Bessette, G. Brassard, L. Salvail & J.A. Smolin, "Experimental Quantum Cryptography," J. of Cryptography, 5, 1992, pp 3-28.

(81) C.H. Bennett & G. Brassard, "Quantum Cryptography: Public Key Distribution and Coin Tossing," Proc. 1984 IEEE Int. Conf. on Computers, Systems & Signal Processing, Bangalore, India, 1984, pp 175-179.

(82) C.H. Bennett, G. Brassard, C. Crepeau, R. Jozsa, A. Peres & W.K. Wootters, "Teleporting an Unknown Quantum State via Dual Classical and Einstein-Podolsky-Rosen Channels," Physical Review Lett., 70 (13), 1993, pp 1895-1899.

(83) C.H. Bennett, G. Brassard, C. Crepeau & M.-H. Skubiszewska, "Practical Quantum Oblivious Transfer," <u>Advances in Cryptology, Proceedings of Crypto '91</u>, Springer-Verlag, Berlin, Germany, 1992, Vol. 576, pp 351-366.

(84) C.H. Bennett, G. Brassard & A.K. Ekert, "Quantum Cryptography," <u>Scientific American</u>, 1992, pp 50-57.

(85) C.H. Bennett, G. Brassard, R. Jozsa, D. Mayers, A. Peres, B. Schumacher & W.K. Wootters, "Reduction of Quantum Entropy by Reversible Extraction of Classical Information," <u>J. of Modern Optics</u>, **41**, 1994, pp 2307-2314.

(86) C.H. Bennett, G. Brassard & N.D. Mermin, "Quantum Cryptography without Bell's Theorem," <u>Physical Review Lett.</u>, **68**, 1992, pp 557-559.

(87) C.H. Bennett, G. Brassard, S. Popescu, B. Schumacher, J.A. Smolin & W.K. Wootters, "Purification of Noisy Entanglement and Faithful Teleportation via Noisy Channels," <u>Physical Review Lett.</u>, **76** (5), 1996, pp 722-725.

(88) C.H. Bennett & D.P. DiVincenzo, "Quantum Computing: Towards an Engineering Era?," <u>Nature</u>, **377**, 1982, pp 389-.

(89) C.H. Bennett & D.P. DiVincenzo, "Progress toward Quantum Computation," <u>Nature</u>, 1995, np.

(90) C.H. Bennett, D.P. DiVincenzo, J.A. Smolin & W.K. Wootters, "Mixed-State Entanglement and Quantum Error Correction," <u>Physical Review A</u>, **54** (5), 1996, pp 3824-3851.

(91) C.H. Bennett, P. Gacs, M. Li, P.M.B. Vitanyi & W.H. Zurek, "Thermodynamics of Computation and Information Distance," <u>25th ACM Symposium on the Theory of Computation (STOC93)</u>, 1993, ACM Press, pp 21-30.

(92) C.H. Bennett, P. Gacs, M. Li, P.M.B. Vitányi & W.H. Zurek, "Information Distance," <u>IEEE Trans. on Information Theory</u>, **IT-44** (4), 1998, pp 1407--1423.

(93) C.H. Bennett & G. Grinstein, "On the Role of Dissipation in Stabilizing Complex and Nonergodic Behavior in Locally Interacting Discrete Systems," <u>Physical Review Lett.</u>, **55**, 1985, pp 657-660.

(94) C.H. Bennett & R.W. Landauer, "The Fundamental Physical Limits of Computation," <u>Scientific American</u>, **253** (1), 1985, pp 48-56.

(95) C.H. Bennett & P.W. Shor, "Quantum Information Theory," <u>IEEE Trans. on Information Theory</u>, **IT-44**, 1998, pp 2724-2742.

(96) C.H. Bennett & S.J. Wiesner, "Communication via One- and Two-Particle Operators on Einstein-Podolsky-Rosen States," <u>Physical Review Lett.</u>, **69**, 1992, pp 2881-2884.

(97) D.B. Benson, "On Convolution," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 205-209.

(98) E. Bernstein & U. Vazirani, "Quantum Complexity Theory," <u>Proceedings of the 23th Annual ACM Symposium on the Theory of Computing (STOC95)</u>, 1993, ACM Press, New York, NY, pp 11-20.

(99) A. Berthiaume & G. Brassard, "Oracle Quantum Computing," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 195-199.

(100) A. Berthiaume, D. Deutsch & R. Jozsa, "The Stabilization of Quantum Computations," Proc. 3rd IEEE Workshop on Physics & Computation, Dallas, TX, 1994, IEEE Computer Society Press, Los Alamitos, CA, pp 60-62.

(101) T. Beth & M. Grassi, "Improved Decoding of Quantum Error Correcting Codes from Classical Codes," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 28-31.

(102) M. Biafore, "Universal Computation in Few-Body Automata," Complex Systems, 67, 1993, pp 221-239.

(103) M. Biafore, "Can Quantum Computers Have Simple Hamiltonians," Proc. 3rd IEEE Workshop on Physics & Computation, Dallas, TX, 1994, IEEE Computer Society Press, Los Alamitos, CA, pp 63-68.

(104) M. Biafore, "Cellular Automata for Nanometer-Scale Computation," Physica D, 70, 1994, pp 415-434.

(105) E. Biham & T. Mor, "Security of Quantum Cryptography against Collective Attacks," Physical Review Lett., 78, 1997, pp 2256-2259.

(106) R.E. Blahut, Principles and Practice of Information Theory, Addison-Wesley, 1987.

(107) M. Blum, "A Machine Independent Theory of the Complexity of Recursive Functions," J. ACM, 14, 1967, pp 322-.

(108) B.M. Boghosian & W. Taylor, IV, "Simulating Quantum Mechanics on a Quantum Computer," Physica D, 120 (1-2), 1998, pp 30-42.

(109) I.A. Boloshin & M.E. Herzenstein, "Information Physics: Hopes and Weak Points," Knowledge Organization, 20 (4), 1993, pp 194-.

(110) R.V. Book & J.H. Lutz, "On Languages with Very High Information Content," Proc. 7th Structure in Complexity Theory Conf., 1992, IEEE Computer Society Press, Los Alamitos, CA, pp 255-259.

(111) A. Borodin, "On Relating Time and Space to Size and Depth," SIAM J. on Computing, 6 (4), 1977, pp 733-744.

(112) D. Boschi, S. Branca, F. De Martini, L. Hardy & S. Popescu, "Experimental Realization of Teleporting an Unknown Pure Quantum State via Dual Classical and Einstein-Podolsky-Rosen Channels," Physical Review Lett., 80 (6), 1998, pp 1121-1125.

(113) D. Bouwmeester, J.-W. Pan, K. Mattle, M. Eibl, H. Weinfurter & A. Zeilinger, "Experimental Quantum Teleportation," Nature, 390 (6660), 1997, pp 575-579.

(114) K. Bowden, "The Spatial Transmission of Information," Proc. 15th Int. ANPA Conf., Cambridge, England, 1993, University of Cambridge, Cambridge, UK, np.

(115) K. Bowden, "Physical Computation and Parallelism (Constructive Postmodern Physics)," Proc. 3rd IEEE Workshop on Physics & Computation, Dallas, TX, 1994, IEEE Computer Society Press, Los Alamitos, CA, pp 78-87.

(116) M. Boyer, G. Brassard, P. Hoyer & A. Tapp, "Tight Bounds on Quantum Searching," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 36-43.

(117) C.F. Boyle, "On the Physical Limitations of Pattern Matching," J. of Experimental & Theoretical Artificial Intelligence, 3 (2), 1991, pp 191-217.

(118) C.F. Boyle, "Physical Laws and Information Content," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 52-57.

(119) C.F. Boyle, "Computation as an Intrinsic Property," <u>Minds & Machines</u>, **4**, 1995, pp 451-467.

(120) C.F. Boyle, "The Physics of Computation," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 44-47.

(121) G. Brassard, "A Quantum Jump in Computer Science," <u>Computer Science Today</u>, J. van Leeuwen, ed., Springer Verlag, Berlin, Germany, 1995, Vol. 1000, pp 1-14.

(122) G. Brassard, "New Trends in Quantum Computing," <u>Proc. 13th Symp. on the Theoretical Aspects of Computer Science</u>, 1996, Springer Verlag, Berlin, Germany, pp 3-10.

(123) G. Brassard, "Searching a Quantum Phone Book," <u>Science</u>, **275**, 1997, pp 627-628.

(124) G. Brassard, S.L. Braunstein & R. Cleve, "Teleportation as a Quantum Computation," <u>Physica D</u>, **120** (1-2), 1998, pp 43-47.

(125) G. Brassard & C. Crepeau, "Quantum Bit Commitment and Coin Tossing Protocols," <u>Advances in Cryptology, Proceedings of Crypto '90</u>, Springer-Verlag, Berlin, Germany, 1990, Vol. 537, pp 49-61.

(126) G. Brassard, C. Crepeau, R. Jozsa & D. Langlois, "A Quantum Bit Commitment Scheme Provably Unbreakable by Both Parties," <u>Proc. 34th IEEE Symp. on the Foundations of Computer Science</u>, 1993, pp 362-371.

(127) S.L. Braunstein, "Quantum Teleportation without Irreversible Detection," <u>Physical Review A</u>, **53** (3), 1996, pp 1900-1902.

(128) S.L. Braunstein & C.M. Caves, "Statistical Distance and the Geometry of Quantum States," <u>Physical Review Lett.</u>, **72**, 1994, pp 3439-3443.

(129) H.J. Bremermann, "Quantum Noise and Information," <u>5th Berkeley Symposium on Mathematical Statistics and Probability</u>, Berkeley, CA, USA, 1967, University of California Press, Berkeley, CA, USA, pp 15-22.

(130) H.J. Bremermann, "Complexity of Automata, Brains and Behaviour," <u>Lecture Notes in BioMathematics</u>, **4**, 1974, pp 304-331.

(131) R.P. Brent & H.T. Kung, "The Chip Complexity of Binary Arithmetic," <u>Proc. 12th ACM Symp. on the Theory of Computing</u>, 1980, ACM Press, New York, NY, USA, pp 190-200.

(132) L. Brillouin, "Maxwell's Demon Cannot Operate: Information and Entropy," <u>Int. J. of Applied Physics</u>, **22**, 1950, pp 334-337.

(133) L. Brillouin, <u>Science and Information Theory</u>, 2nd ed., Academic Press, New York, NY, 1962.

(134) D.C. Brody & L.P. Hughston, "Information Content for Quantum States," <u>J. of Mathematical Physics</u>, **41** (5), 2000, pp 2586-2592.

(135) J.G. Brookshear, <u>Theory of Computation: Formal Languages, Automata, and Complexity</u>, Benjamin/Cummings, Redwood City, CA, 1989.

(136) A.A. Brudno, "Entropy and the Complexity of the Trajectories of a Dynamical System," Trans. Moscow Mathematical Soc., 44, 1983, pp 127-.

(137) S. Brunak & J. Engelbrecht, "Computational Biosequence Analysis by Neural Networks," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 111-115.

(138) A.-P. Bruneau, "Geometrical Patterns Underlying Human Intelligence: Implications in Information Retrieval," Knowledge Organization, 21 (3), 1994, pp 132-139.

(139) N.N. Bugaenko, A.N. Gorban & M.G. Sadovsky, "Maximum Entropy Method in Analysis of Genetic Text and Measurement of Its Information Content," Open Systems & Information Dynamics, 5 (3), 1998, pp 265-278.

(140) M.S. Burgin, "Generalised Kolmogorov Complexity and Other Dual Complexity Measures," Cybernetics, 26, 1990, pp 481-491.

(141) W. Burkot, "Physics Motivated Approach to Combinatorial Optimization Problems," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 51-54.

(142) A. Burks, Essays on Cellular Automata, University of Illinois Press, Urbana, IL, USA, 1970.

(143) A.G. Butkovskiy & Y.I. Samilenko, Control of Quantum Mechanical Processes and Systems, Kluwer Academic Publishers, Boston, MA, 1990.

(144) V. Buzek & M. Hillery, "Quantum Copying: Beyond the No-Cloning Theorem," Physical Review A, 54, 1996, pp 1844-1852.

(145) V.K. Bykovski, "Next-Generation Computing and Computers: Data-Driven, Medium-Based Problem Solving," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 55-62.

(146) A.R. Calderbank & P.W. Shor, "Good Quantum Error-Correcting Codes Exist," Physical Review A, 54 (2), 1996, pp 1098-1105.

(147) F. Carvalho-Rodrigues & J. Dockery, "Defining Systems Based on Information Exchange: Structure from Dynamics," Proc. 1st Conf. on the Foundations of Information Science, Madrid, Spain, 1994, np.

(148) J. Casas-Vazquez & D. Jou, "Lagrange Multipliers in Extended Irreversible Thermodynamics and in Informational Statistical Thermodynamics," Brazilian J. of Physics, 27 (4), 1997, pp 547-559.

(149) G. Castagnoli, "Quantum Computation Based on Retarded and Advanced Propagation," Physica D, 120 (1-2), 1998, pp 48-61.

(150) Cavagna, "Irrelevance of Memory in the Minority Game," Physical Review E, 59 (4), 1999, pp R3783-R3786.

(151) C.M. Caves, "Entropy and Information: How Much Information Is Needed to Assign a Probability?," Complexity, Entropy and the Physics of Information, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 91-115.

(152) C.M. Caves, "Quantitative Limits on the Ability of a Maxwell Demon to Extract Work from Heat," Physical Review Lett., 64, 1990, pp 2111-2114.

(153) C.M. Caves, "Information, Entropy, and Chaos," Physical Origins of Time Asymmetry, J.J. Halliwell, J. Perez-Mercader & W.H. Zurek, eds., Cambridge University Press, Cambridge, UK, 1994, pp 47-89.

(154) C.M. Caves, "Quantum Limits on Bosonic Communication Rates," <u>Reviews of Modern Physics</u>, **66**, 1994, pp 481-537.

(155) C.M. Caves, "A Tale of Two Cities," <u>Science</u>, **282**, 1998, pp 637-638.

(156) C.M. Caves, "Quantum Error Correction and Reversible Operations," <u>J. of Superconductivity</u>, **12**, 1999, pp 707-718.

(157) C.M. Caves, "Predicting Future Duration from Present Age: A Critical Assessment," <u>Contemporary Physics</u>, **41**, 2000, pp 143-153.

(158) C.M. Caves, W.G. Unruh & W.H. Zurek, "Comment on Quantitative Limits on the Ability of a Maxwell Demon to Extract Work from Heat," <u>Physical Review Lett.</u>, **65**, 1990, pp 1387.

(159) N.J. Cerf & C. Adami, "Negative Entropy and Information in Quantum Mechanics," <u>Physical Review Lett.</u>, **79**, 1997, pp 5194-.

(160) N.J. Cerf & C. Adami, "Negative Entropy in Quantum Information Theory," <u>New Developments on Fundamental Problems in Quantum Physics</u>, M. Ferrero & A. van der Merwe, eds., Kluwer Academic Publishers, Dordrecht, Germany, 1997, Vol. 81, pp 77-84.

(161) N.J. Cerf & C. Adami, "Entropic Bell Inequalities," <u>Physical Review A</u>, **55**, 1997, pp 3371-.

(162) N.J. Cerf & C. Adami, "Information Theory of Quantum Entanglement and Measurement," <u>Physica D</u>, **120** (1-2), 1998, pp 62-81.

(163) N.J. Cerf & R. Cleve, "Information-Theoretic Interpretation of Quantum Error-Correcting Codes," <u>Physical Review A</u>, **56**, 1997, pp 1721-.

(164) V. Cerny, "Quantum Computers and Intractable (NP-Complete) Computing Problems," <u>Physical Review A</u>, **48**, 1993, pp 116-119.

(165) S. Cha, I.S. Chung & Y.R. Kwon, "Complexity Measures for Concurrent Programs Based on Information Theoretic Metrics," <u>Information Processing Lett.</u>, **46**, 1993, pp 43-50.

(166) G.J. Chaitin, "On the Length of Programs for Computing Finite Binary Sequences," <u>J. ACM</u>, **13**, 1966, pp 547-569.

(167) G.J. Chaitin, "On the Length of Programs for Computing Finite Binary Sequences: Statistical Considerations," <u>J. ACM</u>, **16**, 1969, pp 145-159.

(168) G.J. Chaitin, "A Theory of Program Size Formally Identical to Information Theory," <u>J. ACM</u>, **22** (3), 1975, pp 329-340.

(169) G.J. Chaitin, "Algorithmic Information Theory," <u>IBM J. of Research & Development</u>, **21**, 1977, pp 350-359.

(170) G.J. Chaitin, <u>Algorithmic Information Theory</u>, Cambridge University Press, Cambridge, UK, 1987.

(171) G.J. Chaitin, <u>Information, Randomness, and Incompleteness: Papers on Algorithmic Information Theory</u>, World Scientific Publishers, Singapore, 1987.

(172) H.F. Chau & H.-K. Lo, "How Much Does It Cost to Teleport?," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 72-75.

(173) P. Cheeseman, R. Kanefsky & W.M. Taylor, "Computational Complexity and Phase Transitions," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 63-68.

(174) L.O. Chua, M. Hasler, G.A. Moschytz & J. Neirynck, "Autonomous Cellular Neural Networks: A Unified Paradigm for Pattern Formation and Active Wave Propagation," IEEE Trans. on Circuits & Systems, 42, 1995, pp 559-577.

(175) I.L. Chuang, R. Laflamme, P.W. Shor & W.H. Zurek, "Quantum Computers, Factoring and Decoherence," Science, 270, 1995, pp 1633-1635.

(176) I.L. Chuang & M.A. Nielsen, "Prescription for Experimental Determination of the Dynamics of a Quantum Black Box," J. of Modern Optics, 44, 1997, pp 2455-2467.

