

DAVID FINKELSTEIN

Emeritus Professor

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Ph.D., Physics, 1953 Massachusetts Institute of Technology

1949-1953

CURRENT RESEARCH

The extension of quantum logic to the deeper levels of physics. This touches on elementary particles and quantum gravity. I have pursued this since college.

MAIN PAST RESEARCH

Black hole ("unidirectional membrane"). Paper A3 (1958)

Gravitational skyrmeons. Paper A5 (1959)

Ball lightning. Papers A13 (1964), A18 (1970), B18

Homotopy classification of condensate order parameters. Paper A5 (1959)

Quaternionic quantum Papers A8 (1962), A10, A11

Higgs field Paper A11, B11 (1964)

Giorgi-Glashow electroweak unification. Paper A11 (1963), B

Topological spin-statistics theorem. Papers A5 (1959), A16 (1962)

Quantum set theory. Book C1 (1996)

Quantum gravity. Paper A56 (2007)

POSITIONS (since 1976)

Chairman, Physics Department, Yeshiva University 1976-1977

Editor, International Journal of Theoretical Physics 1977-2005

Dean of Natural Sciences and Mathematics, Yeshiva University 1978-1979

Director, School of Physics, Georgia Institute of Technology 1979-1980

Professor, School of Physics, Georgia Institute of Technology 1980-2003

Visiting Scientist, Mathematics Institute, Oxford University 1989

Visiting Fellow, Heisenberg Inst. Theor. Physics, Munich, at times 1993-now

Professor Emeritus, School of Physics,
Georgia Institute of Technology 2003-now

SERVICE

Tibetan National Library, Dharmasala: Science Advisor 1998-now

Science for Monks, teaching in various towns in India. 2003-now

Institute Undergraduate Curriculum Committee 2001-2004

Intern. Quantum Structures Assoc., founding secretary 1994-95

J. Mathematical Physics, Ed. Board 1991-1993

APS Dannie Heinneman Prize Committee 1994-1995

NSF-APS Visiting Scientist, Tougaloo College, Tougaloo MI 1964

PUBLICATIONS AND PRESENTATIONS

*Most relevant papers

Book

David Finkelstein, *Quantum Relativity*. Springer, Heidelberg (1996)

Journal articles

*A3 D. Finkelstein, Past-future asymmetry of the gravitational field of a point particle, *Physical Review* 110, 965-977 (1958).

This paper influenced Penrose and Landau and triggered the black-hole industry.

To find the fundamental group of gravity, Misner and I had first found its topological components, and so discovered gravitational skyrmeons. The spherically symmetric g-skyrmeon has a "one-way membrane" (later: "black hole"). Its static form therefore has a singularity; so I checked the Schwarzschild singularity and found it was the same kind.

Eddington got this metric from Whitehead theory but ridiculed passage through the Schwarzschild singularity; Oppenheimer & Snyder passed through said SS but did not have the metric; fortunately I knew of neither difficulty.

A5 D. Finkelstein and C.W. Misner, Some new conservation laws, {*Annals of Physics* 6: 230-243 (1959)

Generalizing the gravitational skyrmeon. But Skyrme's local method gave a skyrmeon current density that my global methods couldn't give.

*A8 D. Finkelstein, J.M. Jauch, S. Schiminovich and D. Speiser, Foundations of quaternion quantum mechanics, *Journal of Mathematical Physics* 3, 207 (1962).

Looking for bigger gauge fields with bigger complex numbers. Only gave electroweak. Forerunner of Clifford quantum theory.

A10 D. Finkelstein, J.M. Jauch, S. Schiminovich and D. Speiser, Some physical consequences of general Q-covariance, *Helvetica Physica Acta* 35, 328-329 (1962)

U(1) doesn't imply charge quantization but SU(2) does.

A11 D. Finkelstein, J.M. Jauch, S. Schiminovich and D. Speiser, Principle of general Q-covariance, *Journal of Mathematical Physics* 4, 788-796 (1963) Gauging quaternions: SU2 and Higgs field.

A13 D. Finkelstein and J. Rubenstein, Ball lightning, *Physical Review* 135, 390-396 (1964)

A16 D. Finkelstein and J. Rubenstein, Connection between spin, statistics, and kinks, *Journal of Mathematical Physics* 9, 1762-1779 (1968).

Reprinted in F. Wilczek, *Fractional Statistics and High-temperature Superconductivity*, World Scientific Press (1991).

*A17 D. Finkelstein, Space-time code, *Physical Review* 184: 1261 (1969)

My first attempt to quantize space-time. Still fundamentalist, alas. But the algebra is useful now for full quantization.

*A29 D. Finkelstein, Cosmological choices, *Synthese* 50, 399-420 (1982)

The idea of a fully quantum theory but no idea of how to make one.

*A30 D. Finkelstein, Quantum set theory and Clifford algebra, *International Journal of Theoretical Physics* 21, 489-503 (1982). Groping - The language is still useful.

*A32 D. Finkelstein and E. Rodriguez, The quantum pentacle, *International Journal of Theoretical Physics* 23, 887-894 (1984)

*A41 D. Finkelstein, Quantum net dynamics, International Journal of Theoretical Physics 28, 441-467 (1989)

*A48. James Baugh, David Ritz Finkelstein, Andrei Galiautdinov, and Heinrich Saller. Clifford algebra as quantum language. Journal of Mathematical Physics 42, 1489-1500 (2001).

* A52. Galiautdinov, A. and Finkelstein, D. (2002) Chronon corrections to the Dirac equation. Journal of Mathematical Physics 43: 4741-4752.

A56. Finkelstein, D. R Homotopy approach to quantum gravity. International Journal of Theoretical Physics 2007 (to appear).

Non-journal publications

*B9 D. Finkelstein, Logic of quantum physics, in Transactions of the New York Academy of Science 25, pp. 621-637 (1963).

Exposition of operational quantum logic. Von Neumann form, alas.

*B10 M. Tavel, D. Finkelstein, and S. Schiminovich, Weak and electromagnetic interactions in quaternion quantum mechanics, Bulletin of the American Physical Society 9, 436 (1965)

Shows the charged massive vector partner of the photon resulting from a slight modulation of \hbar .

*B11 D. Finkelstein, Elementary particles and general relativity, in Theories relativistes de la gravitation (Warsaw-Jablonna), Paris (1964). Reported the Schwarzschild black hole to an audience of three who turned out to be janitorial.

B18 J.R. Powell and D. Finkelstein, Structure of ball lightning, in H.E. Landsberg (ed.), Advances in Geophysics 13, 141-186, Academic Press (1969). Still the best theory of ball lightning; but still DC. Should be redone taking HF into account.

*B30 D. Finkelstein, Beneath time, in J.T. Fraser, N. Lawrence and D. Park (eds.), The Study of Time, III, Springer (1978)

*B34 D. Finkelstein, Logos/mythos, Kenyon Review 1, 136-150 (1979). Philosophical remarks on quantum logic. Most I still believe.

*B36 D. Finkelstein, Quantum set theory and geometry, in L. Castell (ed.), Quantum Theory and the Structures of Time and Space, IV, Hanser (1981)

*B37 D. Finkelstein, Coherence and possibility, Kenyon Review 4, 95-112 (1982)

*B40 D. Finkelstein and E. Rodriguez, Relativity of dynamical law, in P. Weingartner and G. Dorn (eds.) Foundations of Physics, 78-92, Hölder- Pichler-Tempsky (1986). Tries to escape fundamentalism by renouncing absolute law. Right direction.

