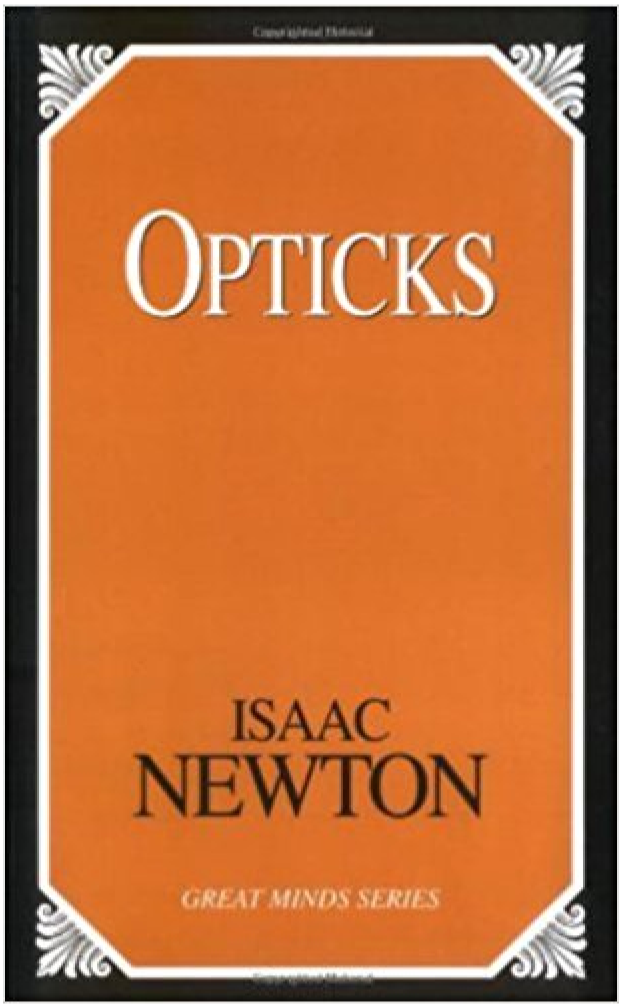
Opticks (Great Minds Series)



Synopsis

Before Newton completed his masterpiece, The Principia Mathematica, he had established his reputation with this treatise on the properties of light. Though on a narrower topic, this work is as impressive in its own right as The Principia, for it provided a scientific analysis of light that became the basis of our modern understanding. Based on experiments in which a beam of light was passed through a prism, Newton showed that white light was complex and could be analyzed as a blend of the various colors of the spectrum. Divided into three books, the first describes his experiments with the spectrum. The second deals with the ring phenomenon, in which concentric rings of colors appear in the thin layer of air separating a lens and an underlying plate of glass. The third book describes his work on diffraction. Also discussed is Newton's theory that light consists basically of "material corpuscles" in motion.Though clearly intended for fellow scientists this classic monument of modern physics is surprisingly readable and understandable for nonspecialists.

Book Information

Series: Great Minds Series

Paperback: 414 pages

Publisher: Prometheus Books; Reprint edition (August 1, 2003)

Language: English

ISBN-10: 1591020956

ISBN-13: 978-1591020950

Product Dimensions: 5.4 x 0.9 x 8.3 inches

Shipping Weight: 1.1 pounds

Average Customer Review: 4.1 out of 5 stars 15 customer reviews

Best Sellers Rank: #621,686 in Books (See Top 100 in Books) #216 inÂ Books > Science & Math > Physics > Optics #3393 inÂ Books > Science & Math > History & Philosophy #21311 inÂ Books > Textbooks > Science & Mathematics

Customer Reviews

Now, thanks to Octavo, anyone with a computer can enjoy priceless works. -- Time, April 5, 1999Octavo editions give readers a firsthand experience of a milestone text: each includes page-by-page views, expert commentaries, and appropriate "marginalia." -- University of Chicago Magazine, October 2004There are no cookie-cutter regimens they follow in their editions. Octavo explores each work and decides how to embellish it. -- Fine Books & Collections, September/October 2004 (cover story)

Imaged from the Warnock Library

If you want to read something by Newton, get the Principia. Whoever translated this book did a horrible job.

