Preface

The basic ideas behind the "principle of the fermionic projector" go back to the years 1990-91 when I was a physics student in Heidelberg. At that time, I was excited about relativity and quantum mechanics, in particular about classical Dirac theory, but I felt uncomfortable with quantum field theory. The dissatisfaction with second quantized fields, which was in part simply a beginner's natural skepticism towards an unfamiliar physical concept, was my motivation for thinking about possible alternatives. Today I clearly understand quantum field theory much better, and many of my early difficulties have disappeared. Nevertheless, some of my objections remain, and the idea of formulating physics in a unified way based on Dirac's original concept of a "sea of interacting particles" seems so natural and promising to me that I have pursued this idea ever since. It took quite long to get from the first ideas to a consistent theory, mainly because mathematical methods had to be developed in order to understand the "collective behavior" of the particles of the Dirac sea.

This book gives me the opportunity to present the main ideas and methods in a somewhat broader context, with the intention of making this area of mathematical physics accessible to both theoretical physicists and applied mathematicians. The emphasis of the main chapters is on the conceptual part, whereas the more technical aspects are worked out in the appendices.

Felix Finster, Regensburg, November 2004