Astronomy Lecture Notes Physics 101 Academics

Gamma ray astronomy, the branch of high energy astrophysics that studies the sky in energetic Ýgamma¨-ray photons, is destined to play a crucial role in the exploration of nonthermal phenomena in the Universe in their most extreme and violent forms. This book presents the motivations and highlights the principal objectives of the field, as well as demonstrates its intrinsic links to other branches of high energy astrophysics. Preference is given to three topical areas: (i) origin of cosmic rays: (ii) physics and astrophysics of relativistic jets: (iii) observational gamma ray cosmology. Also, a significant part of the book is devoted to the discussion of the principal mechanisms of production and absorption of energetic Ýgamma¨-rays in different astrophysical environments, as well as to the description of the detection methods of high energy cosmic Ýgamma¨- radiation.

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)

Astronomy is by nature an interdisciplinary activity: it involves mathematics, physics, chemistry and biology. Astronomers use (and often develop) the latest technology, the fastest computers and the most refined software. In this book twenty-two leading scientists from nine countries talk about how astronomy interacts with these other sciences. They describe modern instruments used in astronomy and the relations

between astronomy and technology, industry, politics and philosophy. They also discuss what it means to be an astronomer, the history of astronomy, and the place of astronomy in society today.

Living the College Life helps you overcome the Freshman Fear Factor! College will be one of the most exciting and intimidating times of your life, and you're going to have questions as you head into this new experience. Living the College Life gives you real answers to common questions--answers from students who have "been there, done that." More than 100 upperclassmen and recent graduates from colleges all over the country candidly discuss what worked--and what didn't work--for them. Topics include what to take with you (this book, for example), academics, social and campus life, relationships, and money. Questions cut to the chase: * How should I handle alcohol issues? * How can I deal with the roommate from hell? * Should I take advantage of that great-sounding credit card? * Should I withdraw from that class I'm having trouble in? * Should I join a sorority or fraternity? * Should I take a computer? Laptop or desktop? * How often should I go home? (Don't ask your mother that question!) Issues are discussed in a quick, painless question/answer format. With this book, you'll have the tools you need to think through the tough questions and make the best decisions for you! With Living the College Life, CliffsNotes--the resource that helps millions get to and through college--now helps you get off to a good start on campus.

Contains abstracts of innovative projects designed to improve undergraduate education in science, mathematics, engineering, and technology. Descriptions are organized by discipline and include projects in: astronomy, biology, chemistry, computer science, engineering, geological sciences, mathematics, physics, and social sciences, as well as a selection of interdisciplinary projects. Each abstract includes a description of the project, published and other instructional materials, additional products of the project, and information on the principal investigator and participating institutions.

Describes how changes in Earth's orientation are observed and computed in terms of tidal forcing and models of Earth's interior.

Astronomical spectrographs analyse light emitted by the Sun, stars, galaxies and other objects in the Universe, and have been used in astronomy since the early nineteenth century. This book provides a comprehensive account of spectrographs from an historical perspective, from their theory and development over the last two hundred years, to the recent advances of the early twenty-first century. The author combines the theoretical principles behind astronomical spectrograph design with their historical development. Spectrographs of all types are considered, with prism, grating or grism dispersing elements. Included are Cassegrain, coudé, prime focus, échelle, fibre-fed, ultraviolet, nebular, objective prism, multi-object instruments and those which are ground-based, on rockets and balloons or in space. The book contains several tables listing the most significant instruments, around 900 references, and over 150 images, making it an indispensable reference for professional astronomers, graduate students, advanced amateur astronomers, and historians of science.

The fourth in a series of major international conferences in the field of Gamma-Ray Astronomy, attended by leading experts as well as young scientists from many universities and research centers. The symposium covered the basic observational and many theoretical topics related to ground and space-based Gamma-Ray Astronomy, Astroparticle Physics and Cosmology.