Sir Isaac Newton (1643-1727) was an English physicist, mathematician, whose Principia (published in 1687) founded classical mechanics, and described universal gravitation and the three laws of motion. His most famous work isÂ The Principia.He begins this 1704 book by stating, "My design in this Book is not to explain the Properties of Light by Hypotheses, but to propose and prove them by Reason and Experiments: In order to which I shall premise the following Definitions and Axioms." (Pg. 1)After an experiment with prisms, he observes, "we find... that when the Rays which differ in Refrangibility are separated from one another, and any one Sort of them is considered apart, the Colour of the Light which they compose cannot be changed by any Refraction or Reflexion whatever, as it ought to be were Colours nothing else than Modifications of Light caused by Refractions, and Reflexions, and Shadows. This Unchangeableness of Colour I am now to describeÃ¢Â Â¦Ã¢Â Â• (Pg. 121)He observes, Ã¢Â Âœall the Productions and Appearances of Colours in the World are derived, not from any physical Change caused in Light by Refraction or Reflexion, but only from the various Mixtures or Separations of rays, by virtue of their different Refrangibility or Reflexibility. And in this respect the Science of Colours becomes a Speculation as truly mathematical as any other part of Opticks. I mean, so far as they depend on the Nature of Light, and are not produced or altered by the Power of Imagination, or by striking or pressing the Eye.Ã¢Â Â• (Pg. 244)He points out, Ã¢Â ÂœNow the smallest Particles of Matter may cohere by the strongest Attractions, and compose bigger Particles of weaker Virtue; and many of these may cohere and compose bigger Particles whose virtue is still weaker, and so on for divers Successions, until the Progression end in the biggest Particles on which the Operations in Chymistry, and the Colours of natural Bodies depend, and which by cohering compose bodies of a sensible Magnitude.Ã¢Â Â• (Pg. 394)He concludes, Ã¢Â ÂœNow by the help of these Principles, all material Things seem to have been composed of the hard and solid Particles above-mentioned, variously associated in the first Creation by the Counsel of an intelligent Agent. For it became him who created them to set them in order. And if he did so, itÃ¢Â Â™s unphilosophical to seek for any other Origin of the World, or to pretend that it might arise out of a Chaos by the mere Laws of Nature; though being once formed, it may continue by those Laws for many Ages. For while Comets move in very excentrick Orbs in all manner of Positions, blind Fate could never make all the Planets move one and the same way in Orbs excentrick, some inconsiderable Irregularities excepted, which may have arisen from mutual Actions of Comets and Planets upon one another, and which will be apt to increase, till this System wants a Reformation. Such a wonderful Uniformity in the Planetary System must be allowed the Effect of Choice.Ã¢Â Â• (Pg. 402)This book will be of keen interest to students of the history of science.

