description of the various ϵ-expansion techniques. Topics such as magnetoelastic and gauge-field couplings, finite size and surface effects and treatment of random systems are also discussed, in addition to the more standard crossover problems such as quadratic and quartic symmetry breaking, long-range and dipolar forces. A brief discussion of multicritical points, marginality in two-dimensional models and the Kondo effect is also presented.

Thus the book, intended for the first-year graduate or advanced undergraduate, does an excellent job in providing a broad overview of the central ideas and applications of the renormalization group.

Brevity, however, is also a disadvantage. Of the currently used techniques, only those based on ϵ or $1/n$ expansions are discussed (position-space renormalization-group methods are mentioned only in the context of the one-dimensional Ising model in an appendix). The book is far from being self-contained; it does not teach any calculational techniques (even the $0(\epsilon)$ recursion relations are presented without derivation). What I find a more serious deficiency of some chapters is the lack of extensive references for the interested reader to follow up; for instance, a three-page introduction to the Callan–Symanzik equations does not contain a single reference. I also could not find any reference to an experimental review article, nor an original experimental figure, even in cases where it would seem most appropriate (such as scaling functions and data collapsing). The present volume is an essentially unrevised translation of the original 1975 French edition; a radical updating of the references would have definitely eliminated most of these shortcomings.

Nevertheless, this is a very well written and organized book, which I would highly recommend as collateral reading for a graduate course on the renormalization group and critical phenomena. The curious science graduate student (or advanced undergraduate) who wishes to gain an understanding and taste the flavor of renormalization-group ideas will certainly find it enjoyable and rewarding. Also, the advanced graduate student, who has already mastered some renormalization group techniques, will gain a broad outlook and many new areas of application.

G. Barton should be commended for an outstanding translation, which may enrich the English vocabulary of American students; for instance, who would know that the domain of attraction of a fixed point may be called its "catchment area"?

As a final remark, I cannot resist the urge to address the issue of the outrageous prices physics students are forced to pay for *any* textbook. One can only hope that the increasing availability of copying machines will eventually force the publishing companies to devote some thought to this matter.

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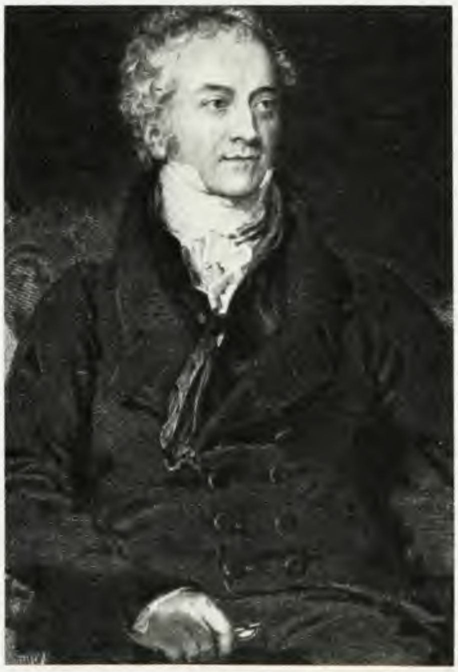
The Development of Newtonian Optics in England

H. Steffens
190 pp. Science History (Neale Watson), New York, 1977. $12.00

Historical research on Isaac Newton, his work and his influence has flourished in the last three decades. The current volume is one of ten Newtoniana book publications issued just by this publishing house alone, a record that measures the real service this firm is rendering to scholars.

Henry John Steffens's book began as an MA thesis while he was a student at Cornell about a dozen years ago, and it combines some of the best of the "old" and the "new" styles of historical scholarship. That is, he presents the history of Newtonian optics in England (and Scotland) as "a continuous development" with extensive quotations from the primary, contemporary publications, thereby emphasizing the conceptual growth of science. But he also is interested in the substantial differences between Newton and "Newtonians" who followed him, thereby aiming to show "in detail the fallacy of believing that Newton's science, or anyone else's, is objective, free from metaphysical assumptions, and exclusively empirical." It is a case study stretching over two centuries, from Newton's teachers to David Brewster, who in the 1830's was the last major holdout in favor of a Newtonian optics steadfastly committed to forces and particles rather than ether and waves.



