

PAUL G. LANGACKER

Positions

Present: Emeritus Professor of Physics, University of Pennsylvania

9/06 - 8/19: Member/Visitor, Institute for Advanced Study

1/11 - 6/18: Senior Scientist/Lecturer, Princeton University

1/96 - 6/01: Chair, Department of Physics and Astronomy, University of Pennsylvania

9/75 - 8/06: Assistant (75-81), Associate (81-85), Professor (85-06) of Physics, University of Pennsylvania

9/74 - 9/75: Research Associate, University of Pennsylvania

9/72 - 9/74: Research Associate, Rockefeller University

Education

Ph.D. (Physics): University of California at Berkeley, 1972

B.A. (Physics): Massachusetts Institute of Technology, 1968

Research Interests

- Theoretical High Energy Physics (weak interactions, neutrino physics, cosmology, grand unification, supersymmetry, superstring physics, chiral symmetry).

Honors

- American Physical Society Outstanding Referee Award, 2015
- LangackerFest, 60th birthday celebration, University of Pennsylvania, 2006
- Henry Primakoff Lecturer, University of Pennsylvania, 2006
- Fermilab Frontier Fellow, 2005
- Keck Distinguished Visiting Professor, Institute for Advanced Study, 2001
- William Smith Term Professor of Physics, University of Pennsylvania, 1993-1998.
- Fellow, American Association for the Advancement of Science (1992), American Physical Society (1987)
- Alexander von Humboldt-Stiftung, Senior U.S. Scientist Award, 1987-1988

Professional Activities

- Member, selection committee for J.J. and Noriko Sakurai Dissertation Award in Theoretical Particle Physics, 2014-2015.
- Co-convenor, Workshop on *Probing the TeV Scale and Beyond*, Mainz Institute for Theoretical Physics, July 2014.
- Editorial Committee, *Annual Reviews of Nuclear and Particle Science*, 2012-2015.
- Co-convenor, Workshop on *First Two Years of the LHC*, Kavli Institute for Theoretical Physics in China, Beijing, Summer, 2012.
- Co-convenor, Workshop on *Strings at the LHC and in the Early Universe*, Kavli Institute for Theoretical Physics, Santa Barbara, Spring, 2010.
- Associate Editor, *Reviews of Modern Physics*, 2007-2013.
- Member, organizing committee for *International Conference on High Energy Physics*, Philadelphia, 2008 (ICHEP2008).
- Member, Organizing Committee, *String Phenomenology, 2008*, Philadelphia, May, 2008.
- Chair, Steering Committee for the LHC Theory Initiative, 2006-2015.
- Member, HEPAP subpanel on the University Grants Program, 2006-2007.
- Co-convenor, Extra Gauge Groups section of study *CP Violation and Non-Standard Higgs*, CERN, 2004-2006.
- Member, organizing committee for APS Study on the Physics of Neutrinos, 2004.
- External review committee for CERN Theoretical Division, 2003.
- Selection Committee for J.J. Sakurai Prize of the American Physical Society: Vice-Chair, 2004; Chair, 2005.
- Co-organizer, Aspen Winter Conference *At the Frontiers of Particle Physics*, 2003.
- Member, High Energy Physics Advisory Panel (HEPAP) of the Department of Energy and National Science Foundation, 2002-2005. Subcommittee on long range goals, 2003.
- Member, program committee for meeting of Division of Particles and Fields of American Physical Society, Philadelphia, 2003.
- Adjunct Professor of Physics, Zhejiang University, Hangzhou, China, 2001-.
- Co-organizer, *Aspen Workshop on Underground Science*, 2002.
- Chair, Department of Physics and Astronomy, University of Pennsylvania, 1996-2001.
- Member of Board of Delaware Valley Chapter of the Alexander von Humboldt Association, 2000-.

