



The Standard Model and Beyond (Series in High Energy Physics, Cosmology and Gravitation)

By Paul Langacker

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The Standard Model and Beyond presents an advanced introduction to the physics and formalism of the standard model and other non-abelian gauge theories. It provides a solid background for understanding supersymmetry, string theory, extra dimensions, dynamical symmetry breaking, and cosmology.

The book first reviews calculational techniques in field theory and the status of quantum electrodynamics. It then focuses on global and local symmetries and the construction of non-abelian gauge theories, before explaining the structure and tests of quantum chromodynamics. The book also describes the electroweak interactions and theory, including neutrino masses. The final chapter discusses the motivations for extending the standard model and examines supersymmetry, extended gauge groups, and grand unification.

Thoroughly covering gauge field theories, symmetries, and topics beyond the standard model, this text equips readers with the tools to understand the structure and phenomenological consequences of the standard model, to construct extensions, and to perform calculations at tree level. It establishes the necessary background for readers to carry out more advanced research in particle physics.

Supplementary materials are provided on the author's website and a solutions manual is available for qualifying instructors.

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The Standard Model and Beyond (Series in High Energy Physics, Cosmology and Gravitation) By Paul Langacker Bibliography

- Rank: #1559235 in Books
- Published on: 2009-12-01
- Original language: English
- Number of items: 1
- Dimensions: 9.21" h x 1.44" w x 6.14" l, 2.35 pounds
- Binding: Hardcover
- 676 pages

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Editorial Review

Review

"... Paul Langacker is a pioneer in the field of high-precision tests of the Standard Model. ... Langacker's book is likely to play a pivotal role at this juncture when the plethora of 'new physics' and alternative models have emerged while experimental data has become too intricate to be comprehensible even to the experts. ... Masterly treatment on the Standard Model by Langacker in Chapter 7, in my opinion, is the heart of the book. ... Decades of past experience of the author in the area of precision tests make the writing lucid and transparent. ... A thorough study of the book would enable the reader to unravel the intricacies involved in the claims of 'new physics.' ... Langacker comprehensively demonstrates the spectacular successes of the Standard Model ... This book would be of great utility to learn and do high quality particle physics in the age of LHC for both theorists and experimentalists. What about 'new physics'? As and when this happens, the contents of the book would be helpful to focus on the matter-of-fact physics and interpret the new data. ..."
?Contemporary Physics, Volume 52, Issue 3, 2011

"... This substantial book ? at more than 600 pages ? gives a detailed and lucid summary of the theoretical foundations of the Standard Model, and possible extensions beyond it. ...I heartily recommend it to particle physicists as a great single-volume reference, especially useful to experimentalists. It also provides a firm, graduate-level foundation for theoretical physicists who plan to pursue concepts beyond the Standard Model to a greater depth."
?Philip Burrows, John Adams Institute, Oxford University, UK, CERN Courier, June 2010

"*The Standard Model and Beyond* is a state-of-the-art description of what we know about the particles and forces that build up the world we see. Most books that cover these topics are quantum field theory books that treat the quarks and leptons, and the electromagnetic, weak, and strong forces as examples. This is the first treatment with the opposite priorities, focusing on the structure and applications of the Standard Model and bringing in the field theory as needed, in a pedagogically reliable and thorough treatment. Langacker knows well that the Standard Model is the platform on which a deeper understanding of the laws of nature will be constructed, perhaps from clues soon to come from the Large Hadron Collider, and provides preparation so the reader can participate in that progress."

?Gordon Kane, Victor Weisskopf Collegiate Professor of Physics and Director of the Michigan Center for Theoretical Physics, University of Michigan, Ann Arbor, USA

"This book is a valuable addition to the field and will remain a classic reference for years to come. It is an indispensable guide to the elementary particle physics of the next decade. It contains many important topics which are hard to find elsewhere except in their undistilled original form. A suitable balance has been struck between standard and more speculative topics. The many exercises are well-chosen and interesting. This fine book deserves to be the primary text in a full-year course at the graduate level for students who have already been exposed to quantum field theory."

?Jonathan L. Rosner, University of Chicago, Illinois, USA

About the Author

Paul Langacker is a Member of the Institute for Advanced Study in Princeton, New Jersey. Dr. Langacker is also Emeritus Professor of Physics and Astronomy at the University of Pennsylvania.

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