THOMAS YOUNG, 1773–1829

The account of the rise and fall of the Newtonian theory of light in its constantly changing forms proceeds in three main stages. First, of course is Newton's own theory, treating a group of problems that went far beyond the more widely known of his experiments. It includes Newton's speculations on the forces operative in the interaction of light and matter, his views of the degree to which studies in science touch on the nature of the Deity and his conceptions of the power and limits of the scientific method itself. Ironically, the large influence of Newton's *Optics* was in good part due to the fact that it could be read primarily as a descriptive and experimental work; like most scientific treatises with pedagogic intent, the more problematical and philosophical aspects were kept rather in the background. That made it that much easier for the more enthusiastic and less profound followers of Newton to use Newton's *Opticks* and build on it their patchwork "Newtonian" optics. While outwardly more modern and positivistic, inside this new construction there resided quietly "a whole corpus of metaphysical assumptions [concerning forces, action at a distance, corpuscularity of light, etc.], unattended and largely unquestioned." Steffens is particularly good and novel in his discussion of Robert Smith's *Compleat System of Opticks* of 1738, the influential text that amalgamated portions of Newton's *Principia* and *Opticks* to produce a corporal theory of light lacking all of Newton's subtleties and hesitancies.

The maturing of the theory of light in eighteenth-century Britain is the subject of the middle portion of Steffens's book. Toward the middle of the century, the ether had become again a proper topic for speculation, and thus there occurred increasingly a bifurcation of the theory of optics into a primarily corpuscularian school and a smaller, primarily etherial school. With the figure of Newton towering over all scientific discussion, both schools were careful to trace at least some of their ancestry to Newton's own writings, even though in thematic terms they were fundamentally opposed to each other. The cast of characters includes Leonhard Euler, John Dolland, Joseph Priestley, Henry Pemberton, Henry Cavendish, Roger Joseph Boscovich, William Herschel, John Robinson and Henry Brougham. Their arguments and some of their experiments are concisely described, particularly those of the last two mentioned, two corpuscularians whose vigorous and sometimes almost reverential espousal of what they took to be the correct Newtonian view caused them to play a major role in the life and work of Thomas Young.

To Young, the third and perhaps most interesting part of Steffens's book is dedicated. I believe he has indeed been for too long a neglected figure in the history of science. This is the more curious as Young is a person with an extraordinarly interesting mind—a linguist, medical doctor, discoverer of the modern view of superposition and interference in acoustics and optics, shaper of the undulatory system of optics for which he endured much abuse from the more orthodox and less cosmopolitan Newtonians, and indeed one of the encyclopaedic nineteenth-century scientists. These are not at all separate characteristics, but can be shown to have grown organically out of his synthesizing approach to the study of nature.

I cannot resist mentioning an example of Young's powerful physical intuition. We now think of the color of thin plates and of Newton's rings as obvious examples of interference demonstrating the wave nature of light. But these phenomena were interpreted quite differently before Young, involving Newton's rather puzzling mechanism of corpuscles of light being directed in accordance with fits of transmission and reflections set up in the medium through which light was propagating. Young came to understand Newton's rings quite differently, and indeed before making any new experiments on light. As a medical student he had become interested in the anatomical and physical aspects of the role of the larynx in producing human speech. This led on the one hand to his later work in languages and linguistics (he was one of the interpreters of the inscriptions of the Rosetta stone) and on the other hand to experiments on organ pipes. Using the established undulatory theory of sound and his own notion of interference, he explained sound made by organ pipes in terms of overtones and the length of the pipe. In one of his early papers (1800) at the age of 27, he notes rather casually what led him to think also of *light* as a wave phenomenon—essentially an acoustic wave in the luminiferous ether: the view that "the colours of light consist in the different frequency of the vibrations of the luminous ether . . . is strongly confirmed by the analogy between the colours of a thin plate and the sounds of a series of organ pipes."

What a lovely insight, that wave propagation and the mathematics of interference phenomena are at work in both cases! However, despite his excellent continuing work, Young had to wait another two decades before he ceased being regarded chiefly as an embarrassment or threat to the reigning Newtonian tradition. Even long after his death in 1829, when Young's Miscellaneous Works were issued in 1855, the editor of the volume, George Peacock, though a scientist generally favorable to Young's ideas, found it necessary to make one of his rare interventions at the very point cited above. Where Young had made the perceptive remark about the analogy, Peacock added a footnote sentence, scolding Young: "This analogy is fanciful and altogether unfounded." Editors, take note.

When the Newtonian system of optics at last slipped into the background in the 1830's, it was not owing to some great "falsification" or crucial experiment, but as Steffens notes because "it simply failed to attract new adherents." The system had been excellently suited to the reigning view of a universe describable in terms of central forces and particles. The wave theory took over when the whole world picture of the latter-day Newtonians gave way, in many parts of physics, to a rival and more powerful world view, one anchored in the notion of fields and in new mathematical tools for dealing with continua. One feels sure that Newton himself would have approved.

