BOOK REVIEWS

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Introductory Nuclear Physics, 2nd ed. Samuel S. M. Wong. 460 pp. Wiley, New York, 1998. Price: $74.95 (cloth) ISBN 0-471-23973-9. (Jim Napolitano, Reviewer.)

I liked this book. As the preface states, ''Nuclear Physics is a subject basic to the curriculum of modern physics.'' This text does a fine job of making that point, incorporating quantum mechanics and quantum field theory to explain the physics of particles, the few body problem, and many body physics. Application of these principles to experiments as well as to the development of modern theories is nicely done. I think, however, that I prefer this book as a very useful reference, as opposed to a course textbook. The flow is not as even as students would like, but that is hard when trying to cover a well-established field for a broad audience.

Although generally at a high level, the book is a bit uneven in deciding whether to include some background information, or to refer the reader to other sources. For example, the second-quantized annihilation and creation operators are used along with their relative phase factors (Section 2-4) in order to explain the isospin of antiparticles, but the quantum field theory is done very briefly and instead we are directed to the classic nuclear physics texts by Bohr and Mottelson, and deShalit and Talmi for details. On the other hand, at the beginning of Chapter 5 on ''Electromagnetic and Weak Interactions,'' nearly a page is taken up in explaining the exponential decay law and the difference between half-life and mean life, a topic almost universally discussed at length in a first undergraduate course in Modern Physics.

A good attempt has been made to update the book in a reasonable way since the first edition, published in 1990. The major additions are two new, separate chapters, one on heavy ion reactions (''Nuclei under Extreme Conditions''), and another on ''Nuclear Astrophysics.'' These include the addresses of a few World Wide Web pages, on topics such as ISOLDE and the Solar Neutrino Problem, which are helpful for getting current information on many of the most rapidly changing topics. There is very little discussion, however, of QCD and how it is currently thought to translate into the quark model, or solutions based on the lattice. Some appendices have been removed, and other rearrangements were made, so the length of the book is essentially unchanged. In addition, I found the text style of the Second Edition more pleasing and easier to read than the first.

I found some of the discussions particularly lovely. The discussion of isospin in Chapter 2 is rigorous but elegant, elucidating the connection with the quark model and providing hard-to-find detail on the isospin of antiparticles in the context of second quantization. Giant resonance in collective motion is treated thoroughly and quantitatively, including examples from the available data. Coulomb Excitation is treated in some detail as the first section in the chapter on Nuclear Reactions. There is a complete discussion regarding high spin states, including superdeformation and the contribution from microscopic effects. The astrophysical significance of the $^{12}C(\alpha,\gamma)^{16}O$ reaction is made clear, as well as the various ways in which the reaction rate is measured at low energies.

I also found some of the end-of-chapter exercises quite intriguing. For example, in Chapter 6 students are given various pieces of experimental data and asked to determine parameters for collective motion in a few different systems. Elsewhere, students are asked to construct the quark model wave functions for mesons and baryons by application of the isospin lowering and raising operator to the wave functions previously derived.

I did identify a few mistakes which should not be in a modern textbook on this subject. For instance, in the discussion on ''neutrino mass measurement'' in Section 5-6, the example discussed and displayed is the $m_\nu = 37\,\mathrm{eV}/c^2$ result from Lubimov *et al.* (1980). Wong states that ''the possibility of zero is by no means ruled out,'' but in fact this spurious measurement was explained by Simpson in Phys. Rev. D **30**, 1110 (1984), who attributed it to an error in the calibration procedure. More recent, and more accurate, measurements of the ^3H end-point shape have been published, but are not cited.

There are some notable errors and peculiarities which may simply be the result of careless editing. Table 1-3 of ''stable'' light nuclei includes ^8Be as well as two isotopes with $A=5$. In Table 1-4 the de Broglie wavelength for a 100-MeV electron (12 fm) is listed next to the wavelength of a photon of the same energy, but written as ''1.2×10'' fm. A list of charge radii of ''Calcium Isotopes,'' Table 4-2, includes ^{48}Ti.

However, all criticisms aside, I do recommend this book to active researchers in the field, or to anyone teaching an upper-level undergraduate or graduate course who needs a good, clear reference on the essential material. With careful attention to pedagogy, the right instructor would find this a very suitable textbook for an upper level course on Nuclear Physics.

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Classical Electrodynamics, 3rd ed. John David Jackson. 808 pp. Wiley, New York, 1999. Price: $84.80 ISBN 0-471-30932-X. (Ronald F. Fox, Reviewer.)

