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BOOK REVIEW

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H. Haken, H.C. Wolf (eds) The physics of atoms and quanta. Introduction to experiments and theory, 6th edn. (Advanced Texts in Physics)

Springer, Berlin Heidelberg New York, 2000. 508 pp (ISBN 3-540-67274-5) US$ 68.99, Euro 60.84, hardcover

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Textbooks on atomic physics are essential for all who study physics and any related subject. A major merit of these books is that not only milestones of experimental physics such as Rutherford's scattering experiments are presented but that quantum mechanics is explained in a more instructive way than in proper theoretical physics texts. This is because quantum mechanics has been developed in the context of atomic physics and is well motivated by the need to explain these phenomena. The book by Haken and Wolf accounts for that strong link between the two fields by including "quanta" already in the title. The book covers four fields: (1) fundamental experiments of atomic physics, (2) the quantum mechanical background, (3) impact on other fields, and (4) frontiers in atomic physics.

This reviewer is most happy with the quantum mechanics part, which is very clear and explicit. Typical examples are the Dirac equation and the Hartree-Fock method. The text is in no way redundant to proper quantum physics textbooks, but more convenient and clear to read for students, especially if they have no ambitions in theoretical physics. On the other hand, the treatment is much more profound than in experimental physics textbooks such as Gerthsen.

The material Haken and Wolf present on experiments is restricted to the very essential parts and, therefore, sometimes fairly short and schematic (see figure 5.3 on black body radiation). The book has been well modernized with respect to earlier ones and refers to many modern applications of atomic physics such as NMR and ESR, surface analysis, X-ray scattering and many others. However, a few examples are still found where historical material remained without considering the impact on modern physics in an adequate way. The parabola mass spectrograph is of little interest for the reader; skip it in favor of the Mathieu equations for the quadrupole mass spectrometer. This modern method is covered very poorly and will remain rather a mystery for the student. Figure 6.12 of a neutron spectrometer is another anachronism and does not even give a vague impression of the scope of modern neutron scattering.

Discussions of frontiers in physics in the text are of great interest as long as they remain theoretical (Schrödingers's poor cat or the Einstein-Podolsky-Rosen paradox), but again the presentation of experiments is sometimes too short. Figure 22.3 does not say anything to the reader without an explanation of the system studied.

The book is well written and very clear. Few errors and misprints can be found after six editions. However, this reviewer wonders if the wide margin throughout most of the book is really helpful for students making notes or if it is just a waste of paper. Many of them would certainly prefer a paperback edition at a reduced weight and price. Nevertheless, the present edition is already very well suited for undergraduate courses in physics and chemistry. Especially for the latter group it is important that exactly the right amount of mathematical overhead is included, and that the theoretical background for many applications is explained in a more profound and concise way than in many texts specialized on one application only. Very helpful also for lectures are the exercises with (brief) solutions.

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