Quasars and active galaxies are the most powerful emitters of radiation in the universe. Modern radio telescope arrays have shown that the ultimate energy source resides in the central few parsecs of the galactic nucleus, and powers the emitting regions by way of two oppositely-directed relativistic jets of energy. This volume presents the latest observations and theories of these remarkable objects. Topics discussed include superluminal motions, the physics of jets and shock fronts in jets, related optical observations, and cosmic evolution. Particular attention is given to the "unified theories," which attempt to show that many of the phenomena in powerful extragalactic objects are different aspects of a single, basic mechanism; the main difference in their appearance is a result of their different orientation with respect to the observer.
IAU S238 report on the physics of black holes, by leading researchers in the field.
This book provides a chronological introduction to the sciences of astronomy and cosmology based on the reading and analysis of significant selections from classic texts, such as Ptolemy’s The Almagest, Kepler’s Epitome of Copernican Astronomy, Shapley’s Galaxies and Lemaître’s The Primeval Atom. Each chapter begins with a short introduction followed by a reading selection. Carefully crafted study questions draw out key points in the text and focus the reader’s attention on the author’s methods, analysis, and conclusions. Numerical and observational exercises at the end of each chapter test the reader’s ability to understand and apply key concepts from the text. The Heavens and the Earth is the first of four volumes in A Student’s Guide Through the Great Physics Texts. This book grew out of a four-semester undergraduate physics curriculum designed to encourage a critical and circumspect approach to natural science, while at the same time preparing students for advanced coursework in physics. This book is particularly suitable as a college-level textbook for students of the natural sciences, history or philosophy. It also serves as a textbook for advanced high-school students, or as a thematically-organized source-book for scholars and motivated lay-readers. In studying the classic scientific texts included herein, the reader will be drawn toward a lifetime of contemplation.
This book is an introduction to gravitational waves and related astrophysics. It provides a bridge across the range of astronomy, physics and cosmology that comes into play when trying to understand the gravitational-wave sky. Starting with Einstein's theory of gravity, chapters develop the key ideas step by step, leading up to the technology that finally caught these faint whispers from the distant universe. The second part of the book makes a direct connection with current research, introducing the relevant language and making the involved concepts less mysterious. The book is intended to work as a platform, low enough that anyone with an elementary understanding of gravitational waves can scramble onto it, but at the same time high enough to connect readers with active research - and the many exciting discoveries that are happening right now. The first part of the book introduces the key ideas, following a general overview chapter and including a brief reminder of Einstein's theory. This part can be taught as a self-contained one semester course. The second part of the book is written to work as a collection of "set pieces" with core material that can be adapted to specific lectures and additional material that provide context and depth. A range of readers may find this book useful, including graduate students, astronomers looking for basic understanding of the gravitational-wave window to the universe, researchers analysing data from gravitational-wave detectors, and nuclear and particle physicists.

IAU Transactions are published as a volume corresponding to each General Assembly. Volume A is produced prior to the Assembly and contains Reports on Astronomy, prepared by each Commission President. The intention is to summarize the astronomical results that have affected the work of the Commission since the production of the previous Reports up to a time which is about one year prior to the General Assembly. Volume B is produced after the Assembly and contains accounts of Commission Meetings which were held, together with other material. The reports included in the present volume range from outline summaries to lengthy compilations and references. Most reports are in English.

This well-illustrated resource provides vital cross-section information for the atomic and molecular collision processes taking place in the boundary region of magnetically confined fusion plasmas and in other laboratory and astrophysical low-temperature plasmas. The expertly assessed information in this noteworthy volume includes the most recent experimental and theoretical results presented in a convenient format. Coverage includes the processes of electron-impact excitation and ionization of plasma edge atoms, electron-ion recombination, dissociative collision processes involving electrons and much more.

This reference encompasses the fields of Geomagnetism and Paleomagnetism in a single volume. Both sciences have applications in navigation, in the search for minerals and hydrocarbons, in dating rock sequences, and in unraveling past geologic movements such as plate motions they have contributed to a better understanding of the Earth. The book describes in fine detail the current state of knowledge and provides an up-to-date synthesis of the most basic concepts. It is an indispensable working tool not only for geophysicists and geophysics students but also for geologists, physicists, atmospheric and environmental scientists, and engineers.