(177) I.L. Chuang & Y. Yamamoto, "A Simple Quantum Computer," Physical Review A, 52, 1995, pp 3489-3496.

(178) I.L. Chuang & Y. Yamamoto, "The Dual-Rail Quantum Bit and Quantum Error Correction," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 82-86.

(179) I.L. Chuang & Y. Yamamoto, "Quantum Bit Regeneration," Physical Review Lett., 77, 1996, pp 4281-.

(180) J.I. Cirac & P. Zoller, "Quantum Computations with Cold Trapped Ions," Physical Review Lett., 74, 1995, pp 4091-4094.

(181) R. Cleve, W. van Dam, M.A. Nielsen & A. Tapp, "Quantum Entanglement and the Communication Complexity of the Inner Product Function," Quantum Computing and Quantum Communications, C.P. Williams, ed., Springer-Verlag, New York, NY, 1999, Vol. 1509, np.

(182) P. Collet, J.P. Crutchfield & J.-P. Eckmann, "Computing the Topological Entropy of Maps," Comm. of Mathematical Physics, 88, 1983, pp 257-262.

(183) R.C. Conant, "Detecting Subsystems of a Complex System," IEEE Trans. on Systems, Man & Cybernetics, 2, 1972, pp 550-553.

(184) D. Conrad, "Consciousness, Privacy, and Information," Proc. 1st Conf. on the Foundations of Information Science, Madrid, Spain, 1994, np.

(185) M. Conrad, "Cross-Scale Information Processing in Evolution, Development and Intelligence," Proc. 1st Conf. on the Foundations of Information Science, Madrid, Spain, 1994, np.

(186) M. Conrad, "Biomolecular Quantum Computing and Consciousness," Toward a Scientific Basis for Consciousness: An Interdisciplinary Conference, Tucson, AZ, 1994, np.

(187) S.A. Cook, "The Complexity of Theorem-Proving Procedures," Proc. 3rd ACM Symp. on the Theory of Computing, 1971, ACM Press, New York, NY, USA, pp 151-158.

(188) C. Cooper, "Complexity in C3I Systems," Complexity International, 1, 1993, pp 7-.

(189) J.D. Corbit & D.J. Garbary, "Fractal Dimension as a Quantitative Measure of Complexity in Plant Development," Proc. Royal Soc. of London, Series B, 262, 1995, pp 1-6.

(190) J.V. Cornacchio, "Maximum Entropy Complexity Measures," Int. J. of General Systems, **3**, 1977, pp 267-271.

(191) P.A. Corning & S.J. Kline, "Thermodynamics, Information and Life Revisited. I. `To Be or Entropy'," Systems Research & Behavioral Science, **15** (4), 1998, pp 273-295.

(192) D.G. Cory, A.F. Fahmy & T.F. Havel, "Ensemble Quantum Computing by Nuclear Magnetic Resonance Spectroscopy," Proc. National Acad. of Sciences, **94**, 1997, pp 1634-1639.

(193) D.G. Cory, M.D. Price & T.F. Havel, "Nuclear Magnetic Resonance Spectroscopy: An Experimentally Accessible Paragigm for Quantum Computing," Physica D, **120** (1-2), 1998, pp 82-101.

(194) T.M. Cover, "What Processes Satisfy the Second Law?," Physical Origins of Time Asymmetry, J.J. Halliwell, J. Perez-Mercader & W.H. Zurek, eds., Cambridge University Press, New York, NY, 1994, pp 98-107.

(195) T.M. Cover, P. Gacs & R.M. Gray, "Kolmogorov's Contributions to Information Theory and Algorithmic Complexity," Ann. of Probability Theory, **17**, 1989, pp 840-865.

(196) T.M. Cover & J.A. Thomas, Elements of Information Theory, John Wiley and Sons, New York, NY, USA, 1991.

(197) C. Crepeau, "Cryptographic Primitives and Quantum Theory," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 200-204.

(198) C. Crepeau, "Quantum Oblivious Transfer," J. of Modern Optics, **41**, 1994, pp 2445-2454.

(199) C. Crepeau, J. van de Graaf & A. Tapp, "Committed Oblivious Transfer and Private Multi-Party Computation," Advances in Cryptology, Proceedings of Crypto '95, Springer-Verlag, Berlin, Germany, 1995, Vol. 963, pp 110-123.

(200) S. Crosby, I. Leslie, J.T. Lewis, N. O'Connell, R. Russell & F. Toomey, "Bypassing Modelling: An Investigation of Entropy as a Traffic Descriptor in the Fairisle ATM Network," IEE Colloquium Twelfth UK Teletraffic Symposium Performance Engineering in Telecommunications Networks, IEE; London, UK, 1995, Digest No.1995/054, pp 23/21-10.

(201) J.P. Crutchfield, Noisy Chaos, Ph.D. Dissertation, University of California, 1983.

(202) J.P. Crutchfield, "Inferring the Dynamic, Quantifying Physical Complexity," Measures of Complexity and Chaos, A. M. Albano, N.B. Abraham, P. E. Rapp & A. Passamante, eds., Plenum Press, New York, NY, 1989, pp 327-.

(203) J.P. Crutchfield, "Chaos and Complexity," Handbook of Metaphysics and Ontology, Philosophia Verlag, München, Germany, 1990, np.

(204) J.P. Crutchfield, "Complexity: Order contra Chaos," Proc. 1990 Int. Conf. on Fuzzy Logic & Neural Networks, Izuka, Japan, 1990, World Scientific Publishers, Singapore, pp 127-.

(205) J.P. Crutchfield, "Information and Its Metric," Nonlinear Structures in Physical Systems -- Pattern Formation, Chaos, and Waves, L.Lam & H.C. Morris, eds., Springer-Verlag, Berlin, Germany, 1990, pp 119-130.

(206) J.P. Crutchfield, "Reconstructing Language Hierarchies," Information Dynamics, H.A.Atmanspracher & H. Scheingraber, eds., Plenum Press, New York, NY, 1990, Vol. 256, pp 45-60.

(207) J.P. Crutchfield, "Discovering Coherent Structures in Nonlinear Spatial Systems," Nonlinear Dynamics of Ocean Waves, A. Brandt, S. Ramberg & M. Shlesinger, eds., World Scientific Publishers, Singapore, 1992, pp 190-216.

(208) J.P. Crutchfield, "Knowledge and Meaning ... Chaos and Complexity," Modeling Complex Phenomena, L. Lam & V. Naroditsky, eds., Springer-Verlag, Berlin, Germany, 1992, pp 66 -101.

(209) J.P. Crutchfield, "Semantics and Thermodynamics," Nonlinear Modeling and Forecasting, M.Casdagli & S. Eubank, eds., Addison-Wesley, Reading, MA, 1992, Vol. XII, pp 317-359.

(210) J.P. Crutchfield, "Unreconstructible at Any Radius," Physics Lett. A, 171, 1992, pp 52-60.

(211) J.P. Crutchfield, "Critical Computation, Phase Transitions, and, Hierarchical Learning in Towards the Harnessing of Chaos," Proc. 7th Toyota Conf., 1994, Elsevier Science, Amsterdam, The Netherlands, np.

(212) J.P. Crutchfield, "Is Anything Ever New? Considering Emergence," Complexity: Metaphors, Models, and Reality, G. Cowan, D. Pines & D. Melzner, eds., Addison-Wesley, Redwood City, CA, 1994, pp 479-497.

(213) J.P. Crutchfield, "Observing Complexity and the Complexity of Observation," Inside versus Outside, H. Atmanspacher, ed., Springer-Verlag, Berlin, Germany, 1994, pp 235-272.

(214) J.P. Crutchfield, "The Calculi of Emergence: Computation, Dynamics and Induction," Physica D, 75, 1994, pp 11-54.

(215) J.P. Crutchfield, "Dynamical Embodiments of Computation in Cognitive Processes," Behavioral & Brain Sciences, 1998, np.

(216) J.P. Crutchfield & D.P. Feldman, "Statistical Complexity of Simple 1D Spin Systems," 55 (2), 1997, pp 1239R-1243R.

(217) J.P. Crutchfield, D.P. Feldman & C.R. Shalizi, "Comment on 'Simple Measure for Complexity'," Physical Review E, 59, 1999, np.

(218) J.P. Crutchfield & J.E. Hanson, "Attractor Vicinity Decay for a Cellular Automaton," Chaos, 3 (2), 1993, pp 215-224.

(219) J.P. Crutchfield & J.E. Hanson, "Turbulent Pattern Bases for Cellular Automata," Physica D, 69, 1993, pp 279-301.

(220) J.P. Crutchfield & N. Kahn, "Turbulent Landscapes--A Dialogue," Complexity, 2 (2), 1996, pp 3-7.

(221) J.P. Crutchfield & B. McNamara, "Equations of Motion from a Data Series," Complex Systems, 1, 1987, pp 417-452.

(222) J.P. Crutchfield & M. Mitchell, "The Evolution of Emergent Computation," Proc. National Acad. of Sciences, 92 (23), 1995, pp 10742-10746.

(223) J.P. Crutchfield & N.H. Packard, "Noise Scaling of Symbolic Dynamics Entropies," Evolution of Order and Chaos, H. Haken, ed., Springer-Verlag, Berlin, Germany, 1982, pp 215-227.

(224) J.P. Crutchfield & N.H. Packard, "Symbolic Dynamics of One-Dimensional Maps: Entropies, Finite Precision, and Noise," <u>Int. J. of Theoretical Physics</u>, **21**, 1982, pp 433-466.

(225) J.P. Crutchfield & N.H. Packard, "Symbolic Dynamics of Noisy Chaos," <u>Physica D</u>, **7**, 1983, pp 201-223.

(226) J.P. Crutchfield & C.R. Shalizi, "Thermodynamic Depth of Causal States: Objective Complexity via Minimal Representations," <u>Physical Review E</u>, **59**, 1999, pp 275-283.

(227) J.P. Crutchfield & K. Young, "Inferring Statistical Complexity," <u>Physical Review Lett.</u>, **63**, 1989, pp 105-108.

(228) J.P. Crutchfield & K. Young, "Computation at the Onset of Chaos," <u>Complexity, Entropy and the Physics of Information</u>, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 223-269.

(229) R.C. Daley & L.G. Hassebrook, "Channel Capacity Model of Binary Encoded Structured Light-Stripe Illumination," <u>Applied Optics</u>, **37** (17), 1998, pp 3689-3696.

(230) R.P. Daley, "Minimal Program Complexity of Sequences with Restricted Resources," <u>Information & Control</u>, **23**, 1973, pp 301-312.

(231) R.P. Daley, "An Example of Information and Computation-Resource Trade-Off," <u>J. ACM</u>, **20** (4), 1973, pp 687-695.

(232) R.P. Daley, "Minimal-Program Complexity of Pseudo-Recursive and Pseudo-Random Sequences," <u>Mathematical Systems Theory</u>, **9**, 1975, pp 83-94.

(233) L. Davidovich, A. Maali, M. Brune, J.M. Raimond & S. Haroche, "Quantum Switches and Nonlocal Microwave Fields," <u>Physical Review Lett.</u>, **71**, 1993, pp 2360-2363.

(234) P.C.W. Davies, "Why Is the Physical World So Comprehensible?," <u>Complexity, Entropy and the Physics of Information</u>, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 61-70.

(235) R.L. Dawes, "Quantum Neurodynamics or "Where Is the State Vector"," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 159-165.

(236) A. De Luca, "Complexity and Information Theory," <u>Coding and Complexity</u>, G.Longo, ed., Springer-Verlag, Berlin, Germany, 1975, pp 207-270.

(237) P.P.B. de Oliveira, "Coupling Computations through Space," <u>Proc. 3rd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1994, IEEE Computer Society Press, Los Alamitos, CA, pp 160-168.

(238) A. De Vos, "Reversible and Endoreversible Computing," <u>Int. J. of Theoretical Physics</u>, **34**, 1995, pp 2251-2266.

(239) A. De Vos, "Introduction to r-MOS Systems," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 92-96.

(240) A. De Vos, "Reversible computing," <u>Progress in Quantum Electronics</u>, **23** (1), 1999, pp 1-49.

(241) J.K. De Vree, "A Note On Information, Order, Stability, And Adaptability," <u>Proc. 1st Conf. on the Foundations of Information Science</u>, Madrid, Spain, 1994, np.

(242) G. Deco & G. Schurmann, "Information Flow and Chaotic Dynamics," <u>Proc. 1996 Int. Workshop on Neural Networks for Identification, Robotics & Signal/Image Processing</u>, 1996, pp 321-329.

(243) J.-P. Delahaye, "Chaitin's Equation: An Extension of Godel's Theorem," <u>Not. of the Am. Mathematical Soc.</u>, **36**, 1989, pp 984-987.

(244) J.S. Denker & Y. leCun, "Natural versus 'Universal' Probability, Complexity, and Entropy," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 122-127.

(245) K. DePryck, "Paradoxes and the Distribution of Probabilites," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 281-283.

(246) D. Deutsch, "Quantum Theory, the Church-Turing Principle and the Universal Quantum Computer," <u>Proc. Royal Soc. of London, Series A</u>, **400**, 1985, pp 97-117.

(247) D. Deutsch, "Quantum Computational Networks," <u>Proc. Royal Soc. of London, Series A</u>, **425**, 1989, pp 73-90.

(248) D. Deutsch, "Quantum Privacy Amplification and the Security of Quantum Cryptography over Noisy Channels," <u>Physical Review Lett.</u>, **77**, 1996, pp 2818-2821.

(249) D. Deutsch, A. Barenco & A.K. Ekert, "Universality of Quantum Computation," <u>Proc. Royal Soc. of London, Series A</u>, **449**, 1995, pp 669-677.

(250) D. Deutsch & R. Jozsa, "Rapid Solution of Problems by Quantum Computation," <u>Proc. Royal Soc. of London, Series A</u>, **439**, 1992, pp 553-558.

(251) T.G. Dewey, "Algorithmic Complexity and Thermodynamics of Fractal Growth Processes," <u>Fractals</u>, **5** (4), 1997, pp 697-706.

(252) S. Dharmasena & L.J. Svensson, "Startup Energies in Energy-Recovery CMOS," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 97-102.

(253) A.G. Dickinsom & J.S. Denker, "Adiabatic Dynamic Logic," <u>IEEE J. of Solid-State Circuits</u>, **30**, 1995, pp 311-315.

(254) D. Dieks, "Communication by EPR Devices," <u>Physics Lett. A</u>, **92**, 1982, pp 271-272.

(255) T. Dittrich & P. Hanggi, <u>Quantm Transport and Dissipation</u>, Wiley-VCH, New York, NY, 1998.

(256) D.P. DiVincenzo, "Quantum Computation," <u>Science</u>, **270**, 1995, pp 255-261.

(257) D.P. DiVincenzo, "Two-Bit Gates Are Univeral for Quantum Computation," <u>Physical Review A</u>, **51** (2), 1995, pp 1015-1022.

(258) D.P. DiVincenzo, "Quantum Channel Capacity of Very Noisy Channels," <u>Physical Review A</u>, **57** (2), 1998, pp 830-839.

(259) D.P. DiVincenzo & D. Loss, "Quantum Information Is Physical," **23** (3-4), 1998, pp 419-432.

(260) D.P. DiVincenzo & B. Terhal, "Decoherence: The Obstacle to Quantum Computation," <u>Physics World</u>, **11** (3), 1998, pp 53-57.

(261) J. Dockery, "C3: Information Science in Uniform," <u>Proc. 1st Conf. on the Foundations of Information Science</u>, Madrid, Spain, 1994, np.

(262) R. Dominguez-Cascante & D. Jou, "Entropy Flux and Lagrange Multipliers: Information Theory and Thermodynamics," <u>Open Systems & Information Dynamics</u>, **5** (4), 1998, pp 319-331.

(263) P. Domokos, J.M. Raimond, M. Brune & S. Haroche, "Simple Cavity-QED Two-Bit Universal Quantum Logic Gate: The Principle and Expected Performances," <u>Physical Review A</u>, **52**, 1995, pp 3554-3559.

(264) D. Dretske, <u>Knowledge and the Flow of Information</u>, MIT Press, Cambridge, MA, 1981.

(265) M. Dudziak, "Quantum Processes and Dynamic Networks in Biological Systems," <u>Toward a Scientific Basis for Consciousness: An Interdisciplinary Conference</u>, Tucson, AZ, 1994, np.

(266) P.A. Dufort & C.J. Lumsden, "The Complexity and Entropy of Turing Machines," <u>Proc. 3rd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1994, IEEE Computer Society Press, Los Alamitos, CA, pp 227-232.

(267) W. Ebeling & M.A. Jimenez-Montano, "On Grammars, Complexity and Information Measures of Biological Macromolecules," <u>Mathematical Biosciences</u>, **52**, 1980, pp 53-71.

(268) W. Ebeling & A.B. Neiman, "Long-Range Correlations between Letters and Sentences in Texts," <u>Physica A</u>, **215**, 1995, pp 233-241.

(269) W. Ebeling & G. Nicolis, "Word Frequency and Entropy of Symbolic Sequences," <u>Chaos, Solitons & Fractals</u>, **2**, 1992, pp 635-650.

(270) W. Ebeling & T. Poschel, "Entropy and Long Range Correlations in Literary English," <u>Europhysics Lett.</u>, **26**, 1994, pp 241-246.

(271) W. Ebeling, T. Poschel & K.F. Albrecht, "Transinformation and Word Distribution of Information-Carrying Sequences," <u>Int. J. of Bifurcation & Chaos</u>, **5**, 1995, pp 51-61.

(272) W. Ebeling, T. Poschel & A.B. Neiman, "Entropy and Compressibility of Symbol Sequences," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 103-107.

