

VITA
George Greenstein

<http://greensteinastronomy.rocketfusion.com/>

Born: 1940

Astrophysicist, Writer, Educator

Education:

Stanford University B.S. (1962) (Physics)
Yale University Ph.D. (1968) (Physics)

Positions Held:

1993 - 2012 Sidney Dillon Professor of Astronomy at Amherst College
1983 - 1993 Professor of Astronomy, Amherst College
1981 - 1984 Chair, Five College Astronomy Department
1977 - 1983 Associate Professor of Astronomy, Amherst College
1971 - 1977 Assistant Professor of Astronomy, Amherst College
1970 - 1971 Research Associate, Princeton University Observatory
1968 - 1970 Research Associate, Yeshiva University

Awards

- American Institute of Physics/U.S. Steel Science Writing Award, 1984.
- Phi Beta Kappa Award in Science, 1984.
- Astronomical Society of the Pacific, Richard H. Emmons Award for innovative college astronomy teaching, 2022.

Member:

American Astronomical Society, International Astronomical Union, The Authors' Guild, PEN

Judge, Phi Beta Kappa Award in Science, 1989-1991.

PhD Dissertation "The Helium Problem in Cosmology"

Listed in "Who's Who in the East", "International Authors and Writers Who's Who".

Bibliography

I. Research Papers:

"Helium Deficiency in Old Halo B Stars", *Nature*, 213, 871 (1967), with J.W. Truran and A.G.W. Cameron.

"Brans-Dicke Cosmology", *Astrophysical Letters* 1, 139 (1968).

"Brans-Dicke Cosmology II", *Astrophysics and Space Science*, 2, 155 (1968).

"Spin Down Effects in Neutron Stars", *Nature*, 222, 862 (1969) with A.G.W. Cameron.

"Primordial Helium Production in 'Magnetic' Cosmologies", *Nature*, 223, 938, (1969).

"Gravitational Radiation from Dense Star Clusters", *Ap.J.*, 158, L145 (1969).

"Superfluid Turbulence in Neutron Stars", *Nature*, 227, 791, (1970).

"Frictional Heating in Neutron Stars", *Nature Phys. Sci.*, 232, 117, (1971);
Nature, 234, 180 (1971).

"GX340+0 as a Hot Neutron Star", *Nature Phys. Sci.*, 238, 71 (1972).

"Masses and Magnetic Fields of Neutron Stars", *Astrophysical Journal*, 177, 251, (1972).

"Effects of Thermal Photon Scattering on Relativistic Electrons near Pulsars", with E. Tademaru, *Nature*, 251, 39 (1974).

"Electrical Conductivity and Magnetic Field Decay in Neutron Stars", with G. Ewart and R. Guyer, *Astrophysical Journal*, 202, 238 (1975).

"Superfluidity in Neutron Stars. I. Steady State Hydrodynamics and Frictional Heating", *Astrophysical Journal*, 200, 281, (1975).

"Superfluidity in Neutron Stars. II. After A Period Jump", *Astrophysical Journal*, 208, 836 (1976).

"The Tungus Event as a Small Black Hole" with J. Burns and K. Verosub, *M.N.R.A.S.*, 197, 355 (1976).

"Radius of the Vela Pulsar" with J. McClintock, *Astrophysical Journal (Letters)*, 208, L41 (1976).

"A Search for Thermal Extreme Ultraviolet Radiation from Nearby Pulsars", with B. Margon, S. Bowyer, M. Lampton, F. Paresce, R. Stern and K. Gordon, *Astronomy and Astrophysics*, 54, 623 (1977).

"Superfluidity in Neutron Stars. III. Relaxation Processes Between the Superfluid and the Crust" with D. Harding and R. Guyer, *Astrophysical Journal*, 222, 991 (1978).

"Thermal/Timing Instability in Neutron Stars", *Nature*, 277, 521 (1979).

"Pulsar Glitches and the Thermal/Timing Instability in Neutron Stars", *BAAS*, 10, 447 (1978).

