

Seeing The Light Optics In Nature Photography Color Vision And Holography

Imagine a world without light. What would it be like? Dark, cold, and lifeless! In *Explore Light and Optics!* With 25 Great Projects, readers ages 7 through 10 find out why light is so important to our world. We use light to communicate. Because of light, there are natural phenomena such as rainbows and the auroras. And it's light that provides living things with the energy they need to exist. In *Explore Light and Optics!*, readers learn how light travels, how the eye works, and why we can see objects. They read about optical inventions that changed the world, including microscopes, telescopes, and cameras. Kids are introduced to modern inventions such as lasers, solar planes, and the hundreds of thousands of miles of fiber optics that make it possible to transmit data all over the world. Through projects ranging from making a spectroscope and concocting invisible ink to creating a periscope and experimenting with lenses, children discover how light can be bent, bounced, and broken. Fun facts, jokes, cartoon illustrations and links to online primary sources spark an interest in the fascinating role light plays in our lives from the sun shining overhead to the cellphone in our back pocket. Allow the young people in your life to be the masters of light - with optics, the science of the future. From the exciting experiments in this book, they'll learn how to: bend light around corners, stop time with a pair of

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sunglasses, pour light into their palms, project a big-screen image from a small TV, fool a doorbell with a bike reflector...plus dozens more experiments! Once they get their heads and hands into optics, their world will never look the same again.

Seeing the Light is the most accessible and comprehensive study of optics and light on the market. Each chapter is a self-contained lesson, making it easy to learn about specific optical concepts. Diagrams, photos, and illustrations help bring concepts to life, and sections at the ends of chapters explore the more advanced aspects of each topic.

The easy way to shed light on Optics In general terms, optics is the science of light. More specifically, optics is a branch of physics that describes the behavior and properties of light—including visible, infrared, and ultraviolet—and the interaction of light with matter. Optics For Dummies gives you an approachable introduction to optical science, methods, and applications. You'll get plain-English explanations of the nature of light and optical effects; reflection, refraction, and diffraction; color dispersion; optical devices, industrial, medical, and military applications; as well as laser light fundamentals. Tracks a typical undergraduate optics course Detailed explanations of concepts and summaries of equations Valuable tips for study from college professors If you're taking an optics course for your major in physics or engineering, let Optics For Dummies shed light on the subject and help you succeed!

The purpose of this book is to provide the most comprehensive, easy-to-use, and informative guide on

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light microscopy. Light and Video Microscopy will prepare the reader for the accurate interpretation of an image and understanding of the living cell. With the presentation of geometrical optics, it will assist the reader in understanding image formation and light movement within the microscope. It also provides an explanation of the basic modes of light microscopy and the components of modern electronic imaging systems and guides the reader in determining the physicochemical information of living and developing cells, which influence interpretation. Brings together mathematics, physics, and biology to provide a broad and deep understanding of the light microscope Clearly develops all ideas from historical and logical foundations Laboratory exercises included to assist the reader with practical applications Microscope discussions include: bright field microscope, dark field microscope, oblique illumination, phase-contrast microscope, photomicrography, fluorescence microscope, polarization microscope, interference microscope, differential interference microscope, and modulation contrast microscope

The most complete and lucid nonmathematical study of light available. Chapters are self-contained, making the book flexible and easy to read. Coverage includes such non-traditional topics as processes of vision and the eye, atmospherical optical phenomena, color perception and illusions, color in nature and in art, Kirilian photography, and holography. Includes experiments that can be carried out with simple equipment. Chapters contain optional advanced sections, and appendixes review the

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mathematics for quantitative aspects. Illustrated, including a four-color insert.

Topology is the study of properties of geometrical objects that remain invariant as the object is bent, twisted, or otherwise continuously deformed. It has been an indispensable tool in particle physics and solid state physics for decades, but in recent years it has become increasingly relevant in classical and quantum optics as well. It makes appearances through such diverse phenomena as Pancharatnam-Berry phases, optical vortices and solitons, and optical simulations of solid-state topological phenomena. This book concisely provides the necessary mathematical background needed to understand these developments and to give a rapid survey of some of the optical applications where topological issues arise.