(273) A. Ehrenfeucht & P. Zeiger, "Complexity Measures for Regular Expressions," <u>Proc. 6th ACM Symp. on the Theory of Computation</u>, Seattle, WA, 1974, np.

(274) A. Einstein, B. Podolsky & N. Rosen, "Can Quantum-Mechanical Description of Physical Reality Be Considered Complete?," <u>Physical Review</u>, **47**, 1935, pp 777-780.

(275) A.K. Ekert, "Quantum Cryptography Based on Bell's Theorem," <u>Physical Review Lett.</u>, **67**, 1991, pp 661-663.

(276) A.K. Ekert & R. Jozsa, "Quantum Computation and Shor's Factoring Algorithm," <u>Reviews of Modern Physics</u>, **68** (3), 1996, pp 733-.

(277) Y.L. Elimontovich, "Entropy, Information, and Criteria of Order in Open Systems," <u>Nonlinear Phenomena in Complex Systems</u>, **2** (4), 1999, pp 1-25.

(278) A.C. Elitzur, "Can Relativity Shed a New Light on Consciousness?," Toward a Scientific Basis for Consciousness: An Interdisciplinary Conference, Tucson, AZ, 1994, np.

(279) D. Ellinas, "Measures of Entanglement of Quantum Systems," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 108-109.

(280) P. Érdi, "The Brain as a Hermeneutic Device," Proc. 1st Conf. on the Foundations of Information Science, Madrid, Spain, 1994, np.

(281) T. Etter, "Quantum Mechanics as a Branch of Mereology," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 110-116.

(282) P.N. Fahn, "Entropy Cost of Information," Proc. 3rd IEEE Workshop on Physics & Computation, Dallas, TX, 1994, IEEE Computer Society Press, Los Alamitos, CA, pp 217-226.

(283) P.N. Fahn, "Maxwell's Demon and the Entropy Cost of Information," Foundations of Physics, **26** (1), 1996, pp 71-93.

(284) P.N. Fahn, "The Case of the Eleatic Computer," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 117-119.

(285) D.P. Feldman & J.P. Crutchfield, "Discovering Noncritical Organization: Statistical Mechanical, Information Theoretic and Computational Views of Patterns in One-Dimensional Spin Systems," J. of Statistical Physics, 1998, np.

(286) D.P. Feldman & J.P. Crutchfield, "Measures of Statistical Complexity: Why?," Physics Lett. A, **238** (4-5), 1998, pp 244-252.

(287) J.H. Felker, "A Link between Information and Energy," Proc. IRE, **40**, 1952, pp 728-729.

(288) D.H. Feng & J. Yuan, Quantum Non-integrability, World Scientific Publishers, Singapore, 1993.

(289) A.E. Ferdinand, "Complex Systems Are Those that Work Even with Maximum Entropy," Int. J. of General Systems, **1**, 1974, pp 19-33.

(290) J.M. Fernandez, Entropy and Computation, Bachelors, Department of Computer Science, Massachusetts Institute of Technology, 1991.

(291) J.M. Fernandez, "Computational Entropies," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 47-51.

(292) R.P. Feynman, "Simulating Physics with Computers," Int. J. of Theoretical Physics, **21**, 1982, pp 467-488.

(293) R.P. Feynman, "Quantum Mechanical Computers," Foundations of Physics, **16** (6), 1986, pp 507-531.

(294) R.P. Feynman, Feynman Lectures on Computation, Addition-Wesley Publishing Co., Inc., Reading, MA, USA, 1996.

(295) P. Fleissner & W. Hofkirchner, "Emergent Information. Towards a Unified Information Theory," Proc. 1st Conf. on the Foundations of Information Science, Madrid, Spain, 1994, np.

17

(296) W. Fontana & L. Buss, "What Would Be Conserved If the Tape Were Played Twice," Proc. National Acad. of Sciences, **91**, 1994, pp 757-761.

(297) J. Ford, "How Random Is a Coin Toss?," Physics Today, 1983, np.

(298) M.P. Frank & M.J. Ammer, "Separations of Reversible and Irreversible Space-Time Complexity Classes," Proc. 13th IEEE Computational Complexity Conf., 1998, np.

(299) M.P. Frank, T.F. Knight, Jr. & N.H. Margolus, Reversibility in Optimally Scalable Computer Architectures, Massachusetts Institute of Technology, Cambridge, MA, 1997.

(300) A.M. Fraser, "Measuring Complexity in Terms of Mutual Information," Measures of Complexity and Chaos, N.B. Abraham, ed., Plenum Press, New York, NY, 1989, pp 117-119.

(301) E. Fredkin, "Digital Mechanics: An Informational Process Based on Reversible Universal CA," Cellular Automata: Theory and Experiment, H. Gutowitz, ed., North Holland, The Netherlands, 1990, pp 254-270.

(302) E. Fredkin, "Digital Mechanics," Physica D, **45**, 1990, pp 254-270.

(303) E. Fredkin, "Digital Mechanics: An Informational Process Based on Reversible Universal CA," Physica D, **45**, 1990, pp 254-.

(304) E. Fredkin, "A Physicist's Model of Computation," Proc. 26th Recontre de Moriond, 1991, pp 283-297.

(305) E. Fredkin, "A New Cosmogony," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 116-121.

(306) E. Fredkin, "The Digital Perspective," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 120-121.

(307) E. Fredkin, R.W. Landauer & T. Toffoli, Proceedings of the 1st Physics of Computation Conference, 1982.

(308) E. Fredkin & T. Toffoli, "Conservative Logic," Int. J. of Theoretical Physics, **21** (3/4), 1982, pp 219-253.

(309) W.R. Frensley, "Gain in Nanoelectronic Devices," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 258-261.

(310) N. Fuchikami, H. Iwata & S. Ishioka, "Thermodynamic Entropy of Computer Devices," J. Physical Soc. of Japan, **68** (12), 1999, pp 3751-3754.

(311) C.A. Fuchs, "Landauer's Principle and Black-Hole Entropy," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 86-92.

(312) C.A. Fuchs, Distinguishability and Accessible Information in Quantum Theory, Ph.D., University of New Mexico, Albuquerque, NM, USA, 1996.

(313) C.A. Fuchs, "Information Gain vs. State Disturbance in Quantum Theory," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 122-126.

(314) C.A. Fuchs & C.M. Caves, "Ensemble-Dependent Bounds for Accessible Information In Quantum Mechanics," <u>Physical Review Lett.</u>, **73**, 1994, pp 3047-3050.

(315) C.A. Fuchs & C.M. Caves, "Mathematical Techniques for Quantum Communication Theory," <u>Open Systems & Information Dynamics</u>, **3**, 1995, pp 345-356.

(316) C.A. Fuchs & A. Peres, "Quantum State Disturbance vs. Information Gain: Uncertainty Relations for Quantum Information," <u>Physical Review A</u>, **53**, 1996, pp 2038-2045.

(317) R. Fugmann, "The Empirical Approach in the Evaluation of Information Systems," <u>Knowledge Organization</u>, **26** (1), 1999, pp 3-9.

(318) P.M. Furth & A.G. Andreou, "Comparing the Bit-Energy of Continuous and Discrete Signal Representations," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 127-133.

(319) D. Gabor, "Communication Theory and Physics," <u>Philosophy Mag.</u>, **41**, 1950, pp 1161-1187.

(320) P. Gacs, "On the Symmetry of Algorithmic Information," <u>Soviet Mathematics Doklady</u>, **15**, 1974, pp 1477-1480.

(321) P. Gacs, <u>Lecture Notes on Descriptional Complexity and Randomness</u>, Technical Report 87-103, 1987.

(322) P. Gacs, "The Boltzmann Entropy and Randomness Tests," <u>Proc. 3rd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1994, IEEE Computer Society Press, Los Alamitos, CA, pp 209-216.

(323) P. Gacs & J. Korner, "Common Information Is Far Less than Mutual Information," <u>Problems of Control & Information Theory</u>, **2**, 1973, pp 149-162.

(324) B.R. Gaines, "On the Complexity of Causual Models," <u>IEEE Trans. on Systems, Man & Cybernetics</u>, **6**, 1976, pp 56-59.

(325) Q. Gao & M. Li, "The Minimum Description Length Principle and Its Application to Online Learning of Handprinted Characters," <u>Proc. 11th Int. Joint Conf. on Artificial Intelligence</u>, Detroit, MI, USA, 1989, pp 843-848.

(326) M. Garey & D.S. Johnson, <u>Computers and Intractability; A Guide to the Theory of NP-Completeness</u>, W.H. Freeman and Co., San Francisco, CA, USA, 1979.

(327) M. Gell-Mann, "What is Complexity?," <u>Complexity</u>, **1**, 1995, pp 16-19.

(328) M. Gell-Mann & J.B. Hartle, "Quantum Mechanics in the Light of Quantum Cosmology," <u>Complexity, Entropy and the Physics of Information</u>, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 425-458.

(329) M. Gell-Mann & S. Lloyd, "Information Measures, Effective Complexity and Total Information," <u>Complexity</u>, **2** (1), 1996, pp 44-52.

(330) B. George, "Tests for System Complexity," <u>Int. J. of General Systems</u>, **3**, 1977, pp 253-257.

(331) R. Geroch & J.B. Hartle, "Computability and Physical Theories," <u>Foundations of Physics</u>, **16**, 1986, pp 533-550.

(332) N.A. Gershenfeld, "Information in Dynamics," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 276-280.

(333) N.A. Gershenfeld, "Signal Entropy and the Thermodynamics of Computation," <u>IBM Systems J.</u>, **35** (3/4), 1996, pp 577-586.

(334) N.A. Gershenfeld & I.L. Chuang, "Bulk Spin-Resonance Quantum Computation," <u>Science</u>, **275**, 1997, pp 350-356.

(335) N.A. Gershenfeld, I.L. Chuang & S. Lloyd, "Bulk Quantum Computation," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 134.

(336) D. Giulini, E. Joos, C. Kiefer, J. Kupsch, I.-O. Stametescu & H.D. Zeh, <u>Decoherence and the Appearance of Classical World in Quantum Theory</u>, Springer Verlag, New York, NY, 1996.

(337) W. Gödert, "Information as a Cognitive Construction: A Communication-Theoretic Model and Consequences for Information Systems," <u>Knowledge Organization</u>, **23** (4), 1996, pp 206-212.

(338) E. Goto, N. Yoshida, K.-F. Loe & W. Hioe, "A Study on Irreversible Loss of Information without Heat Generation," <u>Proc. 3rd Int. Symp. on the Foundations of Quantum Mechanics</u>, Tokyo, Japan, 1989, pp 412-418.

(339) H.W. Gottinger, "Complexity and Information Technology in Dynamic Systems," <u>Kybernetes</u>, **4**, 1975, pp 129-141.

(340) P. Grassberger, "Toward a Quantitative Theory of Self-Generated Complexity," <u>Int. J. of Theoretical Physics</u>, **25**, 1986, pp 907-.

(341) P. Grassberger, "Information and Complexity Measures in Dynamical Systems," <u>Information Dynamics</u>, H.Atmanspacher & H. Scheingraber, eds., Plenum Press, New York, NY, 1991, pp 15-33.

(342) R.B. Griffiths & C.-S. Niu, "Semiclassical Fourier Transform for Quantum Computation," <u>Physical Review Lett.</u>, **76** (17), 1996, pp 3228-3231.

(343) P. Grigolini, <u>Quantum Mechanical Irreversibility and Measurement</u>, World Scientific Publishers, Singapore, 1993.

(344) G. Grossing & A. Zeilinger, "Quantum Cellular Automata," <u>Complex Systems</u>, **2**, 1988, pp 197-208.

(345) L.K. Grover, "A Fast Quantum Mechanical Algorithm for Database Search," <u>Proc. 28th ACM Symposium on the Theory of Computing</u>, 1996, ACM Press, New York, NY, USA, pp 212-219.

(346) L.K. Grover, "Quantum Mechanics Helps in Searching for a Needle in a Haystack," <u>Physical Review Lett.</u>, **79** (2), 1997, pp 325-328.

(347) Y.-P. Gunji, S.-I. Toyoda & M. Migita, "Tree and Loop as Moments for Measurement," <u>Proc. 1st Conf. on the Foundations of Information Science</u>, Madrid, Spain, 1994, np.

(348) J.S. Hagelin, "Is Consciousness the Unified Field? A Field Theorist's Perspective," <u>Toward a Scientific Basis for Consciousness: An Interdisciplinary Conference</u>, Tucson, AZ, 1994, np.

(349) J.S. Hall, "An Electroid Switching Model for Reversible Computer Architectures," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 237-247.

(350) J.S. Hall, "A Reversible Instruction Set Architecture and Algorithms," Proc. 3rd IEEE Workshop on Physics & Computation, Dallas, TX, 1994, IEEE Computer Society Press, Los Alamitos, CA, pp 128-134.

(351) M.J.W. Hall, "Universal Geometric Approach to Uncertainty, Entropy, and Information," Physical Review A, 59 (4), 1999, pp 2602-2615.

(352) J.J. Halliwell, "Information Dissipation in Quantum Cosmology and the Emergence of Classical Spacetime," Complexity, Entropy and the Physics of Information, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 459-469.

(353) J.Y. Halpern & Y. Moses, "Knowledge and Common Knowledge in a Distributed Environment," Proc. 1984 Symp. on the Principles of Distributed Computing, 1984, ACM Press, New York, NY, np.

(354) P. Halpern, "Genetic Algorithms on Structurally Dynamic Lattices," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 135-136.

(355) J.E. Hanson, Computational Mechanics of Cellular Automata, Ph.D. Dissertation, University of California, Berkeley, 1993.

(356) J.E. Hanson & J.P. Crutchfield, "The Attractor-Basin Portrait of a Cellular Automaton," J. of Statistical Physics, 66 (5/6), 1992, pp 1415-1462.

(357) J.E. Hanson & J.P. Crutchfield, "Computational Mechanics of Cellular Automata: An Example," Physica D, 103 (1/4), 1997, pp 169-189.

(358) R. Hanson, "Reversible Agents Need Robots Waste Bits to See, Talk, and Achieve?," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 284-288.

(359) S.Y. Harmon, "Evaluating and Comparing Information Systems," 1998 IEEE International Conference on Systems, Man, and Cybernetics (SMC98), San Diego, CA, USA, 1998, IEEE; New York, NY, USA, pp 1009-1014.

(360) S. Haroche & J.M. Raimond, "Quantum Computing: Dream or Nightmare?," Physics Today, 1996, pp 51-52.

(361) E. Harth, "The Creative Loop: How The Brain Makes A Mind," Toward a Scientific Basis for Consciousness: An Interdisciplinary Conference, Tucson, AZ, 1994, np.

(362) R.V.L. Hartley, "Transmission of Information," Bell System Technical Journal, 27, 1948, pp 535-563.

(363) J. Hartmanis, "Generalized Kolmogorov Complexity and the Structure of Feasible Computations," Proc. 24th IEEE Symp. on the Foundations of Computer Science, 1983, pp 439-445.

(364) T. Hatano & S. Sasa, "Numerical Simulations on Szilard's Engine and Information Erasure," Progress in Theoretical Physics, 100 (4), 1998, pp 695-702.

(365) P. Hausladen, R. Jozsa, B. Schumacher, M.D. Westmoreland & W.K. Wootters, "A Quantum Information Theoretic Interpretation of von Neumann Entropy," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 137-139.

(366) J. Hawrnack & J. Zygmunt, "On the Degree of Complexity of Sentential Logics," Studia Logica, **4**, 1981, pp 142-153.

(367) F.A. Hayek, "The Theory of Complex Phenomena," The Critical Approach to Science and Philosophy, M. Bunge, ed., Collier McMillan, London, UK, 1964, pp 332-349.

(368) B. Hejna & I. Vajda, "Information Transmission in Stationary Stochastic Systems," Proc. 2nd AIP Int. Conf. on Computing Anticipatory Systems, Liege, Belgium, 1999, AIP, pp 405-417.

(369) A. Hemmerling, "On Genuine Complexity and Kinds of Nondeterminism," J. of Information Processing & Cybernetics, **30**, 1995, pp 77-.

(370) S. Henry & K. Kafura, "Software Structure Metrics Based on Information Flow," IEEE Trans. on Software Engineering, **7** (5), 1981, pp 510-518.

(371) J. Hietarinta, "Quantum Integrability Is Not a Trivial Consequence of Classical Integrability," Physics Lett. A, **93**, 1982, pp 55-57.

(372) D. Hofstadter, Godel, Escher, Bach, Random House, New York, NY, 1979.

(373) T. Hogg, "The Dynamics of Complex Computational Systems," Complexity, Entropy and the Physics of Information, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 207-222.

(374) T. Hogg, "Statistical Mechanics of Combinatorial Search," Proc. 3rd IEEE Workshop on Physics & Computation, Dallas, TX, 1994, IEEE Computer Society Press, Los Alamitos, CA, pp 196-202.

(375) T. Hogg, "Quantum Computing and Phase Transitions in Combinatorial Search," J. of Artificial Intelligence Research, **4**, 1996, pp 91-128.

(376) T. Hogg, "A Framework for Structured Quantum Search," Physica D, **120** (1-2), 1998, pp 102-116.

(377) T. Hogg & J.G. Chase, "Quantum Smart Matter," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 147-152.

(378) T. Hogg & B.A. Huberman, "Order, Complexity and Disorder," Mondes en Developpement, 1986, pp 54-55.

(379) A.V. Holden, J.V. Tucker & B.C. Thompson, "Can Excitable Media Be Considered as Computational Systems?," Physica D, **49**, 1991, pp 240-246.

(380) W. Horkijk, J.P. Crutchfield & M. Mitchell, "Embedded-Particle Computation in Evolved Cellular Automata," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 153-158.

