The Physics Teacher

Physics for Realists: Mechanics — Modern Physics with a Common Sense Grounding: Anthony Rizzi

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The Science Before Science: A Guide to Thinking in the 21st Century, by Anthony Rizzi and published by Institute for Advanced Physics Press (IAPpress@iapweb.org), Baton Rouge, LA (2004), xx+390 pp. $19.95 paperback. ISBN 1-4184-6504-6

This is not an easy book to read. It is one of those that requires about three readings (Dirac's *The Principles of Quantum Mechanics* comes to mind). Because the language may be unfamiliar to anyone who has not taken a first course in philosophy, I suggest that you read the glossary first. For example, one has to know that empiriometric science is the primary mode of operation of modern physics. It is the mixed science that is formally mathematical and materially physical. It takes as its mode of explanation the mathematical, but it is trying to explain the physical. Then there are "beings of reason," i.e., those objects of thought that can only exist in the world of the mind, not in the world outside of the mind. It does not take a large new vocabulary and, at the same time, it is enough to make clear errors made by many famous physicists who failed to appreciate subtle points in their thinking. One is reminded of Mortimer J. Adler's *Ten Philosophical Mistakes: Basic Errors in Modern Thought – How They Came about, Their Consequences, and How to Avoid Them*, which is much simpler to read but without the solid connection to physics.

Philosophy is the "science before science," but the author means more than just coming earlier in time. He sees that it also comes before in the sense that a cause precedes its effect.

Many years ago I was chairman of the Two-Year College Committee of the AAPT. At the time we were working on what became the first printing of the "Guidelines for Two-Year College Physics Programs." One point at issue was whether or not there should be a suggested course outline for the algebra/trigonometry-based physics course included in the guidelines. Such an outline would have been helpful to high school teachers teaching college physics and universities teaching a similar course. I submitted my course outline of many years and immediately it was attacked for including Kepler's Three Laws. For some reason it is uniformly thought that modern physics began with Galileo, and that shows in our textbooks. I argue that Kepler was a true modern scientist; he proposed beautiful theories, but as contrary evidence accumulated he rejected his theories in favor of the evidence.

Ralph McInerny in the foreword describes the author as "a physicist who asks fundamental questions about his discipline." And later he makes the author's point that "[o]ur senses grasp real things and the ideas they give rise to bear on the natures of those sensed things." He continues, "This book aims to place modern science in the wider context of human knowledge." Aristotelian physics is still with us for very good reasons.

The preface and "A Note for My Scientific Colleagues" lay out the pattern of the text by describing the aim of each chapter, warning that each chapter builds on the previous chapter and pointing out that the topics are revisited throughout in a spiral approach in an effort to develop the foundation of science in a logical manner.

The 10 chapters are, in order: Science Without Wisdom; A False Sense of Certitude; First Things First; What is Truth?; On Animals, Men and Robots; Galileo Versus St. Thomas?; From the Big Bang and Time Travel to Evolution; The God Chapter; A Mathematical Morality; and How Then Should We Do Science? There are 631 footnotes, seven and a half pages of "Books of Interest," a glossary, an index, and a short note on the author.

The author argues that one must go much farther back than Kepler and Galileo to find the roots of contemporary science. Many of the scientists mentioned you will be familiar with, and others, very important ones, may surprise you. The discussion makes clear that the history and philosophy that most of us grew up with was extremely biased, leading to errors that the author clears up.

The first three chapters are fairly easy reading, emphasizing the primary role of the senses, introducing some to the language of Aristotle and Aquinas, and pointing out the importance of early philosophers along with their errors. Perhaps an important point to realize is that little errors, if not caught early, can lead to big errors. It is interesting

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to note, as the author points out throughout the book, that old wrong ideas keep resurfacing.

Chapter 4 starts a long-ranging discussion of Gödel's theorem. Coupling this discussion with a similar one later on Bell's theorem, beginning in Chapter 6, makes the importance and limitations of these theorems clear for the modern scientist. Chapter 5 answers some touchy questions on where animals and robots fall in the order of "creation." I think that Chapters 6 and 7 will get the most attention from physics teachers unless the Physics Education Researchers (PER) see Chapter 10 as food for thought.

Chapters 8 and 9 will attract atheists, agnostics, and believers with some old arguments in new contexts.

The author hopes that the reader will gain a fundamental understanding on the first read and deepen that understanding on the second. Most of all, I believe that he wants us all to love (filia) wisdom (sophia). I strongly recommend this book. There are few others in the same vein (notably by Mario Bunge), but none so appealing.

Physics for Realists: Mechanics – Modern Physics with a Common Sense Grounding, by Anthony Rizzi and published by Institute for Advanced Physics Press IAPpress@iapweb.org, Baton Rouge, LA (2008), v+554 pp. $95.00 hardback. ISBN 978-0-9816470-0-5

Normally we would not review a first-year college calculus text unless it is an after use in class review or it presents a significantly different approach than others. This text certainly meets the latter criterion. The author builds on his *The Science Before Science: A Guide to Thinking in the 21st Century* to present a text that covers Newtonian mechanics from a point of view that keeps contact with one's pre-scientific experience. I have not studied physics from this perspective in over 50 years. One of my texts at the time was *Cosmology: Elements of a Critique of the Sciences* by Renoirte & Coffey. Both were philosophers (the course was Philosophy 8) who obviously knew some physics, while the book under review is written by a physicist who obviously knows some philosophy.

The preface describes five major ways that the text sets itself apart: Contains a common sense starting point, presents a unifying practical theme in addition to a theoretical theme (Chapter IX describes how to make a manned trip to Mars), presents history that underscores the continuity of physics over the centuries, presents special relativity (Chapter X) starting from common sense and utilizing textual material to that point, and provides a free download of Interactive Physics™ containing text-specific files for a virtual experimental laboratory. The discussion of special relativity completes the sense in which this text is a book of the study of impetus (momentum). (Note: The units of momentum are buridans, or B, for reasons which will be obvious from the text.)

The author is obviously philosophically a realist rather than an idealist and believes that physics is fundamental and should be studied prior to chemistry and biology.

The author's answer to "What is Physics?" in the first chapter is similar to what you might expect, but at the same time there will be elements that are radically different from what you might expect. It is, however, an excellent introduction to the author's approach that you might find yourself going back to, along with Appendices I and II, frequently.

The remaining chapter titles are what you might expect: Vectors and Calculus; Momentum; Changing Momentum: Force, Energy and Work; Harmonic Oscillators; Angular Momentum; and Gravity. While to some extent the content is also not surprising, it is surely done differently. It is as if the author had real trouble with his first introduction to physics and could not skip a topic until he felt that he really understood it. I do not operate that way, but my wife does. Rizzi has done an excellent job and I highly recommend that you experience this text, but note that calculus is a prerequisite.

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MicroReview from the Book Review Editor

• ***Talking Nano: DVD Video Set,*** by Tim Miller, Don Eigler, Eric Mazur, David Rejeski, George Whitesides, and the Amazing Nano Brothers, Dan & Joel, and filmed at and produced by the Museum of Science in Boston, 6 DVDs (2009), $34.99 packaged.

These excellent DVDs are from 20 to 55 minutes and are aimed at a broad audience including very young children: "The Amazing Nano Brothers Juggling Show" should be shown before Tim Miller's brief introduction of Richard Feynman's 1959 vision, leading to Moving Atoms (Eigler), Guiding Light (Mazur), Consumer Products, and a personal perspective on nanotechnology (Whitesides).

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