From its inception in Greek antiquity, the science of optics was aimed primarily at explaining sight and accounting for why things look as they do. By the end of the seventeenth century, however, the analytic focus of optics had shifted to light: its fundamental properties and such physical behaviors as reflection, refraction, and diffraction. This dramatic shift—which A. Mark Smith characterizes as the “Keplerian turn”—lies at the heart of this fascinating and pioneering study. Breaking from previous scholarship that sees Johannes Kepler as the culmination of a long-evolving optical tradition that traced back to Greek antiquity via the Muslim Middle Ages, Smith presents Kepler instead as marking a rupture with this tradition, arguing that his theory of retinal imaging, which was published in 1604, was instrumental in

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prompting the turn from sight to light. Kepler's new theory of sight, Smith reveals, thus takes on true historical significance: by treating the eye as a mere light-focusing device rather than an image-producing instrument—as traditionally understood—Kepler's account of retinal imaging helped spur the shift in analytic focus that eventually led to modern optics. A sweeping survey, *From Sight to Light* is poised to become the standard reference for historians of optics as well as those interested more broadly in the history of science, the history of art, and cultural and intellectual history.

Principles of Optics: Electromagnetic Theory of Propagation, Interference and Diffraction of Light, Sixth Edition covers optical phenomenon that can be treated with Maxwell's phenomenological theory. The book is comprised of 14 chapters that discuss various topics about optics, such as geometrical theories, image forming instruments, and optics of metals and crystals. The text covers the elements of the theories of interference, interferometers, and diffraction. The book tackles several behaviors of light, including its diffraction when exposed to ultrasonic waves. The selection will be most useful to researchers whose work involves understanding the behavior of light.

Thompson provides an accessible review of the current scientific and philosophical discussions of colour vision and is vital reading for all cognitive scientists and philosophers whose interests touch upon this central area. Colour fascinates all of us, and scientists and philosophers have sought to understand the true nature of colour vision for many years. In recent times,

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investigations into colour vision have been one of the success stories of cognitive science, for each discipline within the field - neuroscience, psychology, linguistics, computer science and artificial intelligence, and philosophy - has contributed significantly to our understanding of colour. Evan Thompson's book is a major contribution to this interdisciplinary project. Colour Vision provides an accessible review of the current scientific and philosophical discussions of colour vision. Thompson steers a course between the subjective and objective positions on colour, arguing for a relational account. This account develops a novel 'ecological' approach to colour vision in cognitive science and the philosophy of perception. It is vital reading for all cognitive scientists and philosophers whose interests touch upon this central area.

From science fiction death rays to supermarket scanners, lasers have become deeply embedded in our daily lives and our culture. But in recent decades the standard laser beam has evolved into an array of more specialized light beams with a variety of strange and counterintuitive properties. Some of them have the ability to reconstruct themselves after disruption by an obstacle, while others can bend in complicated shapes or rotate like a corkscrew. These unusual optical effects open new and exciting possibilities for science and technology. For example, they make possible microscopic tractor beams that pull objects toward the source of the light, and they allow the trapping and manipulation of individual molecules to construct specially-tailored nanostructures for engineering or medical use. It has even been found

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that beams of light can produce lines of darkness that can be tied in knots. This book is an introductory survey of these specialized light beams and their scientific applications, at a level suitable for undergraduates with a basic knowledge of optics and quantum mechanics. It provides a unified treatment of the subject, collecting together in textbook form for the first time many topics currently found only in the original research literature. "This century has seen the development of technologies for manipulating and controlling matter and light at the level of individual photons and atoms, a realm in which physics is fully quantum-mechanical. The dominant experimental technology is the laser, and the theoretical paradigm is quantum optics. The Quantum World of Ultra-Cold Atoms and Light is a trilogy, which presents the quantum optics way of thinking and its applications to quantum devices. This book -- "Ultra-Cold Atoms" -- provides a theoretical treatment of ultra-cold Bosons and Fermions and their interactions with electromagnetic fields in a form consistent with the first two books in the trilogy. The book covers five main areas The physics of cold collisions, binding of atoms into molecules, and Feshbach resonances, Bose-Einstein condensation, at zero temperature, and at finite temperature, Quantum kinetic theory, Ultra-cold Fermions, Atoms in optical lattices. The central concept is the quantum stochastic paradigm, formulated for cold collision physics. For Bosons, this yields a suite of techniques; versions of the stochastic Gross-Pitaevskii equation, using which a wide range of dynamic and thermal properties are formulated. The eBook editions of the "Quantum World Trilogy"

