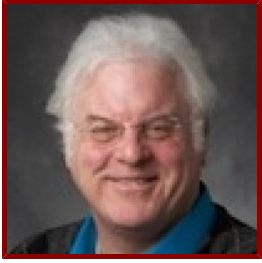


Stanford



Robert Laughlin

Anne T. and Robert M. Bass Professor in the School of Humanities and Sciences
Physics

CONTACT INFORMATION

- **Administrative Contact**

Sybille Katz

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Bio

BIO

Professor Laughlin is a theorist with interests ranging from hard-core engineering to cosmology. He is an expert in semiconductors (Nobel Prize 1998) and has also worked on plasma and nuclear physics issues related to fusion and nuclear-pumped X-ray lasers. His technical work at the moment focuses on “correlated-electron” phenomenology – working backward from experimental properties of materials to infer the presence (or not) of new kinds of quantum self-organization. He recently proposed that all Mott insulators – including the notorious doped ones that exhibit high-temperature superconductivity – are plagued by a new kind of subsidiary order called “orbital antiferromagnetism” that is difficult to detect directly. He is also the author of *A Different Universe*, a lay-accessible book explaining emergent law.

ACADEMIC APPOINTMENTS

- Professor, Physics

ADMINISTRATIVE APPOINTMENTS

- Professor of Applied Physics (Dual Appointment with Physics), Stanford University, (1993-2007)
- Postdoc, AT&T Bell Laboratories, (1979-1981)
- Professor of Physics, Stanford University, (1989- present)

HONORS AND AWARDS

- Onsager Medal, Norwegian University of Science and Technology (2007)
- Doctorate of Letters, University of Maryland (2005)
- Golden Plate, Stanford University (1999)
- Nobel Prize in Physics, Royal Swedish Academy of Sciences (1998)
- Benjamin Franklin Medal for Physics, The Franklin Institute (1998)
- Member, National Academy of Sciences (1994-Present)
- Oliver E. Buckley Prize, American Physical Society (1986)
- E. O. Lawrence Award for Physics, U.S. Department of Energy (1985)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Research Scientist, Lawrence Livermore National Laboratory (1981 - 2004)

- President, Korean Advanced Institute for Science and Technology (2004 - 2006)
- President, Asia-Pacific Center for Theoretical Physics (2004 - 2006)
- Board Member, Science Foundation Ireland (2002 - 2003)

PROGRAM AFFILIATIONS

- Science, Technology and Society

PROFESSIONAL EDUCATION

- Ph.D., Massachusetts Institute of Technology , Physics (1979)
- A.B., University of California at Berkeley , Mathematics (1972)

Teaching

COURSES

2022-23

- Graduate Quantum Mechanics II: PHYSICS 231 (Spr)
- Introduction to the Physics of Energy: PHYSICS 240 (Aut)

2021-22

- Introduction to Nuclear Energy: PHYSICS 241 (Win)
- Introduction to the Physics of Energy: PHYSICS 240 (Aut)

2020-21

- Introduction to Nuclear Energy: PHYSICS 241 (Win)
- Introduction to the Physics of Energy: PHYSICS 240 (Aut)

STANFORD ADVISEES

Doctoral (Program)

Eric Cooper, Joe Finney, Eli Mueller, Aidan O'Beirne, Avikar Periwal, Xinyu Ren, Jonathan San Miguel, Ruby Shi, Kaan Yay

Publications

PUBLICATIONS

- **Powering the Future: How We Will (Eventually) Solve the Energy Crisis and Fuel the Civilization of Tomorrow**
Laughlin, R. B.
New York: Basic Books.2011
- **The Crime of Reason**
Laughlin, R. B.
New York: Basic Books.2008
- **Gossamer superconductivity** *PHILOSOPHICAL MAGAZINE*
Laughlin, R. B.
2006; 86 (9): 1165-1171
- **Looking for a Hero**
Laughlin, R. B.
Seoul: Hans Media.2006
- **A Different Universe: Remaking Physics from the Bottom Down**
Laughlin, R. B.