As this review will appear on multiple editions of Opticks, please select carefully which you purchase. The present edition of this classic work in the history of science is a printing of an edition which was published in 1931 by Messrs G. Bell and Sons of London with a foreword by Albert Einstein and an introduction by E.T. Whittaker. To this wealth of previous introductory material the present edition adds an illuminating preface by I. Bernard Cohen. In an original contribution to the history of science he sets forth the influence that Newton's Opticks, or a treatise of the reflections, refractions, inflections and colours of light, exerted on other sciences during the eighteenth and nineteenth centuries. For physical theory Newton's Opticks presented a corpuscular theory of light which dominated physical thought during the eighteenth century. But Cohen shows that Thomas Young, who performed basic experiments for the wave theory of light, held that his views merely developed those of Newton, whose work Young cited extensively. Cohen also refers to the researches of Marjorie Hope Nicolson, to whom the present edition is dedicated in recognition of her revelation of the influence of the Opticks on the literary imagination in the eighteenth century.The Opticks is divided into the First Book, parts I and II; the Second Book, parts I, II, III, IV; the Third Book, part I. Newton began part I of the First Book with the statement that his design was not to explain the properties of light by hypotheses, but to propose and prove them by reason and experiments. The First Book contains Newton's theory of colors and describes in detail how he varied conditions in order to demonstrate that white light is composed of invariable components. The Second Book describes observations concerning the reflections, refractions and colors of thin transparent bodies. For the description of phenomena of colors of thin films, Newton introduced the concept of "Fits of easy Reflection" for the return of the disposition of any ray of light to be reflected, and also introduced the concept of "Fits of easy Transmission" for the return of its disposition to be transmitted. The interval of its "Fits" is related to the wave length of subsequent wave theory by which the phenomena observed by Newton can be explained readily in terms of interference. The Third Book reports observations concerning the inflections of rays of light, and the colors made thereby. Since Newton did not observe that light is bent into the shadow of a straight edge, a wave phenomenon which is difficult to observe on account of the short wave length of light, he stated his adherence to a corpuscular theory of light. From the phenomenon of double refraction, Newton inferred that the rays of light have sides. The corpuscular theory of light conformed to the general physical theory of atomism which Newton set forth as follows: "It seems probable to me, that God in the Beginning form'd Matter in solid, massy, hard, impenetrable, moveable particles..." "That Nature may be lasting, the Changes of corporeal Things are to be placed only in various Separations and new Associations and Motions of these permanent Particles." (p. 400)Newton's work on optics is of permanent value for its description of original experiments by which new phenomena were discovered, on account of the fundamental nature of the phenomena and also because the experiments admirably illustrate the experimental method of control and variation of conditions of a phenomenon. 20th-Century interest in the Opticks was stimulated by Newton's supplementation of the corpuscular theory by the idea of vibrations in a medium. Newton conjectured that when the rays of light strike a solid body the ether is set in vibration. This combination of corpuscular and wave theory, however, cannot be claimed to have anticipated the dualism of corpuscle and wave aspects of matter and radiation which characterizes quantum theory.Newton outlined his method of procedure in the next to the last paragraph of the third book of the Opticks: "As in Mathematicks, so in Natural Philosophy, the investigation of difficult things by the Method of Analysis, ought ever to precede the Method of Composition. This Analysis consists in making Experiments and Observations, and in drawing general Conclusions from them by Induction, and admitting of no Objection against the Conclusions, but such as are taken from Experiments, or other certain Truths. For Hypotheses are not to be regarded in experimental philosophy." In the terminology of contemporary theory, Newton sought operational definitions of physical concepts. He rejected the occult qualities of the Aristotelians as "Qualities unknown to us and uncapable of being discovered and made manifest." (p. 401)It may be argued that in the Opticks Newton reserved his hypotheses for the Queries. To this one may reply that he expressly stated that the Queries concerned problems of the properties of light on which he did not have time to make further observations and studies. To quote: "And since I have not finished this part of my Design, I shall conclude with proposing only some Queries, in order to a farther search to be made by others." (p. 338) In the very last paragraph of the Opticks Newton stated that in the first two books he proceeded by Analysis. "In this Third Book," he added, "I have only begun the Analysis of what remains to be discovered about Light and its Effects upon the Frame of Nature, hinting several things about it and leaving the Hints to be examined and improved by the further Experiments and Observations of such as are inquisitive."Newton declared that the business of natural philosophy is to argue from phenomena without feigning hypotheses, and to deduce causes from effects, till we come to the very first cause, which certainly is not mechanical. (p. 369) In this procedure of finding causes he used his constructive imagination in the Principia as well as in the Opticks.In an appreciative foreword, Albert Einstein declares that in one person Newton combined the experimenter, the theorist, the mechanic and, not least, the artist in exposition. I heartily subscribes to the further statement of the foreword: "this new edition of his work on optics is...to be welcomed with warmest thanks, because it alone can afford us the enjoyment of a look at the personal activity of this unique man."