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feature an extensive system of hyperlinks for ease of cross reference within the books, as well links to the other books in the trilogy. In the section Viewing the eBooks we explain how these links work, and give some advice on appropriate pdf viewer applications. For more information, please visit: <http://europe.worldscientific.com/quantum-world-of-ultra-cold-atoms-and-light.html>"

A concise, yet deep introduction to geometrical optics, developing the practical skills and research techniques routinely used in modern laboratories. Suitable for both students and self-learners, this accessible text teaches readers how to build their own optical laboratory, and design and perform optical experiments.

Light and light based technologies have played an important role in transforming our lives via scientific contributions spanned over thousands of years. In this book we present a vast collection of articles on various aspects of light and its applications in the contemporary world at a popular or semi-popular level. These articles are written by the world authorities in their respective fields. This is therefore a rare volume where the world experts have come together to present the developments in this most important field of science in an almost pedagogical manner. This volume covers five aspects related to light. The first presents two articles, one on the history of the nature of light, and the other on the scientific achievements of Ibn-Haitham (Alhazen), who is broadly considered the father of modern optics. These are then followed by an article on ultrafast phenomena and the invisible world. The third part includes papers on specific sources of light, the discoveries of which have

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revolutionized optical technologies in our lifetime. They discuss the nature and the characteristics of lasers, Solid-state lighting based on the Light Emitting Diode (LED) technology, and finally modern electron optics and its relationship to the Muslim golden age in science. The book's fourth part discusses various applications of optics and light in today's world, including biophotonics, art, optical communication, nanotechnology, the eye as an optical instrument, remote sensing, and optics in medicine. In turn, the last part focuses on quantum optics, a modern field that grew out of the interaction of light and matter. Topics addressed include atom optics, slow, stored and stationary light, optical tests of the foundation of physics, quantum mechanical properties of light fields carrying orbital angular momentum, quantum communication, and Wave-Particle dualism in action. A complete basic undergraduate course in modern optics for students in physics, technology, and engineering. The first half deals with classical physical optics; the second, quantum nature of light. Solutions.

Since the invention of the laser, our fascination with the photon has led to one of the most dynamic and rapidly growing fields of technology. As the reality of all-optical systems quickly comes into focus, it is more important than ever to have a thorough understanding of light and the optical components used to control it. Comprising chapters drawn from the author's highly anticipated book *Photonics: Principles and Practices*, *Light and Optics: Principles and Practices* offers a detailed and focused treatment for anyone in need of authoritative information on this critical area underlying photonics. Using a

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consistent approach, the author leads you step-by-step through each topic. Each skillfully crafted chapter first explores the theoretical concepts of each topic, and then demonstrates how these principles apply to real-world applications by guiding you through experimental cases illuminated with numerous illustrations. The book works systematically through light, light and shadow, thermal radiation, light production, light intensity, light and color, the laws of light, plane mirrors, spherical mirrors, lenses, prisms, beamsplitters, light passing through optical components, optical instruments for viewing applications, polarization of light, optical materials, and laboratory safety. Containing several topics presented for the first time in book form, *Light and Optics: Principles and Practices* is simply the most modern, comprehensive, and hands-on text in the field.

Practical guide shows how to set up working models of telescopes, microscopes, photographic lenses and projecting systems; how to conduct experiments for determining accuracy, resolving power, more. 234 diagrams.

