

The Principia: Mathematical Principles of Natural Philosophy

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Isaac Newton; Alan E. Shapiro



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BOOKS

At Last! A New Translation of Newton's *Principia*

The *Principia*: Mathematical Principles of Natural Philosophy

▶ Isaac Newton
Translated by I. Bernard Cohen and Anne Whitman, with the assistance of Julia Budenz
Preceded by "A Guide to Newton's *Principia*" by I. Bernard Cohen
U. Calif. P., Berkeley, Calif., 1999.
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Reviewed by Alan E. Shapiro

Virtually everyone who has read Newton's *Principia* in English has read it in the translation by Andrew Motte as revised by Florian Cajori. The Motte-Cajori edition was published by the University of California Press in 1934 and has long been available in paperback. Motte's standard English translation from the Latin appeared in 1729, two years after Newton's death, and by 1934 it was certainly archaic and in need of replacement. For many years, scholars have recognized that Cajori's revision of Motte's translation was inadequate: It was awkward, often inaccurate, and it was based on the second and not the final (third) edition of the *Principia*. I. Bernard Cohen and Anne Whitman have presented us with an entirely new English translation of the *Principia* based, as Newton intended, on his final Latin edition.

The burden of translating the *Principia* into English is akin to undertaking a new translation of the *Bible*. The *Principia* is deservedly one of the most revered scientific works of all time, and people have become accustomed to the old version (although it must be granted that the Motte-Cajori is no King James version). Cohen and Whitman (who died in 1984, after the translation was completed) met the challenge and have produced an excellent, modern translation that is more accurate and easier to read than the Motte-Cajori version.

Some changes of famous passages

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will no doubt be disturbing to some readers. Newton's first law of motion now reads, according to Cohen and Whitman, "Every body perseveres in its state of being at rest or of moving uniformly straight forward, except insofar as it is compelled to change its state by forces impressed." Compare this with the long-familiar Motte-Cajori version: "Every body continues in its state of rest, or of uniform motion in a right line, unless it is compelled to change that state by forces impressed upon it." I have no trouble with the change from "continues" to "perseveres"—indeed I approve of it—but "straight forward" for "in a right line" is less satisfying. I would have preferred "in a straight line," but this is a matter of judgment and taste in translation of the sort that can never be fully resolved. Most likely, I will gradually get used to the new version. In the delicate balance between a freer, more readable translation and a more literal one, Cohen and Whitman have generally chosen the latter. I lean toward the former. (One feature that I found lacking is an index that goes beyond the index of names of people cited in the *Principia* itself; there are detailed tables of contents to the *Guide* and the *Principia*, but these are no substitute for a real index in such a densely packed book.)

Having a more reliable and readable translation than Motte-Cajori does not in fact make the *Principia* all that much easier to handle. It was a difficult book when it was first published in 1687, when all scholars were fluent in Latin, and it is still difficult, because of its sophisticated content, Newton's methods, and his style of mathematical exposition. Cohen recognized this problem and has added an introduction that is really another book: "A Guide to Newton's *Principia*."

The Guide is not simply a guide to reading the *Principia*, but is a veritable cornucopia of topics related to that work, such as issues of translation, historical background, conceptual analyses, mathematical methods, and units used. As we would expect of the doyen of Newton scholars, Cohen's judgments and analyses are up to date, fascinating, and useful. Historians rarely deal with the calculations and numerical results in the *Principia*, but Cohen's treatment of these

is a welcome and illuminating feature of his Guide.

The heart of the Guide is three chapters devoted to the "structure" of the book—essentially a section-by-section commentary—plus another chapter on "How to Read the *Principia*," which parallels the chapters on the structure but gives step-by-step reconstructions of various key propositions. Those who want to read the *Principia* and work through Newton's proofs will need more guidance than Cohen provides here, and Cohen recognizes this. He includes a generous discussion of other commentaries and guides to the *Principia*, with his recommendations to the reader.

Cohen and Whitman's translation deserves to become the new standard, and the University of California Press has complemented it by producing a handsome volume. With this fine translation and the many other commentaries and guides that have been published recently, it is now much easier for serious readers to discover that magisterial work for themselves.

Cosmology and Particle Astrophysics

▶ Lars Bergström and Ariel Goobar
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Physics students find it particularly rewarding when they can reach beyond the routine of "physics education" and get a taste of cutting-edge research. Thus, advanced specialized courses are often our best opportunity to energize our students (both graduate and undergraduate) and motivate them to embrace the challenges we set before them. This is especially so in cosmology, where rapid advances in both theory and experiment are causing many to regard these times as a golden age of cosmology.

Cosmology and Particle Astrophysics by Lars Bergström and Ariel Goobar is intended to support such courses. Targeting their book at advanced undergraduates and beginning graduate students, the authors have correctly identified a gap in the textbook literature. No other text at this level emphasizes the numerous