An Introduction to a
Realistic
Quantum
Physics

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In memoriam

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Preface

It is almost thirty years that I have been teaching university courses in the field that has (almost) totally absorbed my research activity: Quantum Field Theory (QFT) and particle interactions, today known as the Standard Model (SM). I have thus had innumerable occasions to observe the uneasiness, indeed the embarrassment of students when making the jump from Quantum Mechanics (QM) to QFT, the only sensible quantum description of the relativistic world, where the number of particles — quanta cannot be kept fixed. Sensible, that is a good word, but can it be really applied to QM itself? When pressed on this point the students, emerging from their institutional courses on non-relativistic QM, without exception showed how uncertain and uneasy their feeling was about a physical theory which is more than seventy years old, and permeates large sections of modern technology. As to their intellectual attitude toward QM, that is also without exception “conventionalistic” totally centered on rules and procedures, largely based on the Copenhagen interpretation and its subjectivistic probability approach.

I have always regarded (and obviously I have not been alone in this) this state of affairs as very unsatisfactory, including the fact that a critical debate on such fundamental issues has remained confined to a small community of “fundamentalists”, at the frontiers of physics, metaphysics and philosophy. I have thus tried to devote a (necessarily small) part of my lectures to present my point of view, which tries to reappropriate Quantum Physics (QP) to a strongly realistic view of the world, in the great tradition from Galilei to Einstein that has shaped the deep structure of modern science. But without a systematic exposition I felt that my efforts were doomed to have little or no effect at all. Thus I decided to subtract a part of my vacation time (summer 1998) to more or less futile beach talks, and

devote the following Essay to my students (and to whoever cares about the problems addressed in it) who, I hope, will benefit from being presented with ideas and analyses that are not usually found in the literature that is available to them.

This Essay is written in English for two main reasons, first this language is the common language of science, and physics students should know all too well how useful it is to read (and speak) it fluently. The second reason is that I nurture the hope that, some day it will be felt desirable to have access to its ideas in the wide world.

Milano, October 1998.

Giuliano Preparata was born in Padova, Italy on March 10, 1942. Theoretical physics was the focus of his insatiable intellectual curiosity. He succumbed to cancer in Frascati, Italy on April 24, 2000.

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