(381) M. Horodecki & R. Horodecki, "Are There Basic Laws of Quantum Information Processing?," Physics Lett. A, **244** (6), 1998, pp 473-481.

(382) J.W. Howatt & A.L. Baker, "Rigorous Definition and Analysis of Program Complexity Meaures - An Example Using Nesting," J. of Systems & Software, **10**, 1989, pp 139-150.

(383) B.A. Huberman, "The Ecology of Computation," Proc. 1992 Int. Symp. on Information Sciences, Iizuka, Fukuoka, Japan, 1992, np.

(384) B.A. Huberman & T. Hogg, "Phase Transitions in Artificial Intelligence Systems," Artificial Intelligence, **33**, 1987, pp 155-171.

(385) L. Huelsbergen, "A Logically Reversible Evaluator for the Call-by-Name Lambda Calculus," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 159-167.

(386) R.J. Hughes, "Quantum Computation," <u>Feynman and Computation: Exploring the Limits of Computers</u>, A.J.G. Hey, ed., Perseus Books, Reading, MA, 1999, pp 191-221.

(387) R.J. Hughes, G.G. Luther, G.L. Morgan, C.G. Peterson & C. Simmons, "Quantum Cryptography over Underground Optical Fibers," <u>Advances in Cryptography, Proceedings of Crypto '96</u>, Springer-Verlag, Berlin, Germany, 1996, np.

(388) M. Huth, "Symbolic and Sub-Symbolic Knowledge Organization in the Computational Theory of Mind," <u>Knowledge Organization</u>, **22** (1), 1995, pp 10-17.

(389) K. Igeta, "Physical Meaning of Computation," <u>Proc. 1992 Int. Symp. on Information Sciences</u>, Iizuka, Fukuoka, Japan, 1992, np.

(390) K. Igeta, "Physical Meaning of Computation," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 184-191.

(391) K. Igeta, B. Huttner & N. Imoto, "Intrinsic Limit of Classical and Quantum Computational Devices," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 168-169.

(392) K. Igeta & T. Ogawa, "Information Dissipation in Quantum-Chaotic Systems," <u>Chaos, Solitons & Fractals</u>, **5**, 1995, np.

(393) R.S. Ingarden, A. Kossakowski & M. Ohya, <u>Information Dynamics and Open Systems</u>, Kluwer Academic Publishers, Dordrecht, Germany, 1997.

(394) K. Inoue, M. Ohya & H. Suyari, "Characterization of Quantum Teleportation Processes by Nonlinear Quantum Channel and Quantum Mutual Entropy," <u>Physica D</u>, **120** (1-2), 1998, pp 117-124.

(395) E. Insinna, "Jungian Synchronicity, Non-Locality and Consciousness," <u>Toward a Scientific Basis for Consciousness: An Interdisciplinary Conference</u>, Tucson, AZ, 1994, np.

(396) H. Ito, S.-I. Amari & K. Kobayashi, "Identifiability of Hidden Markov Information Sources and Their Minimum Degrees of Freedom," <u>IEEE Trans. on Information Theory</u>, **IT-38**, 1992, pp 324-.

(397) M.N. Izakov, "Self-Organization and Information for Planets and Ecosystems," <u>Physics-Uspekhi</u>, **40** (10), 1997, pp 1035-1042.

(398) J. Ja'Ja & V.K.P. Kumar, "Information Transfer in Distributed Computing with Applications to VLSI," <u>J. ACM</u>, 1984, pp 150-162.

(399) I.R. Jackson, Jr. II, "Quantum Mechanical Neural Networks: An Isoperimetric Extremization," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 151-152.

(400) P. Jaenecke, "Elementary Principles for Representing Knowledge," <u>Knowledge Organization</u>, **23** (2), 1996, pp 88-102.

(401)   M.H. Jakubowski, K. Steiglitz & R.K. Squier, "Relative Computational Power of Integrable and Nonintegrable Soliton Systems," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 171-176.

(402)   B. James, "The Universal Algorithm," Kybernetes, 27 (2), 1998, pp 182-189.

(403)   A.M. Jayannavar, "Simple Model for Maxwell`s-Demon-Type Information Engine," Physical Review E, 53 (3), 1996, pp 2957-2959.

(404)   E.T. Jaynes, "Information Theory and Statistical Mechanics I," Physical Review A, 106 (4), 1957, pp 620-630.

(405)   E.T. Jaynes, "Information Theory and Statistical Mechanics II," Physical Review A, 108 (2), 1957, pp 171-190.

(406)   E.T. Jaynes, "The Minimum Entropy Production Principle," Ann. of Review of Physics & Chemistry, 31, 1980, pp 579-601.

(407)   E.T. Jaynes, "On the Rationale of Maximum-Entropy Methods," Proc. IEEE, 70, 1982, pp 939-952.

(408)   E.T. Jaynes, "Probability in Quantum Theory," Complexity, Entropy and the Physics of Information, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 381-403.

(409)   E.T. Jaynes, "Probability Theory as Logic," Maximum Entropy and Bayesian Methods, P. Fougeres, ed., Kluwer Academic Publshers, Dordrecht, 1990, pp 1-16.

(410)   A.V. Jdanko, "Principal Peculiarities of Cybernetic Systems: A Negentropic and Evolutionary Approach," Kybernetes, 24 (4), 1995, pp 84-97.

(411)   T. Jiang, M. Li & B. Ravikumar, "Formal Models and Computability," The Computer Science and Engineering Handbook, A.B. Tucker, ed., CRC Press, Boca Raton, FL, 1996, np.

(412)   T. Jiang, J. Seiferas & P.M.B. Vitanyi, "Two Heads Are Better than Two Tapes," Proc. 26th ACM Symp. on the Theory of Computing, 1994, ACM Press, New York, NY, USA, pp 668-675.

(413)   M. Jibu, S. Hagan, S. Hameroff, K.H. Pribram & K. Yasue, "Quantum Optical Coherence in Cytoskeletal Microtubules: Implications for Brain Function," BioSystems, 32, 1994, pp 195-209.

(414)   M. Jibu & K. Yasue, "Quantum Optical Coherence in Microtubules: Implications for Consciousness," Toward a Scientific Basis for Consciousness: An Interdisciplinary Conference, Tucson, AZ, 1994, np.

(415)   D.S. Johnson, "A Catalog of Complexity Classes," Handbook of Theoretical Computer Science, J. van Leeuwen, ed., MIT Press (Elsevier), Cambridge, MA, USA, 1990, Vol. A, pp 68-.

(416)   R. Jozsa, "Computation and Quantum Superposition," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 192-194.

(417)   R. Jozsa, "Fidelity for Mixed Quantum States," J. of Modern Optics, 41, 1994, pp 2315-2323.

(418)   R. Jozsa, "Quantum Effects in Algorithms," Chaos, Solitons & Fractals, 10 (10), 1999, pp 1657-1664.

(419) R. Jozsa, D. Robb & W.K. Wootters, "Lower Bound for Accessible Information in Quantum Mechanics," Physical Review A, 49, 1994, pp 668-677.

(420) R. Jozsa & B. Schumacher, "A New Proof of the Quantum Noiseless Coding Theorem," J. of Modern Optics, 41, 1994, pp 2343-2350.

(421) D.W. Juedes, J.I. Lathrop & J.H. Lutz, "Computational Depth and Reducibility," Theoretical Computer Science, 132, 1994, pp 37-70.

(422) S.C. Kak, "On Quantum Numbers and Uncertainty," Nuovo Cimento, 33B, 1976, pp 530-534.

(423) S.C. Kak, "On Information Associated with an Object," Proc. Indian National Science Acad., 50, 1984, pp 386-396.

(424) S.C. Kak, "On Quantum Neural Computing," Information Sciences, 83, 1995, pp 163-180.

(425) S.C. Kak, "Quantum Neural Computing," Advances in Imaging & Electron Physics, 94, 1995, pp 259-314.

(426) S.C. Kak, "Information, Physics and Computation," Foundations of Physics, 26 (1), 1996, pp 127-137.

(427) S.C. Kak, "Speed of Computation and Simulation," Foundations of Physics, 26 (10), 1996, pp 1375-1386.

(428) S.C. Kak, "The Three Languages of the Brain: Quantum, Reorganizational, and Associative," Learning and Self-Organization, K.H. Pribram & R. King, eds., Lawrence Erlbaum Associates, 1996, pp 185-219.

(429) S.C. Kak, "Can We Define Levels of Artificial Intelligence?," J. of Intelligent Systems, 6 (2), 1996, pp 133-144.

(430) S.C. Kak, "Quantum Information in a Distributed Apparatus," Foundations of Physics, 28 (6), 1998, pp 1005-1012.

(431) G. Kampis, "Self-Modifying Systems: A Model for the Constructive Origin of Information," Proc. 1st Conf. on the Foundations of Information Science, Madrid, Spain, 1994, np.

(432) F.W. Kantor, Information Mechanics, John Wiley & Sons, New York, NY, 1977.

(433) F.W. Kantor, "Photon Wavelength, Information Transport Speed, and Mass. An Information Mechanics Perspective," Int. J. of Theoretical Physics, 36 (6), 1997, pp 1317-1319.

(434) F.W. Kantor, "Cosmological Redshift. An Information Mechanics Perspective," Int. J. of Theoretical Physics, 38 (3), 1999, pp 993-996.

(435) H. Kargupta, "Drift, Diffusion and Boltzman Distribution in Simple Genetic Algorithm," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 137-145.

(436) L.H. Kauffman, "Space and Time in Computation, Topology and Discrete Physics," Proc. 3rd IEEE Workshop on Physics & Computation, Dallas, TX, 1994, IEEE Computer Society Press, Los Alamitos, CA, pp 44-53.

(437) L.H. Kauffman, "Noncommutivity and Discrete Physics," Physica D, 120 (1-2), 1998, pp 125-138.

(438) S.A. Kauffman, "Requirements for Envolvability in Complex Systems: Orderly Dynamics and Frozen Components," <u>Complexity, Entropy and the Physics of Information</u>, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 151-192.

(439) J.G. Kemeny, "Two Measures of Complexity," <u>J. of Philosophy</u>, **52**, 1955, pp 722-733.

(440) R.W. Keyes, "Fundamental Limit in Digital Information Processing," <u>Proc. IEEE</u>, **69**, 1981, pp 267-278.

(441) R.W. Keyes & R.W. Landauer, "Minimal Energy Dissipation in Logic," <u>IBM J. of Research & Development</u>, **14**, 1970, pp 152-157.

(442) L.A. Khalfin, "The Quantum-Classical Correspondence in Light of Classical Bell's and Quantum Tsirelson's Inequalities," <u>Complexity, Entropy and the Physics of Information</u>, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 477-493.

(443) J. Kilian, "Founding Cryptography on Oblivious Transfer," <u>Proc. 20th ACM Symp. on the Theory of Computing</u>, Chicago, IL, USA, 1988, ACM Press, New York, NY, USA, pp 20-31.

(444) S. Kirkpatrick, G. Gyorgyi, N. Tishby & L. Troyansky, "The Statistical Mechanics of K-Satisfaction," <u>Advances in Neural Information Processing</u>, **6**, 1993, pp 439-446.

(445) S. Kirkpatrick & B. Selman, "Critical Behavior in the Satisfiability of Random Boolean Expressions," <u>Science</u>, **264**, 1994, pp 1297-1301.

(446) G. Kissin, "Measuring Energy Consumption in VLSI Circuits: A Foundation," <u>Proc. 14th ACM Symp. on the Theory of Computing</u>, San Francisco, CA, 1982, ACM Press, New York, NY, USA, pp 99-104.

(447) G. Kissin, "Functional Bounds on Switching Energy," <u>Proc. 1985 Chapel Hill Conf. on Very Large Scale Integration</u>, Chapel Hill, MD, 1985, Computer Science Press, Potomac, MD, pp 181-196.

(448) G. Kissin, <u>Modeling Energy Consumption in VLSI Circuits</u>, Ph.D. Dissertation, University of Toronto, Toronto, Ontario, 1987.

(449) G. Kissin, "Upper and Lower Bounds on Switching Energy in VLSI," <u>J. ACM</u>, **38** (1), 1991, pp 222-254.

(450) Y.L. Klimontovich, "Information Concerning the States of Open Systems," <u>Prikladnaya Nelineinaya Dinamika</u>, **6** (4), 1998, pp 3-17.

(451) T.F. Knight, Jr., <u>Reversible Computing for Energy Efficient and Trustable Computation</u>, Massachusetts Institute of Technology, Cambridge, MA, 1995.

(452) J.G. Koller & W.C. Athas, "Adiabatic Switching, Low Energy Computing, and the Physics of Storing and Erasing Information," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 267-270.

(453) J.G. Koller, W.C. Athas & L.J. Svensson, "Thermal Logic Circuits," <u>Proc. 3rd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1994, IEEE Computer Society Press, Los Alamitos, CA, pp 119-127.

(454) A.N. Kolmogorov, "On the Shannon Theory of Information in the Case of Continuous Signals," <u>IRE Trans. on Information Theory</u>, **IT-2**, 1956, pp 102-108.

(455) A.N. Kolmogorov, "Three Approaches to the Quantitative Definition of Information," Problems of Information Transmission, **1** (1), 1965, pp 1-7.

(456) A.N. Kolmogorov, "Logical Basis for Information Theory and Probability Theory," IEEE Trans. on Information Theory, **IT-14** (5), 1968, pp 662-664.

(457) A.N. Kolmogorov, "On the Logical Foundations of Information Theory and Probability Theory," Problems of Information Transmission, **5**, 1969, pp 1-4.

(458) D.K. Kondepudi, "Non-Equilibrium Polymers, Entropy, and Algorithmic Information," Complexity, Entropy and the Physics of Information, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 199-206.

(459) D. Koruga, "Information Physics, Neuromolecular Computing and Consciousness," Toward a Scientific Basis for Consciousness: An Interdisciplinary Conference, Tucson, AZ, 1994, np.

(460) P.R. Kotiuga & T. Toffoli, "Potential for Computation in Micromagnetics via Topological Conservation Laws," Physica D, **120** (1-2), 1998, pp 139-161.

(461) E.V. Krishnamurthy, "Computational Power of Quantum Machines, Quantum Grammars and Feasible Computation," Int. J. of Modern Physics, **9** (March), 1998, pp 213-241.

(462) E.V. Krishnamurthy, "Coherent State Evolution and Exactly Solvable Classes of Problems Using Quantum T Computation," Proc. 1999 IEEE Conf. on Parallel Architecture & Compilation Techniques, 1999, np.

(463) E.V. Krishnamurthy, "Integrability and Quantum Parallel Computational Complexity," Proc. 1999 IEEE Conf. on Parallel Architecture & Compilation Techniques, 1999, np.

(464) K. Krohn & J.L. Rhodes, "Complexity of Finite Semi-Groups," Ann. of Mathematics, **88**, 1968, pp 128-160.

(465) M. Lachmann, M.E.J. Newman & C. Moore, The Physical Limits of Communication, Working Paper 99-07-054, Santa Fe Institute, Santa Fe, NM, 1999.

(466) R. Laflamme, C. Miquel, J.P. Paz & W.H. Zurek, "Perfect Quantum Error Correction Code," Physical Review Lett., **77**, 1996, pp 197-.

(467) R. Lahoz-Beltra, S.R. Hameroff & J. Dayhoff, "Phase Transitions in Bound Water and their Role as Cytoskeletal Communication Interface and Medium for Information Representation," Toward a Scientific Basis for Consciousness: An Interdisciplinary Conference, Tucson, AZ, 1994, np.

(468) R.W. Landauer, "Irreversibility and Heat Generation in the Computing Process," IBM J. of Research & Development, **5**, 1961, pp 183-191.

(469) R.W. Landauer, "Stability and Instability in Information Processing and in Steady State Dissipative Systems," Physik 1971, B.G. Teubner, 1971, pp 286-.

(470) R.W. Landauer, "Uncertainty Principle and Minimum Energy Dissipation in the Computer," Int. J. of Theoretical Physics, **21** (3/4), 1982, pp 283-297.

(471) R.W. Landauer, "Dissipation in Computation," Physical Review Lett., **53**, 1984, pp 1205-.

(472) R.W. Landauer, "Fundamental Physical Limitations of the Computational Process," Computer Culture: The Scientific, Intellectual, and Social Impact of the Computer, H. Pagels, ed., 1985, np.

(473) R.W. Landauer, "Fundamental Physical Limitations on the Computing Process," Annals of the New York Academy of Sciences, **426**, 1985, pp 161-170.

(474) R.W. Landauer, "Computation and Physics: Wheeler's Meaning Circuit?," Foundations of Physics, **16** (6), 1986, pp 551-564.

(475) R.W. Landauer, "Energy Requirements in Communication," Applied Physics Lett., **51**, 1987, pp 2056-2058.

(476) R.W. Landauer, "Computation: A Fundamental Physical View," Physica Scripta, **35**, 1987, pp 88-95.

(477) R.W. Landauer, "Dissipation and Noise Immunity in Computation and Communication," Nature, **355**, 1988, pp 779-784.

(478) R.W. Landauer, "Computation, Measurement, Communication and Energy Dissipation," Selected Topics in Signal Processing, S. Haykin, ed., Prentice-Hall, Englewood Cliffs, NJ, 1989, pp 188-196.

(479) R.W. Landauer, "Information Is Physical," Physics Today, **44** (5), 1991, pp 23-29.

(480) R.W. Landauer, "Reversible Computing and Physical Law - Landauer Replies," Physics Today, **45** (3), 1992, pp 100.

(481) R.W. Landauer, "Information is Physical," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 1-4.

(482) R.W. Landauer, "Zig-Zag Path to Understanding," Proc. 3rd IEEE Workshop on Physics & Computation, Dallas, TX, 1994, IEEE Computer Society Press, Los Alamitos, CA, pp 54-59.

