

## Preface

The language required to describe elementary particle physics is that of relativistic quantum field theory. Besides this utilitarian role, quantum field theory is a complex, multi-faceted subject in its own right. A subject whose final chapter is far from being written. The living nature of field theory makes the decision as to the form of its initial presentation to students a difficult one. Certainly with the discovery of the Standard Model of electroweak and strong interactions, non-Abelian gauge theories have played center stage in the field theory theatre for almost two decades. The quantization of such theories is most easily understood in terms of functional integration techniques. However, these techniques are not only unfamiliar even in an ordinary quantum mechanical setting, but their attendant functional formalism, such as the LSZ axioms, generating functionals for time ordered functions and effective actions, often makes elementary particle physics inaccessible to all but the most ardent of theory students. As well there is a need for an approach to field theory that allows the basic ideas of the subject to be presented in one semester. Hence the approach taken in these introductory notes is based on the perturbative evaluation of the quantum mechanical time evolution operator in the interaction representation. The advantage of this presentation is that many of the techniques used are familiar from ordinary quantum mechanics. This allows a clearer picture of the physics that is taking place to emerge. At the same time the introduction of new concepts and techniques occur with a minimum of formalism. It is hoped that this direct approach to the evaluation of  $S$ -matrix elements through the use of Feynman diagrams will provide the student with the needed calculational tools to begin understanding high energy physics. As well it provides a clear conceptual basis for the student's further study, in a second semester course, of the principles upon which relativistic quantum field theory is based and the use of the techniques mentioned earlier.

Transcribing so many handwritten pages of notes to  $\text{\TeX}$  has been an immense undertaking. I thank the many graduate students at Purdue that helped me with this unenviable task. Also I thank my family, Nancy, Shady and Wuffy, for their extreme patience and support over the years it took to complete these notes.

Thomas E. Clark  
August 1988  
West Lafayette, Indiana