New York: Basic Books.2005

- **Spectroscopy of matter near criticality** *ANNALS OF PHYSICS*
Bernevig, B. A., Giuliano, D., Laughlin, R. B.
2004; 311 (1): 182-190
- **The cup of the hand** *SCIENCE*
Laughlin, R. B.
2004; 303 (5663): 1475-1477
- **Hiawatha's Valence Bonding** *Annals of Improbable Research*
Laughlin, R. B.
2004; 10 (6): 8
- **Emergent relativity** *International Symposium on Frontiers in Science*
Laughlin, R. B.
WORLD SCIENTIFIC PUBL CO PTE LTD.2003: 18-43
- **Emergent Relativity and the Physics of Black Hole Horizons** *Analog Models of General Relativity*
Chapline, G., Laughlin, R. B., Santiago, D. I.
edited by Visser, M.
Singapore: World Scientific.2003
- **Truth, ownership, and scientific tradition** *PHYSICS TODAY*
Laughlin, R. B.
2002; 55 (12): 10-11
- **Coordinate representation of the one-spinon one-holon wave function and spinon-holon interaction** *PHYSICAL REVIEW B*
Bernevig, B. A., Giuliano, D., Laughlin, R. B.
2002; 65 (19)
- **The physical basis of computability** *COMPUTING IN SCIENCE & ENGINEERING*
Laughlin, R. B.
2002; 4 (3): 27-30
- **The quantum criticality conundrum** *ADVANCES IN PHYSICS*
Laughlin, R. B., Lonzarich, G. G., Monthoux, P., Pines, D.
2001; 50 (4): 361-365
- **Balanced branching in transcription termination** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Harrington, K. J., Laughlin, R. B., Liang, S.
2001; 98 (9): 5019-5024
- **Spinon attraction in spin-1/2 antiferromagnetic chains** *PHYSICAL REVIEW LETTERS*
Bernevig, B. A., Giuliano, D., Laughlin, R. B.
2001; 86 (15): 3392-3395
- **Hidden order in the cuprates** *PHYSICAL REVIEW B*
CHAKRAVARTY, S., Laughlin, R. B., Morr, D. K., Nayak, C.
2001; 63 (9)
- **Quantum phase transitions and the breakdown of classical general relativity** *PHILOSOPHICAL MAGAZINE B-PHYSICS OF CONDENSED MATTER STATISTICAL MECHANICS ELECTRONIC OPTICAL AND MAGNETIC PROPERTIES*
Chapline, G., Hohlfield, E., Laughlin, R. B., Santiago, D. I.
2001; 81 (3): 235-254
- **The middle way** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Laughlin, R. B., Pines, D., Schmalian, J., Stojkovic, B. P., Wolynes, P.
2000; 97 (1): 32-37

