

# **Constructing a Comprehensive Bibliography of Physics Popularizations**

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by

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## **Abstract**

Following the receipt of dozens of recommendations within the physics community, a database containing more than 200 books was created for use in constructing a bibliography of the best physics popularizations. To determine the potential value of each book to this bibliography, nearly all were acquired, read at least in part, and assessed according to their content and readability. After thoroughly investigating these titles, approximately 100 books were selected for inclusion in the bibliography. This list of popular physics books was organized in a comprehensive manner to maximize its usefulness as a resource to students and educators. Titles were arranged by topic and are currently being evaluated by level of difficulty. The final bibliography will be published in the *American Journal of Physics Resource Letters*.

## **Introduction**

Nearly every academic discipline utilizes popularizations to educate the public and attract a general audience to its field. Popularizations are especially important in scientific fields for which the public expresses a general lack of interest or confusion. For many who have never studied it, or studied it only briefly, physics can be an intimidating subject. Individuals are often frightened or turned off by mathematical physics, especially if they never excelled in math in school. However, if physics is presented in an approachable and nonmathematical manner, many of these same people might find it highly interesting. Such topics as relativity, quantum mechanics, or cosmic expansion are universally fascinating and would surely intrigue many new readers if presented in an understandable way.

As part of an effort to help physics writing reach a wider audience, we have developed a bibliography of the best books featuring physics popularization. This bibliography is comprised of our recommendations to introduce non-scientists, of all ages and educational backgrounds, to physics topics. This bibliography should serve as a valuable resource to educators and to others who wish to learn more about physics, and will eventually appear in the *American Journal of Physics Resource Letters*.

## **Methods**

Since no established methods exist for constructing such a bibliography, we have developed our own approach for collecting and organizing this list of physics titles. We began by soliciting recommendations from the physics community. A brief letter was posted in the *American Journal of Physics* asking readers to write or email the titles of what they considered the best physics popularizations. Dozens of responses were

received and a list of over two hundred titles was compiled from these letters. An additional fifty titles were added to this list as we further investigated available physics popularizations. The titles and their bibliographical information were entered into “EndNote,” a software program designed to store and organize such information. We tried to note how often and how strongly the books were recommended and then began sifting through the books ourselves to formulate our own opinions about how well they suited our bibliography. Time constraints do not allow us to read all of these books in their entirety. However, all that made the final list have been at least skimmed or read briefly to obtain a sense of the clarity, purpose, and style of the book.

In collecting and narrowing down our list of titles, we had to come to a conclusion about what characterizes a good popularization. For us, a good popularization has to be understandable and enjoyable to a general audience. For instance, books that contain any kind of higher math were quickly eliminated. Although there are certain general relationships that are fundamental to the understanding of physics, we have chosen to select books that take a nonmathematical approach to explaining physics, thereby not alienating the non-scientists who make up a large part of the reader base. Therefore, no books will appear in the finalized bibliography which contain expressions like:

$$\langle p \rangle = m \frac{dx}{dt} = -i\hbar \int \left( \Psi^* \frac{\partial \Psi}{\partial x} \right) dx.$$

Such an equation is understandable only to individuals who are familiar with calculus and elementary quantum mechanics. Since our goal is to find books that appeal to a more universal audience, such a book would be most inappropriate for our bibliography.

Furthermore, it is not enough for popularizations to be simple and nonmathematical; they must also be interesting and readable. If the book is not well

written and engaging, it will not effectively reach its audience or help them more greatly appreciate physics. Therefore, when reading or skimming recommended popular books, we looked for those that have a dynamic and smooth writing style. A good popularization must also be readily accessible. Therefore, very few books that are out-of-print will appear in our bibliography. There are a few out-of-print titles, however, which are so well respected and elegantly written that an interested reader will find them worth tracking down at a library or elsewhere.

Since the classification and enumeration of the best popular physics books is a formidable task to begin with, we had to impose certain limits on the scope of this project. For the most part, we have chosen to include only those books that pertain directly to physics, excluding popularizations that relate more closely to other scientific fields. However, due to the growing importance of interdisciplinary science, we have included one grouping of books which specifically address the interfaces between physics and complimentary sciences. Furthermore, although there are certainly valuable physics resources available online and as audio and video recordings, we have limited this bibliography to books only. We hope that someone else will eventually provide a comprehensive investigation of educational physics websites and other media; however, books provide a large enough task for us for the present.