- Member, Department of Energy Review Panel for High Energy Physics Division, Argonne National Laboratory, 2000.
- National Science Foundation Review Panel on Phenomenology and Astroparticle Physics, 2000.
- Organizing Committee, meeting of Northeast Section of *American Association of Physics Teachers*, Philadelphia, October 1999.
- Director, Physics and Astronomy section of Penn Summer Science Academy (PSSA), 1998-2001.
- Scientific Director, Theoretical Advanced Study Institute (TASI) summer school on *Neutrinos in Physics and Astrophysics: from 10^{-33} to 10^{+28} cm*, University of Colorado at Boulder, June 1998.
- Divisional Associate Editor, *Physical Review Letters*, 1998-2004.
- Member, Particle Data Group, 1998 - 2016.
- Co-convener, Workshop on *Solar Neutrinos*, Institute for Theoretical Physics, Santa Barbara, December 1997.
- Co-chair, *SUSY 97*, Philadelphia, May 1997.
- Co-convener, Workshop on *Unification: From the Weak Scale to the Planck Scale*, Institute for Theoretical Physics, Santa Barbara, Fall 1995.
- Member, Planning and Priorities Committee, School of Arts and Sciences, University of Pennsylvania, 1994-95.
- Member, Advisory Committee, Particle Data Group, 1992-1994.
- Member, Editorial Board, *Physical Review D*, 1986-88, 1991-93.
- Chair, Natural Science Association, University of Pennsylvania, 1990-1991.
- Member, Executive Committee of the Division of Particles and Fields, American Physical Society, 1989-1991.
- Scientific Director, Theoretical Advanced Study Institute (TASI) summer school on *Testing the Standard Model*, University of Colorado at Boulder, June 1990.
- Co-Chairman, *Fourth Workshop on Grand Unification*, University of Pennsylvania, April 1983.

Books

- Editor (with H. A. Weldon and P. J. Steinhardt), *Fourth Workshop on Grand Unification* (Birkhäuser, Boston, 1983).
- Editor (with M. Cvetič), *Testing the Standard Model* (Proceedings of TASI-90), (World, Singapore, 1991).
- Editor, *Precision Tests of the Standard Electroweak Model*, (World Scientific, Singapore, 1995).

- Editor (with M. Cvetič), *SUSY '97, Proceedings of the Fifth International Conference on Supersymmetries in Physics*, Nucl. Phys. **B** (Proc. Suppl.) 62 (1998) (North Holland, 1998).
- Editor, *Neutrinos in Physics and Astrophysics: From 10^{-33} to 10^{+28} cm*, (Proceedings of TASI-98), (World, Singapore, 2000).
- *The Standard Model and Beyond* (CRC Press, New York, 2009).
- *Can the Laws of Physics be Unified?* (Princeton University Press, 2017).
- *The Standard Model and Beyond, 2nd edition* (CRC Press, 2017).

Lecture Series and Schools

- Lecturer, *2014 Tri-Institute Summer School on Elementary Particles (TRISEP)*, Sudbury, Canada, June 2014
- Lecturer, *Perimeter Scholars International*, Waterloo, Canada, January 2014
- Lecturer, *Foundations and New Methods in Theoretical Physics*, Saalburg, Germany, September 2013
- Lecturer, *Augusto Garcia Visiting Professorship*, Cinvestav (Center for Research and Advanced Studies), Mexico City, October 2012
- Lecturer, *22nd Chris Engelbrecht Summer School*, Stellenbosch, South Africa, January, 2011
- Lecturer, *SLAC Summer Institute*, August 2010
- Lecturer, *Taiwan Spring School*, March, 2010
- Lecturer, *International Summer School and Conference on High Energy Physics*, Mugla, Turkey, August 2009
- Lecturer, *Theoretical Advanced Study Institute*, Boulder, June 2008
- Lecturer, *The Standard Model and Beyond*, Institute for Advanced Study, July 2007
- Lecturer, *Fermilab Academic Lecture series*, November-December 2005

