function in the theory of the ordinary hypergeometric series, and it may be interesting to note that, as an Appendix, some numerical tables are provided of this rarely investigated product.

Chapters 4 and 5 discuss the hypergeometric integrals and their "basic" generalizations. The stress here is of course on the Barnes-type contour integrals that play such a foremost role in the entire theory, and their extensions in terms of basic functions. Chapters 6 and 7 then cover bilateral and basic bilateral series, and chapter 7 also includes material on the probably best known example of a basic bilateral series, namely the theta function. Finally, chapters 8 and 9 are devoted to Appell and basic Appell series, including some discussion of the Lauricella functions.

The presentation in the work reminds the reader strongly of that in Bailey's book; it is precise and to the point but somewhat terse. The material in the book of course goes far beyond that in Bailey's book, and throughout, the author has also included many of the results of her own extensive research on the topic. But, as in Bailey's book, asymptotic expansions were not covered, probably for the same reason as advanced by Bailey, namely that they belong to complex-function theory. The notation, which in this field tends to become cumbersome at times, has been rather well chosen, although any book on this subject inevitably suffers under the wealth of lengthy and yet highly condensed formulas that demand careful and attentive reading, a mode of activity felt to be "uninspiring" by some.

As stated in the preface: "The theory of generalized hypergeometric functions is fundamental in the field of mathematical physics, since all the general functions studied here contain as special cases all the commonly used functions of analysis. . . . The generalized Gauss function is also used increasingly in mathematical statistics, and the basic analogues of the Gauss functions have many interesting applications in the field of number theory." The author has certainly provided an up-to-date work that should prove to be a standard reference book on this topic and that should be of great interest and value to anybody who in his work has occasion to use these functions or who wishes to familiarize himself with this interesting field.

* * *

Werner C. Rheinboldt is research professor in the Institute for Applied Mathematics and Fluid Dynamics, and Computer Science Center, at the University of Maryland.

Only almost up to date

LEHRBUCH DER EXPERIMENTALPHYSIK. (BERGMANN-SCHAEFER). Volume 3, Optik. By F. Matossi. 590 pp. Walter De Gruyter, Berlin, 1966.

by L. Marton

During the last decade the textbooks of Bergmann and Schaefer have gained sufficient prominence among German college texts in experimental physics to justify reissuing them in more and more revised editions. Matossi took over the task of revising the new edition of the volume on *Optics* and, as it may have been expected from him, he did an extremely thorough job of bringing the volume up to date. The result is an extremely impressive volume of close to 600 pages that differs from the earlier editions in two important respects. One is the omission of all spectroscopy, which has been transferred to a volume on *Atomic Physics*, and the addition of an extensive part on what the author calls "Quantum Optics." Likewise a short chapter has been added on the "Theory of Relativity."

The main chapter headings are: "Geometrical Optics," "Photometry," "Dispersion and Absorption of Light," "Interference and Diffraction," "Polarization and Birefringence." These chapters constitute the first part entitled "Wave Optics." "Quantum Optics" consists of one chapter on the laws of "Thermal Radiation," on the "Corpuscular Nature of Light" and on the "Wave Nature of Matter."

It is unnecessary to say that all this material has been prepared with utmost thoroughness. While I am very impressed with the amount of material brought together, I am somewhat embarrassed to confess to some frustration. I am conversant with certain older German books on optics, particu-

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larly those that have formed parts of larger treatises on experimental physics. Among those older German books are the one by Müller-Pouillet, the one by Chwolson, and last but not least, the one by Grimsehl. This feeling of frustration arises from the fact that this brand new book by Matossi is not very different from all the great classics that I just enumerated. Admittedly, there are additions that make it appear as an up-to-date book, but these additions are rather perfunctory, and do not make the book into a really modern textbook on experimental physics.

One of the difficulties is that maybe I am looking at this book with different eyes than those required for judging a book designed for German teaching. There isn't such a clear-cut distinction between undergraduate and graduate work as is common here, and therefore, it is hard to say whether the book is for undergraduate or graduate teaching. If we judge it entirely by American standards, then I would say that there is too much in it for undergraduate work and too little for graduate work, although it may be very useful for the undergraduate teacher for supplementing an elementary text with beautiful problems in geometrical optics.

At this point I would like to use two examples. Both are taken from the chapter entitled "Wave Character of Matter." I feel it quite debatable whether a chapter like this is needed in a book devoted to optics, and in particular when the treatment is rather perfunctory. For instance, in this volume, five pages are devoted to electron diffraction and eight pages to electron optics. It is obvious that such a treatment cannot cover the ground and it gives perhaps a somewhat distorted view of the importance of these two subjects. It would have been perhaps better to have omitted them completely.

There exist other areas that I would have liked to have seen included. The role of information theory in optics is getting more and more important. While the argument may be valid that the treatment of information theory in a book on experimental physics is perhaps going too far, there exist some related aspects that are close enough to information theory to justify partial inclusion. For instance, the beautiful method of wave-front reconstruction invented by Gabor has been derived from his studies on information theory to some extent. I think that this would have been quite proper in a book on experimental physics, particularly since holography is nowadays a very active branch of optics. Likewise, the beautiful experiment of Brown and Twiss on coherence is quite fundamental, and is sufficiently experimental to take a place in a book of this character. Also the diffraction treatment of geometrical optics that has been so beautifully worked out by the French school is missing. If there is a revision of this book, I recommend that at least these three items be included.

The book is beautifully produced and it is a pleasure to handle it.

* * *

L. Marton is chief of international relations for the National Bureau of Standards.

Matter by structure

SEVEN STATES OF MATTER. By M. Gottlieb, M. Garbuny and W. Emmerich. 247 pp. Walker, New York, 1966. $5.95

by J. E. Romain

I do not remember having read a more fascinating book for months. The authors, three scientists of the Westinghouse Research Laboratory, have succeeded in writing together an homogeneous book, in which the various aspects of matter (from molecular structures to degenerate matter, through crystals, liquid structures, monoatomic films and plasmas) are authoritatively reviewed by men on the leading edge of research in the relevant fields.

The "seven states" of matter are not really seven. Although seven are indeed named: solids, liquids, two-dimensional films, gases, plasmas, degenerate Bose-Einstein systems and degenerate Fermi-Dirac systems, the main theme of the book is the very impossibility of specifying clear-cut boundaries between them, and such limiting cases as glass, liquid crystals, and quick-clay are emphasized. The link between the different states,