### **Bibliographic Organization**

Once effective titles were identified, in order to produce a useful bibliography, a comprehensive sense of organization had to be established. Our bibliography represents a wide variety of books, written in highly different styles and covering large or small amounts of diverse topics in physics. Some follow traditional approaches to the study of

physics, providing instruction on such topics as special relativity or quantum mechanics. Others represent a more humanist appreciation of physics, detailing pivotal periods in physics history and including biographies of some of the most influential physicists of all time. One of the great challenges of this project was to develop a logical and relevant method of organizing such diverse works. The following table defines the organizational categories we have created for this project:

The Nature of Physics	These books attempt to define the character of science and scientific inquiry; they also explore the human understanding of scientific discovery.
Everyday Physics	This category addresses the observations, devices, and experiments accessible through everyday physics.
Light, Optics, and Electromagnetism	These books discuss the physics of light, natural phenomena, and human perception.
Atomic and Nuclear Physics	These books approach physics on the atomic and nuclear scale.
Quantum Physics	These books, which range in difficulty from highly sophisticated to childlike, present diverse approaches to understanding the fundamentals of quantum theory.
Relativity	These books offer explanations of special and/or general relativity theories.
Cosmology	These books discuss topics related to the origin, structure, and space-time relationship of the universe.
Related Sciences	This category includes books which focus primarily on other sciences, including biology, chemistry, astronomy, and math. Yet, many of the topics discussed rely greatly on the understanding and application of physical concepts.
Future Directions in Physics	These books address recently developed or fast-moving areas of physics as well as speculations on the future directions of physics research.
History	This category includes books which discuss some of the significant people and events which shaped physics history.
Biography	These books highlight the life and works of several influential physicists.
In Their Own Words	All of the books in this category were written by some of the great twentieth century physicists to a popular audience.
Essay Collections	These books represent eclectic collections of essays including physics-inspired reflections on life and nature.
Religion and Philosophy	The books in this category discuss some philosophical implications of physical theory and present some personal religious and spiritual approaches to science.

Good Words	This category represents the most diverse and unique collection of physics books, including illustrated physics books, collections of physics-inspired poetry, and discussions of the philosophical and religious implications of physics.
Anthologies	This category includes collections of select writings on physics and physicists.
Coffee Table Books	Although this category title may sound flippant, it describes those books whose educational value stems in part from visual appeal. These books utilize interesting and beautiful pictures to illustrate the topics discussed.

Additionally, we feel it is important to group the books by level of difficulty as well as by subject matter. Although we have not yet done so, before this bibliography is published in its final form, we anticipate also adding the following designations of difficulty: elementary, intermediate, and advanced. Those titles designated as ‘elementary’ we believe can be appreciated by the general public. Titles designated as ‘intermediate’ we consider appropriate for persons who have had at least some high school science. Finally, titles receiving the designation of ‘advanced’ are meant for individuals who have taken some college level science courses.

To further distinguish individual titles in this paper, a star ( $\phi$ ) precedes the bibliographic information for a select few books. These are our selections as the best available popular physics books. These books cover various different physics topics, written in different styles; however, they all share a certain clarity and creativity.

### **Conclusions**

From the initially compiled list of more than two hundred books, approximately one hundred titles have been selected and organized by subject. A full list of these titles can be found in the Appendix. Currently, we are working to assign a difficulty rating (i.e. elementary, intermediate, advanced) and compose a brief discussion of each book’s

particular attributes and merits to accompany its bibliographic information. Since this bibliography is intended to be a resource to educators and others, it is important that adequate information regarding each book's unique qualities is presented in an understandable way. If the bibliography is to be an effective educational tool, it must provide not only accurate bibliographic information but also informative observations and analysis to help students and educators select the best potential books for their needs.

The widespread availability of good physics popularizations serves a number of purposes. As more individuals learn to understand everyday science, the public may come to more greatly understand physics research initiatives, perhaps even increasing public support for federal funding of science research. However, personal enrichment is the chief aim of physics popularization. Popularizations help share the wonder of physics with a greater community of inquisitive readers, helping them discover the beauty of the physical world.



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