Selected Publications

1. Nonrenormalization Theorem in the Chiral Symmetry Limit (with H. Pagels), Phys. Rev. Letters **30**, 630-633 (1973).
2. Chiral Perturbation Theory (with H. Pagels), Phys. Rev. **D8**, 4595-4619 (1973).
3. Light Quark Mass Spectrum in Quantum Chromodynamics (with H. Pagels), Phys. Rev. **D19**, 2070-2079 (1979).
4. Magnetic Monopoles in Grand Unified Theories (with S.-Y. Pi), Phys. Rev. Lett. **45**, 1-4 (1980).

5. A Theoretical and Experimental Review of the Weak Neutral Current: A Determination of its Structure and Limits on Deviations from the Minimal $SU(2)_L \times U_1$ Electroweak Theory (with J. E. Kim, M. Levine, and H. H. Williams), *Rev. Mod. Phys.* **53**, 211-252 (1981).
6. Grand Unified Theories and Proton Decay, *Physics Reports* **72**, 185-385 (1981).
7. Implications of Anomalous Isospin Violation for the Low Energy Nucleon-Nucleon Interaction (with D. A. Sparrow), *Phys. Rev.* **C25**, 1194-1214 (1982).
8. Grand Unified Theories, *The Encyclopedia of Physics, 3rd Edition*, ed. R. M. Besançon (Van Nostrand Reinhold, New York, 1985), p. 521.
9. Editor (with H. A. Weldon and P. J. Steinhardt) of *Fourth Workshop on Grand Unification* (Birkhäuser, Boston, 1983).
10. A Mass Sum Rule for Higgs Bosons in Arbitrary Models (with H. A. Weldon), *Phys. Rev. Lett.* **52**, 1377-1379 (1984).
11. New Heavy Gauge Bosons in pp and $p\bar{p}$ Collisions (with R. W. Robinett and J. L. Rosner) *Phys. Rev.* **D30**, 1470-1487 (1984).
12. A Comprehensive Analysis of Data Pertaining to the Weak Neutral Current and the Intermediate Vector Boson Masses (with U. Amaldi, A. Böhm, L. S. Durkin, A. K. Mann, W. J. Marciano, A. Sirlin, and H. H. Williams), *Phys. Rev.* **D36**, 1385 (1987).
13. Mixing between Ordinary and Exotic Fermions (with D. London), *Phys. Rev.* **D38**, 886 (1988).
14. Lepton Number Violation and Massless Non-Orthogonal Neutrinos (with D. London), *Phys. Rev.* **D38**, 907 (1988).
15. Analysis of Muon Decay with Lepton Number Non-Conserving Interactions (with D. London), *Phys. Rev.* **D39**, 266 (1989).
16. Is the Standard Model Unique?, *Comments on Nuclear and Particle Physics* **19**, 1 (1989).
17. Bounds on the Mass of W_R and the $W_L - W_R$ Mixing Angle ζ in General $SU(2)_L \times SU(2)_R \times U(1)$ Models (with S. Uma Sankar), *Phys. Rev.* **D40**, 1569 (1989).
18. Unification of Two Fundamental Forces (with A. K. Mann), *Physics Today* **42**, # 12, p. 22 (1989).
19. Elementary Particles in Physics (with S. Gasiorowicz), in *Encyclopedia of Physics, Second Edition*, ed. R. G. Lerner and G. L. Trigg, (VCH Publishers, Inc., New York, 1991) p. 328.
20. Implications of Recent $M_{W,Z}$ and Neutral-Current Measurements for the Top-Quark Mass, *Phys. Rev. Lett.* **63**, 1920 (1989).
21. On the Cosmological Production of Light Sterile Neutrinos, UPR-0401T.
22. High Precision Electroweak Experiments: A Global Search for New Physics Beyond the Standard Model (with M. Luo and A. K. Mann), *Rev. Mod. Phys.* **64**, 87 (1992).
23. Implications of Precision Electroweak Experiments for m_t , ρ_0 , $\sin^2 \theta_W$, and Grand Unification (with M. Luo), *Phys. Rev.* **D44**, 817 (1991).