(483) R.W. Landauer, "Is Quantum Mechanically Coherent Computation Useful?," Proc. Drexel-4 Symp. on Quantum Nonintegrability, 1995, International Press, np.

(484) R.W. Landauer, "Is Quantum Mechanics Useful?," Trans. Royal Soc. London A, **353**, 1995, pp 367-376.

(485) R.W. Landauer, "The Physical Nature of Information," Physics Lett. A, **217** (4-5), 1996, pp 187-193.

(486) R.W. Landauer, "Minimal Energy Requirements in Communication," Science, **272** (5270), 1996, pp 1914-1918.

(487) R.W. Landauer, "Energy Needed to Send a Bit," Proc. Royal Soc. of London, Series A, **454** (1969), 1998, pp 305-311.

(488) R.W. Landauer, "Information Is Inevitably Physical," Feynman and Computation: Exploring the Limits of Computers, A.J.G. Hey, ed., Perseus Books, Reading, MA, 1999, pp 77-92.

(489) R.W. Landauer, "Information Is a Physical Entity," Physica A, **263** (1-4), 1999, pp 63-67.

(490) R.W. Landauer & M. Buttiker, "Drift and Diffusion in Reversible Computation," Physica Scripta, **T9**, 1985, pp 155-164.

(491) R.W. Landauer & J.F. Woo, "Cooperative Phenomena in Data Processing," Synergetics, H. Haken, ed., Teubner, Stuttgart, Germany, 1973, pp 97-123.

(492) K.J. Lange, P. McKenzie & A. Trapp, "Reversible Space Equals Deterministic Space," Proc. 12th IEEE Computational Complexity Conf., 1997, IEEE Computer Society Press, Los Alamitos, CA, np.

(493) C.G. Langton, "Computation at the Edge of Chaos: Phase Transitions and Emergent Computation," Physica D, 42 (1/3), 1990, pp 12-37.

(494) P.N. Lawrence, "Physical Limits, and Information as a Form of Matter," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 83-85.

(495) J.P. Leao, "Artificial Physics: The Soul of a New Discipline," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 10-20.

(496) J.P. Leao, "A Quantum-Mechanical Turing Test," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 183-185.

(497) D.S. Lebedev & L.B. Levitin, "The Maximum Amount of Information Transmissible by Electromagnetic Field," Soviet Physics Doklady, 8, 1963, pp 377-379.

(498) D.S. Lebedev & L.B. Levitin, "Information Transmission by Electromagnetic Field," Information & Control, 9 (1), 1966, pp 1-22.

(499) H.S. Leff & A.F. Rex, Maxwell's Demon: Entropy, Information, Computing, Princeton University Press, Princeton, NJ, 1990.

(500) H.S. Leff & A.F. Rex, "Maxwell's Demon and the Culture of Entropy," Physics Essays, 10 (1), 1997, pp 125-149.

(501) C.S. Lent, P.D. Tougaw & W. Porod, "Bistable Saturation in Coupled Quantum Dots for Quantum Cellular Automata," Applied Physics Lett., 62, 1993, pp 714-716.

(502) C.S. Lent, P.D. Tougaw & W. Porod, "Quantum Cellular Automata: The Physics of Computing with Arrays of Quantum Dot Molecules," Proc. 3rd IEEE Workshop on Physics & Computation, Dallas, TX, 1994, IEEE Computer Society Press, Los Alamitos, CA, pp 5-13.

(503) C.S. Lent, P.D. Tougaw, W. Porod & G.H. Bernstein, "Quantum Cellular Automata," Nanotechnology, 4, 1993, pp 49-57.

(504) C.S. Lent, P.D. Tougaw, G. Toth, W. Weng, Y. Brazhnik & W. Porod, "Quantum Cellular Neural Networks," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 186.

(505) J. Leo, Energy Complexity in VLSI, M.S. Thesis, University of Nijmegen, The Netherlands, 1984.

(506) L.A. Levin, "Laws of Information Conservation (Nongrowth) and Aspects of the Foundation of Probability Theory," Problems of Information Transmission, 10 (3), 1974, pp 206-210.

(507) L.A. Levin, "Various Measures of Complexity for Finite Objects (Axiomatic Description)," Soviet Mathematics Doklady, 17 (2), 1976, pp 522-526.

(508) L.A. Levin, "Randomness Conservation Inequalities: Information and Independence in Mathematical Theories," Information & Control, 61 (1), 1984, pp 15-37.

(509) R.Y. Levine & A.T. Sherman, "A Note on Bennett's Time-Space Tradeoff for Reversible Computation," <u>SIAM Journal of Computation</u>, **19** (4), 1990, pp 673-677.

(510) R.D. Levins, "The Limits of Complexity," <u>Hierarchy Theory - The Challenge of Complex Systems</u>, H.H. Pattee, ed., George Braziller, New York, NY, 1973, pp 109-127.

(511) L.B. Levitin, "Information Transmission in the Ideal Photon Channel," <u>Problems of Information Transmission</u>, **1** (3), 1965, pp 55-62.

(512) L.B. Levitin, <u>Physical Limitations in Information Transmission Channels</u>, Ph.D. Thesis, Gorky University, 1969.

(513) L.B. Levitin, "On the Quantum Measure of Information," <u>Proc. 4th Nat. Conf. on Information Theory</u>, Tashkent, USSR, 1969, pp 111-115.

(514) L.B. Levitin, "Does There Exist a Fundamental Limit of Information Processing Rate?," <u>Proc. 3rd Int. Symp. on Radio Electronics</u>, Varna, Bulgaria, 1970, pp 1-15.

(515) L.B. Levitin, "A Thermodynamic Characterization of Ideal Physical Information Channel," <u>J. of Information & Optimization Science</u>, **2**, 1981, pp 259-266.

(516) L.B. Levitin, "Physical Limitations of Rate Depth and Minimum Energy in Information Processing," <u>Int. J. of Theoretical Physics</u>, **21**, 1982, pp 299-309.

(517) L.B. Levitin, "Ideal Corpuscular Information Channels," <u>Proc. IEEE Int. Symp. on Information Theory</u>, St. Johite, Quebec, Canada, 1983, IEEE Press, New York, NY, USA, np.

(518) L.B. Levitin, "Physical Information Theory Part I. Quasiclassical Systems," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 210-214.

(519) L.B. Levitin, "Physical Information Theory Part II. Quantum Systems," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 215-219.

(520) L.B. Levitin, "Information in Direct and Indirect Quantum Measurements," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 220-222.

(521) L.B. Levitin, "Gibbs Paradox and Equivalence Relation between Quantum Information and Work," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 223-226.

(522) L.B. Levitin, "On the Quantum Measure of Information," <u>Ann. de la Fond. Louis de Broglie</u>, **21** (3), 1996, pp 345-348.

(523) L.B. Levitin, "Minimum Energy in Information Transmission," <u>Proc. 1997 IEEE Int. Symp. on Information Theory</u>, Ulm, Germany, 1997, IEEE Press, New York, NY, USA, np.

(524) L.B. Levitin, "Energy Cost of Information Transmission (Along the Path to Understanding)," <u>Physica D</u>, **120** (1-2), 1998, pp 162-167.

(525) L.B. Levitin, "Conditional Entropy and Information in Quantum Systems," <u>Proc. 1998 IEEE Int. Symp. on Information Theory</u>, Cambridge, MA, USA, 1998, IEEE Press, New York, NY, USA, np.

(526) L.B. Levitin, "Energy Requirements in Quantum Communication," Int. J. of Theoretical Physics, 37 (1), 1998, pp 487-494.

(527) L.B. Levitin, "Conditional Entropy and Information in Quantum Systems," Chaos, Solitons & Fractals, 10 (10), 1999, pp 1651-1656.

(528) H.R. Lewis & C.H. Papadimitriou, Elements of a Theory of Computation, Prentice-Hall, Englewood Cliffs, NJ, 1981.

(529) M. Li, "On the Relationship between Complexity and Entropy for Markov Chains and Regular Languages," Complex Systems, 5, 1991, pp 381-399.

(530) M. Li, J. Tromp & P.M.B. Vitanyi, "Reversible Simulation of Irreversible Computation," Physica D, 120 (1-2), 1998, pp 168-176.

(531) M. Li & P.M.B. Vitanyi, "Two Decades of Applied Kolmogorov Complexity," Proc. 3rd IEEE Structure in Complexity Theory Conf., Washington, DC, 1988, pp 80-101.

(532) M. Li & P.M.B. Vitanyi, "Inductive Reasoning and Kolmogorov Complexity," Proc. 4th IEEE Structure in Complexity Theory Conf., 1989, pp 165-185.

(533) M. Li & P.M.B. Vitanyi, "Kolmogorov Complexity and Its Applications," Handbook of Theoretical Computer Science, J. van Leeuwen, ed., Elsevier/MIT Press, Cambridge, MA, 1990, pp 187-254.

(534) M. Li & P.M.B. Vitanyi, "Applications of Kolmogorov Complexity in the Theory of Computation," Complexity Theory Retrospective, A.L. Selman, ed., Springer Verlag, 1990, pp 147-203.

(535) M. Li & P.M.B. Vitanyi, "Kolmogorov Complexity and Combinatorics," Proc. 6th IEEE Structure in Complexity Theory Conf., 1991, pp 154-163.

(536) M. Li & P.M.B. Vitanyi, "Philosophical Issues in Kolmogorov Complexity," Proc. 19th Int. Colloq. on Automata, Languages & Programming, 1992, Springer Verlag, Berlin, Germany, pp 1-15.

(537) M. Li & P.M.B. Vitanyi, "Theory of Thermodynamics of Computation," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 42-46.

(538) M. Li & P.M.B. Vitanyi, "Statistical Properties of Finite Sequences with High Kolmogorov Complexity," Mathematical Systems Theory, 27, 1994, pp 365-376.

(539) M. Li & P.M.B. Vitanyi, "Kolmogorov Complexity Arguments in Combinatorics," J. of Combinatorial Theory A, 66 (2), 1994, pp 226-236.

(540) M. Li & P.M.B. Vitanyi, "A New Approach to Formal Language Theory by Kolmogorov Complexity," SIAM J. on Computing, 24 (2), 1995, pp 398-410.

(541) M. Li & P.M.B. Vitanyi, "Reversibility and Adiabatic Computation: Trading Time and Space for Energy," Proc. Royal Soc. of London, Series A, 452, 1996, pp 769-789.

(542) M. Li & P.M.B. Vitanyi, "Space-Energy Trade-Off in Reversible Simulations," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 191-193.

(543) M. Li & P.M.B. Vitanyi, An Introduction to Kolmogorov Complexity and Its Applications, 2nd ed., Springer-Verlag, New York, NY, 1997.

(544) M. Li & P.M.B. Vitanyi, "Algorithmic Complexity," International Encyclopedia of the Social & Behavioral Sciences, N.J. Smelser & P.B. Baltes, eds., Pergamon, 2001, np.

(545) E.A. Liberman & S.V. Minina, "Cell Molecular Computers and Biological Information as the Foundation of Nature's Laws," Proc. 1st Conf. on the Foundations of Information Science, Madrid, Spain, 1994, np.

(546) K.K. Likharev, "Classical and Quantum Limitations on Energy Consumption in Computation," Int. J. of Theoretical Physics, 21 (3/4), 1982, pp 311-326.

(547) K.K. Likharev, "Rapid Single-Flux-Quantum Logic," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 194-195.

(548) K.K. Likharev & A.N. Korotkov, "Reversible Computation in a System with Discrete Eigenstates," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 194-195.

(549) X. Lin & J. Ohtsubo, "Memory Capacity of Terminal Attractor Optical Associative Memory," Proc. 1996 SPIE Symp. on Optical Recording, Storage & Retrieval Systems, Beijing, China, 1996, SPIE-Int. Soc. Opt. Eng, pp 116-123.

(550) X. Lin, J. Ohtsubo & M. Mori, "Capacity of Optical Associative Memory Using a Terminal Attractor Model," Optics Communications, 146 (1-6), 1998, pp 49-54.

(551) S. Lloyd, "Valuable Information," Complexity, Entropy and the Physics of Information, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 193-198.

(552) S. Lloyd, "Physical Measures of Complexity," 1989 Lectures in Complex Systems, E. Jen, ed., Addison-Wesley, Redwood City, CA, 1990, pp 67-73.

(553) S. Lloyd, "Causality and Information Flow," Information Dynamics, H. Atmaspacker & H. Scheingraber, eds., Plenum Press, New York, NY, 1991, np.

(554) S. Lloyd, "A Potentially Realizable Quantum Computer," Science, 261, 1993, pp 1569-1571.

(555) S. Lloyd, "Envisioning a Quantum Supercomputer," Science, 263, 1994, pp 695.

(556) S. Lloyd, "Quantum Mechanical Computers," Scientific American, 273 (4), 1995, pp 44-50.

(557) S. Lloyd, "Almost Any Quantum Logic Gate Is Universal," Physical Review Lett., 75, 1995, pp 346-349.

(558) S. Lloyd, "Universal Quantum Simulators," Science, 273, 1996, pp 1073-.

(559) S. Lloyd, "A Quantum Analog of Shannon's Noisy Channel Theorem," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 200.

(560) S. Lloyd, "Quantum-Mechanical Maxwell's Demon," Physical Review A, 56 (5), 1997, pp 3374-3382.

(561) S. Lloyd, "Capacity of the Noisy Quantum Channel," Physical Review A, 55 (3), 1997, pp 1613-1622.

(562) S. Lloyd, "Ultimate Physical Limits to Computation," Nature, 1999, np.

(563) S. Lloyd, Physical Limits to Computation, Los Alamos National Laboratory, Los Alamos, NM, 1999.

(564) S. Lloyd & H. Pagels, "Complexity as Thermodymanic Depth," <u>Ann. of Physics</u>, **188**, 1988, pp 186-213.

(565) H.-K. Lo, "Insecurity of Quantum Secure Computations," <u>Physical Review A</u>, **56**, 1997, pp 1154-1162.

(566) H.-K. Lo & H.F. Chau, "Is Quantum Bit Commitment Really Possible?," <u>Physical Review Lett.</u>, **78**, 1997, pp 3410-3413.

(567) H.-K. Lo & H.F. Chau, "Why Quantum Bit Commitment and Ideal Quantum Coin Tossing Are Impossible?," <u>Physica D</u>, **120** (1-2), 1998, pp 177-187.

(568) L. Lofgren, "Complexity of Descriptions of Systems: A Foundational Study," <u>Int. J. of General Systems</u>, **3**, 1974, pp 197-214.

(569) L. Lofgren, "Complexity of Systems," <u>Systems and Control Encyclopedia</u>, M. Singh, ed., Pergamon Press, Oxford, UK, 1987, pp 704-709.

(570) D. Loss & D.P. DiVincenzo, "Quantum Computation with Quantum Dots," <u>Physical Review A</u>, **57** (1), 1998, pp 120-126.

(571) M. Loui, "Complexity Theory," <u>The Computer Science and Engineering Handbook</u>, A.B. Tucker, ed., CRC Press, Boca Raton, FL, 1996, np.

(572) P. Lovland, "Meaning, Motivation, and Disorder: Thermodynamic Model and Possible Experiment," <u>Toward a Scientific Basis for Consciousness: An Interdisciplinary Conference</u>, Tucson, AZ, 1994, np.

(573) E. Lubkin, "Keeping the Entropy of Measurement: Szilard Revisited," <u>Int. J. of Theoretical Physics</u>, **26**, 1987, pp 523-.

(574) T.W. Lynch, "The Energy Content of Knowledge," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 78-82.

(575) J. Machta, "The Computational Complexity of Pattern Formation," <u>J. of Statistical Physics</u>, **70**, 1993, pp 949-.

(576) J. Machta, "Entropy, Information, and Computation," <u>American J. of Physics</u>, **67** (12), 1999, pp 1074-1077.

(577) J. Machta & R. Greenlaw, "The Parallel Complexity of Growth Models," <u>J. of Statistical Physics</u>, **77**, 1994, pp 755-.

(578) J. Machta & R. Greenlaw, "Parallel Computational Complexity and Logical Depth in Statistical Physics," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 201-207.

(579) J. Machta & R. Greenlaw, "The Computational Complexity of Generating Random Fractals," <u>J. of Statistical Physics</u>, **82**, 1996, pp 1299-.

(580) J. Maddox, "Complicated Measures of Complexity," <u>Nature</u>, **344**, 1990, pp 705-.

(581) G. Mahler & V.A. Weberruss, <u>Quantum Networks</u>, Springer Verlag, New York, NY, 1995.

(582) K. Mainzer, <u>Thinking in Complexity : The Complex Dynamics of Matter, Mind, and Mankind</u>, 2nd ed., Springer Verlag, New York, NY, 1996.

(583) V. Majernik, "A Realistic Maxwell's Demon Is in Fact a Cognitive Robot," <u>Kybernetes</u>, **28** (9), 1999, pp 1065-1071.

(584) A. Manaster-Ramer & Q. Yu, "Linguistic Mechanism, Physical Mechanism, and Secondary Non-r.e.ness of the Physical World," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 24-33.

(585) M. Manthey, "Toward an Information Mechanics," <u>Proc. 3rd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1994, IEEE Computer Society Press, Los Alamitos, CA, pp 95-110.

(586) C. Marand & P.D. Townsend, "Quantum Key Distribution over Distances as Long as 30km," <u>Optics Lett.</u>, **20**, 1995, pp 1695-1697.

(587) J.-P. Marc, G. Brassard & C.H. Bennett, "How to Decrease Your Enemy's Information," <u>Advances in Cryptology, Proceedings of Crypto '85</u>, H.C. Williams, ed., Springer-Verlag, Berlin, Germany, 1986, Vol. 218, pp 468-476.

