

Foreword

During the twentieth century the concept of particle underwent a profound change. An electron differs from the particle of Newton in having discrete properties. All electrons have identical mass, charge and spin. The charge and spin of the electron and other elementary particles are logical properties which the particles either have or not. There are a number of other such logical properties. Mass is a more obscure matter but is logical none the less. This book attempts to show why such a change has come about. As a historical matter these investigations did not start from this problem. They began from trying to give physical interpretation to a curious algebraic construction of A.F.Parker-Rhodes. This construction gave rise to a graded algebra having exactly four levels with which were associated the numbers 3, 10, 137 and 10^{38} . The rough correspondence of the last two with the inverses of the electromagnetic and gravitational coupling constants and the restriction to four levels suggested a physical connection. It transpired that a very abstract account of the discrete process by which knowledge of the universe is gained provides a reason for an algebraic structure more general than Parker-Rhodes' but having his as a special case. The fact that the more general structure then modifies 137 to a value agreeing with the measured value of the inverse fine-structure constant to better than one part in ten million confirms its correctness. The discrete nature of elementary particles follows from the essentially discrete nature of the process. This explanation is logically prior to one invoking Planck's constant, since assuming the existence of Planck's constant is equivalent to assuming the discreteness. The fact that the algebraic structure contains a substructure agreeing with that of the quarks is a further confirmation of its correctness. Much more work is needed to evaluate all the implications for physics but it is hoped that this book will serve to inspire it.