24. W and Z Physics, in *TeV Physics*, ed. T. Huang *et al.*, (Gordon and Breach, Philadelphia, 1991), p. 53.
25. Editor (with M. Cvetič) of *Testing the Standard Model* (Proceedings of TASI-90), (World, Singapore, 1991).
26. Constraints on Additional Z Bosons (with M. Luo), *Phys. Rev.* **D45**, 278 (1992).
27. Determination of g_R/g_L in Left-Right Symmetric Models at Hadron Colliders (with M. Cvetič and B. Kayser), *Phys. Rev. Lett.* **68**, 2871 (1992).
28. Uncertainties in Coupling Constant Unification (with N. Polonsky), *Phys. Rev.* **D47**, 4028 (1993), hep-ph/9210235.
29. $V'Z$ and $V'W$ Production as Tests of Heavy Gauge Boson Couplings at Future Hadron Colliders (with M. Cvetič), *Phys. Rev.* **D46**, 4943 (1992), hep-ph/9207216.
30. Five Phases of Weak Neutral Current Experiments From the Perspective of a Theorist, *Discovery of Weak Neutral Currents: The Weak Interaction Before and After*, ed. A. K. Mann and D. B. Cline, AIP Conference Proceedings 300 (AIP, New York, 1994), p. 289, hep-ph/9305255.
31. Astrophysical Solutions are Incompatible with the Solar Neutrino Data (with S. Bludman and N. Hata), *Phys. Rev.* **D49**, 3622 (1994), hep-ph/9306212.
32. Model Independent Determination of Solar Neutrino Fluxes with and without MSW (with N. Hata), *Phys. Rev.* **D52**, 420 (1995), hep-ph/9409372.
33. Implications of High Precision Experiments and the CDF Top Quark Candidates (with J. Erler), *Phys. Rev.* **D52**, 441 (1995), hep-ph/9411203.
34. Editor of *Precision Tests of the Standard Electroweak Model*, (World, Singapore, 1995), and articles on pp 1, 15, 883.
35. The Strong Coupling, Unification, and Recent Data (with N. Polonsky), *Phys. Rev.* **D52**, 3081 (1995), hep-ph/9503214.
36. DPF Long Range Planning Study: Neutrino Mass Working Group (P. Langacker, R. Rameika, H. Robertson, conveners), in *PARTICLE PHYSICS: perspectives and opportunities*, ed R. Peccei *et al.*, (World, Singapore, 1996).
37. Big Bang Nucleosynthesis in Crisis (with N. Hata, R. Scherrer, G. Steigman, D. Thomas, T. Walker, and S. Bludman), *Phys. Rev. Lett.* **75**, 3977 (1995), hep-ph/9505319.
38. Implications of Abelian Extended Gauge Structures From String Models (with M. Cvetič), *Phys. Rev.* **D54**, 3570 (1996), hep-ph/9511378.
39. Conservation of Baryon Number, in the *Macmillan Encyclopedia of Physics* (Macmillan, New York, 1996).
40. Phase Transitions and Vacuum Tunneling Into Charge and Color Breaking Minima in the MSSM (with A. Kusenko and G. Segre), *Phys. Rev.* **D54**, 5824 (1996), hep-ph/9602414.

