Preface

This book on the *Perturbed Evolution* of quantum systems grew out of a set of lecture notes for a fourth-year undergraduate course at the National University of Singapore (NUS). The reader is expected to be familiar with the subject matter of a solid introduction to quantum mechanics, such as Dirac's formalism of kets and bras, Schrödinger's and Heisenberg's equations of motion, and the standard examples that can be treated exactly, with harmonic oscillators and hydrogen-like atoms among them.

After brief reviews of quantum kinematics and dynamics, including discussions of Bohr's principle of complementarity and Schwinger's quantum action principle, the attention turns to the elements of time-dependent perturbation theory and then to the scattering by localized interactions. Fermi's golden rule, the Born series, and the Lippmann–Schwinger equation are returning themes.

A chapter on general angular momentum prepares the ground for a discussion of indistinguishable particles. The scattering of two particles of the same kind, the basic properties of two-electron atoms, and a glimpse at many-electron atoms illustrate the matter. Throughout the text, the learning student will benefit from the dozens of exercises on the way and the detailed exposition that does not skip intermediate steps.

Two companion books on *Basic Matters* and *Simple Systems* cover the material of the preceding courses at NUS for second- and third-year students, respectively. The three books are, however, not strictly sequential but rather independent of each other and largely self-contained. In fact, there is quite some overlap and a considerable amount of repeated material. While the repetitions send a useful message to the self-studying reader about what is more important and what is less, one could do without them and teach most of *Basic Matters*, *Simple Systems*, and *Perturbed Evolution* in a coherent two-semester course on quantum mechanics.

All three books owe their existence to the outstanding teachers, colleagues, and students from whom I learned so much. I dedicate these lectures to them.

I am grateful for the encouragement of Professors Choo Hiap Oh and Kok Khoo Phua who initiated this project. The professional help by the staff of World Scientific Publishing Co. was crucial for the completion; I acknowledge the invaluable support of Miss Ying Oi Chiew and Miss Lai Fun Kwong with particular gratitude. But nothing would have come about, were it not for the initiative and devotion of Miss Jia Li Goh who turned the original handwritten notes into electronic files that I could then edit.

I wish to thank my dear wife Ola for her continuing understanding and patience by which she is giving me the peace of mind that is the source of all achievements.

Singapore, March 2006 *BG Englert*

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