Introduction to Nonimaging Optics covers the theoretical foundations and design methods of nonimaging optics, as well as key concepts from related fields. This fully updated, revised, and expanded Second Edition: Features a new and intuitive introduction with a basic description of the advantages of nonimaging optics Adds new chapters on wavefronts for a prescribed output (irradiance or intensity), infinitesimal étendue optics (generalization

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of the aplanatic optics), and Köhler optics and color mixing Incorporates new material on the simultaneous multiple surface (SMS) design method in 3-D, integral invariants, and étendue 2-D Contains 21 chapters, 24 fully worked and several other examples, and 1,000+ illustrations, including photos of real devices Addresses applications ranging from solar energy concentration to illumination engineering Introduction to Nonimaging Optics, Second Edition invites newcomers to explore the growing field of nonimaging optics, while providing seasoned veterans with an extensive reference book.

Have you wondered why the sky is blue? Why the sunset is red? How hummingbirds show us their many colors? Why the road ahead sometimes seems to have water on it, when it does not? Have you wondered how telescopes work to give a magnified image of distant objects? How do microscopes provide a magnified image of close objects? How do spectrosopes, eye glasses, cameras, binoculars, and similar instruments work? How do the simple rear view mirrors in cars dim and provide wide fields of view? In this book, William L. Wolfe attempts to describe many of the natural phenomena caused by light, and the optical devices that use it in terms everyone can understand. From the early wave-particle arguments to the mathematical theory of electromagnetism to

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Einstein's work on the quantization of light, different descriptions of what constitutes light have existed for over 300 years. Light - The Physics of the Photon examines the photon phenomenon from several perspectives. It demonstrates the importance of study in

Seeing the Light Optics in Nature, Photography, Color, Vision, and Holography John Wiley & Sons Incorporated

This book covers the technology of switching or modulating light in semiconductor optical waveguides. Currently a key function for optical communications systems is the conversion of data from an electrical signal to an optical signal for transmission in very low loss optical fibres and the converse process of optical to electrical conversion the O/E/O data conversion. This conversion between electronic and photonic signals imposes an energy consumption overhead on optical communication systems. So many research workers have been attracted to ultrafast all-optical switching of data in different formats. As a way of introduction to all-optical switching in semiconductor waveguides the book covers the electro-optic effect, electroabsorption and electrorefraction; effects that can be used in semiconductor optical modulation devices. But the book focuses on all-optical switching using second and third order optical nonlinearities in AlGaAs optical waveguides. It

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covers a variety of device configurations including integrated nonlinear couplers and Mach-Zehnder interferometers. Further, it provides design software in suit of Mathematica notebooks that can be used to explore the device design.

Polarized Light and Optical Systems presents polarization optics for undergraduate and graduate students in a way which makes classroom teaching relevant to current issues in optical engineering. This curriculum has been developed and refined for a decade and a half at the University of Arizona's College of Optical Sciences. Polarized Light and Optical Systems provides a reference for the optical engineer and optical designer in issues related to building polarimeters, designing displays, and polarization critical optical systems. The central theme of Polarized Light and Optical Systems is a unifying treatment of polarization elements as optical elements and optical elements as polarization elements.

Quantum Optics in Phase Space provides a concise introduction to the rapidly moving field of quantum optics from the point of view of phase space. Modern in style and didactically skillful, Quantum Optics in Phase Space prepares students for their own research by presenting detailed derivations, many illustrations and a large set of workable problems at the end of each chapter. Often, the theoretical treatments are accompanied by the corresponding

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experiments. An exhaustive list of references provides a guide to the literature. Quantum Optics in Phase Space also serves advanced researchers as a comprehensive reference book. Starting with an extensive review of the experiments that define quantum optics and a brief summary of the foundations of quantum mechanics the author Wolfgang P. Schleich illustrates the properties of quantum states with the help of the Wigner phase space distribution function. His description of waves ala WKB connects semi-classical phase space with the Berry phase. These semi-classical techniques provide deeper insight into the timely topics of wave packet dynamics, fractional revivals and the Talbot effect. Whereas the first half of the book deals with mechanical oscillators such as ions in a trap or atoms in a standing wave the second half addresses problems where the quantization of the radiation field is of importance. Such topics extensively discussed include optical interferometry, the atom-field interaction, quantum state preparation and measurement, entanglement, decoherence, the one-atom maser and atom optics in quantized light fields. Quantum Optics in Phase Space presents the subject of quantum optics as transparently as possible. Giving wide-ranging references, it enables students to study and solve problems with modern scientific literature. The result is a remarkably concise yet comprehensive and accessible text- and

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reference book - an inspiring source of information and insight for students, teachers and researchers alike.