"Pulsar Timing Observation, X-Ray Transients and the Thermal/Timing Instability in Neutron Stars", *Astrophysical Journal*, 231, 880 (1979).

"Pulsar Glitches, Fast and Slow", *BAAS*, 11, 426 (1979).

"Pulsar Timing IV: Physical Models for Timing Noise Processes", with J.M. Cordes, *Astrophysical Journal*, 245, 1060 (1981).

"Long Term Evolution of Superfluid Neutron Stars", with Timothy J. Carroll, *BAAS*, 14, 967 (1982).

"Thermal X-Rays from Neutron Stars: the 'Light' Curve", with Gregory J. Hartke, *BAAS*, 14, 1967 (1982).

"Thermal X-Rays from Neutron Stars: Implications for PSR 1509-58 and PSR 1055-52", with Gregory J. Hartke, *BAAS*, 14, 966 (1982).

"Pulse-Like Character of Thermal X-rays from Neutron Stars", with G. Hartke, *Astrophysical Journal*, 271, 283 (1983).

"A Burst Emission Mechanism for Coherent Radiation from Pulsars" with E.R. Harrison and E. Tademaru, *Nature*, 308, 826 (1984).

"Small Black Holes: Ionization Tracks and Range", with Jack O. Burns, *American Journal of Physics*, 52, 531 (1984).

"Order-of-Magnitude 'Theory' of Stellar Structure", *American Journal of Physics*, 55, 804 (1987).

"Cognizable Worlds" The Anthropic Principle and the Fundamental Constants of Nature", with Allen Kropf, American Journal of Physics, 57, 746 (1989).

"Do Quantum Jumps Occur at Well-Defined Moments of Times?" with Arthur Zajonc, American Journal of Physics, 63, 743 (1995).

"An Intuitive Approach to the Earth's Centrifugal Bulge", The Physics Teacher, 60, 369 (May 2022).

"The Shape of the Earth: An Early Test of Newtonian Physics", The Physics Teacher , 60, 365 (May 2022).

II. Review Articles

"Draft Report on Neutron Stars", in Transactions of the I.A.U.: Reports on Astronomy, Vol. XV B (1973).

"Prospects for Detecting Blackbody X-Rays from Neutron Stars", with J. McClintock, Science, 185, 487 (1974).

"Superfluidity in Neutron Stars" in Proceedings of I.A.U. Symposium #53 on the Physics of Dense Matter, D. Reidel Pub. Co. (1974).

"Glitches, Timing Noise and Pulsar Thermometry", in Proceedings of I.A.U. Symposium #95 'Pulsars' W. Sieber and R. Wielebinski (eds) (1981).

III. Interpretive Essays

"Informalism in Physics", The Yale Review, Winter 1973.

"Creativity in Science: A Personal Account", in Proceedings of the Conference on Creativity and Science, University of Hawaii, March 23-24, 1985. Also in The Massachusetts Review, Spring, 1986.

"An Invitation to Strangers", Science '85, June 1985.

"Heavenly Fire", Science '85, July 1985.

"The Magician", (A Profile of George Gamow), The American Scholar, Fall, 1989.

"A Universe of Universes", Astronomy Magazine, October 1989.

"First Light for Space Telescope", Air and Space Magazine, April/May 1990.

"The Bulldog", (A Profile of Ludwig Boltzmann), The American Scholar, Winter, 1991.

"The Dragon" in "Teaching What We Do", Amherst College Press, 1991.

"Luie's Gadgets", (A Profile of Luis Alvarez), The American Scholar, Winter, 1992.

"A Gentleman of the Old School: Homi Bhabha and the Development of Science in India", The American Scholar, Summer, 1992. Reprinted in Current Science (India), vol 64, #2 (1993) and Physics News (India) in the press.

"Imps" (essay-review on Chaos), The Yale Review, 80, #1 & 2, April, 1992.

"The Ladies at Observatory Hill", (A Profile of Annie Jump Cannon and Cecilia Payne-Gaposchkin), The American Scholar, Summer, 1993.

