
Astronomical Optics

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Choosing and Using a Refracting

Telescope Springer Science & Business Media

The construction of sensitive low noise detectors, preservation of image quality and restriction of unwanted radiation are among the concerns of this up-to-date account of optical techniques available to astronomers.

Selected Papers on Astronomical Optics
Springer

The blossoming of adaptive optical techniques has brought about a revolution in the field of astronomical observation. Coupled with the new generation of large, ground-based telescopes, it allows us to achieve an unprecedented angular

resolution in the analysis of faint astronomical sources at optical wavelengths. This book provides the basic concepts of adaptive optics, discusses the possible instrumental strategies and the state-of-the-art technical achievements of this development and presents the key astrophysical programs which will most benefit from it. Over fifteen well-known experts have contributed to making this volume a comprehensive one, with steady progression as well as full coverage of the various aspects of the field. Students graduating in optical sciences and astrophysics, astronomers, engineers interested in atmospheric turbulence compensation will find this book a reference text on the subject.

Optimizing the U.S. Ground-Based Optical and Infrared Astronomy System CRC Press

For every astronomical topic that I have approached there has turned out to be a broader realm of possibilities than is commonly accepted or acknowledged. The "excursions" of this book are the examples. They mostly depart from the mainstream of conventional wisdom to offer a wider perspective with opportunities for further research. While my intent is to supplement that mainstream, the effect may appear to dismiss rather than to reconsider accepted tenets. Ample praise and credit for those accomplishments are already available in textbooks. Readers may very well disagree with some of the notions presented in these excursions, but I hope that they will pause long enough to evaluate the scientific basis for any disagreement. For the most part, these excursions remain

incomplete and unfulfilled, yet they contain many ideas that are not available elsewhere. Whether these ideas are perceived as a collection of unproven claims or as a storehouse of fresh opportunities will depend entirely on the attitude of the reader. The excursions do cover a rather wide span of disciplines, and that may lead to an unfocused overall impression. My hope is thereby to attract a broader audience than that of a single discipline, and to expose them to neighboring disciplines. The excursions all do have the common thread of optical science related to astronomy.

Telescopes and Techniques Springer Science & Business Media

Astrophysics is facing challenging aims such as deep cosmology at redshift higher than 10 to constrain cosmology models, or the detection of exoplanets, and possibly terrestrial exoplanets, and several others. It requires unprecedented ambitious R&D programs, which have definitely to rely on a tight cooperation between astrophysics and optics communities. The book addresses most of the most critical interdisciplinary domains where they interact, or where they will do. A first need

is to collect more light, i.e. telescopes still larger than the current 8-10 meter class ones. Decametric, and even hectometric, optical (from UV to IR wavelengths) telescopes are being studied. Whereas up to now the light collecting surface of new telescopes was approximately 4 times that of the previous generation, now this factor is growing to 10 to 100. This quantum leap urges to implement new methods or technologies developed in the optics community, both in academic labs and in the industry. Given the astrophysical goals and technological constraints, new generation adaptive optics with a huge number of actuators and laser guide stars devices have to be developed, from theoretical bases to experimental works. Two other newcomers in observational astrophysics are interferometric arrays of optical telescopes and gravitational wave detectors. Up-to-date reviews of detectors and of spectrographs are given, as well as forefront R&D in the field of optical coatings and of guided optics. Possible new ways to handle photons are also addressed, based on quantum physics. More and more signal processing algorithms are a part and parcel of any

modern instrumentation. Thus finally the book gives two reviews about wavefront processing and about image restoration and deconvolution algorithms for ill conditioned cases.

Adaptive Optics for Astronomical Telescopes Springer Science & Business Media

This book offers an essential compendium of astronomical high-resolution techniques. Recent years have seen considerable developments in such techniques, which are critical to advances in many areas of astronomy. As reflected in the book, these techniques can be divided into direct methods, interferometry, and reconstruction methods, and can be applied to a huge variety of astrophysical systems, ranging from planets, single stars and binaries to active galactic nuclei, providing angular resolution in the micro- to tens of milliarcsecond scales. Written by experts in their fields, the chapters cover adaptive optics, aperture masking imaging, spectra disentangling, interferometry, lucky imaging, Roche tomography, imaging with interferometry, interferometry of AGN, AGN reverberation mapping, Doppler- and

magnetic imaging of stellar surfaces, Doppler tomography, eclipse mapping, Stokes imaging, and stellar tomography. This book is intended to enable a next generation of astronomers to apply high-resolution techniques. It informs readers on how to achieve the best angular resolution in the visible and near-infrared regimes from diffraction-limited to micro-arcsecond scales.