Intended for students in the visual arts and for others with an interest in art, but with no prior knowledge of physics, this book presents the science behind what and how we see. The approach emphasises phenomena rather than mathematical theories and the joy of discovery rather than the drudgery of derivations. The text includes numerous problems, and suggestions for simple experiments, and also considers such questions as why the sky is blue, how mirrors and prisms affect the colour of light, how compact disks work, and what visual illusions can tell us about the nature of perception. It goes on to discuss such topics as the optics of the eye and camera, the different sources of light, photography and holography, colour in printing and painting, as well as computer imaging and processing.

Optical science and engineering affect almost every aspect of our lives. Millions of miles of optical fiber carry voice and data signals around the world. Lasers are used in surgery of the retina, kidneys, and heart. New high-efficiency light sources promise dramatic reductions in electricity consumption. Night-vision equipment and satellite surveillance are changing how wars are fought. Industry uses optical methods in everything from the production of computer chips to the construction of tunnels. *Harnessing Light* surveys this multitude of applications, as well as the status of the optics industry and of research and education in optics, and identifies actions that could enhance the field's contributions to society and facilitate its continued technical development.

Optics has been part of scientific enquiry from its beginning and remains a key element of modern science. This book provides a concise treatment of physical optics starting with a

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brief summary of geometrical optics. Scalar diffraction theory is introduced to describe wave propagation and diffraction effects and provides the basis for Fourier methods for treating more complex diffraction problems. The rest of the book treats the physics underlying some important instruments for spectral analysis and optical metrology, reflection and transmission at dielectric surfaces and the polarization of light. This undergraduate-level text aims to aid understanding of optical applications in physical, engineering and life sciences or more advanced topics in modern optics.

Light is an element that draws together many areas of human knowledge: physics, chemistry, biology, astronomy, engineering, and art. Moreover, optical phenomena and the technologies based on them are widespread in our daily lives. However, it can be difficult to understand or explain these phenomena. What is light? Where are optics and photonics present in our lives and in nature? What lies behind different optical phenomena? What is an optical instrument? How does the eye resemble an optical instrument? How can we explain human vision?

Designed for a nonmathematical undergraduate optics course addressed to art majors, this four-part treatment discusses the nature and manipulation of light, vision, and color.

Questions at the end of each chapter help test comprehension of material, which is almost completely presented in a nonmathematical manner. 170 black-and-white illustrations. 1983 edition.

This book studies the eighteenth-century origins and early phase of a fundamental debate in optics: whether light is a particle or wave. Specifically, it is the first in-depth study of the contents and reception of Leonhard Euler's wave theory of light. The author shows that contrary to what has been assumed, the debate did not start in 1672 with Newton's particle theory of light. Rather, it only really got under way

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after Euler published his wave theory in 1746. He also corrects the misapprehension that Newton's theory was prevalently held in Germany in the early years of the debate, but really only became dominant around 1795. In his discussion, Professor Hakfoort demonstrates in dramatic fashion the relevance of chemical experiments on physical optics. Finally, in the epilogue, the author reflects on the mathematical, experimental, and metaphysical aspects of physical optics that shaped early modern science.

Rays Waves and Photons is a history of the development of our knowledge of light and its many applications. Some forty different subjects are described historically including optical design, microscopes, cameras, spectacles, military, medical and fiber optics and lasers. Each has its own chapter and its own history.

