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978-0-521-37140-7 - Unification of Fundamental Forces: The First of the  
1988 Dirac Memorial Lectures

Abdus Salam

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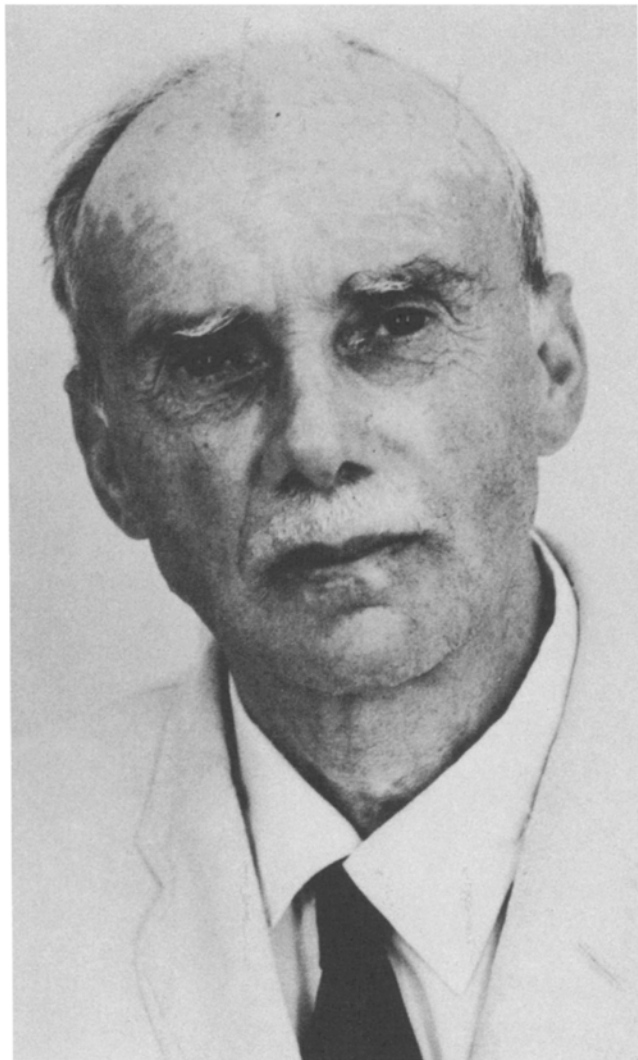
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Paul Dirac

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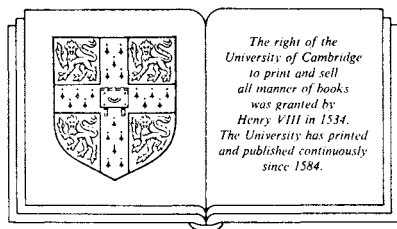
THE FIRST OF THE 1988 DIRAC  
MEMORIAL LECTURES

ABDUS SALAM

*Imperial College, London*

*and International Centre for Theoretical Physics, Trieste, Italy*

Lecture notes compiled by  
Jonathan Evans and Gerard Watts



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## FOREWORD

John C. Taylor

*University of Cambridge*

From time to time, science succeeds in unifying apparently diverse sets of phenomena. These unifications provide some of the most impressive achievements in the sciences. Unification, in this sense, means understanding how apparently different effects are really aspects of a single underlying thing. In the nineteenth century, for example, electricity and magnetism were unified. They are different, but they are intimately interconnected, and in general situations it is impossible to imagine one without the other.

In physics, one of the unifications of the present century has been that of electromagnetism with the weak force. These are apparently totally different. Electromagnetism ranges across any distance, from atomic to astronomical. The weak force, on the other hand, operates deep within the atomic nucleus (for example) to produce radioactive decay. This

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## JOHN C. TAYLOR

unification was mainly the work of three men, Sheldon Glashow, Abdus Salam and Steven Weinberg. They made use of earlier theoretical ideas of two British physicists Peter Higgs and Tom Kibble. Finally, a Dutch theoretician, Gerard t' Hooft, put the equations into a form in which any competent physicist could handle them in standard ways. The experimental implications of all this are at present being tested with the new high-energy colliders at CERN, Fermilab and Stanford. A whole new branch of physics is unfolding, just as the science of electromagnetism did in the last century.

In this volume, Abdus Salam, one of the discoverers of the electro-weak unification, writes about unification in physics in the past and present, and describes hopes for the future. The whole enterprise takes place within the framework of quantum mechanics, of which one of the main architects was the great English physicist Paul Dirac. The volume is based upon a Dirac Memorial Lecture given at Cambridge University in 1988.

Salam and other authors of the electro-weak theory operated squarely within the framework of quantum theory, which was laid down in the first half of this century. Two of the great founders of quantum theory were Werner Heisenberg and Paul Dirac. A lecture by each of these is included in this



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*Foreword*

volume. These, like Salam's lecture, provide fascinating insights into the thoughts of creative theoretical physicists.

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