- **The theory of everything** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Laughlin, R. B., Pines, D.
2000; 97 (1): 28-31
- **Quantum number fractionalization in antiferromagnets** *Workshop with Learning on Field Theories for Low-Dimensional Condensed Matter Systems*
Laughlin, R. B., Giuliano, D., Caracciolo, R., White, O. L.
SPRINGER-VERLAG BERLIN.2000: 83-115
- **Differential light scattering: Probing the sonoluminescence collapse** *PHYSICAL REVIEW E*
Vacca, G., Morgan, R. D., Laughlin, R. B.
1999; 60 (6): R6303-R6306
- **Nobel Lecture: Fractional quantization** *REVIEWS OF MODERN PHYSICS*
Laughlin, R. B.
1999; 71 (4): 863-874
- **A critique of two metals** *ADVANCES IN PHYSICS*
Laughlin, R. B.
1998; 47 (6): 943-958
- **Magnetic induction of $d(x^2-y^2)+id(xy)$ order in high-T-c superconductors** *PHYSICAL REVIEW LETTERS*
Laughlin, R. B.
1998; 80 (23): 5188-5191
- **Parallels Between Quantum Antiferromagnetism and the Strong Interactions** *Proceedings of the Inaugural Conference of the Asia-Pacific Center for Theoretical Physics*
Laughlin, R. B.
edited by Cho, Y. M., Hong, J. B., Yang, C. N.
Singapore: World Scientific.1998
- **Evidence for quasiparticle decay in photoemission from underdoped cuprates** *PHYSICAL REVIEW LETTERS*
Laughlin, R. B.
1997; 79 (9): 1726-1729
- **Evidence for composite nature of quasiparticles in the 2D t-J model** *NUCLEAR PHYSICS B*
Beran, P., Poilblanc, D., Laughlin, R. B.
1996; 473 (3): 707-720
- **Evidence for electron decay in photoemission from Sr₂CuO₂Cl₂** *Conference on Spectroscopies in Novel Superconductors*
Laughlin, R. B.
PERGAMON-ELSEVIER SCIENCE LTD.1995: 1627-32
- **NUMERICAL EVIDENCE FOR ELECTRON DECAY IN THE 2-DIMENSIONAL T-J MODEL** *International Euroconference on Magnetic Correlations, Metal-Insulator-Transitions, and Superconductivity in Novel Materials*
Laughlin, R. B.
SPRINGER/PLENUM PUBLISHERS.1995: 443-66
- **FRACTIONAL VORTICES AS EVIDENCE OF TIME-REVERSAL SYMMETRY-BREAKING IN HIGH-TEMPERATURE SUPERCONDUCTORS** *PHYSICAL REVIEW LETTERS*
Sigrist, M., Bailey, D. B., Laughlin, R. B.
1995; 74 (16): 3249-3252
- **TUNNELING GAP AS EVIDENCE FOR TIME-REVERSAL SYMMETRY-BREAKING AT SURFACES OF HIGH-TEMPERATURE SUPERCONDUCTORS** *PHYSICA C-SUPERCONDUCTIVITY AND ITS APPLICATIONS*
Laughlin, R. B.
1994; 234 (3-4): 280-284
- **RESPONSE FUNCTION OF THE T-J MODEL CALCULATED USING ANYON TECHNIQUES** *PHYSICAL REVIEW B*
TIKOFISKY, A. M., Laughlin, R. B.
1994; 50 (14): 10165-10189

