<<超对称和超引力导论>>

图书基本信息

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前言

This book has evolved out of a number of courses that I have given on supersymmetry and supergravity. While giving these lectures I became convinced of the need for a book which contained a pedagogical introduction to most aspects of supersymmetric theories. Although the content of this book has been to some extent constrained by those areas that were my research activities at the time 1 wrote my lecture notes, most major areas relevant for an Introduction are covered, as well as some more advanced topics. Some of the latter are concerned with the quantum properties of supersymmetric theories and the construction of supergravity theories. The final chapter contains a discussion of free gauge covariant string field theory. Supersymmetric theories have had an important influence on the theoretical physics community. It has encouraged the quest for a single unified theory of physics and has lead to a wider understanding of what can constitute the space-time we live in. On a more generaIlevel . it has made more acceptable the study of ideas which are at first sight rather distantly related to experi. mental data. Some effort has been made to present a stepby. step and necessarily technical derivation of the results . However. by studying the subject itself, it iS hoped that the reader will also come to appreciate more fully the concepts that may be abstracted from supersymmetric theories. I would like to express my gratitude to King's College, the California Institute of Technology and CERN where this manuscript was written and typed. I also wish to thank my collaborators for the insights they have shared with me.

内容概要

The first edition of this book was completed in 1986, however, much of the material was written long before. It focused on the development of fourdimensional supersymmetric models including supergravity with emphasis on their ultraviolet properties. Already in 1983, our understanding of the finiteness of rigid supersymmetric theories had led to the realization that supersymmetry was most unlikely to solve the celebrated inconsistency of quantum mechanics and gravity. This, and the fact that many aspects Of supersymmetric theories had been worked out, lead to a search for new ideas. It was inevitable that string theory, which had been extensively developed in the late 1960's and early 1970's would be revived from its dormant state. We recall that supersymmetry was discovered independently in two ways, one of which was within the superstring which contained it as a symmetry. Also during the dormant stage, theoreticians had developed BRST symmetry, conformal models, the vertex operator representation of Liealgebras, the use of the gauge group Es for grand unified models, even within the context of ten-dimensional supersymmetric theories and gained further understanding of anomalies. All these enabled the solution of some of the problems which the original pioneers of string theory had encountered.

作者简介

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章节摘录

插图：Supersymmetry was discovered by Golfand and Liktman.A theory invar .ant under a non。
linear realization of supersymmetry was giyen by Akulov and Volkov.In a separate development，supersymmetry was introduced as a two-dimensional symmetry of the world sheet within the context of string theories·However，supersymmetry only became widely known when this two-dimensional symmetry was generalized to four dimensions and used to construct the Wess-Zumino model. To this day，there is no firm evidence that supersymmetry is realized in Nature.Neither is there any completely compelling reason to believe that supersymmetry is required to resolve any of the paradoxes of our present theories of physics.However，it is possible that supersymmetry may be re.qmred to explain the new phenomena found already，or in the near future.in particle accelerators.On the theoretical side，there are also some reasonsto hOpe that supersymmetry is required.In Nature。
there are at least two vastly different energy scales：the weak scale（100 GeV）and the Planck scale（10GeV）.There are also some reasons to believe that there should be one or more Intermediate scales.Although the origin of these vastly different scalesis unknown，it is considered to be natural to have a theory in which phenome.na at the lowest scale are not polluted by much larger effects arising fromthe higher scales.Some supersymmetric theories are natural in this sense.andit is a consequence of this argument that the superpartners of the observed particles ought to have masses around the weak scale and hence should be seen in the near future（see Chapter 1 9）.This particular property of super.symmetric theories IS a consequence of the fact that the spin.zero states are related by supersymmetry to states of spin. The most uncertain aspect of the standard model of weak and electromag.netlc interactions is the spin-zero sector.In fact，many ofthe 19 free parameters of this model arise due to the undetermined interactions of the spin.zero fields with themselves and the spin-fields.It is natural to hope that some of theselree parameters are fixed in a supersymmetric theory.In fact，this has not been achmved within the context of supersymmetric models with onlY one super.symmetry，but 1t is likely to be the case should one succeed in constructing a realistic model with more than one supersymmetry.

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