"Our Address in the Universe", (A Profile of Margaret Geller and John Huchra), Harvard Magazine, Jan.-Feb., 1994.

"Teaching Science by Seminar." Physics Today, May 1994.

"Who Are Our Students -- And Why Does It Matter?", Proceedings of I.A.U. Colloquium #162 "New Trends in Astronomy Teaching", L. Gouguenheim, D. McNally and J. R. Percy, eds, Cambridge University Press 1998.

"A Department-Wide Commitment to Inquiry-Based Teaching," BAAS, 31, 1000, 1999

"An Inquiry-Based Undergraduate Course Investigating Unseen Matter in the Universe," BAAS, 31, 938, 1999 (with A. J. Lovell).

"Duking It Out With Quantum Mechanics," The Scientific American (Online), May 7, 2019

<https://blogs.scientificamerican.com/observations/duking-it-out-with-quantum-mechanics/>

"A Little-Known Quantum Mechanics Theorem Explains The Nature Of All Reality," Salon May 19, 2019 <https://www.salon.com/2019/05/19/a-little-known-quantum-mechanics-theorem-explains-the-nature-of-all-reality/>

IV. Education and Education Policy

"The Ancient Universe: How Astronomers Know the Vast Scale of Cosmic Time," with Andrew Fraknoi, Bruce Partridge and John Percy, a special edition of "The Universe

in the Classroom.' Published by the American Astronomical Society and the Astronomical Society of the Pacific (2001) -- see also https://www.researchgate.net/publication/261539781_An_Ancient_Universe_How_Astronomers_Know_the_Vast_Scale_of_Cosmic_Time

"Goals for 'Astro 101:' Report on a Workshop for Astronomy Department Leaders," with Bruce Partridge, Astronomy Education Review, vol 2, pg 46 (2003) <http://aas.org/files/resources/101-FinalReport.pdf>

"Writing is Thinking: Using Writing to Teach Science," 2013, Astronomy Education Review, vol 12 issue 1 (2013), http://www.portico.org/Portico/%2523!journalAUSimpleView/tab=PDF?cs=ISSN_15391515?ct=E-Journal%20Content?auId=ark:/27927/pgg3ztfcttc%23!journalAUSimpleView/tab=PDF?cs=ISSN_15391515?ct=E-Journal%2520Content?auId=ark:/27927/pgg3ztfcttc#!journalAUSimpleView/tab=PDF?cs=ISSN_15391515?ct=E-Journal%20Content?auId=ark:/27927/pgg3ztfcttc

"Inquiry Textbooks for the Sciences," 2013 http://greensteinastronomy.rocketfusion.com/files/Inquiry_Textbooks_in_the_Sciences.pdf

"Interesting Problems for Physics and Astronomy 101 and 102" (2020) <https://greensteinastronomy.com/p/25/Interesting-Problems>

"Teacher's Aid for the Starlight and Breakthrough Starshot Initiatives" (2020) <https://greensteinastronomy.com/p/26/Interstellar-Travel>

V. Books

"FROZEN STAR"
125,000 words
Freundlich Books; Publication date: May 31, 1984

A discussion of pulsars and black holes in non-technical language accessible to the general public, including an account of the process of their discovery and of the personal experiences of a number of workers in the field.

Frozen Star was the winner of the 1984 AIP-United States Steel Foundation Science Writing Award to a Scientist, and of the 1984 Phi Beta Kappa Award in Science. It was a main selection of the Book-of-the-Month Science section and of the Astronomy Book Club. Paperback edition published by New American Library - May 1985.

Commonwealth Edition, published by Macdonald/Future (London); publication date September 1, 1984.

French Edition, published by Editions du Seuil (Paris) January 1987.

German Edition, published by Econ Verlag (Dusseldorf) 1985. Licensed to the Bertelsman book club in Germany, the Donauland Kremayr and Scheriau book club in Australia and the Buch-und Schall Plattenfreunde book club in Switzerland. Paperback edition published by Deutscher Taschenbuch Verlag.