Aperture Synthesis Princeton University Press

The second edition of *Electronic Imaging in Astronomy: Detectors and Instrumentation* describes the remarkable developments that have taken place in astronomical detectors and instrumentation in recent years - from the invention of the charge-coupled device (CCD) in 1970 to the current era of very large telescopes, such as the Keck 10-meter telescopes in Hawaii with their laser guide-star adaptive optics which rival the image quality of the Hubble Space Telescope. Authored by one of the world's foremost experts on the design and development of electronic imaging systems for astronomy, this book has been written on several levels to appeal to a broad readership. Mathematical

expositions are designed to encourage a wider audience, especially among the growing community of amateur astronomers with small telescopes with CCD cameras. The book can be used at the college level for an introductory course on modern astronomical detectors and instruments, and as a supplement for a practical or laboratory class.

The Telescope Springer

New astronomical facilities, such as the under-construction Large Synoptic Survey Telescope and planned 30-meter-class telescopes, and new instrumentation on existing optical and infrared (OIR) telescopes, hold the promise of groundbreaking research and discovery. How can we extract the best science from these and other astronomical facilities in an era of potentially flat federal budgets for both the facilities and the research grants? *Optimizing the U.S. Ground-Based Optical and Infrared Astronomy System* provides guidance for these new programs that align with the scientific priorities and the conclusions and recommendations of two National Research Council (NRC) decadal surveys, *New Worlds, New Horizons for Astronomy and Astrophysics*

and *Vision and Voyages for Planetary Sciences in the Decade 2013-2022*, as well as other NRC reports. This report describes a vision for a U.S. OIR System that includes a telescope time exchange designed to enhance science return by broadening access to capabilities for a diverse community, an ongoing planning process to identify and construct next generation capabilities to realize decadal science priorities, and near-term critical coordination, planning, and instrumentation needed to usher in the era of LSST and giant telescopes.

Popular Astronomy Springer Science & Business Media

A valuable reference that fills a number of niches including that of a buyer's guide, technical desk reference and observer's field guide. It documents the past market and its evolution, right up to the present day. In addition to appealing to practical astronomers - and potentially saving them money - it is useful both as a historical reference and as a detailed review of the current market place for this bustling astronomical consumer product. What distinguishes this book from other publications on astronomy is the

involvement of observers from all aspects of the astronomical community, and also the major manufacturers of equipment. It not only catalogs the technical aspects of the many modern eyepieces but also documents amateur observer reactions and impressions over the years, using many different eyepieces. Eyepieces are the most talked-about accessories and collectible items available to the amateur astronomer. No other item of equipment commands such vigorous debate, or has evolved into such a remarkable array of forms and functions. 'Choosing and Using Astronomical Eyepieces' provides a vast amount of reference material to point readers towards the best buys and the right eyepieces for different kinds of observing.

Optics Springer Science & Business Media
Introduction. Preliminaries: Definitions and Paraxial Optics. Fermat's Principle: An Introduction. Introduction to Aberrations. Fermat's Principle and Aberrations. Reflecting Telescopes. Schmidt Telescopes and Cameras. Catadioptric Telescopes and Cameras. Auxiliary Optics for Telescopes. Diffraction Theory and Aberrations. Transfer Functions: Hubble Space

Telescope. Spectrometry: Definitions and Basic Principles. Dispersing Elements and Systems. Grating Aberrations: Concave Grating Spectrometers. Adaptive Optics: An Introduction. Detectors, Signal-to-Noise, and Detection Limits. Large Mirrors and Telescope Arrays. Table of Symbols. Index.