Astronomy is written in clear non-technical language, with the occasional touch of humor and a wide range of clarifying illustrations. It has many analogies drawn from everyday life to help non-science majors appreciate, on their own terms, what our modern exploration of the universe is revealing. The book can be used for either aone-semester or two-semester introductory course (bear in mind, you can customize your version and include only those chapters or sections you will be teaching.) It is made available free of charge in electronic form (and low cost in printed form) to students around the world. If you have ever thrown up your hands in despair over the spiraling cost of astronomy textbooks, you owe your students a good look at this one. Coverage and Scope Astronomy was written, updated, and reviewed by a broad range of astronomers and astronomy educators in a strong community effort. It is designed to meet scope and sequence requirements of introductory astronomy courses nationwide. Chapter 1: Science and the Universe: A Brief Tour Chapter 2: Observing the Sky: The Birth of Astronomy Chapter 3: Orbits and Gravity Chapter 4: Earth, Moon, and Sky Chapter 5: Radiation and Spectra Chapter 6: Astronomical Instruments Chapter 7: Other Worlds: An Introduction to the Solar System Chapter 8: Earth as a Planet Chapter 9: Cratered Worlds Chapter 10: Earthlike Planets: Venus and Mars Chapter 11: The Giant Planets Chapter 12: Rings, Moons, and Pluto Chapter 13: Comets and Asteroids: Debris of the Solar System Chapter 14: Cosmic Samples and the Origin of the Solar System Chapter 15: The Sun: A Garden-Variety Star Chapter 16: The Sun: A Nuclear Powerhouse Chapter 17: Analyzing Starlight Chapter 18: The Stars: A Celestial

Census Chapter 19: Celestial Distances Chapter 20: Between the Stars: Gas and Dust in Space Chapter 21: The Birth of Stars and the Discovery of Planets outside the Solar System Chapter 22: Stars from Adolescence to Old Age Chapter 23: The Death of Stars Chapter 24: Black Holes and Curved Spacetime Chapter 25: The Milky Way Galaxy Chapter 26: Galaxies Chapter 27: Active Galaxies, Quasars, and Supermassive Black Holes Chapter 28: The Evolution and Distribution of Galaxies Chapter 29: The Big Bang Chapter 30: Life in the Universe Appendix A: How to Study for Your Introductory Astronomy Course Appendix B: Astronomy Websites, Pictures, and Apps Appendix C: Scientific Notation Appendix D: Units Used in Science Appendix E: Some Useful Constants for Astronomy Appendix F: Physical and Orbital Data for the Planets Appendix G: Selected Moons of the Planets Appendix H: Upcoming Total Eclipses Appendix I: The Nearest Stars, Brown Dwarfs, and White Dwarfs Appendix J: The Brightest Twenty Stars Appendix K: The Chemical Elements Appendix L: The Constellations Appendix M: Star Charts and Sky Event Resources

"Glorious."—Wall Street Journal Rescued from obscurity, Feynman's Lost Lecture is a blessing for all Feynman followers. Most know Richard Feynman for the hilarious anecdotes and exploits in his best-selling books "Surely You're Joking, Mr. Feynman!" and "What Do You Care What Other People Think?" But not always obvious in those stories was his brilliance as a pure scientist—one of the century's greatest physicists. With this book and CD, we hear the voice of the great Feynman in all his ingenuity, insight, and acumen for argument. This breathtaking lecture—"The Motion of the Planets Around the Sun"—uses nothing more advanced than high-school geometry to explain why the planets orbit the sun elliptically rather than in perfect circles, and conclusively demonstrates the astonishing fact that has mystified and intrigued thinkers since Newton: Nature obeys mathematics. David and Judith Goodstein give us a beautifully written short memoir of life with Feynman, provide meticulous commentary on the lecture itself, and relate the exciting story of their effort to chase down one of Feynman's most original and scintillating lectures.

This book leads directly to the most modern numerical techniques for compressible fluid flow, with special consideration given to astrophysical applications. Emphasis is put on high-resolution shock-capturing finite-volume schemes based on Riemann solvers. The applications of such schemes, in particular the PPM method, are given and include large-scale simulations of supernova explosions by core collapse and thermonuclear burning and astrophysical jets. Parts two and three treat radiation hydrodynamics. The power of adaptive (moving) grids is demonstrated with a number of stellar-physical simulations showing very crispy shock-front structures.

The nonlinear theory of oscillating systems brings new aspects into the study of variable stars. Beyond the comparison of linear periods and the estimate of stability, the appearance and disappearance of possible modes can be studied in detail. While nonlinearity in stellar pulsations is not a very complicated concept, it generally requires extensive and sometimes so phisticated numerical studies. Therefore, the development of appropriate computational tools is required for applications of nonlinear theory to real phenomena in variable stars. Taking trends in variable star studies into consideration, the International Astronomical Union organized a colloquium for the nonlinear phenomena of variable stars at Mito, Japan in 1992. The colloquium served to give an overview of the new frontiers of variable star studies and to encourage further

development of this field. The colloquium covered the fundamental theory, interesting observational facts, and the numerical modeling. The publication of the proceedings was somewhat delayed since one of the editors, M. T., was overwhelmed by administrative work. We are sorry that the excellent reviews of Drs. H. :Mori, M. Sano, and K. Makishima cannot be found in the proceedings. We also miss the summary given by Dr. W. W. Dziembowski. Throughout the editing procedure Dr. Y. Tanaka of Ibaraki University kindly helped us. Because of the unfortunate delay of the publication~ the significance of several papers may be affected. Even so, we believe that the papers are useful to variable star researchers because of their scientific importance.