(588) R. Margalef, "Information and Uncertainty in Living Systems, A View from Ecology," <u>Proc. 1st Conf. on the Foundations of Information Science</u>, Madrid, Spain, 1994, np.

(589) N.H. Margolus, "Physics-Like Models of Computation," <u>Physica D</u>, **10** (1/2), 1984, pp 81-85.

(590) N.H. Margolus, "Quantum Computation," <u>Annals of the New York Academy of Sciences</u>, **480**, 1986, pp 487-497.

(591) N.H. Margolus, <u>Physics and Computation</u>, Ph.D. Thesis, Massachusetts Institute of Technology, Laboratory for Computer Science, Cambridge, MA, 1988.

(592) N.H. Margolus, "Parallel Quantum Computation," <u>Complexity, Entropy and the Physics of Information</u>, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 273-287.

(593) N.H. Margolus, "Fundamental Physical Constraints on the Computational Process," <u>Nanotechnology: Research and Perspectives</u>, B.C.Crandall & J. Lewis, eds., MIT Press, Cambridge, MA, 1992, np.

(594) N.H. Margolus, "A Bridge of Bits," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 253-257.

(595) N.H. Margolus & L.B. Levitin, "The Maximum Speed of Dynamical Evolution," <u>Physica D</u>, **120** (1-2), 1998, pp 188-195.

(596) P.C. Marijuán, "'Gloom in the Society of Enzymes': On The Nature Of Biological Information," <u>Proc. 1st Conf. on the Foundations of Information Science</u>, Madrid, Spain, 1994, np.

(597) P. Martin-Lof, "The Definition of Random Sequences," <u>Information & Control</u>, **9** (6), 1966, pp 602-619.

(598) D. Mathis & M. Mozer, "On the Computational Utility of Consciousness," <u>Toward a Scientific Basis for Consciousness: An Interdisciplinary Conference</u>, Tucson, AZ, 1994, np.

(599) H. Matsueda, E. Goto & K.-F. Loe, "Information Erasure without Entropy Production of k ln 2 per Bit by a Quasi-Static Potential Change Subjected to Brownian Motion," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 212-214.

(600) H. Matsueda & S. Takeno, "Quantum Gates Implemented by the Coherent Properties of Nonlinear Excitons," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 215-222.

(601) H. Matsueda & S. Takeno, "Quantum Computer Implemented by the Coherent Properties of Nonlinear Excitons," <u>Proc. 1st Int. Conf. on the Theory & Applications of Cryptology</u>, Praha, 1996, pp 225-233.

(602) H. Matsueda & S. Takeno, "Nonlinear Coherent Excitonic Solid Gates for Quantum Computation," <u>Proc. 1996 Int. Symp. on Nonlinear Theory & Its Applications</u>, Kochi, Japan, 1996, pp 165-168.

(603) K. Matsuno, "Internalist Stance and the Physics of Information," <u>Proc. 1st Conf. on the Foundations of Information Science</u>, Madrid, Spain, 1994, np.

(604) D.J. Matzke, "Physics of Computational Abstraction," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 34-41.

(605) D.J. Matzke, "Impact of Locality and Dimensionality Limits on Architecture Trends," <u>Proc. 3rd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1994, IEEE Computer Society Press, Los Alamitos, CA, pp 30-35.

(606) D.J. Matzke, "Information Is Protophysical," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 223-225.

(607) D. Mayers, "On the Security of the Quantum Oblivious Transfer and Key Distribution Protocols," <u>Advances in Cryptology, Proceedings of Crypto '95</u>, Springer-Verlag, Berlin, Germany, 1995, Vol. 963, pp 124-135.

(608) D. Mayers, "Quantum Key Distribution and String Oblivious Transfer in Noisy Channels," <u>Advances in Cryptology, Proceedings of Crypto '96</u>, Springer-Verlag, Berlin, Germany, 1996, Vol. 1109, pp 343-357.

(609) D. Mayers, "Unconditionally Secure Quantum Bit Commitment Is Impossible," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 226-228.

(610) D. Mayers, "Unconditionally Secure Quantum Bit Commitment Is Impossible," <u>Physical Review Lett.</u>, **78**, 1997, pp 3414-3417.

(611) M. McCabe, "A Complexity Measure," <u>IEEE Trans. on Software Engineering</u>, **2**, 1976, pp 308-320.

(612) R.C. Merkle, "Towards Practical Reversible Logic," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 227-228.

(613) R.C. Merkle, "Reversible Electronic Logic Using Switches," <u>Nanotechnology</u>, **4**, 1993, pp 21-40.

(614) V.V. Mityugov, "Entropy, Information and Work in Quantum Statistics," <u>Problems of Control & Information Theory</u>, **2**, 1973, pp 243-256.

(615) R. Monasson & R. Zecchina, "The Entropy of the K-Satisfiability Problem," <u>Physical Review Lett.</u>, **76**, 1996, pp 3881-3885.

(616) R. Monasson, R. Zecchina, S. Kirkpatrick, B. Selman & L. Troyansky, "Phase Transition and Search Cost in the (2 + p) - SAT Problem," <u>Proc. 4th Workshop on</u>

Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 229-232.

(617) C. Monroe, D.M. Meekhof, B.E. King, W.M. Itano & D.J. Wineland, "Demonstration of a Fundamental Quantum Logic Gate," Physical Review Lett., **75**, 1995, pp 4714-4717.

(618) C. Monroe & D.J. Wineland, "Future of Quantum Computing Proves to Be Debatable," Physics Today, 1996, pp 107-108.

(619) M.S. Montemerlo, J.C. Love, G.J. Opiteck, D.J.K. Goldhaber & J.C. Ellenbogen, "Technologies and Designs for Electronic Nanocomputers: A Review," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 233.

(620) R. Morck & H. Morowitz, "Value and Information: A Profit Maximizing Strategy for Maxwell`s Demon," Complexity, **1** (2), 1995, pp 58-63.

(621) E. Morin, "Complexity," Int. J. of Social Science, **26**, 1974, pp 583-597.

(622) E. Morin, "On the Definition of Complexity," The Science and Praxis of Complexity, E.A. Aida, ed., United Nations University, Tokyo, Japan, 1984, pp 62-68.

(623) A. Moshowitz, "Entropy and the Complexity of Graphs," Bull. of Mathematical Biophysics, **30**, 1968, pp 175-204, 225-140.

(624) V.F. Mukhanov, "The Entropy of Black Holes," Complexity, Entropy and the Physics of Information, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 47-52.

(625) A. Muller, H. Zbinden & N. Gisin, "Underwater Quantum Coding," Nature, **378**, 1995, pp 449-.

(626) J. Muller-Quade, H. Aagedal, T. Beth & M. Schmid, "Algorithmic Design of Diffractive Optical Systems for Information Processing," Physica D, **120** (1-2), 1998, pp 196-205.

(627) K. Nakamura, Quantum Chaos, Cambridge University Press, Cambridge, UK, 1994.

(628) S.K. Ng, "Information and System Modelling," Mathematical & Computer Modelling, **23** (5), 1996, pp 1-15.

(629) G. Nicols & I. Prigogine, Exploring Complexity: An Introduction, Freeman, New York, NY, 1989.

(630) M.A. Nielsen, "Computable Functions, Quantum Measurements, and Quantum Dynamics," Physical Review Lett., **79**, 1997, pp 2915-2918.

(631) M.A. Nielsen, C.M. Caves & B. Schumacher, "Information-Theoretic Approach to Quantum Error Correction and Reversible Measurement," Proc. Royal Soc. of London, Series A, **454**, 1998, pp 277-304.

(632) M.T. Nielsen & C.M. Caves, "Reversible Quantum Operations and Their Application to Teleportation," Physical Review A, **55** (4), 1997, pp 2547-2556.

(633) H.P. Noyes, "Bit-String Physics: A Novel 'Theory of Everything'," Proc. 3rd IEEE Workshop on Physics & Computation, Dallas, TX, 1994, IEEE Computer Society Press, Los Alamitos, CA, pp 88-94.

(634) M.B. O'Neal & W.R. Edwards, "Complexity Measures for Rule-Based Programs," IEEE Trans. on Knowledge & Data Engineering, **6**, 1994, pp 669-680.

(635) K. Obenland & A. Despain, "Simulation of Factoring on a Quantum Computer Architecture," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 234-237.

(636) M. Ohya, "On Compound State and Mutual Information in Quantum Information Theory," IEEE Trans. on Information Theory, **IT-29**, 1983, pp 770-774.

(637) M. Ohya, "Some Aspects of Quantum Information Theory and Their Applications to Irreversible Processes," Reports of Mathematical Physics, **27**, 1989, pp 19-47.

(638) M. Ohya & D. Petz, Quantum Entropy and Its Use, Springer-Verlag, Berlin, Germany, 1993.

(639) M. Ohya, D. Petz & N. Watanabe, "On Capacities of Quantum Channels," Probability & Mathematical Statistics, **17**, 1997, pp 179-197.

(640) M. Ohya & N. Watanabe, "On the Mathematical Treatment of the Fredkin-Toffoli-Milburn Gate," Physica D, **120** (1-2), 1998, pp 206-213.

(641) A. Ommaya, "Emotion as Consciousness: A Thermodynamic Approach," Toward a Scientific Basis for Consciousness: An Interdisciplinary Conference, Tucson, AZ, 1994, np.

(642) R. Omnes, "Some Progress in Measurement Theory: The Logical Interpretation of Quantum Mechanics," Complexity, Entropy and the Physics of Information, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 495-512.

(643) E.T.L. Omtzigt, "Computational Spacetimes," Proc. 3rd IEEE Workshop on Physics & Computation, Dallas, TX, 1994, IEEE Computer Society Press, Los Alamitos, CA, pp 239-245.

(644) A. Orlowski, "Measures of Distance between Quantum States," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 239-242.

(645) P. Orponen & M. Matamala, "Universal Computation by Finite Two-Dimensional Coupled Map Lattices," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 243-247.

(646) N.H. Packard, J.P. Crutchfield, J.D. Farmer & R.S. Shaw, "Geometry from a Time Series," Physical Review Lett., **45**, 1980, pp 712-716.

(647) G.M. Palma, K.-A. Suominen & A.K. Ekert, "Quantum Computation and Dissipation," Proc. Royal Soc. of London, Series A, **452**, 1996, pp 567-.

(648) C.H. Papadimitriou & M. Sipser, "Communication Complexity," J. of Computer & System Sciences, **28** (2), 1984, pp 260-269.

(649) F. Papentin, "On Order and Complexity," J. of Theoretical Biology, **87**, 1980, pp 1-456.

(650) M.H. Partovi, "Entropy and Quantum Mechanics," Complexity, Entropy and the Physics of Information, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 357-366.

(651) R. Paton, "Metaphors, Models and Bioinformation," <u>Proc. 1st Conf. on the Foundations of Information Science</u>, Madrid, Spain, 1994, np.

(652) P. Patra, <u>Approaches to Design of Circuits for Low-Power Computation</u>, Ph.D., University of Texas at Austin, Austin, TX, USA, 1995.

(653) P. Patra & D.S. Fussell, "Conservative Delay-Insensitive Circuits," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 248-259.

(654) P. Patra & D.S. Fussell, "On Efficient Adiabatic Design of MOS Circuits," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 260-269.

(655) H.H. Pattee, "Physical Problems of Decision-Making Constraints," <u>Int. J. of Neuroscience</u>, **3**, 1972, pp 99-106.

(656) P.L. Patterson, "Entropy, Fault Tolerance, and Multicomputer Networks," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 232-236.

(657) D. Pearson, "Programming a Crystal-Lattice Computer," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 270-274.

(658) L. Peliti & A. Vulpiani, eds., <u>Measures of Complexity</u>, Springer-Verlag, Berlin, Germany, 1988.

(659) T. Pellizzari, S.A. Gardiner, J.I. Cirac & P. Zoller, "Decoherence, Continuous Observation and Quantum Computing: A Cavity QED Model," <u>Physical Review Lett.</u>, **75** (21), 1995, pp 3788-3791.

(660) R. Penrose, "Quantum Coherence and Consciousness," <u>Toward a Scientific Basis for Consciousness: An Interdisciplinary Conference</u>, Tucson, AZ, 1994, np.

(661) I.C. Percival, "Information and the Quantum State," <u>Proc. 1992 Int. Symp. on Information Sciences</u>, Iizuka, Fukuoka, Japan, 1992, np.

(662) A. Peres, "Reversible Logic and Quantum Computers," <u>Physical Review A</u>, **32**, 1985, pp 3266-3276.

(663) A. Peres, "Thermodynamic Constraints and Quantum Axioms," <u>Complexity, Entropy and the Physics of Information</u>, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 345-356.

(664) A. Peres, "Storage and Retrieval of Quantum Information," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 155-158.

(665) A. Peres, "Error Correction and Symmetrization in Quantum Computers," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 275-277.

(666) P. Petrov, "Non-Replicative Fredkin's Rules in Homogeneous Cellular Spaces," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 278-281.

(667) T.E. Phipps, Jr. & M.H. Brill, "Bayesian Entropy and Inference," <u>Physics Essays</u>, **8** (4), 1995, pp 615-625.

(668) J.R. Pierce, <u>Symbols, Signals and Noise: The Nature and Process of Communication</u>, Harper and Brothers, New York, NY, 1961.

(669) J.R. Pierce, An Introduction to Information Theory: Symbols, Signals and Noise, 2nd ed., Dover Publications Inc., New York, NY, USA, 1980.

(670) S. Pincus, "Approximate Emtropy (Apen) as a Complexity Measure," Chaos, 5, 1995, pp 110-117.

(671) N. Pippenger, "Complexity Theory," Scientific American, 239, 1978, pp 90-100.

(672) I. Pitowsky, "The Physical Church Thesis and Physical Computational Complexity," Iyyun, A Jerusalem Philosophical Quarterly, 39, 1990, pp 81-99.

(673) R.P. Poplavskii, "Thermodynamic Models of Information Processes," Soviet Physics Uspekhi, 115, 1975, pp 222-241.

(674) R.P. Poplavskii, "Maxwell Demon and Correlations between Information and Entropy," Soviet Physics Uspekhi, 128, 1979, pp 165-176.

(675) W. Porod, H.K. Harbury & C.S. Lent, "Study of Wave Phenomena in Physically-Coupled Device Arrays Using the Helmholtz Equation as a Model," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 282.

(676) V. Pratt, "Linear Logic for Generalized Quantum Mechanics," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 166-180.

(677) K.H. Pribram, "Complexity and Causality," The Science and Praxis of Complexity, E.A. Aida, ed., United Nations University, Tokyo, Japan, 1984, pp 119-132.

(678) K.H. Pribram, "Dendritic Microprocessing and Consciousness," Toward a Scientific Basis for Consciousness: An Interdisciplinary Conference, Tucson, AZ, 1994, np.

(679) P. Prosser, An Empirical Study of Phase Transitions in Binary Constraint Satisfaction Problems, Technical Report, No. AISL-49-93, University of Strathclyde, Glasgow, Scotland, 1993.

(680) P. Pylkkanen, "Mind, Consciousness and the Quantum Theory," Toward a Scientific Basis for Consciousness: An Interdisciplinary Conference, Tucson, AZ, 1994, np.

(681) M. Rasetti, E. Tagliati, P. Zanardi & R. Zecchina, "A Many-Body Hamiltonian Approach to Quantum Computation," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 283-287.

(682) J.H. Reif, Quantum Information Processing: Compression, Coding, and Related Computations, Technical Report, Duke University, Durham, NC, 1999.

(683) A.F. Rex, "The Operation of Maxwell's Demon in a Low Entropy System," American J. of Physics, 55, 1987, pp 359-362.

(684) A.F. Rex & R. Larsen, "Entropy and Information for an Automated Maxwell's Demon," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 93-101.

(685) I.A. Rezek, Information Dynamics in Physiological Control Systems, Ph.D., Imperial College of Science, Technology and Medicine, University of London, London, UK, 1997.

(686) I.A. Rezek & S.J. Roberts, <u>Causal Analysis with Information Flow</u>, University of London, London, England, 1998.

(687) J. Rissanen, "Modeling by Shortest Data Description," <u>Automatica</u>, **14**, 1978, pp 462-471.

(688) J. Rissanen, "A Universal Prior for Integers and Estimation by Minimum Description Length," <u>Ann. of Statistics</u>, **11** (2), 1983, pp 416-431.

(689) J. Rissanen, "Universal Coding, Information, Prediction, and Estimation," <u>IEEE Trans. on Information Theory</u>, **IT-30**, 1984, pp 629-636.

(690) J. Rissanen, "Stochastic Complexity and Modeling," <u>Ann. of Statistics</u>, **14** (3), 1986, pp 1080-1100.

(691) J. Rissanen, "Stochastic Complexity," <u>J. Royal Statistical Soc.</u>, **49**, 1987, pp 223-239/252-265.

(692) J. Rissanen, "Complexity of Models," <u>Complexity, Entropy and the Physics of Information</u>, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 117-125.

(693) R. Rivest & A. Shamir, "How to Reuse a 'Write-Once' Memory," <u>Information & Control</u>, **55**, 1982, pp 1-19.

(694) R.A. Rock, "Integrative Complexity and Non-Specific Set as Determinants of Performance in a Complex Solving Task," <u>J. of Behavioural Science</u>, **1**, 1969, pp 17-25.

(695) H. Rogers, <u>Theory of Recursive Functions and Effective Computability</u>, McGraw-Hill, New York, NY, 1967.

(696) R. Rosen, "On Information and Complexity," <u>Complexity, Language and Life: Mathematical Approaches</u>, J.L.Casti & A. Karlquist, eds., Springer-Verlag, Berlin, Germany, 1985, pp 174-195.