41. Is the vacuum stable? (with A. Kusenko), Phys. Lett. **B391**, 29 (1997), hep-ph/9608340.
42. Electroweak Breaking and the Mu Problem in Supergravity Models with an Additional $U(1)$ (with M. Cvetič, D. A. Demir, J. R. Espinosa, and L. Everett), Phys. Rev. **D56**, 2861 (1997), hep-ph/9703317.
43. Solutions to Solar Neutrino Anomaly (with N. Hata), Phys. Rev. **D56**, 6107 (1997), hep-ph/9705339.
44. Intermediate Scales, Mu Parameter, and Fermion Masses from String Models (with G. Cleaver, M. Cvetič, J. R. Espinosa, and L. Everett), Phys. Rev. **D57**, 2701 (1998), Phys. Rev. **D58**, E 119905 (1998), hep-ph/9705391.
45. Z' Physics and Supersymmetry (with M. Cvetič), in *Perspectives on Supersymmetry*, ed. G. Kane (World, Singapore, 1998), p312, hep-ph/9707451. Revised version in the reprinted edition, 2010.
46. Classification of Flat Directions in Perturbative Heterotic Superstring Vacua with Anomalous $U(1)$ (with G. Cleaver, M. Cvetič, J. R. Espinosa, and L. Everett), Nucl. Phys. **B525**, 3 (1998), hep-th/9711178.
47. Editor (with M. Cvetič), *SUSY '97, Proceedings of the Fifth International Conference on Supersymmetries in Physics*, Nucl. Phys. **B** (Proc. Suppl.) 62 (1998) (North Holland, 1998).
48. A Mechanism for Ordinary-Sterile Neutrino Mixing, Phys. Rev. **D58**, 093017 (1998), hep-ph/9805281.
49. Flat Directions in Three Generation Free Fermionic String Models (with G. Cleaver, M. Cvetič, J. R. Espinosa, and L. Everett), Nucl. Phys. **B545**, 47 (1999), hep-th/9805133.
50. Physics Implications of Flat Directions in Free Fermionic Superstring Models I: Mass Spectrum and Couplings (with G. Cleaver, M. Cvetič, J. R. Espinosa, L. Everett, and J. Wang), Phys. Rev. **D59**, 055005 (1999), hep-ph/9807479.
51. Physics Implications of Flat Directions in Free Fermionic Superstring Models II: Renormalization Group Analysis (with G. Cleaver, M. Cvetič, J. R. Espinosa, L. Everett, and J. Wang), Phys. Rev. **D59**, 115002 (1999), hep-ph/9811355.
52. Blowing up the four-dimensional $Z(3)$ orientifold (with M. Cvetič, L. Everett, and J. Wang), JHEP 9904:020 (1999), hep-th/9903051.
53. Constraints on Extended Neutral Gauge Structures (with J. Erler), Phys. Lett. **B456**, 68 (1999), hep-ph/9903476.
54. A Low-Energy Solution to the μ Problem in Gauge Mediation (with N. Polonsky and J. Wang), Phys. Rev. **D60**, 115005 (1999), hep-ph/9905252.
55. Indications for an Extra Neutral Gauge Boson in Electroweak Precision Data (with J. Erler), Phys. Rev. Lett. **84**, 212 (2000), hep-ph/9910315.
56. Electroweak Model and Constraints on New Physics (with J. Erler), in *Review of Particle Properties*, (<http://pdg.lbl.gov/>). D. Groom et al., Eur. Phys. J. **C15**, 1 (2000), p. 95.
57. Alternative Supersymmetric Spectra (with L. Everett, M. Pluemacher, and J. Wang), Phys. Lett. **B477**, 233 (2000), hep-ph/0001073.