Designed for a two-semester advanced undergraduate or graduate level course, this distinctive and modern textbook provides students with the physical intuition and mathematical skills to tackle even complex problems in quantum mechanics with ease and fluency. Beginning with a detailed introduction to quantum states and Dirac notation, the book then develops the overarching theoretical framework of quantum mechanics, before explaining physical quantum mechanical properties such as angular momentum and spin. Symmetries and groups in quantum mechanics, important components of current research, are covered at length. The second part of the text focuses on applications, and includes a detailed chapter on quantum entanglement, one of the most exciting modern applications of quantum mechanics, and of key importance in quantum information and computation. Numerous exercises are interspersed throughout the text, expanding upon key concepts and further developing students' understanding. A fully worked solutions manual and lecture slides are available for instructors.

Concise and self-contained, this textbook gives a graduate-level introduction to the physical processes that shape planetary systems, covering all stages of planet formation. Writing for readers with undergraduate backgrounds in physics, astronomy, and planetary science, Armitage begins with a description of the structure and evolution of protoplanetary disks, moves on to the formation of planetesimals, rocky, and giant planets, and concludes by describing the gravitational and gas dynamical evolution of planetary systems. He provides a self-contained account of the modern theory of planet formation and, for more advanced readers, carefully selected references to the research literature, noting areas where research is ongoing. The second edition has been thoroughly revised to include observational results from NASA's Kepler mission, ALMA observations and the JUNO mission to Jupiter, new theoretical ideas including pebble accretion, and an up-to-date understanding in areas such as disk evolution and planet migration.

This book is a concise primer on galactic radio astronomy for undergraduate and graduate students, and provides wide coverage of galactic astronomy and astrophysics such as the physics of interstellar matter and the dynamics and structure of the Milky Way Galaxy and galaxies. Radio astronomy and its technological development have led to significant progress in galactic astronomy and contributed to understanding interstellar matter and galactic structures. The book begins with the fundamental physics of radio-wave radiation, i.e., black body radiation, thermal emission, synchrotron radiation, and HI and molecular line emissions. The author then gives overviews of ingredients of galactic physics, including interstellar matter such as the neutral (HI), molecular hydrogen, and ionized gases, as well as magnetic fields in

galaxies. In addition, more advanced topics relevant to the Galaxy and galaxies are also contained here: star formation, supernova remnants, the Galactic Center and black holes, galactic dynamics and dark-matter halos, magnetism of galaxies, interstellar gases in galaxies, and starbursts. A unique feature of this book is its focus on how to analyze and interpret radio astronomical observation data and how to describe the underlying physics from such data. A wealth of figures and images will be a great help for undergraduate and graduate students to understand the contents. Furthermore, the well-summarized contents of theory and observation will appeal to young researchers as well.

This book is written to conclude the NATO Advanced Research Workshop "Quantum Noise in Mesoscopic Physics" held in Delft, the Netherlands, on June 2-4, 2002. The workshop was co-directed by M. Reznikov of Israel Institute of Technology, and me. The members of the organizing committee were Yaroslav Blanter (Delft), Chirstopher Glattli (Saclay and ENS Paris) and R. Schoelkopf (Yale). The workshop was very successful, and we hope that the reader will be satisfied with the scientific level of the present book. Before addressing scientific issues I find it suitable to address several non-scientific ones. The workshop was attended by researchers from many countries. Most of them perform their activities in academic institutions, where one usually finds the necessary isolation from the problems and sores of the modem world. However, there was a large group of participants for which such isolation was far from perfect. War, hatred, and violence rage just several miles away of their campuses and laboratories, poisoning everyday life in the land of Israel.

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 43 records literature published in 1987 and received before August 15, 1987. 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. Beate Gobel, Ms. Monika Kohl, Ms. Sylvia Matyssek, Ms. Doris Schmitz-Braunstein, Ms. Utta-Barbara Stegemann. Mr. Jochen Heidt and Mr. Kristopher Polzine supported our task by careful proof reading. It is a pleasure to thank them all for their encouragement. Heidelberg, October 1987 The Editors Contents Introduction . . . . . 1 Concordance Relation: PHYS-AAA 3 Abbreviations 5 Periodicals, Proceedings, Books, Activities 001 Periodicals . . . . . 10 002 Bibliographical Publications, Documentation, Catalogues, Data Bases 50 003 Books ..... .