Astronomical Optics Springer Science & Business Media

Since the 1960s, astrophysical discoveries have blossomed, due to the emergence of powerful and new observational tools. Among them, a fantastic improvement of the sharpness of astronomical images, obtained with ground based optical telescopes, has been the result of two revolutions: adaptive optics and optical interferometry. Written for a general audience, interwoven with fascinating details about the evolution of vision and optics, this book tells a personal story of these revolutions in observational astronomy, born two centuries ago and blossoming in the past fifty years. With the construction of the Very Large Telescope in Chile, Europe played a leading role where young scientists, joining creative astronomers and engineers, have

developed a superb creativity. Today, incredibly sharp images of exoplanetary systems and black hole environments are obtained and reveal new questions about Earth-like objects or fundamental physics. The author has been one of the actors of this adventure. His first-hand testimony is opening the future to new horizons.

Electronic Imaging in Astronomy

Springer Science & Business Media

During the last two decades, optical stellar interferometry has become an important tool in astronomical investigations requiring spatial resolution well beyond that of traditional telescopes. This book, first published in 2006, was the first to be written on the subject. The authors provide an extended introduction discussing basic physical and atmospheric optics, which establishes the framework necessary to present the ideas and practice of interferometry as applied to the astronomical scene. They follow with an overview of historical, operational and planned interferometric observatories, and a selection of important astrophysical discoveries made with them. Finally, they present some as-yet untested ideas for instruments both on the ground and in

space which may allow us to image details of planetary systems beyond our own.

Telescopes, Eyepieces, and Astrographs Springer

This book by one of the leaders in adaptive optics covers the fundamental theory and then describes in detail how this technology can be applied to large ground-based telescopes to compensate for the effects of atmospheric turbulence. It includes information on basic adaptive optics components and technology, and has chapters devoted to atmospheric turbulence, optical image structure, laser beacons, and overall system design. The chapter on system design is particularly detailed and includes performance estimation and optimization. Combining a clear discussion of physical principles with numerous real-world examples, this book will be a valuable resource for all graduate students and researchers in astronomy and optics.

Astronomical Optics Cambridge University Press

The Optics was a product of Kepler's most creative period. It began as an attempt to give astronomical optics a solid foundation, but soon transcended this

narrow goal to become a complete reconstruction of the theory of light, the physiology of vision, and the mathematics of refraction. The result is a work of extraordinary breadth whose significance transcends most categories into which it might be placed. It gives us precious insight into Kepler's thought during this crucial period, an insight all the more valuable in that most of his working papers from that time have been lost. Second, it is the culmination of a long and rich tradition in the science of optics, in distinct contrast with the new optical thought represented by Descartes. And third, it presents discoveries in the physiology of vision, photometry, and the geometry of conic sections which have become part of our intellectual heritage. Especially notable are Kepler's discovery of the inverted retinal image, his theoretical grounding of the inverse-square photometric law, and his insights into the relations between the various conic sections.

Astronomical Optics Springer Science & Business Media

Choosing and Using a Refracting Telescope has been written for the many

amateur astronomers who already own, or are intending to purchase, a refracting telescope – perhaps to complement their existing arsenal of larger reflecting telescopes – or for the specialist who requires a particular refractor for serious astronomical applications or nature studies. Four hundred year ago, during the winter of 1609, a relatively unknown Italian scientist, Galileo Galilei designed a spyglass with two crude lenses and turned it skyward. Since then, refractors have retained their dominance over all types of reflector in studies of the Moon, planets and double stars because of the precision of their optics and lack of a central obstruction in the optical path, which causes diffraction effects in all commercially-made reflectors. Most mature amateur astronomers got started with a 60mm refractor, or something similar. Thirty years ago, there was little choice available to the hobbyist, but in the last decade long focus crown-flint achromats have moved aside for some exquisitely crafted apochromatic designs offered by leading commercial manufacturers. There has been a huge increase in the popularity of these

telescopes in the last few years, led by a significant increase in the number of companies (particularly, William Optics, Orion USA, StellarVue, SkyWatcher and AstroTech) who are now heavily marketing refractors in the amateur astronomical magazines. In *Choosing and Using a Refracting Telescope*, well-known observer and astronomy writer Neil English celebrates the remarkable history and evolution of the refracting telescope and looks in detail at the instruments, their development and their use. A major feature of this book is the way it compares not only different classes of refractor, but also telescopes of each class that are sold by various commercial manufacturers. The author is perhaps uniquely placed to do this, having used and tested literally hundreds of different refracting telescopes over three decades. Because it includes many diverse subjects such as imaging with consumer-level digital cameras, imaging with webcams, and imaging with astronomical CCD cameras – that are not covered together in equal depth in any other single volume – *Choosing and Using a Refracting Telescope* could become the ‘refractor bible’ for amateur astronomers

at all levels, especially those who are interested in imaging astronomical objects of every class.

