**I. INTRODUCTION**

Civic scientific literacy, which can be defined roughly as the ability to read and understand the Tuesday science section of the *New York Times*, is estimated to be a little below 20% in the United States.¹ In comparison, conventional literacy hovers around 75%. Scholars of scientific literacy warn that this level—a mere fifth of the population—may be insufficient to sustain this century’s industrial production and to inform responsible, thoughtful consumption. It may not even be high enough to safeguard the effective exercise of democracy. Important public policy choices associated with emerging energy, information, and biological technologies make unprecedented demands upon scientific literacy. Remedy is possible by two routes. Pre-collegiate and college teachers must obviously bear the brunt of the effort, but informal science educators, including science writers, journalists, movie makers, and web masters must also do their part. This Resource Letter is intended as a helpful tool in the ongoing endeavor to relieve the public’s fear of physics by replacing it with an appreciation of the beauty and power of science, and ultimately with understanding.

There is a significant distinction between the intended audiences for the books listed in this bibliography, and for this Resource Letter itself. One consists of every imaginable reader: there is something for all ages and for all levels of expertise from the school child to the professional physicist. The other, by contrast, should include teachers planning popular readings as primary or secondary sources in a course, professional physicists who want a general overview of the field, and writers looking for suggestions. Primarily, though, this bibliography is intended as a handy checklist for readers of the *American Journal of Physics*. All of us are familiar with the experience of having a family member, a student, a neighbor, an acquaintance, or a guest at a party ask us to recommend a good book about relativity, or the Big Bang, or the interpretation of quantum mechanics. For those occasions it is convenient to have on hand a short, selective list of books that address the subject at the appropriate level.

The popular literature about physics-related subjects is vast and growing. For the sake of effectiveness we have purposely kept this list short, trusting that modern methods of electronic searching and data retrieval can cover a much broader area than any Resource Letter. Starting with well over two hundred titles that we are familiar with, or that were recommended by helpful colleagues who kindly responded to our call for suggestions,² we have pruned the list to about a hundred, using accuracy, timeliness, and writing style as selection criteria. We know that we have missed many good books, and that our selections necessarily reflect our personal tastes, but we are confident that those we have included represent a useful starting point. If one were to set out to build a library of popular physics books, one might well begin with this core selection. By the same token, all of us should make sure that the catalogues of our institutions and our public libraries include at least this list.

To stay within the bounds of a short checklist, we have restricted ourselves to books, thereby excluding journal articles, films, tapes, CDs, websites, and most textbooks. We include only a tiny, representative selection of biographies and histories, but no fiction, no plays, and no science fiction. Most of the books are about physics, but a few works are included from adjoining disciplines such as mathematics, astronomy, biophysics, geophysics, and oceanography. Originally we had intended to list only books in print, but since many readers have access to good libraries, and since the used and out-of-print book markets have recently become widely accessible on the internet, we decided to relax that

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¹Electronic mail: hcvonb@wm.edu

²DOI: 10.1119/1.1632494
criterion. For the purpose of electronic searching, we have accepted the recommendation of several of our correspondents to include ISBN numbers.

The ten books marked with an asterisk represent our personal list of favorites. Besides quality they have little in common. They have, each in its own way, struck a chord. Our most difficult chore has been the assignment of levels of difficulty: E for elementary, I for intermediate, and A for advanced. Although we tried to match them to the three levels of background education (primary school, high school, college), and to assign level A to those books that require the understanding of some mathematical equations, we must concede that our effort has not been very successful. All the books in this Resource Letter are intended for the general public, and all are accessible. Some require more intellectual effort than others, but that is true for any written document, accessible, non-mathematical panorama of the current state of physics. ISBN: 0674216458. (E)

II. THE NATURE OF PHYSICS

1. The Nature of the Physical World. A. S. Eddington (University of Michigan Press, Ann Arbor, MI, 1958). Based on the Gifford Lectures of 1927, this work is an assessment of the profound changes in scientific thought that resulted from the advent of relativity and quantum theory just a few years earlier. Though dated, the writing is inspired and completely non-mathematical. Still an important historical and scientific document. ISBN: 0472060155. (I)