Covering the theory of computation, information and communications, the physical aspects of computation, and the physical limits of computers, this text is based on the notes taken by one of its editors, Tony Hey, on a lecture course on computation given b

This new, fourth, edition of Allen's classic Astrophysical Quantities belongs on every astronomer's bookshelf. It has been thoroughly revised and brought up to date by a team of more than ninety internationally renowned astronomers and astrophysicists. While it follows the basic format of the original, this indispensable reference has grown to more than twice the size of the earlier editions to accommodate the great strides made in astronomy and astrophysics. It includes detailed tables of the most recent data on: - General constants and units - Atoms, molecules, and spectra - Observational astronomy at all wavelengths from radio to gamma-rays, and neutrinos - Planetary astronomy: Earth, planets and satellites, and solar system small bodies - The Sun, normal stars, and stars with special characteristics - Stellar populations - Cataclysmic and symbiotic variables, supernovae - Theoretical stellar evolution - Circumstellar and interstellar material - Star clusters, galaxies, quasars, and active galactic nuclei - Clusters and groups of galaxies - Cosmology. As well as much explanatory material and extensive and up-to-date bibliographies.

The authors explore solar flares by applying physics and theoretical investigations.

This volume highlights astronomy in the curriculum, and addresses how the teaching and learning of astronomy can be improved worldwide.

Stellar magnetism is the study of the magnetic field of the Sun and other stars and is a rapidly developing field of astrophysics. This book, an authoritative account with broad astronomical scope, has grown out of the lifelong work of an outstanding researcher in the subject.

Written by a leading expert, this monograph presents recent developments on supernova remnants, with the inclusion of results from various satellites and ground-based instruments. The book details the physics and evolution of supernova remnants, as well as provides an up-to-date account of recent multiwavelength results. Supernova remnants provide vital clues about the actual supernova explosions from X-ray spectroscopy of the supernova material, or from the imprints the progenitors had on the ambient medium supernova remnants are interacting with - all of which the author discusses in great detail. The way in which supernova remnants are classified, is reviewed and explained early on. A chapter is devoted to the related topic of pulsar wind nebulae, and neutron stars associated with supernova remnants. The book also includes an extended part on radiative processes, collisionless shock physics and cosmic-ray acceleration, making this book applicable to a wide variety of astronomical sub-disciplines. With its coverage of fundamental physics and careful review of the state of the field, the book serves as both textbook for advanced students and as reference for researchers in the field.

The extraordinary, unlikely tale of Tycho Brahe and Johannes Kepler and their enormous contribution to astronomy and understanding of the cosmos is one of the strangest stories in the history of science. Kepler was a poor, devoutly religious teacher with a genius for mathematics. Brahe was an arrogant,

extravagant aristocrat who possessed the finest astronomical instruments and observations of the time, before the telescope. Both espoused theories that seem off-the-wall to modern minds, but their fateful meeting in Prague in 1600 was to change the future of science. Set in one of the most turbulent and colourful eras in European history, when medieval was giving way to modern, Tycho and Kepler is a double biography of these two remarkable men.

ASTRONOMY LECTURE NOTES Physics 101By Alain J. Brizard

Essential Radio Astronomy is the only textbook on the subject specifically designed for a one-semester introductory course for advanced undergraduates or graduate students in astronomy and astrophysics. It starts from first principles in order to fill gaps in students' backgrounds, make teaching easier for professors who are not expert radio astronomers, and provide a useful reference to the essential equations used by practitioners. This unique textbook reflects the fact that students of multiwavelength astronomy typically can afford to spend only one semester studying the observational techniques particular to each wavelength band. Essential Radio Astronomy presents only the most crucial concepts—succinctly and accessibly. It covers the general principles behind radio telescopes, receivers, and digital backends without getting bogged down in engineering details. Emphasizing the physical processes in radio sources, the book's approach is shaped by the view that radio astrophysics owes more to thermodynamics than electromagnetism. Proven in the classroom and generously illustrated throughout, Essential Radio Astronomy is an invaluable resource for students and researchers alike. The only textbook specifically designed for a one-semester course in radio astronomy Starts from first principles Makes teaching easier for astronomy professors who are not expert radio astronomers Emphasizes the physical processes in radio sources Covers the principles behind radio telescopes and receivers Provides the essential equations and fundamental constants used by practitioners Supplementary website includes lecture notes, problem sets, exams, and links to interactive demonstrations An online illustration package is available to professors