(697) B.J. Ross, "Running Programs Backwards: The Logical Inversion of Imperative Computation," <u>Formal Aspects of Computing</u>, **9**, 1997, pp 331-348.

(698) E. Rossi & C.G. Lawrence, "The Psychobiology of Mind-Body Communication: The Complex, Self-Organizing Field of Information Transduction," <u>Proc. 1st Conf. on the Foundations of Information Science</u>, Madrid, Spain, 1994, np.

(699) O.E. Rossler, "Einstein Completion of Quantum Mechanics Made Falsifiable," <u>Complexity, Entropy and the Physics of Information</u>, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 367-373.

(700) O.E. Rossler, "Ultraperspective and Endophysics," <u>Proc. 1st Conf. on the Foundations of Information Science</u>, Madrid, Spain, 1994, np.

(701) M.S. Roulston, "Estimating the Errors on Measured Entropy and Mutual Information," <u>Physica D</u>, **125** (3-4), 1999, pp 285-294.

(702) D. Sahal, "System Complexity: its Conceptions and Measurement in the Design of Engineering Systems," <u>IEEE Trans. on Systems, Man & Cybernetics</u>, **6**, 1976, pp 440-445.

(703) J.R. Sanchez, F. Family & C.M. Arizmendi, "Algorithmic Complexity of Thermal Ratchet Motion," <u>Physics Lett. A</u>, **249** (4), 1998, pp 281-285.

(704) J.E. Savage, <u>The Complexity of Computing</u>, John Wiley and Sons, New York, NY, 1976.

(705) G.G. Scarrot, "The Need for a 'Science' Of Information," J. of Information Technology, 1 (2), 1986, pp 33-38.

(706) G.G. Scarrot, "The Nature of Information," The Computer Journal, 32 (3), 1989, np.

(707) R. Schack & C.M. Caves, "Information and Entropy in the Baker's Map," Physical Review Lett., 69, 1992, pp 3413-3416.

(708) R. Schack & C.M. Caves, "Information and Available Work in the Perturbed Baker's Map," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 69-74.

(709) W. Schempp, "Quantum Neural Holography," Toward a Scientific Basis for Consciousness: An Interdisciplinary Conference, Tucson, AZ, 1994, np.

(710) A. Schenkel, J. Zhang & Y.-C. Zhang, "Long-Range Correlations in Human Writings," Fractals, 1, 1993, pp 47-57.

(711) M. Schiffer, "Quantum Limit for Information Transmission," Physical Review A, 43, 1991, pp 5337-.

(712) M. Schiffer, "The Interplay between Gravitation and Information Theory," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 294-298.

(713) A. Schlaffer & J.A. Nossek, "Is There a Connection between Adiabatic Switching and Reversible Computing?," 1997 European Conference on Circuit Theory and Design (ECCTD 97), Budapest, Hungary, 1997, Tech. Univ. Budapest; Budapest, Hungary, pp 944-946.

(714) J. Schmidhuber, Discovering Problem Solutions with Low Kolmogorov Complexity and High Generalization Capability, Technical Report No. FKI-194-94, Technische Universit at Munchen, Munchen, Germany, 1994.

(715) T.D. Schneider, "Use of Information Theory in Molecular Biology," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 102-110.

(716) T.D. Schneider, "Sequence Logos, Machine/Channel Capacity, Maxwell's Demon, and Molecular Computers: A Review of the Theory of Molecular Machines," Nanotechnology, 5, 1994, pp 1-18.

(717) T.D. Schneider, "New Approaches in Mathematical Biology: Information Theory and Molecular Machines," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 288-291.

(718) T.D. Schneider, G.D. Stormo, L. Gold & A. Ehrenfeucht, "Information Content of Binding Sites on Nucleotide Sequences," J. of Molecular Biology, 188, 1986, pp 415-431.

(719) C.P. Schnorr, "A Unified Approach to the Definition of Random Sequences," Mathematical Systems Theory, 5, 1971, pp 246--258.

(720) C.P. Schnorr, "Process Complexity and Effective Random Tests," J. of Computer & System Sciences, 7, 1973, pp 376-388.

(721) L. Schruben & E. Åcesan, "Complexity of Simulation Models: A Graph Theoretic Approach," Proceedings of the 1993 Winter Simulation Conference, 1993, IEEE Press, Piscataway, NJ, pp 641-649.

(722) B. Schumacher, "Information from Quantum Measurements," <u>Complexity, Entropy and the Physics of Information</u>, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 29-37.

(723) B. Schumacher, "Sending Entanglement through Noisy Quantum Channels," <u>Physical Review A</u>, **51**, 1993, pp 2614-2628.

(724) B. Schumacher, "Quantum Coding," <u>Physical Review A</u>, **51** (4), 1995, pp 2738-2747.

(725) B. Schumacher, "Entropy Exchange and Coherent Quantum Information," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 292-296.

(726) B. Schumacher, H. Barnum, C.A. Fuchs & R. Jozsa, "General Fidelity Limit for Quantum Channels," <u>Physical Review A</u>, **54**, 1996, pp 4707-.

(727) B. Schumacher, P. Hausladen, R. Jozsa, M.D. Westmoreland & W.K. Wootters, "Classical Information Capacity of a Quantum Channel," <u>Physical Review A</u>, **54**, 1996, pp 1869-.

(728) B. Schumacher & M.A. Nielsen, "Quantum Data Processing and Error Correction," <u>Physical Review A</u>, **54**, 1996, pp 2629-2635.

(729) B. Schumacher, M.D. Westmoreland & W.K. Wootters, "Limitations on the Amount of Accessible Information in a Quantum Channel," <u>Physical Review Lett.</u>, **76**, 1996, pp 3452-.

(730) G. Schwarz, "Estimating the Dimension of a Model," <u>Ann. of Statistics</u>, **6**, 1978, pp 461-464.

(731) D. Schweizer & Y. Abu-Mostafa, <u>Kolmogorov Metric Spaces</u>, Technical Report No. 256-80, California Institute of Technology, Pasadena, CA, USA, 1988.

(732) A. Scott, "Hierarchical Organization in the Brain ~ Emergence Of Consciousness," <u>Toward a Scientific Basis for Consciousness: An Interdisciplinary Conference</u>, Tucson, AZ, 1994, np.

(733) J.M. Seaman & F. Koenig, "A Comparison Measures of Cognitive Complexity," <u>Sociometry</u>, **37**, 1974, pp 375-390.

(734) B. Selman & S. Kirkpatrick, "Critical Behavior in the Computational Cost of Satisfiability Testing," <u>Artificial Intelligence</u>, **81**, 1996, pp 106-128.

(735) C.R. Shalizi & J.P. Crutchfield, "Computational Mechanics: Pattern and Prediction, Structure and Simplicity," <u>Comm. of Mathematical Physics</u>, **40**, 1999, np.

(736) C.R. Shalizi & J.P. Crutchfield, "Pattern Discovery and Computational Mechanics," <u>Proc. 17th Int. Conf. on Machine Learning</u>, 2000, np.

(737) C.E. Shannon, "A Mathematical Theory of Communication," <u>Bell Systems Technical J.</u>, **27**, 1948, pp 379-423, 623-656.

(738) C.E. Shannon, "Communication in the Presence of Noise," <u>Proc. IRE</u>, **37**, 1949, pp 10-21.

(739) C.E. Shannon & W. Weaver, <u>The Mathematical Theory of Communication</u>, University of Illinois Press, Urbana, IL, USA, 1949.

(740) J. Shipman, "Aspects of Computability in Physics," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 299-314.

(741) P.W. Shor, "Algorithms for Quantum Computation: Discrete Logarithms and Factoring," Proc. 35th IEEE Symp. on the Foundations of Computer Science, 1994, IEEE Computer Society Press, Los Alamitos, CA, USA, pp 124-134.

(742) P.W. Shor, "Scheme for Reducing Decoherence in Quantum Memory," Physical Review A, 52 (4), 1995, pp 2493-2496.

(743) P.W. Shor, "Fault Tolerant Quantum Computation," Proc. 37th IEEE Symp. on the Foundations of Computer Science, 1996, IEEE Computer Society Press, Silver Spring, MD, USA, pp 56-65.

(744) P.W. Shor, "Polynomial-Time Algorithms for Prime Factorization and Discrete Logarithms on a Quantum Computer," SIAM J. on Computing, 26 (5), 1997, pp 1484-1509.

(745) R.G. Shoup, "A Complex Logic for Computation with Simple Interpretations for Physics," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 128-136.

(746) R.G. Shoup, "Space, Time, Logic, and Things," Proc. 3rd IEEE Workshop on Physics & Computation, Dallas, TX, 1994, IEEE Computer Society Press, Los Alamitos, CA, pp 36-43.

(747) F. Siddiqi & C. Cantor, "DNA Computational Mechanism," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 297.

(748) H.T. Siegelmann, "Computation beyond the Turing Limit," Science, 268 (5210), 1995, pp 545-548.

(749) H.T. Siegelmann & S. Fishman, "Analog Computation with Dynamical Systems," Physica D, 120 (1-2), 1998, pp 214-235.

(750) H.T. Siegelmann & E.D. Sontag, "On the Computational Power of Neural Nets," J. of Computer & System Sciences, 50, 1995, pp 132-150.

(751) T. Siegfried, The Bit and the Pendulum: How the New Physics of Information Is Revolutionizing Science, John Wiley and Sons, New York, NY, USA, 2000.

(752) R.N. Silver, "Quantum Statistical Inference," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 315-326.

(753) D.R. Simon, "On the Power of Quantum Computation," Proc. 35th IEEE Symp. on the Foundations of Computer Science, 1994, IEEE Computer Society Press, Los Alamitos, CA, USA, pp 116-123.

(754) H.A. Simon, "The Architecture of Complexity," The Sciences of the Artificial, MIT Press, Cambridge, MA, 1981, pp 192-229.

(755) L. Skyttner, "Information Theory-A Psychological Study in Old and New Concepts," Kybernetes, 27 (3), 1998, pp 284-311.

(756) T. Sleator & H. Weinfurter, "Realizable Universal Quantum Logic Gates," Physical Review Lett., 74, 1995, pp 4087-4090.

(757) N.J.A. Sloane & A.D. Wyner, Claude Elwood Shannon: Collected Papers, IEEE Press, Piscataway, NJ, USA, 1993.

(758) B.M. Smith, The Phase Transition in Constraint Satisfaction Problems: A Closer Look at the Mushy Region, Technical Report No. 93.41, University of Leeds, Leeds, England, 1994.

(759) L. Snyder & A. Tyagi, "The Energy Complexity of Transitive Functions," <u>Proc. 24th Allerton Conf. on Communication, Control & Computing</u>, 1986, pp 562-572.

(760) P. Solomon & D.J. Frank, "The Case for Reversible Computation," <u>Proc. 1994 Int. Workshop on Low Power Design</u>, Napa Valley, CA, USA, 1994, pp 93-98.

(761) R.J. Solomonoff, "A Formal Theory of Inductive Inference, Part 1," <u>Information & Control</u>, **7** (1), 1964, pp 1-22.

(762) R.J. Solomonoff, "A Formal Theory of Inductive Inference, Part 2," <u>Information & Control</u>, **7** (2), 1964, pp 224-254.

(763) R.J. Solomonoff, "The Discovery of Algorithmic Probability," <u>J. of Computer & System Sciences</u>, **55** (1), 1997, pp 73-88.

(764) R.J. Solomonoff, D.I. Dowe, K.B. Korb & J.J. Oliver, "Does Algorithmic Probability Solve the Problem of Induction?," <u>Proc. 1996 Conf. on Information, Statistics & Induction in Science</u>, Melbourne, Vic., Australia, 1996, World Scientific; Singapore, pp 7-8.

(765) H. Soodak & A.S. Iberall, "Thermodynamics and Complex Systems," <u>Self-Organising Systems: The Emergence of Order</u>, F.E. Yates, ed., Plenum Press, New York, NY, 1987, pp 459-469.

(766) Y.N. Srivastava, G. Vitiello & A. Widom, "Quantum Measurements, Information and Entropy Production," <u>Int. J. of Modern Physics B</u>, **13** (28), 1999, pp 3369-3382.

(767) A.M. Steane, "Multiple Particle Interference and Quantum Error Correction," <u>Proc. Royal Soc. of London, Series A</u>, 1995, np.

(768) A.M. Steane, "Error Correcting Codes in Quantum Theory," <u>Physical Review Lett.</u>, **77** (5), 1996, pp 793-797.

(769) S. Stenholm, "Polarization Coding of Quantum Information," <u>Optics Communications</u>, **123**, 1996, pp 287-296.

(770) T. Stonier, "Towards a New Theory of Information," <u>Telecommunications Policy</u>, **10** (4), 1986, pp 278-281.

(771) T. Stonier, "Towards a General Theory of Information: Information and Entropy," <u>Future Computing Systems</u>, **2** (4), 1990, pp 409-427.

(772) T. Stonier, <u>Information and the Internal Structure of the Universe: An Exploration into Information Physics</u>, Springer-Verlag, London, UK, 1990.

(773) T. Stonier, "Information as a Basic Property of the Universe," <u>Proc. 1st Conf. on the Foundations of Information Science</u>, Madrid, Spain, 1994, np.

(774) T. Stonier, "Information as a Basic Property of the Universe," <u>BioSystems</u>, **38** (2,3), 1996, pp 135-140.

(775) T.S. Sundresh, "Information Complexity, Information Matching and System Integration," <u>Proc. 1997 IEEE Int. Conf. on Systems, Man & Cybernetics</u>, Orlando, FL, USA, 1997, IEEE; New York, NY, USA, pp 1826-1831.

(776) L.J. Svensson & J.G. Koller, "Driving a Capacitive Load without Dissipating fCV^2," <u>Proc. 1994 IEEE Symp. on Power Electronics</u>, 1994, IEEE Press, New York, NY, USA, pp 100-101.

(777) J.A. Swanson, "Physical Versus Logical Coupling in Memory Systems," <u>IBM J. of Research & Development</u>, **4**, 1960, pp 305-310.

(778) L. Szilard, "On the Decrease of Entropy in a Thermodynamic System by the Intervention of Intelligent Beings," Quantum Theory and Measurement, J.A. Wheeler & W.H. Zurek, eds., Princeton University Press, Princeton, NJ, 1983, pp 539-548.

(779) H. Szu, "Thermodynamics Energy for Both Supervised and Unsupervised Learning Neural Nets at a Constant Temperature," Int. J. of Neural Systems, 9 (3), 1999, pp 175-186.

(780) E. Taborsky, "Emotions as Forms of Consciousness," Proc. 1999 IEEE Int. Symp. on Intelligent Control, Intelligent Systems & Semiotics, Cambridge, MA, USA, 1999, IEEE; Piscataway, NJ, USA, pp 58-63.

(781) S. Takagi, "Some Simple Consequences of the Loss of Information in a Spacetime with a Horizon," Complexity, Entropy and the Physics of Information, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 53-60.

(782) S. Takeuchi, "A Simple Quantum Computer: Experimental Realization of the Deutsch-Jozsa Algorithm with Linear Optics," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 299-302.

(783) W.G. Teich & G. Mahler, "Information Processing at the Molecular Level: Possible Realizations and Physical Constraints," Complexity, Entropy and the Physics of Information, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 289-300.

(784) K. Thearling, "Evolution, Entropy, and Parallel Computation," Proc. 3rd IEEE Workshop on Physics & Computation, Dallas, TX, 1994, IEEE Computer Society Press, Los Alamitos, CA, pp 246-254.

(785) C.D. Thompson, "Area-Time Complexity for VLSI," Proc. 11th ACM Symp. on the Theory of Computing, 1979, ACM Press, New York, NY, USA, pp 81-88.

(786) J. Tian & M.V. Zelkowitz, "Complexity Measure Evaluation and Selection," IEEE Trans. on Software Engineering, 21, 1995, pp 641-650.

(787) T. Toffoli, "Computation and Construction Universality of Reversible Cellular Automata," J. of Computer & System Sciences, 15, 1977, pp 213-231.

(788) T. Toffoli, "Reversible Computing," Proc. 7th Int. Colloq. on Automata, Languages & Programming, 1980, Springer-Verlag, Berlin, Germany, pp 632-644.

(789) T. Toffoli, "Bicontinuous Extensions of Invertible Combinatorial Functions," Mathematical & Systems Theory, 14, 1981, pp 13-23.

(790) T. Toffoli, "Bicontinuous Extension of Reversible Combinatorial Functions," Mathematical Systems Theory, 14, 1981, pp 13-23.

(791) T. Toffoli, "Comment on `Dissipation in Computation'," Physical Review Lett., 53, 1984, pp 1204.

(792) T. Toffoli, "Information Transport Obeying the Continuity Equation," IBM J. of Research & Development, 32 (1), 1988, pp 29-36.

(793) T. Toffoli, "How Cheap Can Mechanics' First Principles Be?," Complexity, Entropy and the Physics of Information, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 301-318.

(794) T. Toffoli, "What Are Nature's `Natural' Ways of Computing?," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 5-9.

(795) T. Toffoli, "Occam, Turing, von Neumann, Jaynes: How Much Can You Get for How Little," <u>InterJournal</u>, 1994, np.

(796) T. Toffoli, "Power Management Options for Nanoscale Cellular Automata," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 303-307.

(797) T. Toffoli, "How Much Physics Is Just Computation?," <u>Superlattices & Microstructures</u>, **23** (3/4), 1998, pp 381-406.

(798) T. Toffoli, "Quo Vadimus?--Much Hard Work Is Still Needed," <u>Physica D</u>, **120** (1-2), 1998, pp 1-11.

(799) T. Toffoli, "Action, or the Fungibility of Computation," <u>Feynman and Computation: Exploring the Limits of Computers</u>, A.J.G. Hey, ed., Perseus Books, Reading, MA, 1999, pp 349-392.

