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New Worlds, New Horizons in Astronomy and Astrophysics CRC Press Specifically traces the impact of Einstein's ideas on astronomy, including the way we interpret observations of stars and galaxies. Includes comments from principals in important discoveries, illuminating the

processes behind these results. Presents many applications of relativity that have not been shown in earlier popular-level books and illustrates how deeply physics permeates the way we interpret many astronomical phenomena. Highlights light-travel delays in cosmic jets, using gravitational lensing to trace cosmic mass distribution. Illustrations employ new and archival data from ground- and space-based observatories.

The Century of Space Science

Cambridge University Press

The ideal one-semester astrophysics introduction for science undergraduates—now expanded and fully updated Winner of the American Astronomical Society's Chambliss Award, Astrophysics in a Nutshell has become the text of choice in astrophysics courses for science majors at top universities in North America and beyond. In this expanded and fully updated second edition, the book gets even better, with a new chapter on extrasolar planets; a greatly expanded chapter on the interstellar medium; fully updated facts and figures on all subjects, from the observed properties of white dwarfs to the latest results from precision cosmology; and additional instructive problem

sets. Throughout, the text features the same focused, concise style and emphasis on physics intuition that have made the book a favorite of students and teachers. Written by Dan Maoz, a leading active researcher, and designed for advanced undergraduate science majors, Astrophysics in a Nutshell is a brief but thorough introduction to the observational data and theoretical concepts underlying modern astronomy. Generously illustrated, it covers the essentials of modern astrophysics, emphasizing the common physical principles that govern astronomical phenomena, and the interplay between theory and observation, while also introducing subjects at the forefront of modern research, including black holes, dark matter, dark energy, and gravitational lensing. In addition to serving as a course textbook, Astrophysics in a Nutshell is an ideal review for a qualifying exam and a handy reference for teachers and researchers. The most concise and current astrophysics textbook for science majors—now expanded and fully updated with the latest research results Contains a broad and well-balanced selection of traditional and current topics Uses simple, short, and clear derivations of physical results Trains students in the essential skills of order-of-magnitude analysis Features a new chapter on extrasolar planets, including discovery techniques Includes new and expanded sections and problems on the physics of shocks, supernova remnants, cosmic-ray acceleration, white dwarf properties, baryon acoustic oscillations, and more Contains instructive problem

sets at the end of each chapter Solutions manual (available only to professors)

The Black Hole at the Center of Our Galaxy **W. W. Norton & Company**

A comprehensive review of the latest results of all methods to determine the Hubble constant - the hottest debate in contemporary astronomy and cosmology.

Gravitational Lensing and Microlensing Cambridge University Press

These "excursions" into astronomical optics discuss innovative, often radical, suggestions for the design of optical instruments. Providing a storehouse of ideas and approaches not available elsewhere, Mertz suggests opportunities for further exploration and development rather than proven solutions. Covering a wide array of topics, from x-ray telescopes to gravitational lenses and from microscope objectives to Fourier transform spectroscopy, the excursions share a common thread of optical science related to astronomy. The book should thus interest researchers and graduate students in astronomy, optics, and optical engineering. Appendices provide Fortran code for some of the design techniques discussed in the book and for Monte Carlo image synthesis

Einstein's Telescope: The Hunt for Dark Matter and Dark Energy in the Universe Springer

One of the most

attractive features of the young discipline of Space Science is that many of the original pioneers and key players involved are still available to describe their field. Hence, at this point in history we are in a unique position to gain first-hand insight into the field and its development. To this end, The Century of Space Science, a scholarly, authoritative, reference book presents a chapter-by-chapter retrospective of space science as studied in the 20th century. The level is academic and focuses on key discoveries, how these were arrived at, their scientific consequences and how these discoveries advanced the thoughts of the key players involved. With over 90 world-class contributors, such as James Van Allen, Cornelis de Jager, Eugene Parker, Reimar L ü st, and Ernst Stuhlinger, and with a Foreword by Lodewijk Woltjer (past ESO Director General), this book will be immensely useful to readers in the fields of space science, astronomy, and the history of science. Both academic institutions and researchers will find that this major reference work makes an invaluable addition to their collection.

The Sky at Einstein's Feet Springer Science & Business Media

For about half a century the general theory of relativity attracted little attention from physicists. However, the discovery of compact objects such as quasars and pulsars, as well as candidates for black holes on the one hand, and the microwave background radiation on the other hand completely changed the picture. In addition, developments in

elementary particle physics, such as predictions of the behavior of matter at the ultrahigh energies that might have prevailed in the early stages of the big bang, have greatly en hanced the interest in general relativity. These developments created a large body of readers interested in general relativity, and its applications in astrophysics and cosmology. Having neither the time nor the inclination to delve deeply into the technical literature, such readers need a general introduction to the subject before exploring applica tions. It is for these readers that the present volume is intended. Keeping in mind the broad range of interests and wanting to avoid mathematical compli cations as much as possible, we have ventured to combine all three topics relativity, astrophysics, and cosmology-in a single volume. Naturally, we had to make a careful selection of topics to be discussed in order to keep the book to a manageable length.