Optical Astronomical Spectroscopy
Springer Nature

Historically, the discovery of tools, or evidence that tools have been used, has been taken as proof of human activity; certainly the invention and spread of new tools has been a critical marker of human progress and has increased our ability to observe, measure, and understand the physical world. In astronomy the tools are telescopes and the optical and electronic instruments that support them. The use of the telescope by Galileo marked the beginning of a new and productive way to study and understand the universe in which we live. The effects of this new tool on what we can see, and how we see ourselves, are well known. However, after almost four centuries of developing ever more sensitive and subtle instruments as tools for astronomy, it might have been expected that only a few minor improvements would remain to be made, or that possibly the law of diminishing returns would have taken effect. On the contrary, the new instruments and ideas

for new instruments described in this book make it clear that the rate of progress has not diminished, and that this subject is still as exciting and productive as ever.

Instrumentation for Ground-Based Optical Astronomy was chosen as the theme for the Ninth Santa Cruz Summer Workshop in Astronomy and Astrophysics.

Adaptive Optics in Astronomy SPIE-International Society for Optical Engineering

Astronomy Methods is an introduction to the basic practical tools, methods and phenomena that underlie quantitative astronomy. Taking a technical approach, the author covers a rich diversity of topics across all branches of astronomy, from radio to gamma-ray wavelengths. Topics include the quantitative aspects of the electromagnetic spectrum, atmospheric and interstellar absorption, telescopes in all wavebands, interferometry, adaptive optics, the transport of radiation through matter to form spectral lines, and neutrino and gravitational-wave astronomy. Clear, systematic presentations of the topics are accompanied by diagrams and problem sets. Written for undergraduates and graduate students, this book contains a

wealth of information that is required for the practice and study of quantitative and analytical astronomy and astrophysics.

Astronomical Observations Springer Science & Business Media

Commercially-made astronomical telescopes are better and less expensive than ever before, and their optical and mechanical performance can be superb. When a good-quality telescope fails to perform as well as it might, the reason is quite probably that it needs a little care and attention! Here is a complete guide for anyone who wants to understand more than just the basics of astronomical telescopes and accessories, and how to maintain them in the peak of condition. The latest on safely adjusting, cleaning, and maintaining your equipment is combined with thoroughly updated methods from the old masters. Here, too, are details of choosing new and used optics and accessories, along with enhancements you can make to extend their versatility and useful lifetime. This book is for you. Really. Looking after an astronomical telescope isn't only for the experts - although there are some things that only an expert should attempt - and

every serious amateur astronomer will find invaluable information here, gleaned from Barlow Pepin's many years' experience working with optical instruments.

Grab 'n' Go Astronomy Cambridge University Press

This book is uniquely about the relationship between the optical telescope and astronomy as they developed together. It covers the time between the telescope's pivotal invention in the 1600's up to the modern era of space-based telescopes. Over the intervening centuries, there were huge improvements in the optical resolution of telescopes, along with changes in their positioning and nature of application that forever altered the course of astronomy. For a long time, the field was an exclusive club for self-motivated stargazers who could afford to build their own telescopes. Many of these leisure-time scholars left their mark by virtue of their meticulous observations and record keeping. Although they would now be considered amateurs, these figures and their contributions were pivotal and are covered in this book alongside professionals, for the first time giving a complete picture of the history of

telescopic science.

Reflecting Telescope Optics I Cambridge University Press

Proceedings of SPIE present the original research papers presented at SPIE conferences and other high-quality conferences in the broad-ranging fields of optics and photonics. These books provide prompt access to the latest innovations in research and technology in their respective fields. Proceedings of SPIE are among the most cited references in patent literature.

An Introduction to Optical Stellar Interferometry Springer

Written by a recognized expert in the field, this clearly presented, well-illustrated book provides both advanced level students and professionals with an authoritative, thorough presentation of the characteristics, including advantages and limitations, of telescopes and spectrographic instruments used by astronomers of today. Written by a recognized expert in the field Provides both advanced level students and professionals with an authoritative, thorough presentation of the characteristics, including advantages and

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