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European Science in the Seventeenth Century

J. Redwood, ed.
208 pp. Barnes and Noble (Harper and Row), New York, 1977. $13.50.

The aim of this collection is to give "the student and lay reader" source materials concerning the founding of modern science in the seventeenth century, drawn from "the many books, documents and papers relating to the natural philosophers and their world." There are four sections, the first dealing with "aims and methods," followed by a second section on "the enterprises and achievements of the contemporary natural philosophers." A third section "attempts to display the range of institutional work in science in the journals which proliferated in the late seventeenth century," and a final section is "an attempt to show the importance of the microscope," and "to give brief biographical accounts of a few of the people most involved with the scientific movement."

The value of any such collection depends upon the editor's choice of texts. Every selection in this book is worth reading, although it is to be doubted that the "lay reader," for whom the volume is said to be intended, will make very much of a selection from William Molyneux's presentation of experiments (and their analyses) on refraction. This is a curious selection in any event, since it concludes in Johannes Kepler's incorrect rule of refraction, without even a hint to the reader that when this book was published in 1692 the true law (Snell's law) had been published by René Descartes more than half a century earlier and was widely known. How much more interesting it would have been to have given the reader the proof of this law that Descartes published in 1637 in his essay on dioptrics, which was one of the treatises for which his famous *Discourse on Method* was written as an introduction. It is also rather astonishing that there are no selections in optics from either Christiaan Huygens or Isaac Newton.

Of the 41 selections that make up this volume, 31 were written by British authors. Furthermore, no selections were specially translated for this volume. A special section is devoted to the microscope, but there is not even a single selection concerning the revelations of the telescope, even though the telescope was developed in the seventeenth century just as the microscope was, and its revelations were of more general importance for science and for the imagination at large than those of the microscope.

In this volume one looks in vain for the greatness of science in the seventeenth century. Newton is represented by the preface to the first edition of his *Principia*, his "Rules of Reasoning," and the brief introduction to Book III; but his laws of motion, his system of the world, his principle and law of universal gravitation are conspicuous by their absence, as in his discovery of the nature of color and the composition of white light or sunlight. Descartes appears as a philosopher of science, but his principles of the "mechanical philosophy" are absent, as are his positive contributions to cosmology, the physics of light and refraction, and the laws of motion. There is no selection from Huygens. There is not a sentence of Kepler's, nor is there a presentation of any of Galileo's remarkable discoveries (his definition of uniform motion is given, but not his analysis of uniformly accelerated motion or his discovery of the laws of free fall).

John Redwood's short introductions to the sections are often inexact. For instance, it is said (page 63) that Newton "argued that a work like the *Opticks* was merely a set of queries, his own opinions culled from insufficient mathematics or evidence, which were to be kept as questions to avoid masquerading as serious proven scientific work." In the first edition, the Queries occupy a mere six out of 281 pages, and the bulk of the work is composed of descriptions of experiments and their interpretations.

In defense of the selections, it could be argued that they were intended to convey the general intellectual current of the age, rather than to record the greatness of science and of scientific discoveries. This would account for a selection by Henry Power on the microscope, rather than the work of the great microscopist Antony van Leeuwenhoek. But here again the editor fails, since one of the great general currents in scientific thought in the seventeenth century was atomism, a subject here conspicuous by its absence. Pierre Gassendi, one of the important figures in the revival of atomism, appears in these pages with a reflection on the anatomy of the heart. The otherwise uniformed reader would never guess that Gassendi was important for the physical sciences, not merely in relation to atomism, but because of his experiments on inertial motion and the publication of the first unambiguous statement concerning linear inertia.

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Qualitative Methods in Quantum Theory

A. B. Migdal
437 pp. W. A. Benjamin, Reading, Mass., 1977. $21.50

This book by the well known Soviet theorist Arkadii Beinusovich Migdal is a revision and major expansion of his earlier book with V. P. Krainov, *Approximation Methods in Quantum Mechanics* (W. A. Benjamin, New York, 1969). The first three chapters, on dimensional and "model" approximations, perturbation theory and the quasiclassical approximation, made up the earlier book. Three new chapters, on analytic properties of physical quantities, many-body problems and quantum field theory, have been added. It is not a textbook in the usual sense, but rather an attempt to reveal those tricks of the trade that shorten the derivation of results.

The reader's reaction to this book may be influenced by his willingness to use units in which not only h or c but also π is set equal to one. I must admit that I am one of those who do not care for this style, and so someone else might write an entirely different review. I do not object to the unavoidable (and for this book, essential) lack of mathematical rigor, but in some cases the author oversimplifies the basic physics for the sake of a quick answer. Moreover, the whole exposition is rather terse, offering little assistance to the reader who may have difficulty with a particular point.

The examples in the first chapter seem to be randomly selected and arbitrarily ordered. The results on page 85 *appear* dimensionally incorrect. This is actually not so, since units were chosen such that the speed of light has the dimensionless value $c = 137.2$ (*sic*; the correct value is 137.04), but one must search back to page 32 to confirm this fact.

The second and third chapters are the