In the 1990s, nanoparticles and quantum dots began to be used in optical, electronic, and biological applications. Now they are being studied for use in solid-state quantum computation, tumor imaging, and photovoltaics. Handbook of Nanophysics: Nanoparticles and Quantum Dots focuses on the fundamental physics of these nanoscale materials and structures. Each peer-reviewed chapter contains a broad-based introduction and enhances understanding of the state-of-the-art scientific content through fundamental equations and illustrations, some in color. This volume provides an overview of the major categories of nanoparticles, including amorphous, magnetic, ferroelectric, and zinc oxide nanoparticles; helium nanodroplets; and silicon, tetrapod-shaped semiconductor, magnetic ion-doped semiconductor, and natural polysaccharide nanocrystals. It also describes their properties and interactions. In the group of chapters on nanofluids, the expert contributors discuss the stability of nanodispersions, liquid slip at the molecular scale, thermophysical properties, and heat transfer. They go on to examine the theory, self-assembly, and teleportation of quantum dots. Nanophysics brings together multiple disciplines to determine the structural, electronic, optical, and thermal behavior of nanomaterials; electrical and thermal conductivity; the forces between nanoscale objects; and the transition between classical and quantum behavior. Facilitating communication across many disciplines, this landmark publication

encourages scientists with disparate interests to collaborate on interdisciplinary projects and incorporate the theory and methodology of other areas into their work.

Explore the curiosities of our galaxy! Too often, textbooks obscure the beauty and wonder of outer space with tedious discourse that even Galileo would oppose. Astronomy 101 cuts out the boring details and lengthy explanations, and instead, gives you a lesson in astronomy that keeps you engaged as you discover what's hidden beyond our starry sky. From the Big Bang and nebulae to the Milky Way and Sir Isaac Newton, this celestial primer is packed with hundreds of entertaining astronomy facts, charts, and photographs you won't be able to get anywhere else. So whether you're looking to unravel the mystery behind black holes, or just want to learn more about your favorite planets, Astronomy 101 has all the answers--even the ones you didn't know you were looking for.

Solar and stellar photospheres constitute the layers most accessible to observations, forming the interface between the interior and the outside of the stars. The solar atmosphere is a rich physics laboratory, in which the whole spectrum of radiative, dynamical, and magnetic processes that tranfer energy into space can be observed. As the fundamental processes take place on very small spatial scales, we need high· resolution observations to explore them. On the other hand the small-scale processes act together to form global properties of the sun, which have their origins in the solar interior. The rapid advances in observational techniques and theoreticallllodelling over the past decade made it very timely to bring together scientists from east and west to the first lAU Symposium on this topic. The physics of the photosphere involves complicated interactions between magnetic fields, convection, waves, and radiation. During the past decade our understanding of these gener ally small-scale structures and processes has been dramatically advanced. New instrumen tations, on ground and in space, have given us new means to study the granular convection. Diagnostic methods in Stokes polarimetry have allowed us to go beyond the limitations of spatial resolution to explore the structure and dynamics of the subarcsec magnetic struc tures. Extensive numerical simulations of the interaction between convection and magnetic fields using powerful supercomputers are providing deepened physical insight. Granulation, magnetic fields, and dynamo processes are being explored in the photospheres of other stars, guided by our improved understanding of the solar photosphere.

The XXth General Assembly of the International Astronomical Union was held in Baltimore, Maryland USA from August 02 to 11, 1988. The Inaugural Ceremony on August 02 was held in the presence of representatives of the United States Governn:ent, t~e S~ate of Maryland, the City of Baltimore and the host institution -the Johns Hopkins Umverslty- as well as of the National and Local Organising Committees. The scientific programme maintained the high standards of the Union and the scientific proceedings may be found either in this volume or in volume 8 of Highlights of Astronomy. The scientific programme was organised by the 40 Commission Presidents and coordinated by the General Secretary (1985-1988), Dr. J.-P. Swings. The local arrangements were effectively made through the National Organising Committee under the Chairmanship of Prof. F. Drake and the Local Organising Committee under the co-Chairmanship of Prof. A. Oavidsen and Dr. R. Giacconi. The smooth day to day operation of the meeting resulted from the incomparable dedication of Karen Weinstock

and Harold Screen.