Curriculum Vitae

Howard Georgi

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BORN

January 6, 1947
San Bernardino, California

MARITAL STATUS

Married, two children

DEGREES

June 1967	B.A., Harvard College Graduated magna cum laude with highest honors in chemistry and physics.
June 1971	Ph.D. Yale University Honorary Sterling Fellow.

POSITIONS

1971-73	Research Fellow, Harvard University.
1973-76	Junior Fellow, Society of Fellows, Harvard University.
1976-80	Associate Professor of Physics Harvard University.
1980-	Professor of Physics.
1982-98	Senior Fellow, Harvard Society of Fellows.
1982-2004	Editor, Physics Letters B.
1991-94	Chair, Department of Physics. Harvard University.
1992-	Mallinckrodt Professor of Physics.
1998-	Master of Leverett House.
2002-	Head Tutor in Physics and Chemistry and Physics Concentrations.
2005-10	Harvard College Professor

COMMITTEES AND BOARDS

1983-86	BNL High Energy Advisory Committee.
1992-95	LBL Physics Division Visiting Committee.
1993-94	SSC Laboratory PAC.
1994-98	FNAL PAC — chair 97-98.
1994-97	Annual Reviews Editorial Board.
1994-97	American Physical Society Committee on the Status of Women in Physics.
1995-98	Executive Committee, American Physical Society Forum on Education.
1996-99	Vice Chair, Chair Elect and Chair — Division of Particles and Fields of the American Physical Society.
1996-99	Co-chair — Committee on Women in Science and Engineering, National Research Council.
2002-06	External Advisor to the Hunter College Gender Equity Project.
2006-	Boston University Women in Science and Engineering, Advisory Board.

FELLOWSHIPS AND HONORS

1971-73	NSF Postdoctoral Fellow.
1976-80	Alfred P. Sloan Foundation Fellow.
1982-	Fellow, American Academy of Arts and Sciences.
1994-	Fellow, American Physical Society Division of Particles and Fields *for innovative work in particle physics including the standard model, QCD, SU(2)×U(1) symmetry breaking, and GUTs.*
1995	Sakurai Prize, American Physical Society. *For his pioneering contributions to the unification of strong and electroweak interactions, and for his application of quantum chromodynamics to the properties and interactions of hadrons.*
1995-	National Academy of Sciences.
1999	Levenson Memorial Teaching Award.
2000	Dirac Medal from the Abdus Salam International Centre for Theoretical Physics. *for pioneering contributions to the quest for a unified theory of quarks and leptons and of the strong, weak, and electromagnetic interactions.*
2002	Phi Beta Kappa Teaching award from α-ι of Massachusetts.
2004	Levenson Memorial Teaching Award (first repeat winner).
2006	Pomeranchuk Prize from the Institute for Theoretical and Experimental Physics — Moscow *for the unification of Interactions and the understanding of the Standard Theory*.
2009	Fellow, Association for Women in Science. *for his pioneering and sustained advocacy of women in physics*.

BOOKS

1981	Lie Algebras in Particle Physics (Benjamin/Cummings, Reading, MA).
1999	Revised Edition.
1984	Weak Interactions and Modern Particle Theory (Benjamin/Cummings, Menlo Park, CA), Now available on my web page.
1992	The Physics of Waves (Prentice-Hall, Inc., Englewood Cliffs, NJ) Now available on my web page.

Student Theses

1. Quantum Bound States in a Color-Confined Theory by William N. Celmaster, June 1977.
2. Calculations in Quark Models by Edward Henry Farhi, April 1979.
3. Predictions and Limitations of Perturbative QCD by Samuel Davis, May 1979
4. Topics in the Theory of Leptoproduction by Jonathan Lewis Sheiman, May 1979.
5. Monopoles and Dions in Grand Unified Models by Theodore Nikos Tomaras, May 1980.
6. Mass Mixing and CP Violation in the $B_0 - \bar{B}_0$ System by Jon Hagelin, April 1981.
7. Generalized Gauge Hierarchies by Sara Lynn Dawson, May 1981.
8. Decoupling and Grand Unification by Lawrence John Hall, May 1981.
9. Low Energy Supersymmetry by Robert Mark Claudson, May 1982.
10. Phenomenological Lagrangian and the Light Mesons by Andrew Charles Redfield, May 1982.
11. Large Weak Isospin and the W Mass by Peter Louis Galison, May 1983.
12. Chiral Quarks and the Non-Relativistic Quark Model by Aneesh Vasant Manohar, May 1983.
13. Functional Techniques in Superspace by Ian Norman McArthur, May 1984.
14. Spontaneously Broken CP and the Renormalization of θ, by Ann Nelson, May 1984.
15. Supersymmetries of the World by Benjamin Grinstein Aks, May 1984.
16. Topics in Elementary Particle Physics by Michael John Dugan, May 1985.
17. Family Structure of Quarks and Leptons by Michael Sup Shin, May 1985.
18. The Composite Higgs Mechanism by David Benjamin Kaplan, May 1985.