Green, red, and blue. These are the color states of the three editions of perhaps the most famous electrodynamics text in the post-war era. Long ago the question: ''have you had a course in 'Jackson'?'' became synonymous with ''have you studied advanced electrodynamics?'' I actually learned advanced electrodynamics in 1965 from the green edition that first appeared in 1962. When I began teaching the subject in 1978, it was from the 1975 red edition. I taught this course ten times over a 20-year period. Finally, last Fall quarter, and again this Spring quarter, I taught from the blue, third edition. I think these experiences qualify me to have an informed opinion about the book.

The only other text I can think of for graduate level physics with a similar mystique is Herbert Goldstein's *Classical Mechanics*. This text has been challenged in recent years by the beautifully elegant *Mathematical Methods of Classical Mechanics* by V. I. Arnold. No such challenge yet exists for Jackson. In the sixties, Wolfgang Panofsky and Melba Phillips' *Classical Electricity and Magnetism* was an alternative choice. I studied from it for a year as a senior at Reed College in 1963 and enjoyed its elegant style. It presented a really good alternative to the green Jackson. But the red and blue Jacksons set Jackson apart as a unique choice, in part because of the breadth of the coverage and in part because of its enormous collection of problems. One criticism about the problems, however, is the dearth of examples taken from a number of subfields of physics, e.g., biophysics and condensed matter. I have not compared Jackson with L. D. Landau and E. M. Lifshitz's *The Classical Theory of Fields* because this excellent reference work contains very few problems (the solutions to which are in the text) and very few practical applications. While a very valuable resource, it is not preferred over Jackson as a text for an introductory-level graduate course.

The study of Jackson involves two equally important steps. First one must ''read'' the text. It is not that one must ''read between the lines'' to get the full meaning. Rather, one must ''fill in between the lines.'' Over and over again one discovers that between one line and another, or between one equation and another, up to a whole page of handwritten details needs to be interpolated. As a teacher using Jackson as the text, I find that my lectures are often devoted to this task. Second, one must do the problems. Some problems are clearly integral to the development in the text (and are cited as such), but many others strengthen the students' skills and deepen their grasp of the subject. With each new edition, new problems have been added and the blue edition contains many problems from modern applications and research. These two steps cannot be fully achieved in a single course. Students will have to continue to develop their mastery of the text long after they conclude the brief exposure afforded by taking the typical graduate level course.

Some physicists felt that the enlarged red edition was too big for the typical graduate course. The blue edition has new material but is barely larger than the red because several old topics have been eliminated. Some new sections have been included so that personal computers can be used to do numerical work, e.g., in electrostatics (blue chapters 1 and 2). Material on optical fibers has been added, and old material on magnetohydrodynamics and plasmas (red chapter 10) has been greatly reduced and now appears in blue chapter 7 (Plane Electromagnetic Waves and Wave Propagation). The multipole chapter (red chapter 16) has been eliminated and some of its material is incorporated into the end of blue chapter 9 (Radiating systems, Multipole fields and Radiation). Half of red chapter 9 is now the blue chapter 10 (Scattering and Diffraction). I think these are good changes. One change caught me by surprise last Fall. Jackson has violated his pact with the late Edward Purcell (to whom the third edition is dedicated) and has introduced SI units into the first ten chapters, reverting to the pact (Gaussian units) for the remainder of the book. At first I didn't like this change, but after last Fall, I have decided that this is actually good for the students. They will run into both sets of units frequently enough in other contexts that this use of both in one text will make them more adept at conversion, which is not completely trivial in all instances. Fortunately, the failure to be consistent in this usage of units at the end of section 3.3 is being corrected in the March 1999 reprinting of the third edition.

I am not always happy with the presentation of material in Jackson. For example, I find that I must add a discussion of the symmetry of the Dirichlet Green function with respect to its two vector arguments, $\mathbf{x}$ and $\mathbf{x}'$ and explicitly exemplify its utility with the example of the Green function for a point charge outside a conducting sphere. All of the ingredients for this discussion are in the text; they just aren't used for this purpose. Students are often confused by the switching between $\mathbf{x}$ and $\mathbf{x}'$. The example just mentioned tends to clear this up. The occasional lack of elegance is more than compensated by the coverage. The end of chapter reference lists, suggested readings, and brief commentaries are also of great value. Some of these have been appropriately updated in the blue edition.

I see no reason not to consider Jackson the text of choice for the next millennium, or at least the next centi-millennium.

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