

# David J. Gross Biography

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David Jonathan Gross (February 19, 1941-) was born in Washington, D.C., USA, the son of Bertram Myron Gross, a civil servant first for the US federal administration and then for the State of Israel as well as an academic, and Nora Gross (née Faine). The family moved to Israel in 1953, where Gross completed his high school education.

Gross received a BSc in Physics (1962) from the Hebrew University of Jerusalem, and moved to the University of California, Berkeley, for graduate studies. There, he obtained a PhD in Physics (1966) for thesis entitled "Investigation of the Many-Body, Multi Channel Partial-Wave Scattering Amplitude," under the supervision of Geoffrey F. Chew. He was then a Junior Fellow at Harvard (1966-1969), before joining the Princeton faculty as assistant professor of physics. He climbed through the ranks, eventually becoming Eugene Higgins Professor of Physics (1986-1996), before taking the directorship (1997-2012) of the Kavli Institute for Theoretical Physics at the University of California, Santa Barbara. Since 2002, he is also the Frederick W. Gluck Chair and the Chancellor's Chair in Theoretical Physics.

Gross has been a central figure in particle physics and string theory. His discovery, with his student Frank Wilczek, of asymptotic freedom—the primary feature of non-Abelian gauge theories—led Gross and Wilczek to the formulation of quantum chromodynamics, the theory of the strong nuclear force. Asymptotic freedom is a phenomenon where the nuclear force weakens at short distances, which explains why experiments at very high energy can be understood as if nuclear particles are made of non-interacting quarks. The flip side of asymptotic freedom is that the force between quarks grows stronger as one tries to separate them. This is the reason why the nucleus of an atom can never be broken into its quark constituents. QCD completed the Standard Model, which details the three basic forces of particle physics—the electromagnetic force, the weak force, and the strong force. Gross has also made seminal contributions to the theory of Superstrings, a burgeoning enterprise that brings gravity into the quantum framework. With collaborators, he originated the "Heterotic String Theory," the prime candidate for a unified theory of all the forces of nature. During Gross' 1983-1984 sabbatical in Paris and Jerusalem, he also studied spin glass models using Parisi's replica symmetry breaking scheme. This work unified notably Bernard Derrida's random energy model with more physical models.

For his advances, Gross was notably named fellow of the American Physical Society (APS, 1976) and of the MacArthur Foundation (1987) and is a member of the National Academy of Sciences (1986) and of the American Academy of Arts and Sciences (1986). He also received (with Wilczek and David Politzer) the J. J. Sakurai Prize for Theoretical Particle Physics of the APS (1986), "for their analyses of nonabelian gauge theories at short distances, and the implications of these insights for the understanding of the strong interac-

tion between quarks”; the Harvey prize (2000) for his “contributions to all aspects of elementary particle physics and in particular for the discovery of the ‘Asymptotic Freedom’ property of the strong interactions among the most elementary constituents of matter”; and the Nobel Prize in Physics (2004) “for the discovery of asymptotic freedom in the theory of the strong interaction”. He has received many other awards, including the Dirac Medal (of the ICTP, 1988), and holds honorary degrees from the US, Britain, France, Israel, Argentina, Brazil, Belgium, China, the Philippines, and Cambodia.