19. Effective Field Theories for Low Energy Physics by Andrew Glen Cohen, May 1986.
20. Topics in Lattice Gauge Theory by Gregory Kilcup, May 1986.
21. Light Composite Fermions by David Ariel Kosower, May 1986.
22. Consequences of Supersymmetry by Donald Arthur Spector, October 1986.
23. Applications of Effective Lagrangian by Jonathan Maitland Flynn, May 1987.
24. Composite Technicolor Standard Models by R. Sekhar Chivukula, May 1987.
25. Enhancing The Standard Model by Lisa J. Randall, May 1987.
26. Electroweak and Flavor Symmetry Breaking by Elizabeth Helen Simmons, May 1990.
27. Real and Imaginary Strong Interactions by Junegone Chay, May 1990.
28. The Heavy Quark Effective Field Theory by Adam Frederick Falk, May 1991.
29. Symmetries and Strong Interactions by Michael Eric Luke, May 1991.
30. Effective Quantum Field Theories by Peter Leslie Cho, May 1992.
31. Symmetries, Anomalies and Effective Field Theory by Vineer Bhansali, September 1992.
32. Effective Field Theory Calculation of the W and Z Masses by Anemarie DeYoung, April 1993.
33. Effective Field Theory and the Signatures of New Physics by Christopher Carone, June 1994.
34. Effective Field Theories with Instantons by Samuel Osofsky, June 1994.
35. Matching Calculation and Massless Composite Particles by Chia-Hung Vincent Chang, June 1995.
36. Topics in Effective Field Theories by Lev Kaplan, June 1996
37. Topics in High Energy Phenomenology by David Joseph Morin, June 1996.
38. Methods in QCD and Non-Perturbative Physics by Dean Junyuel Lee, June 1998.
39. Reparametrization Invariance in Heavy Quark Effective Field Theory by Matt McIrvin, June 1998.
40. An S3 Symmetry of Non-Relativistic Quark Models and a Top Quark Seesaw model by Hael Switzer Collins, June 1999.
41. Chiral orbifold construction of field theories with extra dimensions by Girma Hailu, June 2003.
42. Topics in Little Higgs physics by Spencer Chang, June 2004.

Some Research Accomplishments in Particle Theory:

- Constructed the $SU(5)$ and $SO(10)$ grand unified theories, with Glashow.*Unity of all Elementary Particle Forces*, (with S. L. Glashow), Phys. Rev. Lett. **32** 438 (1974).
- Developed the theory of coupling constant renormalization in GUTs, with Quinn and Weinberg. *Hierarchy of Interactions in Unified Gauge Theories*, (with H. Quinn and S. Weinberg), Phys. Rev. Lett. **33** 451 (1974).
- Did one of the first calculations of QCD radiative corrections, with Appelquist. e^+e^- *Annihilation in Gauge Theories of Strong Interactions*, (with T. Appelquist), Phys. Rev. **D8** 4000 (1973).
- Developed the modern QCD-motivated quark model, understood the Σ-Λ mass difference as the result of the quark mass dependence of color-magnetism, and correctly predicted the masses of the low-lying charmed particles, with De Rujula and Glashow. *Hadron Masses in a Gauge Theory*, (with A. De Rujula and S. Glashow), Phys. Rev. **D12** 147 (1975).
- Developed the theory and did one the first phenomenological analyses of scaling violation in deep inelastic lepton-hadron scattering, with Politzer, and De Rujula and Politzer. *Electroproduction Scaling in an Asymptotically Free Theory of Strong Interactions*, (with H. David Politzer), Phys. Rev. **D9** 416 (1974); *Demythification of Electroproduction Local Duality and Precocious Scaling*, Annals of Physics **103** 315 (1977).
- Developed the idea of Gluon fusion for Higgs production, with Glashow, Machacek, and Nanopoulos. *Higgs Bosons from Two Gluon Annihilation in Proton-Proton Collisions*, (with S. L. Glashow, M. Machacek, and D. V. Nanopoulos), Phys. Rev. Lett. **40** 692 (1978).
- Helped develop the modern theory of perturbative QCD, with Politzer and others. *Clean Tests of QCD in* $\mu - P$ *Scattering*, (with H. D. Politzer), Phys. Rev. Lett. **40** 3 (1978); *Perturbation Theory and the Parton Model in QCD*, (with R. K. Ellis, M. Machacek, H. D. Politzer, and G. G. Ross), Nucl. Phys. **B152** 285 (1979).
- Helped develop the modern view of effective field theories. *Effective Field Theory*, in **Annual Review of Nuclear and Particle Science**, ed. J. D. Jackson, vol. 43, 209 (1994)
- Constructed an $SU(5)$ GUT with softly broken supersymmetry, with Dimopoulos. This work laid the foundation for the supersymmetric standard model and predicted $\sin^2\theta$ in agreement with present day precise tests. *Softly Broken Supersymmetry and SU(5)*, (with S. Dimopoulos), Nucl. Phys. **B193**, 150 (1981).
- Developed the chiral quark model, with Manohar. *Chiral Quarks and the Nonrelativistic Quark Model*, (with A. Manohar), Nucl. Phys. **B234**, 189 (1984).
- Developed the theory of composite Higgs bosons, with Kaplan and Dimopoulos. *SU(2)×U(1) Breaking by Vacuum Misalignment*, (with D. Kaplan), Phys. Lett. **136B**, 183 (1984); *Composite Higgs Scalars*, (with D. Kaplan and S. Dimopoulos), Phys. Lett. **136B**, 187 (1984).