3. It Must be Beautiful: Great Equations of Modern Science, edited by G. Farmelo (Granta, New York, 2002). An anthology of eleven essays (six from physics) by as many authors who unpack the meaning of the key equations of modern science, which are usually avoided in popularizations. ISBN: 1862075557. (I)

4. Thematic Origins of Scientific Thought: Kepler to Einstein, G. Holton (Harvard University Press, Cambridge, MA, 1988), revised ed. One of today’s most creative historians of science, an exquisitely fluid writer, points out the unheralded role of prejudices and unspoken assumptions, which he calls themata, as background for mathematical analyses, which he calls themata, as background for mathematical analysis and empirical observation. ISBN: 0674877489. (A)

5. Consilience: The Unity of Knowledge, E. O. Wilson (Vintage, New York, 1999). A modern-day Lucretius argues eloquently that all science is related and is ultimately reducible to the laws of physics. Consilience, the coming together of explanations from different disciplines, is a promising, newly identified theme (in the sense of Ref. 4) in understanding the nature of science. ISBN: 067976867X. (A)

6. Seeking Ultimates: An Intuitive Guide to Physics, P.T. Landsberg (Institute of Physics, Philadelphia, 2000). A wise, witty, and widely accessible, non-mathematical panorama of the current state of physics from quarks to quasars. Keeping the ultimate purpose of science in view, the author does not shy away from touching on questions beyond our reach, out to the limits of knowledge. ISBN: 0750306572. (I)

III. EVERYDAY PHYSICS


10. *The Flying Circus of Physics with Answers, J. Walker (John Wiley & Sons, Inc., Hoboken, NJ, 1977). Over 600 common observations of mundane mysteries in the physical world, phrased in the form of questions. These are by turns simple, strange, and startling: all are baffling. With the help of over 1600 references each puzzle is solved in a brief paragraph. A delight for everyone from six-year olds to Nobel laureates. ISBN: 047102984X. (E)


IV. WAVES AND ELECTROMAGNETISM


V. ATOMS AND NUCLEI


18. Taming the Atom: The Emergence of the Visible Microworld, H.C. von Baeyer (Dover Publications, Mineola, NY, 2000). The story of how new instruments have made atoms visible for the first time in their 2500 year history, without, however, making them any less mysterious. ISBN 0486414477. (E)


VI. QUANTUM PHYSICS

21. *Mr. Tompkins in Paperback, G. Gamow (Cambridge University Press, New York, 1993), 2nd ed., including Mr. Tompkins in Wonderland and Mr. Tompkins Explores the Atom. The fantastic adven-
22. Thirty Years That Shook Physics: The Story of Quantum Theory
G. Gamow (Dover Publications, Mineola, NY, 1985), reprinted. A lighthearted personal account of the development of the quantum theory, including both biography and physics, by one of its most colorful contributors. ISBN: 048624895X. (I)


24. In Search of Schrödinger’s Cat: Quantum Physics and Reality, J. Gribbin (New Age Books, New York, 1984). A clear explanation, by a prolific science writer, written at a time when fundamental thought experiments were just beginning to make their way into the laboratory. ISBN: 0553342533. (E)


27. QED: The Strange Theory of Light and Matter, R. P. Feynman (Princeton University Press, Princeton, NJ, 1989). In a triumph of reductionism, Feynman derives the observed properties of the world from one single axiom—a simple caricature of the rules of quantum mechanics. The exercise is intellectually challenging, but rewards the diligent reader with a deeper understanding of the mechanics, if not the meaning, of quantum theory. ISBN: 0691024170. (A)


29. Einstein’s Legacy, J. Schwinger (Dover Publications, Mineola, NY, 2002). A popularization by a great physicist who is almost unknown to the public. Characteristically, it is technically demanding, but Schwinger’s clarity of thought and economy of expression are unmatched. ISBN: 0486419746. (A)