Spanish Language Edition, published by Fondo de Cultura Economica, (Mexico City), September 1988.

Japanese Edition, by Chijin Shokan Ltd. (Tokyo) 1993.

"THE SYMBIOTIC UNIVERSE"

70,000 words

William Morrow: Publication date, February 1988

A discussion in non-technical language accessible to the general public of the Anthropic Principle, the fitness of the universe for life and the creation of reality by observation in quantum mechanics.

"The Symbiotic Universe" is a selection of the Quality Paperback Book Club, of the Astronomy Book Club and of the MacMillan Book Club.

German Edition published by Econ Verlag (Dusseldorf), November 1988.

"THE QUANTUM CHALLENGE:

MODERN RESEARCH ON THE FOUNDATIONS OF QUANTUM MECHANICS"

with Arthur Zajonc

60,000 words

Jones & Bartlett Publishers 1997

A discussion of the extraordinary phenomena of quantum mechanics, and of the enormous challenge they present to our conception of the physical world. The level of treatment makes this book appropriate for advanced undergraduate science, mathematics and engineering students. A unique feature is that it presents conceptual issues in an experimental format, in which the puzzles of quantum

mechanics are dramatized by means of reference to actual contemporary experiments.

Second edition published August, 2005. Features:

- brought up to date
- experiments for the undergraduate laboratory
- a new chapter on quantum information and computation

"PORTRAITS OF DISCOVERY: PROFILES IN SCIENTIFIC GENIUS"

80,000 words

John Wiley & Sons 1997

A collection, aimed at the general public, of profiles of ten physicists and astronomers. The subjects' lives and careers are probed in depth, full attention being paid to their scientific work, to the twists and turns of their lives, and to the social implications of their work. Where relevant the profiles also treat of extra scientific issues such as women in science, the role of science in developing countries, and the stunning rise of big science in our time.

"UNDERSTANDING THE UNIVERSE:
AN INQUIRY APPROACH TO ASTRONOMY AND THE NATURE OF SCIENTIFIC
RESEARCH"

656 pages, 513 BW illus, 39 color illus, 297 exercises

Cambridge University Press

Feb 2013

An introductory though challenging textbook aimed at non-science college students, emphasizing inquiry learning, critical analysis and the nature of science.

- Material is covered in great depth, but only those topics most essential to the field.
- Relates scientific concepts to everyday experience
- Active learning: emphasizes how we know what we know. Involves the student in the chain of reasoning, including blind alleys.
- Two-track system of mathematics at the level of simple arithmetic with exponential notation. First *the Logic of the Calculation*, then the *Detailed Calculation* in a sidebar.
- "You Must Decide:" questions in which the student is asked to make a firm choice concerning an issue for which there is no "right answer" – and to defend this choice in a well reasoned essay.
- "The Nature of Science:" This Chapter deals not with any particular astronomical topic, but with science as a way of thinking that is unique in history. What has made science such a powerful agent of change in modern society?

QUANTUM STRANGENESS:
WRESTLING WITH BELL'S THEOREM AND
THE ULTIMATE NATURE OF REALITY
30,000 words
MIT Press, publication date May 2019

A personal memoir in which the author struggles to comprehend the implications of quantum mechanics for our understanding of the ultimate nature of reality. We have known for decades that the world of the quantum was strange. But not until John Bell came along did we realize just how strange it is.

See also

- “Duking It Out With Quantum Mechanics,” The Scientific American (Online), May 7, 2019 <https://blogs.scientificamerican.com/observations/duking-it-out-with-quantum-mechanics/>
- “A Little-Known Quantum Mechanics Theorem Explains The Nature Of All Reality,” Salon May 19, 2019 <https://www.salon.com/2019/05/19/a-little-known-quantum-mechanics-theorem-explains-the-nature-of-all-reality/>
- “How Quantum Theory Clashes With Reality,” Salon June 2, 2019 <https://www.salon.com/2019/06/02/how-quantum-theory-clashes-with-reality/>