

time for the Einstein Observatory to one month, instead of the six months originally allotted, "Giacconi protested loudly." In one particular instance NASA, worried about the schedule, overruled the scientists and engineers by directing a contractor to stop polishing the mirror one day early. "This decision eventually caused a substantial loss of efficiency at high energies, where it was needed most because the mirrors naturally become less efficient at high energies." Perhaps worst of all, NASA disregarded Giacconi's argument that the satellite could be controlled with magnetic torquing instead of with booster jets that would be dependent on a finite supply of gas. NASA had its way, even though the extra cost would have been less than half a percent of the total cost of the mission, and providing computer management of the postlaunch to save gas was more expensive than a magnetic-torquing system would have been. The organization saved only in a bookkeeping sense, as it "did not object because the money came not from the hardware budget but from postlaunch operations funds," and so wound up diminishing money for data analysis. "This does not take into account the incalculable loss of scientific data due to the premature demise of the observatory," Giacconi and Tucker conclude.

The final part of the book is devoted to various aspects of science that were aided by or developed as a result of data gained with the Einstein Observatory and other x-ray satellites; these include studies of neutron stars, black holes, active galaxies, quasars and cosmology.

The *X-Ray Universe* is illustrated with occasional black-and-white photographs of scientists, rockets and data, and with five color photographs. The book contains a useful list of additional readings and a good index. It is a pleasure to see such a sturdy book with a sewn binding.

Every student of astronomy, on whatever level, should surely read this book. And all scientists would find it a fascinating survey of a new field, with important lessons to teach about the nature of science in general and big science as it is today. I hope that Giacconi can bring to the Hubble Space Telescope the same success that he brought to the Einstein Observatory, and that his jousting with bureaucracy works.

Computational Physics

Steven E. Koonin

403 pp. Benjamin/Cummings, Menlo Park, Calif., 1985. \$32.50

Computer software usually suffers from one of two defects: It is either too simple to do anything exciting or

too complex to do anything understandable. To solve the problem of complexity, software authors have tried to develop user-friendly presentations of the material or supplied manuals to explain what may not be user friendly. Both of these approaches often fail. The user-friendly presentation is seen as a block to actually running the software—it is a textual presentation in a computer environment. The manual is seen as subservient to the software and is ignored or lost—it is a textual presentation competing with a computer environment. In *Computational Physics*, a textbook with accompanying disk for IBM PCs and compatibles, Steven E. Koonin has solved these problems by turning the computer manual into a textbook that explains, chapter by chapter, both the physics and the algorithms behind some of the most impressive physics software I have ever seen. Unlike software manuals, Koonin's textbook concentrates on the theoretical aspects of each particular problem and includes the programs as part of the exercises and projects at the end of each chapter. This approach makes the text and software synergistic rather than competitive.

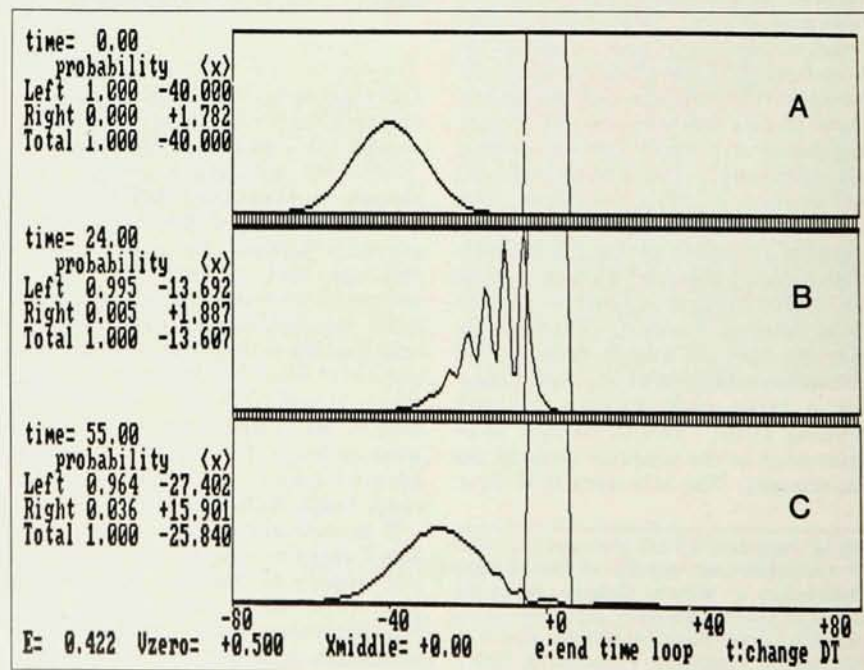
Computational Physics covers a variety of numerical techniques in areas such as differential equations, matrix operations, boundary-value problems and Monte Carlo methods. These numerical techniques are applied to an even wider variety of computa-

tional physics problems. Examples include using the fourth-order Runge-Kutta algorithm to determine the structure of white dwarf stars, applying Gauss-Seidel iteration to Laplace's equation in two dimensions, using the Numerov algorithm to find bound solutions to the Schrödinger equation and solving the hydrogen molecule with the path-integral Monte Carlo method. The book is also filled with helpful computer techniques, among them a method for generating normally distributed random values from uniformly distributed random values.