The Extragalactic Distance Scale

Springer

The observation, in 1919 by A.S. Eddington and collaborators, of the gra- tational de?ection of light by the Sun proved one of the many predictions of Einstein ' s Theory of General Relativity: The Sun was the ?rst example of a gravitational lens. In 1936, Albert Einstein published an article in which he suggested - ing stars as gravitational lenses. A year later, Fritz Zwicky pointed out that galaxies would act as lenses much more likely than stars, and also gave a list of possible applications, as a means to determine the dark matter content of galaxies and clusters of galaxies. It was only in 1979 that the ?rst example of an extragalactic gravitational lens was provided by the observation of the distant quasar QSO 0957+0561, by D. Walsh, R.F. Carswell, and R.J. Weymann. A few years later, the ?rst lens showing images in the form of arcs was detected. The theory, observations, and applications of gravitational lensing cons- tute one of the most rapidly growing branches of

astrophysics. The gravitational de?ection of light generated by mass concentrations along a light path producesmagni?cation,multiplicity, anddistortionofimages, anddelaysp- ton propagation from one line of sight relative to another. The huge amount of scienti?c work produced over the last decade on gravitational lensing has clearly revealed its already substantial and wide impact, and its potential for future astrophysical applications.

Astronomy and Astrophysics Abstracts John Wiley & Sons Draws on cutting-edge findings in the field of astrophysics to augment Einstein's theories and define the unseen matter of the universe, in an account that attempts to explain why the universe appears to be expanding at an accelerating rate in spite of current understandings about gravity. 20,000 first printing.

General Relativity, Astrophysics, and Cosmology Wiley Light observed from distant objects is found to be deflected by the gravitational field of massive objects near the line of sight - an effect predicted by Einstein in his first paper setting forth the general theory of relativity, and confirmed by Eddington soon afterwards. If the source of the light is sufficiently distant and bright, and if the intervening object is massive enough and near enough to the line of sight, the gravitational field acts like a lens, focusing the light and producing one or more bright images of the source. This book, by renowned researchers in the field, begins by discussing the basic physics behind gravitational lenses: the optics of curved space-time. It then derives the appropriate equations for predicting the properties of these

lenses. In addition, it presents up-to-date observational evidence for gravitational lenses and describes the particular properties of the observed cases. The authors also discuss applications of the results to problems in cosmology.

Astrophysical Applications of Gravitational Lensing Princeton University Press

Briefly surveys the history of cosmology, looks at new developments in astronomical observation, and discusses current theories about the universe's origins

Review of Radio Science Cambridge University Press

The observation, in 1919 by A.S. Eddington and collaborators, of the gra- tational de?ection of light by the Sun proved one of the many predictions of Einstein ' s Theory of General Relativity: The Sun was the ?rst example of a gravitational lens. In 1936, Albert Einstein published an article in which he suggested - ing stars as gravitational lenses. A year later, Fritz Zwicky pointed out that galaxies would act as lenses much more likely than stars, and also gave a list of possible applications, as a means to determine the dark matter content of galaxies and clusters of galaxies. It was only in 1979 that the ?rst example of an extragalactic gravitational lens was provided by the observation of the distant quasar QSO 0957+0561, by D. Walsh, R.F. Carswell, and R.J. Weymann. A few years later, the ?rst lens showing images in the form of arcs was detected. The theory, observations, and applications of gravitational lensing cons- tute one of the most rapidly growing branches of astrophysics. The gravi- tional de?ection of light generated by mass concentrations along a light path prod ucesmagni?cation,mult iplicity,anddistortionof images,anddelaysp- ton propagation from one line of sight relative to another. The huge amount of scienti?c work produced over the last decade on gravitational lensing has clearly

revealed its already substantial and wide impact, and its potential for future astrophysical applications.

Gravitational Lenses
Princeton University Press

Driven by discoveries, and enabled by leaps in technology and imagination, our understanding of the universe has changed dramatically during the course of the last few decades. The fields of astronomy and astrophysics are making new connections to physics, chemistry, biology, and computer science. Based on a broad and comprehensive survey of scientific opportunities, infrastructure, and organization in a national and international context, New Worlds, New Horizons in Astronomy and Astrophysics outlines a plan for ground- and space- based astronomy and astrophysics for the decade of the 2010's. Realizing these scientific opportunities is contingent upon maintaining and strengthening the foundations of the research enterprise including technological development, theory, computation and data handling, laboratory experiments, and human resources. New Worlds, New Horizons in Astronomy and Astrophysics proposes enhancing innovative but moderate-cost programs in space and on the ground that will enable the community to respond rapidly and flexibly to new scientific discoveries. The book recommends beginning construction on survey telescopes in space and on the ground to investigate the nature of dark energy, as well as the next generation of large ground-based giant optical telescopes and a new class of space-based gravitational observatory to

observe the merging of distant black holes and precisely test theories of gravity. New Worlds, New Horizons in Astronomy and Astrophysics recommends a balanced and executable program that will support research surrounding the most profound questions about the cosmos. The discoveries ahead will facilitate the search for habitable planets, shed light on dark energy and dark matter, and aid our understanding of the history of the universe and how the earliest stars and galaxies formed. The book is a useful resource for agencies supporting the field of astronomy and astrophysics, the Congressional committees with jurisdiction over those agencies, the scientific community, and the public.

