Physics, the Human Adventure: From Copernicus to Einstein and Beyond FREE

James Evans

Physics Today **54** (10), 69 (2001);
https://doi.org/10.1063/1.1420555

Holton and Brush: A Classic Revived and Enriched

Physics, the Human Adventure: From Copernicus to Einstein and Beyond

Gerald Holton
and Stephen G. Brush
Rutgers U. P., New Brunswick, N.J., 2001. $75.00, $39.00 paper (582 pp.). ISBN 0-8135-2907-7, ISBN 0-8135-2908-5 paper

Reviewed by James Evans

Gerald Holton and Stephen G. Brush's *Physics, the Human Adventure* is a book with a long history. In 1952, Holton published his groundbreaking *Introduction to Concepts and Theories in Physical Science* (Addison–Wesley). He identified his project with the aims enunciated in a Harvard University committee report, *General Education in a Free Society* (Harvard U. Press, 1945). Holton's goal was to make science a vital part of a liberal education curriculum. His text taught plenty of physics, of course; but it also aspired to examine the nature of the scientific enterprise itself, to recount its historical development, and to introduce students to its great literature. Holton's was one of the first among a substantial number of innovative physics textbooks published in the 1950s and 1960s. It helped awaken the American physics community to new possibilities in the teaching of nonscience majors. In 1973, Stephen G. Brush produced a substantially revised second edition, incorporating a good deal of new material.

Although the 1952 edition opened a new road, it was in many ways only a "humanized" physics textbook. It began, traditionally, with chapters on one-dimensional kinematics and projectile motion before proceeding to Newton's laws. Topics treated early in the book included coefficients of friction and Atwood's machine. The text was leavened with plenty of history and philosophy of science, but the problems at the end of each chapter were mostly of the usual kind. The second edition represented a sharper turn in the new direction. The book began, more compellingly, with the big story of a new cosmology (Ptolemy, Copernicus, Kepler) to motivate a new physics (Galileo and Newton). The old book had ended with the Bohr atom. Brush attempted to extend the story to quantum mechanics and special relativity (though the relativity chapter was too heavily studded with equations to be accessible to its audience).

Physics, the Human Adventure is essentially a third edition of *Introduction to Concepts and Theories in Physical Science*. The treatment of historical and philosophical issues has grown in sophistication, reflecting both authors' maturation as historians of physics. The routine problem-solving, reduced in the Brush edition, has continued to diminish—although plenty remains. The chapter on relativity has been extended and improved. New material reflects Brush's recent work on the history of theories of the origins of the solar system. The penultimate chapter treats the expansion of the universe and the standard cosmology of the late 20th century, so that the book now opens and closes with a grand cosmological question. The final chapter, on "thematic elements and styles in science," reflects Holton's work and is a suitably general and engaging subject with which to end.

According to the authors' introduction, all chapters of the second edition have been reworked. However, comparison of the two versions shows that much of the 1972 edition has been only lightly retouched. For example, the same erroneous diagram of the Ptolemaic system appears in all three editions. The figure correctly shows the centers of the epicycles of Venus and Mercury on the line connecting Earth with the Sun, but it fails to show the radii of the epicycles of the outer planets parallel (as they must be) to this same line. Moreover, the text asserts that it was "curious" that the positions of the inferior planets were linked to that of the Sun, while the other planets "seemed to move more freely." In fact, Ptolemy mentions explicitly that, for each planet, one motion is constrained by that of the Sun and the other is free. And it was the motion of the outer planets on their epicycles in lockstep with the Sun that provided Copernicus one of his best clues. So, in fact, this edition differs from the second mainly in the new material. As before, the two grand themes are dynamics and the atom.

Who might profitably use such a book? I think it is fair to say that this remains a challenging book. The discourse is dignified, the historical and philosophical issues are serious, and the student's intellect is respected. Many of the end-of-chapter problems are so broadly framed that they might serve better as topics for class discussion than as homework assignments. It must also be said that the writing is sometimes cumbersome. This is may be too demanding a book for a general liberal-arts course at a typical American university. But it might work well in a self-selected student group—in a liberal-arts honors program, for example. The authors also suggest the book for collateral reading in a physics majors' course. Physics and engineering majors certainly would benefit, but success would require that the teacher commit perhaps one a day week to the broader conceptual and historical issues.

In spite of its imperfections, this book, in its three editions spanning half a century, is one of the great textbooks of our time. Though it is certainly not for everyone, it offers a compelling account of the development of the modern world view and a richly rewarding look at the place of physics in the Western intellectual tradition. It is a grand thing to have the new edition available.

JAMES EVANS *is a physicist and a historian of science at the University of Puget Sound, Tacoma, Washington; he has written extensively on ancient Greek astronomy and early modern physics.*

The Origin and Evolution of Planetary Nebulae

Sun Kwok
Cambridge U. Press, New York, 2000. $69.95 (243 pp.). ISBN 0-521-62313-8

The intricate morphologies and striking symmetries of the so-called planetary nebulae—rings, helixes, and butterflies—have long made them favorites of amateur and professional astronomers alike. Their popular appeal continues to the present: The