dia, starting with modulation and modulation instability (chapter 9), proceeding to solitons (chapter 10) and concluding with a quick survey of some additional effects that may complicate the pulse propagation in glass fibers and are of technological interest (chapter 11).

The presentation is fluid and coherent, but it suffers somewhat by the near absence of physical considerations. The material is actually a collection of different examples that may be found scattered throughout several well-established books in nonlinear optics, examples that are frequently used to illustrate in classical terms different aspects of the subject. The principal merit of this book is its arrangement of these examples in a coherent and self-contained way and adapted for readers who have a good background in electromagnetism but have no background in quantum mechanics. This treatment allows the reader to get a quick glimpse of the topic and its potential applications before approaching more advanced treatments of the subject. The drawbacks of such a presentation are evident when nonlinear effects close to resonances are discussed or problems related to quantum noise or relaxation become relevant.

Despite such evident limitations, *Nonlinear Optics* has definite merits, one being that it renders the topic accessible to engineering students and engineers who are interested in applications, and it will help with further reading. The notations and definitions are also geared to such a readership, as are the exercises that accompany the chapters.

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Black Holes: Gravitational Interactions

Peter D. D'Eath
Oxford U. P., New York, 1996.
286 pp. $80.00 hc
ISBN 0-19-851479-4

There has been a considerable revival of interest in recent years in the study of a number of phenomena involving black holes. Much of the impetus for this renewed interest has arisen from the construction of the Laser Interferometer Gravitational Wave Observatory (LIGO), which should be able to detect gravitational radiation from the mergers of black holes. Further impetus has been provided by the efforts of several research groups that aim to calculate numerically the details of the process of black-hole collisions. Finally, recent developments in string theory—which successfully reproduced the Bekenstein–Hawking formula for black-hole entropy for certain classes of black holes—have led to renewed interest in the theory of scattering by black holes.

The theory of linear waves propagating in a black-hole background was developed to a highly advanced state in the 1970s, but the theory of nonlinear interactions between black holes remains in a relatively rudimentary state. One analytical technique that has been successfully applied to study certain nonlinear phenomena involving black holes is the method of matched asymptotic expansions. The basic idea of this approach is to develop two (or more) different perturbation approximations, valid in different local regions of spacetime. When these local domains of validity have a non-empty intersection, the results can be matched in the overlap region, and a great deal of information often can be extracted. However, it is quite difficult to obtain any rigorous results from this approach, since it is very difficult to establish rigorously the domain of validity and convergence properties of the various perturbation approximations.

Peter D'Eath's *Black Holes* is mainly devoted to the application of matched asymptotic expansions to two problems: the motion of a (small) black hole in a background spacetime and the collision of two Schwarzschild black holes at (nearly) the speed of light. Most of the research described in the book was carried out by D'Eath and his students, but comprehensive references to other work are provided.

The book is written in a clear style, and I encountered no obvious errors or misstatements. Some general introductory material on black holes is provided, but in a form that is much too terse for a novice to follow. The organization of the book is generally good, although there is some noticeable repetition of material from chapter to chapter.

The calculations presented are quite complex—particularly in the chapters analyzing the high-speed collisions of black holes—and it would take enormous effort by the reader to work through the details of these calculations. Furthermore, the focus of the book is much more on results than on methods, so the reader who is interested in learning the methods in order to apply them to other problems will not have an easy time extracting the necessary information. Finally, near the end of the book, it is found that this method produces an unphysical answer for the mass of a black hole resulting from the collision of two black holes at the speed of light: This final mass is greater than the initial energy, thus contradicting conservation of energy. D'Eath believes that the explanation of this contradiction lies in the failure of a certain uniformity condition to hold, thus invalidating the calculation. However, this leaves the reader to wonder whether any of the other (physically reasonable) results presented earlier in the book might also be invalid, for similar reasons.

In summary, this book makes a useful contribution to the literature by presenting an impressive series of calculations and results relating to the motion of a black hole and the collision of two black holes. However, for the reasons given in the previous paragraph, interest in the book will probably be limited to a small number of specialists.

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New Books

Atomic and Molecular Physics

The Art of Molecular Dynamics Simulation. D. C. Rapaport. Cambridge U. P., New York, 1997. 400 pp. $39.95 *pb* ISBN 0-521-59942-3

Computational Atomic Structure: An MCHF Approach. C. F. Fischer, T. Brage, P. Jönsson. IOP, Philadelphia, 1997. 279 pp. $170.00 *hc* ($50.00 *pb*) ISBN 0-7503-0374-3 *hc* (0-7503-0466-9 *pb*)

Electron Spectrometry of Atoms using Synchrotron Radiation. *Cambridge Monographs on Atomic, Molecular and Chemical Physics 6.* V. Schmidt. Cambridge U. P., New York, 1997. 431 pp. $120.00 *hc* ISBN 0-521-55053-X

Particle Modeling. *Modeling and Simulation in Science, Engineering, & Technology.* D. Greenspan. Birkhäuser, Boston, 1997. 274 pp. $69.95 *hc* ISBN 0-8176-3985-3

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Ligand–Receptor Energetics: A Guide for the Perplexed. I. M. Klotz. Wiley, New York, 1997. 170 pp. $44.95 *pb* ISBN 0-471-17626-5

Chemical Physics

Advanced Molecular Dynamics and Chemical Kinetics. G. D. Billing, K. V. Mikkelsen. Wiley, New York, 1997. 288 pp. $54.95 *hc* ISBN 0-471-12740-X

Chemical Reactions and Their Control on the Femtosecond Time Scale, XXth Solvay Conference on Chemistry. *Advances in Chemical Physics 101.* P.