58. Flavor Changing Effects in Theories with a Heavy Z' Boson with Family Non-Universal Couplings (with M. Pluemacher), Phys. Rev. **D62**, 013006 (2000), hep-ph/0001204.
59. D=4, N=1 Type IIB orientifolds with continuous Wilson lines, moving branes, and their field theory realization (with M. Cvetič), Nucl. Phys. **B586**, 287 (2000), hep-th/0006049.
60. Editor, *Neutrinos in Physics and Astrophysics: From 10^{-33} to 10^{+28} cm*, (Proceedings of TASI-98), (World, Singapore, 2000).
61. Neutrino Oscillation Workshop 2000: Conference Summary, *NOW2000*, Otranto, Italy, September 2000, Nucl. Phys. Proc. Suppl. **100**, 383 (2001), hep-ph/0101244.
62. Physics Implications of Precision Electroweak Experiments, *Alberto Sirlin Symposium*, New York University, October, 2000, J. Phys. G **29**, 35 (2003), hep-ph/0102085.
63. Electroweak Model and Constraints on New Physics (with J. Erler), in 2001 WWW update for 2002 edition of *Review of Particle Properties*, (URL: <http://pdg.lbl.gov/>). Print edition: K. Hagiwara et al., Phys. Rev. D **66**, 010001 (2002), p.98.
64. Precision electroweak data: Phenomenological analysis, in *Proceedings of the APS/DPF/DPB Summer Study on the Future of Particle Physics (Snowmass 2001)* ed. R. Davidson and C. Quigg, hep-ph/0110129.
65. Implications of gauge unification for time variation of the fine structure constant (with G. Segre and M. J. Strassler), Phys. Lett. B **528**, 121 (2002), hep-ph/0112233.
66. Constraints on large extra dimensions from neutrino oscillation experiments (with H. Davoudiasl and M. Perelstein), Phys. Rev. D **65**, 105015 (2002), hep-ph/0201128.
67. The $Z-Z'$ Mass Hierarchy in a Supersymmetric Model with a Secluded $U(1)'$ -Breaking Sector (with J. Erler and T. Li), Phys. Rev. D **66**, 015002 (2002), hep-ph/0205001.
68. Phenomenology of A Three-Family Standard-like String Model (with M. Cvetič and G. Shiu), Phys. Rev. D **66**, 066004 (2002), hep-ph/0205252.
69. No-go for detecting CP violation via neutrinoless double beta decay (with V. Barger, S. L. Glashow, and D. Marfatia), Phys. Lett. B **540**, 247 (2002), hep-ph/0205290.
70. A Three-Family Standard-like Orientifold Model: Yukawa Couplings and Hierarchy (with M. Cvetič and G. Shiu), Nucl. Phys. B **642**, 139 (2002), hep-th/0206115.
71. Recent developments in precision electroweak physics (update prepared for *Alberto Sirlin Symposium*), J. Phys. G **29**, 1 (2003), hep-ph/0211065.
72. Review Of Particle Physics (K. Hagiwara et al.), Phys. Rev. D **66**, 010001 (2002), (URL: <http://pdg.lbl.gov/>).
73. Effects of genuine dimension-six Higgs operators (with V. Barger, T. Han, B. McElrath and P. Zerwas), Phys. Rev. D **67**, 115001 (2003), hep-ph/0301097.
74. Primordial nucleosynthesis constraints on Z' properties (with V. Barger and H. S. Lee), Phys. Rev. D **67**, 075009 (2003), hep-ph/0302066.