Gravitational Lensing Cambridge University Press
One of the most spectacular predictions of Einstein's theory of general relativity is the occurrence of gravitational lenses in our galactic system. Nowadays the mastering of the mathematics together with the technology available to astronomers allow Einstein's prediction to be confirmed. Several reviews here give the reader the chance to understand the basic theoretical concept of gravitational lensing and to obtain an overview of observational work. The present state of the field and latest results are given in a large number of specialized papers. Anextensive source and subject index make these proceedings valuable also as areference book for all researchers active in the field.

Formation of Structure in the Universe Springer Science & Business Media
Essays discuss the present state of knowledge following recent

discoveries about the structure of the universe, galaxies, quasars, neutrinos, and other topics, and suggest areas for future research

Cosmology and Particle Astrophysics

Springer Science & Business Media

Astronomy and Astrophysics Abstracts aims to present a comprehensive documen tation of the literature concerning all aspects of astronomy, astrophysics, and their border fields. It is devoted to the recording, summarizing, and indexing of the relevant publications throughout the world. Astronomy and Astrophysics Abstracts is prepared by a special department of the Astronomisches Rechen-Institut under the auspices of the International Astronomical Union. Volume 34 records literature published in 1983 and received before February 17, 1984. Some older documents which we received late and which are not surveyed in earlier volumes are included too. We acknowledge with thanks contributions of our colleagues all over the world. We also express our gratitude to all organiza tions, observatories, and publishers which provide us with complimentary copies of their publications. Starting with Volume 33, all the recording, correction, and data processing work was done by means of computers. The recording was done by our technical staff members Ms. Helga Ballmann, Ms. Mona El-Choura and Ms. Monika Kohl. Mr. Martin Schlotelburg and Mr. Ulrich Oberall supported our task by careful proofreading. It is a pleasure to thank them all for their encouragement. Heidelberg, March 1984 The Editors Contents Introduction . . . . . Concordance Relation: ICSU-AB-

AAA 3 Abbreviations 10 Periodicals, Proceedings, Books, Activities 001 Periodicals . . . . . 15 002 Bibliographical Publications, Documentation, Catalogues, Atlases 50 003 Books ..... 58 004 History of Astronomy 67 005 Biography . . 71 006 Personal Notes 73 007 Obituaries . . . *Fritz Zwicky* John Wiley & Sons Incorporated "Splendidly satisfying reading, designed for a nonspecialist audience."—Kirkus Reviews, starred review Evalyn Gates, a talented astrophysicist, transports readers to the edge of contemporary science to explore the revolutionary tool—"Einstein's telescope"—that is unlocking the secrets of the Universe. Einstein's telescope, or gravitational lensing, is so-called for the way gravity causes space to distort and allow massive objects to act like "lenses," amplifying and distorting the images of objects behind them. By allowing for the detection of mass where no light is found, scientists can map out the distribution of dark matter and come a step closer to teasing out the effects of dark energy on the Universe—which may forever upend long-held notions about where the Universe came from and where it is going. *Astrophysical Applications of Gravitational Lensing* Springer Science & Business Media This is an exhaustive review of our theoretical and observational knowledge of gravitational lensing 10 years after the discovery of the first lensed quasar, Q0957+561. Gravitational optics, optical, infrared, and radio observations of quasar-lens candidates, microlensing, arcs in clusters of galaxies, and radio rings are presented. In particular, the continuing survey of quasar-lens

candidates, the new measurement of the time delay in 0957+561, the suspended microlensing effect through the galaxy 2237+030, as well as the discovery of new arcs and the measurement of new redshifts for two of them are presented. Numerous papers on the modelling of arcs and rings show how it should be possible to probe dark matter with these unexpected gravitational telescopes. Finally, tables summarize all the lens candidates we know today.

Gravitational Lenses
Cambridge University Press
Gravitational lenses offer the best, and sometimes the only, means of tackling key problems in many fields of astrophysics and cosmology. According to Einstein's theory, the curvature of light-rays increases with mass; gravitational lenses can be used to map the distribution of mass in a Universe in which virtually all matter is dark matter of an unknown nature. Gravitational lensing has significantly improved our knowledge of many astrophysical phenomena, such as exoplanets, galaxies, active galactic nuclei, quasars, clusters, large-scale structure and the Universe itself. All these topics are covered fully in this book, together with two tutorials on lens and microlensing modelling. The future of lensing in relation to large surveys and the anticipated discoveries of thousands more gravitational lenses is also discussed, making this volume an ideal guide for postgraduate students and practising researchers in the use of gravitational lenses as a tool in their investigations.

Gravitational Lensing: An Astrophysical Tool
Springer Science & Business Media
This book presents gravitational lensing as an essential tool in astrophysics for tracking dark matter at all scales in the Universe.

Gravitational Lensing: Strong, Weak and Micro
National Academies Press
An up-to-date and comprehensive graduate-level textbook on the fast-moving subject of structure

formation in cosmology, written by eleven world-leading authorities.