(800) T. Toffoli, M. Biafore & J.P. Leao, eds., <u>Proceedings of the 4th Workshop on Physics and Computation (PhysComp96)</u>, New England Complex Systems Institute, Cambridge, MA,, 1996.

(801) T. Toffoli & N.H. Margolus, "Invertible Cellular Automata: A Review," <u>Physica D</u>, **45**, 1990, pp 229-253.

(802) T. Toffoli & N.H. Margolus, "Programmable Matter," <u>Physica D</u>, **47**, 1993, pp 263-272.

(803) J.D. Touch, "Physics Analogs in Communication Models," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 248-252.

(804) H. Touchette & S. Lloyd, "Information-Theoretic Limits of Control," <u>Physical Review Lett.</u>, **84** (6), 2000, pp 1156-1159.

(805) J.F. Traub, G.W. Wasilkowski & H. Woznaikowski, <u>Information-Based Complexity</u>, Academic Press, San Diego, CA, 1988.

(806) J.F. Traub & H. Wozniakowski, "Information-Based Complexity: New Questions for Mathematicians," <u>Mathematical Intelligencer</u>, **13** (2), 1991, pp 34-43.

(807) P. Trebbia, "Maxwell's Demon and Data Analysis," <u>Philosophical Trans. of the Royal Soc. London, Series A</u>, **354** (1719), 1996, pp 2697-2711.

(808) L. Troyansky & N. Tishby, "Moments of Satisfaction: Statistical Properties of a Large Random K-CNF Formula," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 308-313.

(809) L. Troyansky & N. Tishby, "Permanent Uncertainty: On the Quantum Evaluation of the Determinant and the Permanent of a Matrix," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 314-318.

(810) Q.A. Turchette, C.J. Hood, W. Lange, H. Mabuchi & H.J. Kimble, "Measurement of Conditional Phase Shifts for Quantum Logic," <u>Physical Review Lett.</u>, **75**, 1995, pp 4710-4713.

(811) F. Turner, "Nonlinear Time and the Human Brain," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 21-23.

(812) A. Tyagi, <u>The Role of Energy in VLSI Computations</u>, Ph.D., University of Washington, Seattle, WA, 1988.

(813) A. Tyagi, "Energy-Time Trade-Offs in VLSI Computations," <u>Proc. 9th Conf. on the Foundations of Software Technology & Theoretical Computer Science</u>, 1989, Springer-Verlag, pp 301-311.

(814) A. Tyagi, "A Principle of Least Computational Action," <u>Proc. 2nd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 262-266.

(815) A. Tyagi, "Encoded Arithmetic for Reversible Logic," <u>Proc. 3rd IEEE Workshop on Physics & Computation</u>, Dallas, TX, 1994, IEEE Computer Society Press, Los Alamitos, CA, pp 135-142.

(816) S.V. Ulyanoy, G. Degli Antoni, K. Yamafuji, T. Fukuda, G.G. Rizzotto & I. Kurawaki, "Physical Limits and Information Bounds of Micro Vontrol. II. Quantum Soft Computing and Quantum Searching Algorithms," <u>Proc. 1998 Int. Symp. on Micromechatronics & Human Science</u>, Nagoya, Japan, 1998, IEEE; Piscataway, NJ, USA, pp 217-224.

(817) K. Umeno, "Simulating Quantum Non-Integrable Systems with Quantum Computers," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 319-322.

(818) W.G. Unruh, "Maintaining Coherence In Quantum Computers," <u>Physical Review A</u>, **51**, 1995, pp 992-997.

(819) D.R. Upper, <u>Theory and Algorithms for Hidden Markov Models and Generalized Hidden Markov Models</u>, Ph.D. Dissertation, Mathematics Department, University of California, 1997.

(820) L. Valiant, "The Complexity of Computing the Permanent," <u>Theoretical Computer Science</u>, **8**, 1979, pp 189-201.

(821) J. Van Campenhout & T.M. Cover, "Maximum Entropy and Conditional Probability," <u>IEEE Trans. on Information Theory</u>, **IT-27** (4), 1981, pp 483-489.

(822) W. van Dam, "A Universal Quantum Cellular Automaton," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 323-331.

(823) M.H. Van Emden, <u>An Analysis of Complexity</u>, Technical Report, Mathematisch Centrum, Amsterdam, The Netherlands, 1971.

(824) M. Van Lambalgen, "Algorithmic Information Theory," <u>J. of Symbolic Logic</u>, **54**, 1989, pp 1389-1400.

(825) P.M.B. Vitanyi, "Non-Sequential Computation and Laws of Nature," <u>VLSI Algorithms and Architectures (Proceedings Aegean Workshop on Computing, 2nd International Workshop on Parallel Processing and VLSI)</u>, Springer Verlag, Berlin, Germany, 1986, Vol. 227, pp 108-120.

(826) P.M.B. Vitanyi, "A Modest Proposal for Communication Costs in Multicomputers," <u>Concurrent Computations, Algorithms, Architecture, and</u>

Technology, S.K. Tewksbury, B.W. Dickinson & S.C. Schwartz, eds., Plenum Press, New York, NY, 1988, pp 203-216.

(827) P.M.B. Vitanyi, "Locality, Communication and Interconnect Length in Multicomputers," SIAM Journal of Computing, **17** (4), 1988, pp 659-672.

(828) P.M.B. Vitanyi, "Multiprocessor Architectures and Physical Law," Proc. 3rd IEEE Workshop on Physics & Computation, Dallas, TX, 1994, IEEE Computer Society Press, Los Alamitos, CA, pp 24-29.

(829) P.M.B. Vitanyi, "Physics and the New Computation," Proc. 20th Int. Symp. on the Mathematical Foundations of Computer Science, Prague, 1995, Springer-Verlag, Heidelberg, Germany, pp 106-128.

(830) P.M.B. Vitanyi, "Three Approaches to the Quantitative Definition of Information in an Individual Pure Quantum State," Proc. 15th IEEE Computational Complexity Conf., 2000, np.

(831) P.M.B. Vitanyi & M. Li, "Algorithmic Arguments in Physics of Computation," Proc. 4th Workshop on Algorithms & Data Structures, Kingston, Ontario, Canada, 1995, Springer-Verlag, Heidelberg, Germany, pp 315-333.

(832) P.M.B. Vitanyi & M. Li, "Reversible Simulation of Irreversible Computation," Proc. 11th IEEE Computational Complexity Conf., 1996, pp 301-306.

(833) P.M.B. Vitanyi & M. Li, "Minimum Description Length Induction, Bayesanism and Kolmogorov Complexity," IEEE Trans. on Information Theory, **IT-46** (2), 2000, pp 446-464.

(834) A.G. Vitushkin, Theory of Transmission and Processing of Information, Pergamon Press, Oxford, UK, 1961.

(835) A.Y. Vlasov, "Quantum Theory of Computation and Relativistic Physics," Proc. 4th Workshop on Physics & Computation, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 332-333.

(836) J. von Neumann, Theory of Self-Reproducing Automata, University of Illinois Press, Urbana, IL, 1966.

(837) J. Vuillemin, "A Combinatorial Limit to the Computing Power of VLSI," IEEE Trans. on Computers, 1983, pp 294-300.

(838) X.-J. Wang, "Intermittent Fluctuations and Complexity," Complexity, Entropy and the Physics of Information, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 319-330.

(839) W. Weaver, "Science and Complexity," American Scientist, **36**, 1968, pp 536-544.

(840) B. Weber, F.J. Depew & J.D. Smith, eds., Entropy, Information, and Evolution, MIT Press, Cambridge, MA, 1988.

(841) A. Wehrl, "General Properties of Entropy," Reviews of Modern Physics, **50**, 1978, pp 221-.

(842) G. Weisbuch, Complex Systems Dynamics, Addison-Wesley, New York, NY, 1990.

(843) G.R. Welch, "The Enzymatic Basis of Information Processing in the Living Cell," Proc. 1st Conf. on the Foundations of Information Science, Madrid, Spain, 1994, np.

(844) M.D. Westmoreland, J. Krone & B. Schumacher, "Analysis of Billiard Ball Computation Using Phase Space Logics," Physica D, **120** (1-2), 1998, pp 236-252.

(845) E.J. Weyuker, "The Evaluation of Software Complexity Measures," IEEE Trans. on Software Engineering, **14**, 1988, pp 1357-1365.

(846) J.A. Wheeler, "The Computer and the Universe," Int. J. of Theoretical Physics, **21**, 1982, pp 557-572.

(847) J.A. Wheeler, "Physics as Meaning Circuit: Three Problems," Frontiers of Non-Equilibrium Statistical Physics, G.T. Moore & M.O. Scully, eds., Plenum Press, New York, NY, 1986, np.

(848) J.A. Wheeler, "Information, Physics, Quantum: The Search for Links," Complexity, Entropy and the Physics of Information, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 3-28.

(849) J. Wicken, "Entropy, Information, and Nonequilibrium Evolution," Systematic Zoology, **32**, 1983, pp 438-443.

(850) J. Wicken, "Entropy and Information: Suggestions for a Common Language," Philosophy of Science, **54** (2), 1987, pp 176-193.

(851) J. Wicken, Evolution, Information and Thermodynamics, Oxford University Press, New York, NY, 1987.

(852) J. Wicken, "Thermodynamics, Evolution, and Emergence," Entropy, Information, and Evolution, B.Weber et al., eds., MIT Press, Cambridge, MA, 1988, pp 139-172.

(853) J. Wicken, "Can the Information Contents of Biological Systems Be Quantified?," Systems Research, **6** (2), 1989, pp 133-142.

(854) J. Wicken, "Evolution and Thermodynamics: The New Paradigm," Systems Research, **6** (3), 1989, pp 181-186.

(855) E.O. Wiley & D.R. Brooks, "Nonequilibrium Thermodynamics and Evolution," Systematic Zoology, **32**, 1983, pp 209-219.

(856) C.P. Williams & T. Hogg, "Phase Transitions and Coarse-Grained Search," Proc. 3rd IEEE Workshop on Physics & Computation, Dallas, TX, 1994, IEEE Computer Society Press, Los Alamitos, CA, pp 203-208.

(857) D.G. Willis, "Computational Complexity and Probability Constructions," J. ACM, 1970, pp 241-259.

(858) S. Winograd, "Redundancy and Complexity of Logical Elements," Information & Control, **5**, 1963, pp 177-194.

(859) F. Wolf, "On the Quantum Mechanics of Dreams and the Arising of the Self-Concept," Toward a Scientific Basis for Consciousness: An Interdisciplinary Conference, Tucson, AZ, 1994, np.

(860) S. Wolfram, "Statistical Mechanics of Cellular Automata," Reviews of Modern Physics, **55**, 1983, pp 601-644.

(861) S. Wolfram, "Universality and Complexity in Cellular Automata," Physica D, **10**, 1984, pp 1-35.

(862) S. Wolfram, "Origins of Randomness in Physical Systems," Physical Review Lett., **55**, 1985, pp 449-452.

(863) S. Wolfram, "Complex Systems Theory," Emerging Syntheses in Science, D. Pines, ed., Addison-Wesley, New York, NY, 1988, pp 183-190.

(864) S. Wolfram, ed., Cellular Automata and Complexity, Addison-Wesley, Reading MA, 1994.

(865) D.H. Wolpert, The Relationship between Many-to-One Mappings and Thermodynamic Irreversibility, Technical Report No. LA-UR--90-4108, Los Alamos National Laboratory, Los Alamos, NM, 1990.

(866) D.H. Wolpert, "Memory Systems, Computation, and the Second Law of Thermodynamics," Int. J. of Theoretical Physics, 31, 1992, pp 743-785.

(867) D.H. Wolpert, "The Second Law, Computation, and the Temporal (a)symmetry of Memory," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 58-62.

(868) D.H. Wolpert, Self-Dissimilarity: An Empirical Measure of Complexity, Technical Report No. 97-12-087, Santa Fe Institute, Santa Fe, NM, 1997.

(869) C.H. Woo, "Laws and Boundary Conditions," Complexity, Entropy and the Physics of Information, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 127-135.

(870) W.K. Wootters, "Local Accessibility of Quantum States," Complexity, Entropy and the Physics of Information, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 39-46.

(871) W.K. Wootters, "The Two Extremes of Information in Quantum Mechanics," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 181-183.

(872) S.-M.A. Yang, C.-T. Sun & C.-H. Hsu, "Energy, Matter, and Entropy in Evolutionary Computation," Proc. 1996 IEEE Int. Conf. on Evolutionary Computation, Nagoya, Japan, 1996, IEEE; New York, NY, USA, pp 196-200.

(873) A. Yao, "The Entropic Limitations on VLSI Computations," Proc. 13th ACM Symp. on the Theory of Computing, Milwaukee, WN, 1981, ACM Press, New York, NY, USA, pp 308-311.

(874) A.C. Yao, "Some Complexity Questions Related To Distributed Computing," Proc. 11th ACM Symp. on the Theory of Computing, 1979, ACM Press, New York, NY, USA, pp 209-213.

(875) A.C.-C. Yao, "Security of Quantum Protocols against Coherent Measurements," Proc. 25th ACM Symp. on the Theory of Computing, 1995, ACM Press, New York, NY, USA, pp 67-75.

(876) F.E. Yates, "Complexity and the Limits to Knowledge," Americal J. of Physiology, 235, 1978, pp R201-R204.

(877) K. Young, The Grammar and Statistical Mechanics of Complex Physical Systems, Ph.D. Dissertation, University of California, Santa Cruz, Santa Cruz, CA, USA, 1991.

(878) K. Young & J.P. Crutchfield, "Fluctuation Spectroscopy," Chaos, Solitons & Fractals, 4, 1993, pp 5-39.

(879) P. Young, The Nature of Information, Praeger-Greenwood, Westport, CT, 1987.

(880) S.G. Younis & T.F. Knight, Jr., "Practical Implementation of Charge Recovering Asymptotycally Zero Power CMOS," Proc. 1993 Symp. on Integrated Systems, 1993, MIT Press, Cambridge, MA, USA, pp 234-250.

(881) H.P. Yuen & M. Ozawa, "Ultimate Information Carrying Limit of Quantum Systems," Physical Review Lett., 70, 1993, pp 363-.

(882) A. Zee, "Information Processing in Visual Perception," Complexity, Entropy and the Physics of Information, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 331-341.

(883) H.D. Zeh, "Quantum Measurements and Entropy," Complexity, Entropy and the Physics of Information, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 405-422.

(884) B.P. Zeigler, "Simulation Based Structural Complexity of Models," Int. J. of General Systems, 2, 1976, pp 217-223.

(885) X.-D.N. Zhang, "Complexity of Neural Network Learning in the Real Number Model," Proc. 2nd IEEE Workshop on Physics & Computation, Dallas, TX, 1993, IEEE Computer Society Press, Los Alamitos, CA, pp 146-150.

(886) J. Ziv & N. Merhav, "A Measure of Relative Entropy between Individual Sequences with Application to Universal Classification," IEEE Trans. on Information Theory, IT-39 (4), 1993, pp 1270-1279.

(887) D. Zonar, "Consciousness and Bose-Einstein Condensates," Toward a Scientific Basis for Consciousness: An Interdisciplinary Conference, Tucson, AZ, 1994, np.

(888) W.H. Zurek, "Information Transfer in Quantum Measurements: Irreversibility and Amplification," Quantum Optics, Experimental Gravitation and Measurement Theory, P. Meystre & M.O. Scully, eds., Plenum, New York, NY, 1983, pp 87-116.

(889) W.H. Zurek, "Reversibility and Stability of Information Processing Systems," Physical Review Lett., 53 (4), 1984, pp 391-394.

(890) W.H. Zurek, "Algorithmic Randomness and Physical Entropy," Physical Review A, 40 (8), 1989, pp 4731-4751.

(891) W.H. Zurek, "Thermodynamic Cost of Computation: Algorithmic Complexity and the Information Metric," Nature, 341 (6238), 1989, pp 112-124.

(892) W.H. Zurek, "Algorithmic Information Content, Church-Turing Thesis, Physical Entropy, and Maxwell's Demon," Complexity, Entropy and the Physics of Information, W.H. Zurek, ed., Perseus Books, Reading, MA, 1990, pp 73-89.

(893) W.H. Zurek, ed., Complexity, Entropy and the Physics of Information, SFI Studies in the Sciences of Complexity, Perseus Books, Reading, MA, 1990.

(894) W.H. Zurek, "Decoherence, Chaos, Quantum-Classical Correspondence, and the Algorithmic Arrow of Time," Physica Scripta, T76, 1998, pp 186-198.

(895) W.H. Zurek, "Decoherence, Einselection and the Existential Interpretation (The Rough Guide)," Philosophical Trans. of the Royal Soc. London, Series A, 356 (1743), 1998, pp 1793-1821.

(896) W.H. Zurek, "Algorithmic Randomness, Physical Entropy, Measurements, and the Demon of Choice," Feynman and Computation: Exploring the Limits of Computers, A.J.G. Hey, ed., Perseus Books, Reading, MA, 1999, pp 393-410.

(897) W.H. Zurek & R. Laflamme, "Quantum Logic on Qubytes," <u>Proc. 4th Workshop on Physics & Computation</u>, Boston, MA, USA, 1996, New England Complex Systems Institute, Cambridge, MA, USA, pp 334-338.

(898) A.K. Zvonkin & L.A. Levin, "The Complexity of Finite Objects and the Development of the Concepts of Information and Randomness by Means of the Theory of Algorithms," <u>Russian Mathematical Surveys</u>, **25** (6), 1970, pp 83-124.

MISSION
OF
AFRL/INFORMATION DIRECTORATE (IF)

The advancement and application of Information Systems Science and Technology to meet Air Force unique requirements for Information Dominance and its transition to aerospace systems to meet Air Force needs.