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The Science and the Life of Albert Einstein
Abraham Pais

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Gravity, Black Holes and the Universe

I. Nicolson

264 pp. Halsted (Wiley), New York, 1981.
\$24.95

This book should be required reading for two audiences: undergraduates and specialists in general relativity. The remarkable feat of Iain Nicolson is to have provided at once both a very readable introductory account of gravitation and an up-to-date critical presentation of this esoteric field. I say this as a general relativist who despaired of finding a book for my "science for nonscientists" university courses. I have developed a fear of opening one more popular account of black holes, because of the inaccurate or superficial treatment that most books offer this complex subject.

I first expected Nicolson to fall into the "wormhole" syndrome. Most popular authors cannot resist telling the story of how space travelers will be able to rocket from one corner of the universe to the other, using the "maximal analytic extensions" (or Penrose-Carter diagrams) of black holes. That looked possible in 1968. However, a decade of work has shown such attempts at travel would destroy the unstable throat itself and crush the would-be explorers in a singularity. Nicolson points out this result: "It is sad in a way to lose so exciting a possibility as travel through black holes."

The other great failing of most books on relativity is their lack of up-to-date astrophysics, particularly observational. I believe many working relativists could benefit from the excellent overview of where we are looking for black holes today: binary x-ray sources, supernova remnants, the galactic center, and centers of radio galaxies and quasars. His diagrams and

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photographs are scientifically accurate and relevant.

Finally, I very much enjoyed the historical introduction to gravity. Having taught a course on the subject, I found his treatment very balanced and easy to read. I may use his book as a text for my undergraduate course on black holes.

Perhaps it is because Nicolson is not a working relativist that he has been able to give such a clear account. However, I am very impressed that an outsider would be aware of the subtleties in the field. For example, he has a very clear discussion of the fact that Seyferts (spiral radio galaxies) do not have double radio lobes, while elliptical radio galaxies do, which tells us that the gas content of galaxies (spirals have a lot, ellipticals very little) may be crucial in the formation of such lobes. This is an obvious point, but one that many researchers in the field would be hard pressed to put forth so succinctly.

My thanks to Nicolson. I took forward to his next book!

LARRY SMARR
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Science Observed: Essays Out of My Mind

J. Bernstein
Basic Books, New York, 1982. \$16.95

Physics—and science in general—is extraordinarily fortunate in having Jeremy Bernstein to interpret us to educated nonphysicists. I find great and continued pleasure in reading his clear and literate writing about us.

I have always felt that the profile by Jeremy Bernstein is the ultimate biography from the subject's point of view: respectful, clear, nearly impersonal. His wart-free portraits of the great scientists show them as they must wish to be seen. In this mixed collection of profiles, essays, capsule biographies and even a story, Bernstein takes several steps away from his too-generous portrayals and toward being a writer rather than an apologist: He reveals at least a few of his own emotions and his own "warts." There is, for instance, an account of Los Alamos of considerable power, especially in the description of his own immature attempt to dissuade Adlai Stevenson from supporting a test ban treaty; in another essay he discloses his own anger at a college president's stupidity at closing down a research reactor. The minor pieces are, in fact, unexpected and almost unalloyed sources of delight: the wonderfully accurate skewering of *The Tao of Physics* and its phony ilk, the revelation of what we all know about cranks but couldn't express as well, a concluding piece on artificial intelligence not

in the manner of Douglas Hofstadter but how he might have written with sufficient prodding and editing.

About half the book returns to Bernstein's more familiar turf, writing for *The New Yorker*: a long, expanded profile on Marvin Minsky introducing the artificial intelligence world; a shorter piece on Stanley Kubrick's 2001, and chess (the only "padding" in the book, I felt, was the extra bit here about covering Fischer-Spassky for *Playboy*); and a profile type of piece on Harold Furth and plasma physics. With Minsky, as with the pieces on J. Robert Oppenheimer, Erwin Schrödinger, and plasma physics, one is still left looking for the warts and the clay feet, aspects which some of Minsky's colleagues in the computer world would have happily supplied. Scientists do compete, backbite, carry on personal feuds, ride hobbyhorses, bluff, puff themselves up, make egregious mistakes in judgment: Why do we never hear of these things except 300 years later (or in the only honest book I know about science, the *Double Helix*)? In the case of Minsky, one is left with far too positive a view of the scientific field itself; the notable failures, as in speech recognition, pattern recognition, linguistics, the game of Go, not to mention the simple economic mess of software glut, are not visible. In the case of Oppenheimer, why were the "wonderfully productive" years 1930-1940 so devoid of major achievements? Why has his handpicked faculty at the Institute of Advanced Study been so surprisingly sterile in the actual event? In the case of fusion, several real problems are glossed over, one explicitly: It is not at all true that tritium is harmless; quite the opposite. There has to be—and there is in all of these cases—a different side which Bernstein in his enthusiasm seldom probes. For the good of the our public images let this be a best-seller! For the good of informing the public about what scientists do, let Bernstein take a few more critical steps.

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and Princeton University

Foundations of Optical Waveguides

G. H. Owyang
245 pp. Elsevier, New York, 1981. \$45.00

This book presents a treatise on the wave propagation in planar and cylindrical waveguides from the field point of view. Gilbert H. Owyang, a professor of electrical engineering at the Worcester Polytechnic Institute, points out in his preface, "this text is the result of notes developed for undergraduate and

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