

Read me first

Quantum Mechanics

K. Konishi, G. Paffuti, 2008

Last version: April 2008

● The notebooks

We choose to write the solutions to problems proposed in the book *Quantum Mechanics: A New Introduction*, in the form of *Mathematica* notebooks. This allows the reader to experiment, modify and extend problems freely. The choice of *Mathematica* is due both to author's preferences and to the possibility of using numerical, graphical and symbolics tools at the same time. The expert reader can easily translate most of the material in alternative languages as MatLab or even in a low-level language, as C or Fortran.

For each chapter a certain number of *Mathematica* files called **Problems_chapN.nb** are provided, which contain the solutions of problems of more analytical nature, as well as a number of notebooks, **NB-ChapN_1.nb**, **NB-ChapN_2.nb** ... for each problem to be studied numerically.

There is no need for any knowledge of *Mathematica* program to read the solutions for the first type of problems (analytical): the solutions are provided in the form of pdf files also.

In some chapters where several numerical notebooks are present, a file: **Guide_to_NB.nb** gives a brief introduction to the content of *Mathematica* notebooks of that Chapter.

■ Requirements

It is assumed that the reader has access to a computer running a current version of *Mathematica* (version 6.0 or newer). For readers without access to a licensed copy of *Mathematica*, it is possible to access the notebooks using a trial version of the software (downloadable from <http://www.wolfram.com/products/mathematica/trial.cgi>). It is possible to read, but not to modify, the notebooks using the free Mathreader, <http://www.wolfram.com/products/mathreader/>

■ Reader Prerequisites

For each notebook it is assumed that the reader is familiar with the content of the corresponding book's chapter.

No knowledge of *Mathematica* is needed to read the solutions of *analytical* problems (which are given also in the form of pdf files).

Numerical problems need some familiarity with *Mathematica* language. As far as possible, we tried to avoid instructions which are either too involved or too cryptic, explaining as much as possible unfamiliar commands, where used.

It is assumed that the reader who wishes to modify the notebooks is familiar with basic actions in *Mathematica* front end, such as entering Greek characters, using palettes, copying and pasting cells, and so on. Freely available tutorials on these and more subjects can be found at <http://library.wolfram.com/>

■ References and supplemental material

The standard reference for the language is S.Wolfram book: *The Mathematica Book*, Wolfram Media, Champaign, 2003.

The reader can make a thorough study of the language and see several applications in the four volumes book: M. Trott, *The Mathematica Guidebook*, Springer 2006.

Examples of code can be found at <http://library.wolfram.com/infocenter/MathSource>

■ Reproducibility of the results

All notebooks have been written and runned with *Mathematica* 6.0 on a 3-GHz Mac-Intel computer with 4 GB RAM. With this hardware most notebooks need at most few minutes to run (usually few seconds).

In general, regardless the type of the computer used, with the same version of *Mathematica* (6.0), the reader should get the same results as shown in the notebooks. Some deviations of the results may appear for several reasons:

- Input involving the function `Random[]`. Reproducibility can be achieved usually using `SeedRandom[]`.
- Calculations showing some of the differences of floating-point numbers and the machine-dependent representation of these on various computers.
- Pictures using various fonts and sizes because of their availability (or lack thereof) and shape on different computers.
- Calculations involving `Timing` because of different clock speeds, architectures, operating systems, and libraries.

● Notebook style

As a general rule we have chosen to make the notebooks such that they are independent of each other as far as possible. This allows an easier use for the reader.

We changed slightly the standard stylesheet, the modifications are included in the file **Style07.nb**. With this stylesheet, the title of each notebook on the top appears in a purple background color. More importantly, all lines of *input* type (where the *Mathematica* commands appear) can be distinguished by their yellow background color. Lines in a light pink backgrounds are *Mathematica* outputs. All other lines are just the text. If a notebook does not appear correctly formatted, the stylesheet can be selected from the Menu: choose Format > Stylesheet > Other... from Format Menu and then select the file Style07.nb, which is found in the same CD. For easier use the file can be put in the folder SystemFiles > FrontEnd > StyleSheets > Book inside the *Mathematica* Folder.

For Mac users: the folder *Mathematica.app* can be accessed by pressing the Cntrl key and the mouse on the icon of *Mathematica* .

The reader who want to create a notebook with the same style can copy the content of a notebook in a new file and delete its content. If she/he want to add sections, problems, observations etc., she/he can use the submenu style in the top-left of the file. To change programmatically the style choose Edit Style Sheet from the Format menu .

Independence of notebooks has a cost in term of code also. Sometimes parts of code are replicated in several files. We expect that assembling code together in *Mathematica* packages can cause troubles to less expert readers. Since our goal is to write a physics book, not a book on *Mathematica*, we tried to avoid such a trouble as much as possible.