- **SPIN SUSCEPTIBILITY AND GAP STRUCTURE OF THE FRACTIONAL-STATISTICS GAS** *PHYSICAL REVIEW B*
Levy, J. L., Laughlin, R. B.
1994; 50 (10): 7107-7123
- **TIME-REVERSAL SYMMETRY-BREAKING IN SUPERCONDUCTORS - A PROPOSED EXPERIMENTAL TEST** *PHYSICAL REVIEW B*
Beasley, M. R., Lew, D., Laughlin, R. B.
1994; 49 (17): 12330-12332
- **GAUGE-THEORY OF THE 3-DIMENSIONAL CHIRAL SPIN LIQUID** *NUCLEAR PHYSICS B*
TIKOFISKY, A. M., LIBBY, S. B., Laughlin, R. B.
1994; 413 (3): 579-604
- **D-WAVE SUPERCONDUCTIVITY WITH A GAP** *Conference on Strongly Correlated Electronic Materials: The Los Alamos Symposium 1993*
Laughlin, R. B.
ADDISON-WESLEY PUBL CO.1994: 566-569
- **New Elementary Particles in Quantum Antiferromagnets and Their Potential Relevance to High-Temperature Superconductivity** *Modern Perspectives in Many-Body Physics: Proceedings of the 6th Physics Summer School*
Laughlin, R. B.
edited by Das, M. P., Mahanty, J.
Singapore: World Scientific.1994
- **FRACTIONAL-STATISTICS GAS WITH SPIN AND STABILITY OF THE SUPERFLUID STATE** *PHYSICAL REVIEW B*
Beran, P., Laughlin, R. B.
1993; 48 (14): 10382-10390
- **COMPUTATION OF THE OPTICAL CONDUCTIVITY OF THE T-J MODEL USING ANYON TECHNIQUES** *PHYSICAL REVIEW LETTERS*
TIKOFISKY, A. M., Laughlin, R. B., Zou, Z.
1992; 69 (25): 3670-3673
- **QUANTUM-MECHANICS OF THE FRACTIONAL-STATISTICS GAS - RANDOM-PHASE APPROXIMATION** *PHYSICAL REVIEW B*
Dai, Q., Levy, J. L., Fetter, A. L., Hanna, C. B., Laughlin, R. B.
1992; 46 (9): 5642-5677
- **ABSENCE OF CIRCULAR-DICHOISM IN HIGH-TEMPERATURE SUPERCONDUCTORS** *PHYSICAL REVIEW LETTERS*
LAWRENCE, T. W., Szoke, A., Laughlin, R. B.
1992; 69 (9): 1439-1442
- **MACROSCOPICALLY DOPED CHIRAL-SPIN-LIQUID STATE** *PHYSICAL REVIEW B*
Zou, Z., Levy, J. L., Laughlin, R. B.
1992; 45 (2): 993-1012
- **HOLE PROPAGATOR OF THE CHIRAL SPIN LIQUID** *PHYSICAL REVIEW B*
Laughlin, R. B.
1992; 45 (1): 400-414
- **ANYONS AND SUPERCONDUCTIVITY - RANDOM PHASE APPROXIMATION** *INTERNATIONAL JOURNAL OF MODERN PHYSICS B*
Fetter, A. L., Hanna, C. B., Laughlin, R. B.
1991; 5 (16-17): 2751-2790
- **CURRENT STATUS OF SEMIIONIC PAIRING THEORY OF HIGH-TC SUPERCONDUCTORS** *WORKSHOP ON PHYSICS AND MATHEMATICS OF ANYONS*
Laughlin, R. B.
WORLD SCIENTIFIC PUBL CO PTE LTD.1991: 1507-19
- **NON-ABELIAN MONOPOLES IN THE 3-DIMENSIONAL CHIRAL SPIN LIQUID** *NUCLEAR PHYSICS B*
LIBBY, S. B., Zou, Z., Laughlin, R. B.
1991; 348 (3): 693-713
- **QUANTUM-MECHANICS OF THE FRACTIONAL-STATISTICS GAS - PARTICLE-HOLE INTERACTION** *PHYSICAL REVIEW B*