- Constructed simple composite models with massless fermions. *A Tool Kit For Builders of Composite Models*, Nuclear Physics **B266**, 274 (1986).
- Constructed technicolor models without flavor-changing neutral current problems, with Chivukula and Randall. *A Composite Technicolor Standard Model of Quarks*, (with R.S. Chivukula and L. Randall) Nucl. Phys. **B292**, 93 (1987).
- Developed the heavy quark effective field theory. *An Effective Field Theory for Heavy Quarks at Low Energies*, Phys. Lett. **B240**, 447 (1990).
- Found a class of 4-dimensional field theories in which extra dimensions arise dynamically, providing a new slant on the meaning of space. *(De)constructing dimensions*, (with N. Arkani-Hamed and A.G. Cohen) Phys. Rev. Lett. **86**, 4757 (2001).
- Constructed the first "little higgs" model, in which the Higgs boson is a pseudo-Goldstone boson without fine tuning. *Electroweak symmetry breaking from dimensional deconstruction*, (with N. Arkani-Hamed and A.G. Cohen) Phys. Lett. **B513**, 232 (2001).
- Suggested a way of searching for scale invariant matter not describable in terms of particles in "Unparticle physics," Phys. Rev. Lett. 98 (2007) 221601, hep-ph/0703260; "Another Odd Thing About Unparticle Physics," Phys. Lett. B650 (2007) 275278, arXiv:0704.2457 [hep-ph]

References

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[2] H. Georgi, "Energy-momentum tensors and scale invariance in the thirring model," *Phys. Rev.* **D2** (1970) 2908–2911.

[3] H. Georgi and S. L. Glashow, "Gauge theories without anomalies," *Phys. Rev.* **D6** (1972) 429.

[4] H. Georgi and S. L. Glashow, "Unified weak and electromagnetic interactions without neutral currents," *Phys. Rev. Lett.* **28** (1972) 1494.

[5] H. Georgi and S. L. Glashow, "Attempts to calculate the electron mass," *Phys. Rev.* **D7** (1973) 2457–2463.

[6] H. Georgi and S. L. Glashow, "Spontaneously broken gauge symmetry and elementary particle masses," *Phys. Rev.* **D6** (1972) 2977–2982.

[7] H. Georgi, "Anomalies of the axial-vector currents in a thirring model with internal symmetry," *Phys. Rev.* **D4** (1971) 2254–2259.

[8] H. Georgi and T. Goldman, "Baryon mass differences in a gauge model of strong and electromagnetic interactions," *Phys. Rev. Lett.* **30** (1973) 514–517.

[9] H. Georgi, "Gauge model of vector-meson masses," *Phys. Rev.* **D7** (1973) 1258–1280.

[10] H. Georgi and S. L. Glashow, "Gauge theory of weak and electromagnetic interactions with han-nambu quarks," *Phys. Rev.* **D7** (1973) 561–563.

[11] T. Appelquist and H. Georgi, "$e^+ e^-$ annihilation in gauge theories of strong interactions," *Phys. Rev.* **D8** (1973) 4000–4002.

[12] H. Georgi and S. L. Glashow, "Pseudo-cabibbo structure in a gauge theory of weak interactions and electromagnetism," *Phys. Lett.* **B44** (1973) 191–194.

[13] H. Georgi and A. Pais, "Cp - violation as a quantum effect," *Phys. Rev.* **D10** (1974) 1246.

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[17] H. Georgi and H. D. Politzer, "Electroproduction scaling in an asymptotically free theory of strong interactions," *Phys. Rev.* **D9** (1974) 416–420.

[18] H. Georgi and S. L. Glashow, "Unity of all elementary particle forces," *Phys. Rev. Lett.* **32** (1974) 438–441.

[19] H. Georgi, H. R. Quinn, and S. Weinberg, "Hierarchy of interactions in unified gauge theories," *Phys. Rev. Lett.* **33** (1974) 451–454.

[20] H. Georgi and A. Pais, "Calculability and naturalness in gauge theories," *Phys. Rev.* **D10** (1974) 539.

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[46] H. Georgi, "The winner of the vector model look alike contest,". Presented at Orbis Scientiae, Coral Gables, Fla., Jan 17- 21, 1977.

[47] A. De Rujula, H. Georgi, and S. L. Glashow, "A theory of flavor mixing," *Ann. Phys.* **109** (1977) 258.

[48] H. Georgi and M. Machacek, "A simple qcd prediction of jet structure in $e^+ e^-$ annihilation," *Phys. Rev. Lett.* **39** (1977) 1237.

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[97] H. Georgi and S. L. Glashow, "Unextended technicolor and unification," *Phys. Rev. Lett.* **47** (1981) 1511.

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