30. *Black Holes and Time Warps: Einstein’s Outrageous Legacy, K. S. Thorne, with a foreword by S. W. Hawking and an introduction by S. W. Hawking (Bantam Books, New York, 1998). A charming, thorough, and carefully organized account by one of the world’s leading experts on black holes. Puts relativity and cosmology into their scientific and historical contexts, and spices them with personal anecdotes from a wide circle of colleagues. Can be read in parts or as a whole. Helpful editorial apparatus includes a glossary, a chronology, and a name index. ISBN: 0393312763. (I)


VIII. COSMOLOGY


35. A Brief History of Time: From the Big Bang to Black Holes, S. Hawking (Bantam Books, New York, 1988), 10th anniversary ed. Probably the only physics book ever mentioned in the Guinness Book of World Records. Covers a broad range of topics including elementary particles, the expansion of the universe, black holes, and the question for a unifying theory. Comprehensive to anyone with a high school science background, but not as well written as, for example, Refs. 30 and 33 with which it overlaps in subject matter. ISBN: 0553380168. (I)

36. The Universe in a Nutshell, S. Hawking (Bantam Books, New York, 2001). This sequel to Ref. 35 brings cosmology up to date in the form of a lavishly illustrated coffee table book with considerable visual appeal. ISBN: 055380202X. (E)


IX. RELATED SCIENCES


and engagingly written exposition of the conundrums of infinity by a mathematician. Includes a good discussion of Godel’s work. ISBN: 0691001723. (I)


49. *The Double Helix: A Personal Account of the Discovery of the Structure of DNA. J. D. Watson (Simon & Schuster, New York, 2001). An iconoclastic description of the people and events that contributed to the discovery of the structure of DNA. Details the role of physics (X-ray diffraction, the nature of the chemical bond) in one of the greatest advances in science. ISBN: 074321630X. (E)

XI. HISTORY

50. The Universe Next Door: The Making of Tomorrow’s Science, M. Chalmers (Oxford University Press, New York, 2002). A tour of the most outlandish speculations currently bubbling at the edges of conventional physics. A hundred years from now, most of these ideas will have been discarded—but which ones will survive? An antidote to the notion that physics is dead, but not recommended for the gullible. ISBN: 0195143825. (E)

51. *Chaos: Making a New Science, J. Gleick (Penguin Books, New York, 1988). After nearly a century of refuge in the neighboring pastures of pure mathematics, the computer-driven field of nonlinear dynamics (of which chaos is one chapter) has returned to play a permanent and dominant role in physics. Although he has been criticized for selective reporting, the author, a journalist, succeeds brilliantly in evoking the mounting excitement of physicists as they begin to appreciate the significance of this historic development. ISBN: 0140092501. (E)


59. The Physics of Star Trek, L. Krauss (HarperCollins, 1996). A clever account of what is, and what is not, possible according to our current understanding. This highly popular book helps to define the boundary between science and science fiction. ISBN: 0060977108 (E)

XII. BIOGRAPHY


 reference text is missing
combine biographical and scientific essays with photos and anecdotes in a balanced and informative way. ISBN: 0674624165. (I)


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**HOW VS. WHY**

. . . ‘Does it matter what happened precisely?’
‘Of course,’ Lower replied.
‘Why?’
‘Because it is always important to establish the truth.’
‘And you think that can be done, do you?’
‘Yes.’
Stahl snorted. ‘Then you are more optimistic than I am.’
‘What do you spend your time doing, then?’
‘I amuse my masters,’ he replied in a disagreeable tone. ‘They want to find out what happens if you mix verdigrice with oil of nitre, so I mix it for them. What happens if you heat it, so I heat it.’
‘And then try to work out why it happens.’
He waved his hand airily. ‘Pfaff. No. We try to work out how it happens. Not why.’
‘There is a difference?’
‘Of course. A dangerous difference. The gap between how and why troubles me greatly, as it should you. It is the difference that will bring the world down on our heads.’

Submitted by Alan DeWeerd.