Unfortunately, because of the breadth of coverage, neither the numerical techniques nor the physics problems are presented with sufficient explanation or motivation for this book to stand alone as a text. It could be used in a computational-physics course following advanced undergraduate courses in quantum mechanics. It could also be used as supplementary material in other physics courses to demonstrate the application of computational techniques to their topics. The computer programs that accompany the text, used in conjunction with the text, would make excellent classroom demonstrations or computer laboratory "experiments" in a wide variety of courses.

Sixteen computer programs on the disk, written in BASIC, demonstrate the application of numerical techniques to physics problems. The appendix includes a listing of each program.

Gaussian wave packet with an energy of 0.422 units tunneling through a barrier with an energy of 0.500 units. The three graphs show the packet before, during and after making contact with the barrier. They were obtained with one of the programs included with *Computational Physics*, reviewed here.



Unification and Supersymmetry:

Frontiers of Quark-Lepton Physics

R. N. Mohapatra

This book deals with the latest theoretical advances in elementary particle physics via the concepts of unified gauge theories, supersymmetry, and supergravity.

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The programs run relatively slowly but usually give the numerical results together with a graphical presentation of the solution. The graphical presentations increase the user's appreciation of both the physics problems being solved and the power of the numerical techniques. It is difficult to express in words the drama of watching a wave packet tunnel through a barrier (even if it did take over three hours) or seeing a small perturbation change the energy levels of the symmetric wavefunctions in a square well.

The combination of text and software adds a new dimension to learning. Koonin has combined a series of fairly sophisticated physics problems with equally sophisticated computer programs to make *Computational Physics* fun—and it is not often that a book aimed at the advanced undergraduate can be called fun.

PETER B. KRAMER

Cambridge Research Laboratory

Fiber Optics: Technology and Applications

Steward D. Personick

251 pp. Plenum, New York, 1985. \$45.00

In *Fiber Optics: Technology and Applications*, Stewart Personick presents a very good overview on fiberoptic technology and communication systems. The book was written for a short course for people who want to get acquainted with this field. It is definitely not a book with in-depth information for researchers who are looking for answers to specific problems.

This book is composed of two parts: Part I provides a brief introduction to various components such as optical fibers, connectors, cables, light sources, detectors and receivers. Part II describes various concepts of fiber-optical systems, including telecommunication trunking, data links, local-area networks, telemetry, sensing systems and some broad-band networks.

Following a brief introductory remark, Personick discusses fiberoptic hardware in several chapters, starting with a qualitative description of fibers as optical waveguides and an introduction to techniques for drawing, cabling, splicing and connecting fibers. There follows a brief description of light sources—light-emitting diodes and laser diodes—and simple circuits commonly used for these sources. The book next covers the output characteristics of the two most common detectors—APD and p-i-n photodiodes—along with a reasonably comprehensive discussion of optical receiver design. Personick also describes a few basic fiberoptic components such as couplers, dividers, multiplexers and switches—with good illustrations for the configu-

rations of these components. After a short chapter pointing out some of the noise problems in optical-fiber communication systems, Personick describes a variety of fiberoptic telecommunications trunk systems that use the optical components introduced in the earlier chapters. Subsequent chapters deal with fiber data links between computer terminals; local-area networks (including several examples of LAN designs using various types of star couplers); analog signal links for video, telemetry, and if and rf systems (including a discussion of performance requirements for an ideal analog system); and broad-band networks such as CATV, video distribution networks and loop carrier systems. Personick then discusses a few fiber sensors and materials, merely scratching the surface of this group of devices; routine fiber-loss measurement techniques using both the transmission and reflection approaches; and the technique for measuring the fiber bandwidth. The last chapter gives a brief introduction to emerging technology involving integrated optoelectronics, ultra-high-speed switching and optical heterodyne techniques.

In summary, this book gives a very broad overview of the entire field. For those who want simply to get a taste of the subject, the book will serve very well. I am disappointed that it does not treat any of the above-mentioned topics in depth. A comprehensive textbook on fiberoptic telecommunication systems for systems engineers would be very much in demand, but this book does not fulfill that need.

P. K. CHEO

United Technologies Research Center
East Hartford, Connecticut

Foundations of Radiation Hydrodynamics

Dimitri Mihalas and Barbara Weibel Mihalas

718 pp. Oxford U.P., New York, 1984. \$75.00

That radiative transfer coupled with fluid flow is important in a variety of astrophysical phenomena—most notably, supernova explosions, accretion flows and bursts—is apparent even to those not directly involved in building theoretical models for these objects. Yet even among those who to some extent practice this allegedly arcane discipline to blow up, spin up, collapse or pulsate a star, there is some misunderstanding, or rather a lack of understanding, of how to incorporate radiative transport into a reasonably complete calculation.

This problem perhaps stems from poor communication between the radiative-transfer specialists, who devel-

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