This new, updated and enlarged edition of the successful and exceptionally well-structured textbook features new chapters on such hot topics as optical angular momentum, microscopy beyond the resolution limit, metamaterials, femtocombs, and quantum cascade lasers. It provides comprehensive and coherent coverage of fundamental optics, laser physics, and important modern applications, while equally including some traditional aspects for the first time, such as the Collins integral or solid immersion lenses. Written for newcomers to the topic who will benefit from the author's ability to explain difficult theories and effects in a straightforward and readily comprehensible way.

Optical Bistability: Controlling Light with Light focuses on optical bistability in nonlinear optical systems. Emphasis is on passive (non-laser) systems that exhibit reversible bistability with input intensity as the hysteresis variable, along with the physics and the potential applications of such

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systems for nonlinear optical signal processing. This book consists of seven chapters and begins with a historical overview of optical bistability in lasers and passive systems. The next chapter describes steady-state theories of optical bistability, including the Bonifacio-Lugiato model, as well as the boundary conditions of an optical cavity and the coupled Maxwell-Bloch equations. Both intrinsic and hybrid experiments are then described, along with light-by-light control, pulse reshaping, and external switching. The transient phenomena that arise either from instabilities in the bistable systems themselves or from fluctuations in the number of nonlinear atoms or in the number of intracavity photons are also considered. The final chapter examines the characteristics and fundamental limitations of an ideal device, the prospect of improving devices by identifying giant nonlinearities, and the utilization of the full power of optics by parallel processing. This monograph is intended for new entrants and active workers in the field of optical bistability.

We live in a world of optical marvels - from the commonplace but beautiful rainbow, to the rare and eerie superior mirage. But how many of us really understand how a rainbow is formed, why the setting sun is red and flattened, or even why the sky at night is not absolutely black? This beautiful and informative guide provides clear explanations to all naturally occurring optical phenomena seen with the

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naked eye, including shadows, halos, water optics, mirages and a host of other spectacles. Separating myth from reality, it outlines the basic principles involved, and supports them with many figures and references. A wealth of rare and spectacular photographs, many in full color, illustrate the phenomena throughout. In this new edition of the highly-acclaimed guide to seeing, photographing and understanding nature's optical delights, the authors have added over 50 new images and provided new material on experiments you can try yourself.

Optics--a field of physics focusing on the study of light--is also central to many areas of biology, including vision, ecology, botany, animal behavior, neurobiology, and molecular biology. *The Optics of Life* introduces the fundamentals of optics to biologists and nonphysicists, giving them the tools they need to successfully incorporate optical measurements and principles into their research. Sönke Johnsen starts with the basics, describing the properties of light and the units and geometry of measurement. He then explores how light is created and propagates and how it interacts with matter, covering topics such as absorption, scattering, fluorescence, and polarization. Johnsen also provides a tutorial on how to measure light as well as an informative discussion of quantum mechanics. *The Optics of Life* features a host of examples drawn from nature and everyday life, and several

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appendixes that offer further practical guidance for researchers. This concise book uses a minimum of equations and jargon, explaining the basic physics of light in a succinct and lively manner. It is the essential primer for working biologists and for anyone seeking an accessible introduction to optics. Some images inside the book are unavailable due to digital copyright restrictions.

Reproduction of the original: *Treatise On Light* by Christiaan Huygens

This book uses art photography as a point of departure for learning about physics, while also using physics as a point of departure for asking fundamental questions about the nature of photography as an art. Although not a how-to manual, the topics center around hands-on applications, most-often illustrated by photographic processes that are inexpensive and easily accessible to students (including a versatile new process developed by the author, and herein first described in print). A central theme is the connection between the physical interaction of light and matter on the one hand, and the artistry of the photographic processes and their results on the other. *Geometry and the Nature of Light* focuses on the physics of light and the optics of lenses, but also includes extended discussions of topics less commonly covered in a beginning text, including symmetry in art and physics, different physical processes of the

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scattering of light, photograms (photographic shadow prints) and the nature of shadows, elements of 2-dimensional design, pinhole photography and the view camera. Although written at a beginning undergraduate level, the topics are chosen for their role in a more general discussion of the relation between science and art that is of interest to readers of all backgrounds and levels of expertise.

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