

## PREFACE

The understanding of nuclear and elementary particle physics has now reached a historical turning point. During the last decade, a revolution has quietly occurred – a revolution called “Gauge Theory”. For the first time in 50 years, since the birth of modern nuclear physics, gauge theory allows us to understand how the fundamental forces of nature may be unified within a single coherent theory. The discovery of gauge theory rivals in importance the development of both relativity and quantum mechanics. In contrast to the situation less than 10 years ago, gauge theory now dominates nearly all phases of elementary particle physics today. Even the reasons for performing new experiments are now judged by their relevance for testing the predictions of gauge theory.

Clearly, such an exciting development should be widely accessible and understandable not only to theoreticians but also to experimental physicists, students and the “intelligent layman” as well. Like politics and war, gauge theory has become too important to be left only to the experts. Unfortunately, for the reader who wishes to first understand the basic physical ideas behind gauge theory, the published literature can present a daunting challenge. The reason for the difficulty is that gauge theory represents a totally new synthesis of quantum mechanics and symmetry ideas which have been applied to the entire field of elementary particle physics.

I believe that gauge theory can be appreciated by the non-expert; that is the *raison d’être* for this primer. In order to emphasize the physics of gauge theory rather than the mathematical formalism, I have used a new intuitive approach and designed the text primarily for the reader with only a background in quantum mechanics. My goal in this primer is to hopefully leave the reader with an appreciation of the elegance and beauty of gauge theory.

This book was motivated by my own desire as a “non-expert” to learn something about gauge theory. Over a period of 4–5 years, I wrote a series of short pedagogical articles on gauge theory topics for the American and European Journals of Physics. These articles allowed me to test the ideas and the writing style for this primer. I also found that trying to satisfy the high standards of the referees for these journals encouraged me to develop much clearer explanations for many gauge theory topics. I am indebted to these referees who do their work in anonymity.

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