-
- Hanna, C. B., Laughlin, R. B., Fetter, A. L.
1991; 43 (1): 309-319
- **CHARGED EXCITATIONS OF THE CHIRAL SPIN LIQUID** *PHYSICAL REVIEW B*
Zou, Z., Laughlin, R. B.
1990; 42 (7): 4073-4079
 - **Fractional Statistics in the Quantum Hall Effect** *Fractional Statistics and Anyon Superconductivity*
Laughlin, R. B.
edited by Wilzcek, F.
Singapore: World Scientific.1990: 262
 - **QUANTUM-MECHANICS OF THE FRACTIONAL-STATISTICS GAS - HARTREE-FOCK APPROXIMATION** *PHYSICAL REVIEW B*
Hanna, C. B., Laughlin, R. B., Fetter, A. L.
1989; 40 (13): 8745-8758
 - **THEORY OF THE SPIN LIQUID-STATE OF THE HEISENBERG-ANTIFERROMAGNET** *PHYSICAL REVIEW B*
KALMEYER, V., Laughlin, R. B.
1989; 39 (16): 11879-11899
 - **RANDOM-PHASE APPROXIMATION IN THE FRACTIONAL-STATISTICS GAS** *PHYSICAL REVIEW B*
Fetter, A. L., Hanna, C. B., Laughlin, R. B.
1989; 39 (13): 9679-9681
 - **SPIN HAMILTONIAN FOR WHICH QUANTUM HALL WAVEFUNCTION IS EXACT** *ANNALS OF PHYSICS*
Laughlin, R. B.
1989; 191 (1): 163-202
 - **Fractional Quantization in High-Temperature Superconductivity** *Mechanisms of High-Temperature Superconductivity*
Laughlin, R. B.
edited by Kamimura, H., Oshiyama, A.
Heidelberg: Springer.1989: 76
 - **Fractional Statistics in the Quantum Hall Effect** *Two-Dimensional Strongly Correlated Electron Systems*
Laughlin, R. B.
edited by Gan, Z., Sun, Z.
London: Gordon and Breach.1989: 199
 - **THE RELATIONSHIP BETWEEN HIGH-TEMPERATURE SUPERCONDUCTIVITY AND THE FRACTIONAL QUANTUM HALL-EFFECT** *SCIENCE*
Laughlin, R. B.
1988; 242 (4878): 525-533
 - **SUPERCONDUCTING GROUND-STATE OF NONINTERACTING PARTICLES OBEYING FRACTIONAL STATISTICS** *PHYSICAL REVIEW LETTERS*
Laughlin, R. B.
1988; 60 (25): 2677-2680
 - **EQUIVALENCE OF THE RESONATING-VALENCE-BOND AND FRACTIONAL QUANTUM HALL STATES** *PHYSICAL REVIEW LETTERS*
KALMEYER, V., Laughlin, R. B.
1987; 59 (18): 2095-2098
 - **DIFFERENTIAL CONDUCTANCE IN 3-DIMENSIONAL RESONANT TUNNELING** *PHYSICAL REVIEW B*
KALMEYER, V., Laughlin, R. B.
1987; 35 (18): 9805-9808
 - **POSITRONIUM TIME-OF-FLIGHT SPECTROSCOPY OF DISSIMILAR METALS** *PHYSICAL REVIEW B*
Howell, R. H., ROSENBERG, I. J., Fluss, M. J., Goldberg, R. E., Laughlin, R. B.
1987; 35 (10): 5303-5306