75. Dynamical supersymmetry breaking in standard-like models with intersecting D6-branes (with M. Cvetič and J. Wang), *Phys. Rev. D* **68**, 046002 (2003), hep-th/0303208.
76. Alternatives to the seesaw: Extra Z' s and constraints on large extra dimensions, *Int. J. Mod. Phys. A* **18**, 4015 (2003) and in *Neutrinos and implications for physics beyond the standard model*, ed. R. Shrock (World, Singapore, 2003), p269, hep-ph/0304053.
77. Time variation of fundamental constants as a probe of new physics, in *Dirac Centennial Symposium*, ed. H. Baer and A. Belyaev (World, Singapore, 2003), p157, hep-ph/0304093.
78. Hiding relativistic degrees of freedom in the early universe (with V. Barger, J. Kneller, D. Marfatia, and G. Steigman), *Phys. Lett. B* **569**, 123 (2003), hep-ph/0306061.
79. TeV physics from the top down, *SUGRA20*, ed. P. Nath (Rinton, US, 2004), p492, hep-ph/0308033.
80. Electroweak physics, *Conference on the Intersections of Nuclear and Particle Physics*, AIP Conf. Proc. **698**, 1 (2004), hep-ph/0308145.
81. Z' mediated flavor changing neutral currents in B meson decays (with V. Barger, C. W. Chiang, and H. S. Lee), *Phys. Lett. B* **580**, 186 (2004), hep-ph/0310073.
82. Big bang nucleosynthesis constraints on Z' properties (with V. Barger and H. S. Lee), to be published in the Proceedings of SUSY 2003, hep-ph/0402048.
83. An NMSSM without domain walls (with T. Han and B. McElrath), to be published in the Proceedings of SUSY 2003, hep-ph/0402064.
84. Electroweak baryogenesis in a supersymmetric $U(1)'$ model, (with J. Kang, T. j. Li, and T. Liu), *Phys. Rev. Lett.* **94**, 061801 (2005), hep-ph/0402086.
85. Beyond the MSSM, to be published in the Proceedings of SUSY 2003, hep-ph/0402203.
86. Electroweak Model and Constraints on New Physics (with J. Erler), in 2004 WWW update for 2004 edition of *Review of Particle Properties*, (URL: <http://pdg.lbl.gov/>).
87. $B_s - \bar{B}_s$ mixing in Z' models with flavor-changing neutral currents, (with V. Barger, C. W. Chiang, and J. Jiang), *Phys. Lett. B* **596**, 229 (2004), hep-ph/0405108.
88. The Higgs sector in a $U(1)'$ extension of the MSSM, (with T. Han and B. McElrath), *Phys. Rev. D* **70**, 115006 (2004), hep-ph/0405244.
89. Solution to the $B \rightarrow \pi K$ Puzzle in a Flavor-Changing Z' Model, (with V. Barger, C. W. Chiang, and H. S. Lee), *Phys. Lett. B* **598**, 218 (2004), hep-ph/0406126.
90. Review Of Particle Physics (S. Eidelman et al), *Phys. Lett. B* **592**, 1 (2004), (URL: <http://pdg.lbl.gov/>).
91. D6-brane splitting on type IIA orientifolds, (with M. Cvetič, T. J. Li, and T. Liu), *Nucl. Phys. B* **709**, 241 (2005), hep-th/0407178.
92. Neutralino relic density in a supersymmetric $U(1)'$ model, (with V. Barger, C. Kao, and H. S. Lee), *Phys. Lett. B* **600**, 104 (2004), hep-ph/0408120.

