and head of agricultural chemistry and soils.

Dr. Fuller has published over 100 scientific articles and papers in national and international journals. He has co-authored or contributed chapters to seven scientific books. The areas of agricultural biochemistry, soil-plant relationships, and phosphorus chemistry have occupied most of his research effort. The use of radioisotopes in biology is of long standing, since he was one of the first to be trained in isotope use by the U.S. Atomic Energy Commission. Most of his contract research with the AEC over 20 years was in the field of uranium fission fallout and its relation in the food chain.

Nuclear Structure Theory

Author	J. M. Irvine
Publisher	Pergamon Press, Inc. (1972)
Pages	478
Price	$27.00
Reviewer	G. R. Satchler

Upon first skimming through *Nuclear Structure Theory*, I was very pleased and looked forward to having it close to my desk for reference purposes. However, a more careful reading considerably modified my initial enthusiasm. I now have very mixed feelings.

To put these remarks in context, I should add that I am a practicing nuclear theorist, mainly in the field of nuclear reactions; however, reaction theorists cannot avoid contact with theories of the internal structure of nuclei, the subject of J. M. Irvine's book. This is no book for beginners; the author assumes the reader has had a basic undergraduate course in nuclear physics, but I believe he will need much more—namely some *working* knowledge of the field—before he can feel at home with all of this book. It is a conglomerate of materials at all levels, from the elementary to the sophisticated. Indeed, I have the feeling (and this is reinforced by his own comments in the Preface) that the author's motivation was simply to write a book without giving much thought to his prospective readers. He speaks of it as a "guide-book," but that does not seem completely appropriate. For example, I cannot help contrasting the very elementary discussion of mass spectrometers in Chap. 3 with the leap into the very sophisticated Brueckner theory in Chap. 6.

Perhaps all of this is quibbling. Certainly a useful book could have resulted, and in many ways it has. Part II is a concise (maybe too concise for the uninitiated) summary of the many-body theory of nuclear matter and finite nuclei, while Part III is a similarly concise tour of nuclear models, particularly the shell model with its various extensions. (In this latter part, the somewhat cursory treatment of the collective model is unfortunate, but it is in keeping with the tone of the remainder of the book.) Part I is largely introductory (the two-nucleon system, systematics of nuclear masses and shapes, etc.), while Part IV contains the mathematical apparatus needed for understanding the earlier parts.

A large amount of space is taken up by tables and such, not all of which necessarily serve a useful purpose. For example, there are 52 pages of nuclear energy-level diagrams, covering all nuclei up to $A = 40$ and every tenth one after that. The reproduction of some of these is very indistinct, at least in my copy. Furthermore, such diagrams are constantly being updated and are available in professional data evaluation journals. A more serious criticism of other sets of tables is that they lack a proper explanation. Thirteen pages of two-body interaction matrix elements are given, but I see no mention of the residual interaction used or even what units the numbers refer to. There are 36 pages of coefficients for Nilsson wave functions for a nucleon moving in a deformed potential well, but I did not find any *explicit* definition of these, especially of the phase conventions employed. No doubt those of us who are relatively familiar with this game could figure out these things in an hour or so; the newcomer would have more difficulty. There are other examples, such as Figs. 13.9 through 13.14 and Table 15.1, where the results of calculations are given without any indication as to the input quantities.

Other less important criticisms abound as well! Some of these are minor "misprints" and I know only too well how those can slip by. Others are of more consequence. The notation used is not always clearly defined; for example, although the old hands will know immediately what T stands for in Eq. (2.17), it should be defined for the benefit of those less familiar with the subject. (Incidentally, the usage "isotopic" spin is *passé*; isobaric or just plain iso have become accepted now.) In addition, "equivalent uniform" is not defined on p. 49; in this connection, when he refers on p. 52 to a "radius to half-density" I believe he actually means the equivalent uniform radius—not the same thing.

The optical model is done an injustice on p. 47, where it is said that analyses using it have inherent uncertainties of 25% or so. On the contrary, much more accurate information than that can be obtained. Similarly, it is suggested on p. 50 that analyses of electron scattering data are subject to errors of the same order. Again, quantities like the mean square radius can be found to an accuracy an order of magnitude better than that. The case of ^{40}Ca is mentioned, but only in conjunction with a reference which is 16 years old; work of recent years using comparison methods has yielded quite accurate information on the structure of the density distributions of the calcium isotopes.

Twice it is mentioned that the relativistic Thomas spin-orbit coupling is an order of magnitude smaller than that needed for the shell model, but it is not pointed out that it also has the wrong sign; this is further confused by a sign error in going from Eq. (13.3) to Eq. (13.4)! In addition, the insistence (p. 240) on a constant form for the spin-orbit coupling term in the shell model is rather misleading since much of current usage takes the Thomas form [Eq. (13.3)], suitably renormalized.

Some minor errors I have noticed include that the distance denoted ω in Fig. 4.3 is really $\sim\frac{1}{2}\ \omega$, that the "potential" Eq. (4.15) referred to on p. 51 should be "density" and that, while Table 8.1 and Fig. 8.4 are said to refer to the same calculation, the numbers shown do not agree at all. Further, reference is made to overlaps in Table 8.1 which, in fact, are not there.

In summary, it is hard to give a simple judgment on this book; its treatment is somewhat uneven and it is not clearly directed to any one audience. I can only recommend that the reader scan his library's copy to discover for himself whether it contains enough material of interest to warrant his buying it. The newcomer to the theory of nuclear structure could find it valuable as a supplement to other sources but not as his only text; indeed, the author himself explicitly disclaims that this is a "conventional textbook."

G. R. Satchler received his BA, MA, and DPhil (1955) from Oxford University. Since 1959 he has been with the Physics Division of Oak Ridge National Laboratory where he now heads the nuclear theory group. His principal interest has been the theory of direct nuclear reactions and its application to the analysis of experimental data, although he has also made contributions to the theory of nuclear structure. His publications include the book Angular Momentum, *which he coauthored with D. M. Brink.*