- **Dilute Fermi Liquid of Polarons in Copper Oxide Superconductors** *Novel Superconductivity*
Laughlin, R. B., Hanna, C. B.
edited by Wolf, S. A., Kresin, V. Z.
New York: Plenum.1987: 553
- **Electrical Resistivity as Quantum Chaos** *Chaos '87: International Conference on the Physics of Chaos and Systems Far from Equilibrium*
Laughlin, R. B.
edited by Duong-Van, M.
Amsterdam: North-Holland.1987: 213
- **Elemental Theory: The Incompressible Quantum Fluid** *The Quantum Hall Effect*
Laughlin, R. B.
edited by Prange, R. E., Girvin, S. M.
New York: Springer.1987: 233
- **MECHANISM OF CURRENT MODULATION BY OPTIC PHONONS IN HETEROJUNCTION TUNNELING EXPERIMENTS** *PHYSICAL REVIEW B*
Hanna, C. B., Hellman, E. S., Laughlin, R. B.
1986; 34 (8): 5475-5483
- **OSCILLATIONS IN THE CURRENT-VOLTAGE CHARACTERISTICS OF GAAS-ALGAAS TUNNEL-JUNCTIONS** *PHYSICAL REVIEW LETTERS*
Hanna, C. B., Laughlin, R. B.
1986; 56 (23): 2547-2547
- **DESTRUCTION OF THE FRACTIONAL QUANTUM HALL-EFFECT BY DISORDER** *SURFACE SCIENCE*
Laughlin, R. B.
1986; 170 (1-2): 167-172
- **TEMPERATURE-DEPENDENCE OF INTERATOMIC FORCES IN THE THOMAS-FERMI APPROXIMATION** *PHYSICAL REVIEW A*
Laughlin, R. B.
1986; 33 (1): 510-518
- **ONE DIMENSIONAL POLARON EFFECTS AND CURRENT INHOMOGENEITIES IN SEQUENTIAL PHONON EMISSION** *PHYSICA B & C*
Hellman, E. S., Harris, J. S., Hanna, C. B., Laughlin, R. B.
1985; 134 (1-3): 41-46
- **SCALING OF CONDUCTIVITIES IN THE FRACTIONAL QUANTUM HALL-EFFECT** *PHYSICAL REVIEW B*
Laughlin, R. B., Cohen, M. L., KOSTERLITZ, J. M., Levine, H., LIBBY, S. B., Pruisken, A. M.
1985; 32 (2): 1311-1314
- **Quasiparticle Aggregation in the Fractional Quantum Hall Effect** *Proceedings of the 17th International Conference on the Physics of Semiconductors*
Laughlin, R. B.
edited by Chadi, D. J., Harrison, W. A.
New York: Springer.1985: 255
- **The Gauge Argument for Accurate Quantization of the Hall Conductance** *Two-Dimensional Systems, Heterostructures and Superlattices*
Laughlin, R. B.
edited by Bauer, G., Kuchar, F., Heinrich, H.
Heidelberg: Springer.1984: 272
- **Fractional Quantization of the Hall Conductance** *Two-Dimensional Systems, Heterostructures and Superlattices*
Laughlin, R. B.
edited by Bauer, G., Kuchar, F., Heinrich, H.
Heidelberg: Springer.1984: 285
- **PRIMITIVE AND COMPOSITE GROUND-STATES IN THE FRACTIONAL QUANTUM HALL-EFFECT** *SURFACE SCIENCE*
Laughlin, R. B.
1984; 142 (1-3): 163-172
- **LEVITATION OF EXTENDED-STATE BANDS IN A STRONG MAGNETIC-FIELD** *PHYSICAL REVIEW LETTERS*

- Laughlin, R. B.
1984; 52 (25): 2304-2304
- **EXCITONS IN THE FRACTIONAL QUANTUM HALL-EFFECT** *PHYSICA B & C*
Laughlin, R. B.
1984; 126 (1-3): 254-259
 - **QUANTIZED MOTION OF 3 TWO-DIMENSIONAL ELECTRONS IN A STRONG MAGNETIC-FIELD** *PHYSICAL REVIEW B*
Laughlin, R. B.
1983; 27 (6): 3383-3389
 - **ANOMALOUS QUANTUM HALL-EFFECT - AN INCOMPRESSIBLE QUANTUM FLUID WITH FRACTIONALLY CHARGED EXCITATIONS** *PHYSICAL REVIEW LETTERS*
Laughlin, R. B.
1983; 50 (18): 1395-1398
 - **HELIUM DIFFRACTION FROM THE GAAS(110) SURFACE AND THE GENERATION OF HELIUM-SURFACE POTENTIALS** *PHYSICAL REVIEW B*
Laughlin, R. B.
1982; 25 (4): 2222-2247
 - **UNIVERSAL BEHAVIOR IN THE ELECTRICAL-CONDUCTIVITY OF STRONG-SCATTERING EXPANDED FLUID METALS** *PHYSICAL REVIEW B*
Laughlin, R. B.
1982; 26 (12): 7019-7022
 - **EXCHANGE THEORY OF RESISTIVITY SATURATION** *PHYSICAL REVIEW B*
Laughlin, R. B.
1982; 26 (6): 3479-3482
 - **QUANTIZED HALL CONDUCTIVITY IN 2 DIMENSIONS** *PHYSICAL REVIEW B*
Laughlin, R. B.
1981; 23 (10): 5632-5633
 - **OPTICAL-ABSORPTION EDGE OF SIO₂** *PHYSICAL REVIEW B*
Laughlin, R. B.
1980; 22 (6): 3021-3029