93. Neutrino physics (theory), *ICHEP 2004*, ed. H. Chen et al., (World Singapore, 2005), p198, hep-ph/0411116.
94. Neutrino masses in supersymmetric $SU(3)_C \times SU(2)_L \times U(1)_Y \times U(1)'$ models, (with J. H. Kang and T. J. Li), Phys. Rev. D **71**, 015012 (2005), hep-ph/0411404.
95. Theory of neutrinos, (R. N. Mohapatra et al.), *APS Neutrino Study*, hep-ph/0412099.
96. Muon anomalous magnetic moment in a supersymmetric $U(1)'$ model, (with V. Barger, C. Kao, and H. S. Lee), Phys. Lett. B **614**, 67 (2005), hep-ph/0412136.
97. Z' discovery limits for supersymmetric $E(6)$ models, (with J. Kang), Phys. Rev. D **71**, 035014 (2005), hep-ph/0412190.
98. Extended joint ECFA/DESY study on physics and detector for a linear e^+e^- collider, (with K. Ackermann et al.), DESY-PROC-2004-0.
99. Toward realistic intersecting D-brane models, (with R. Blumenhagen, M. Cvetič, and G. Shiu), ARNPS **55**, 71 (2005), hep-th/0502005.
100. Massive neutrinos and (heterotic) string theory, (with J. Giedt, G. L. Kane, and B. D. Nelson), Phys. Rev. D **71**, 115013 (2005), hep-th/0502032.
101. Status and Phenomenology of the Standard Model, Czech. J. Phys. **55**, B501 (2005), hep-ph/0503068.
102. Elementary Particles in Physics (with S. Gasiorowicz), in *Encyclopedia of Physics, Third Edition*, ed. R. C. Lerner and G. L. Trigg, (Wiley-VCH, 2005), p671.
103. Gauge coupling unification in the standard model, (with V. Barger, J. Jiang, and T. Li), Phys. Lett. B **624**, 233 (2005), hep-ph/0503226.
104. Non-canonical gauge coupling unification in high-scale supersymmetry breaking, (with V. Barger, J. Jiang, and T. Li), Nucl. Phys. B **726**, 149 (2005), hep-ph/0504093.
105. Neutrino physics, (with J. Erler and E. Peinado), J. Phys. Conf. Ser. **18**, 154 (2005), hep-ph/0506257.
106. String-inspired triplet see-saw from diagonal embedding of $SU(2)_L$ in $SU(2)_A \times SU(2)_B$, (with B. D. Nelson), Phys. Rev. D **72**, 053013 (2005), hep-ph/0507063.
107. Lightest Neutralino in Extensions of the MSSM, (with V. Barger and H. S. Lee), Phys. Lett. B **630**, 85 (2005), hep-ph/0508027.
108. Theory of neutrinos: A white paper, (with R. N. Mohapatra et al.), Rept. Prog. Phys. **70**, 1757 (2007), hep-ph/0510213.
109. Supersymmetry parameter analysis: SPA convention and project, (with J. A. Aguilar-Saavedra et al.), Eur. Phys. J. C **46**, 43 (2006), hep-ph/0511344.
110. Higgs sector in extensions of the MSSM, (with V. Barger, H. S. Lee and G. Shaughnessy), Phys. Rev. D **73**, 115010 (2006), hep-ph/0603247.
111. Book review (*The Cosmic Landscape; String Theory and the Illusion of Intelligent Design*, by L. Susskind), Physics Today, June 2006, p. 61.

112. Electroweak Model and Constraints on New Physics (with J. Erler), in 2006 WWW update for 2006 edition of *Review of Particle Properties*, (URL: <http://pdg.lbl.gov/>). Print edition: W. M. Yao et al, J. Phys. G **33**, 1 (2006), p119.
113. Review Of Particle Physics (W. M. Yao et al, J. Phys. G **33**, 1 (2006), (URL: <http://pdg.lbl.gov/>).
114. Workshop on CP studies and non-standard Higgs physics, (E. Accomando *et al.*), hep-ph/0608079.
115. Extra Gauge Groups, (with A. Raspereza and S. Riemann), for *CP studies and non-standard Higgs physics*, CERN report, 2006-009, p 271.
116. The Higgs Sector in a Secluded Sector $U(1)'$ Model, (with T. Han and B. McElrath), for *CP studies and non-standard Higgs physics*, CERN report, 2006-009, p 277.
117. Comparison of Higgs Bosons in the Extended MSSM Models, (with V. Barger, H. S. Lee and G. Shaughnessy), for *CP studies and non-standard Higgs physics*, CERN report, 2006-009, p 226.
118. New grand unified models with intersecting D6-branes, neutrino masses, and flipped $SU(5)$ (with M. Cvetič), Nucl. Phys. B **776**, 118 (2007), hep-th/0607238.
119. Neutralino signatures of the singlet extended MSSM (with V. Barger and G. Shaughnessy), Phys. Lett. B **644**, 361 (2007), hep-ph/0609068.
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Additional materials, including my scientific autobiography, AIP oral history transcript, full and condensed CVs, research statement, slides of lectures and a graduate course at Princeton, videos of a lecture series at the Perimeter Institute, and supplementary materials for my graduate text can be found at web.sas.upenn.edu/pgl.