An Introduction To Star Formation

Structure and Evolution of Single Stars: An introduction is intended for upper-level undergraduates and beginning graduates with a background in physics. Following a brief overview of the background observational material, the basic equations describing the structure and evolution of single stars are derived. The relevant physical processes, which include the equation of state, opacity, nuclear reactions and neutrino losses are then reviewed. Subsequent chapters describe the evolution of low-mass stars from formation to the final white dwarf phase. The final chapter deals with the evolution of massive stars.

This book is based on a series of lectures for an Astrophysics of the Interstellar Medium (ISM) master's degree in Astrophysics and Cosmology at Padova University. From the cold molecular phase in which stars and planetary systems form, to the very hot coronal gas that surrounds galaxies and galaxy clusters, the ISM is everywhere. Studying its properties is vital for the exploration of virtually any field in astronomy and cosmology. These notes give the student a coherent and accurate mathematical and physical approach, with continuous references to the real ISM in galaxies. The book is divided into three parts. Part One introduces the equations of fluid dynamics for a system at rest and acoustic waves, and then explores the real ISM through the role of thermal conduction and viscosity, concluding with a discussion of shock waves and turbulence. In Part Two, the electromagnetic field is switched on and its role in modulating shock waves and contrasting gravity is studied. Part Three describes dust

and its properties, followed by the main stellar sources of energy. The last two chapters respectively address the various components of the ISM and molecular clouds and star formation.

An Introduction to Stellar Astrophysics aspires to provide the reader with an intermediate knowledge on stars whilst focusing mostly on the explanation of the functioning of stars by using basic physical concepts and observational results. The book is divided into seven chapters, featuring both core and optional content: Basic concepts Stellar Formation Radiative Transfer in Stars Stellar Atmospheres Stellar Interiors Nucleosynthesis and Stellar Evolution and Chemically Peculiar Stars and Diffusion. Student-friendly features include: Detailed examples to help the reader better grasp the most important concepts A list of exercises is given at the end of each chapter and answers to a selection of these are presented. Brief recalls of the most important physical concepts needed to properly understand stars. A summary for each chapter Optional and advanced sections are included which may be skipped without interfering with the flow of the core content. This book is designed to cover the most important aspects of stellar astrophysics inside a one semester (or half-year) course and as such is relevant for advanced undergraduate students following a first course on stellar astrophysics, in physics or astronomy programs. It will also serve as a basic reference for a full-year course as well as for researchers working in related fields.

This book is a comprehensive treatment of star formation, one of the most active fields of modern astronomy. The reader is guided through the subject in a logically compelling manner. Starting from a general description of stars and interstellar clouds,

the authors delineate the earliest phases of stellar evolution. They discuss formation activity not only in the Milky Way, but also in other galaxies, both now and in the remote past. Theory and observation are thoroughly integrated, with the aid of numerous figures and images. In summary, this volume is an invaluable resource, both as a text for physics and astronomy graduate students, and as a reference for professional scientists.

An Introduction to Star Formation

Protostars and Planets IV

An Introduction to Nuclear Astrophysics

A Problem Solving Approach with MATLAB

Interstellar and Intergalactic Medium

Using fundamental physics, the theory of stellar structure and evolution can predict how stars are born, how their complex internal structure changes, what nuclear fuel they burn, and their ultimate fate. This textbook is a stimulating introduction for undergraduates in astronomy, physics and applied mathematics, taking a course on the physics of stars. It uniquely emphasises the basic physical principles governing stellar structure and evolution. This second edition contains two new chapters on mass loss from

stars and interacting binary stars, and new exercises. Clear and methodical, it explains the processes in simple terms, while maintaining mathematical rigour. Starting from general principles, this textbook leads students step-by-step to a global, comprehensive understanding of the subject. Fifty exercises and full solutions allow students to test their understanding. No prior knowledge of astronomy is required, and only a basic background in physics and mathematics is necessary.

The formation of the first stars (Pop III stars) and galaxies is one of the great outstanding challenges in modern astrophysics and cosmology. The first stars are likely key drivers for early cosmic evolution and will be at the center of attention over the next decade. The best available space and ground-based telescopes like the Hubble Space Telescope probe the Universe to high redshifts and provide us with tantalizing hints; but they cannot yet directly detect the first generation of stars and the formation of the first galaxies. This is left as key science

for future telecopes like the James Webb Space Telescope. This book is based in part on classroom tested lectures related to Pop III stars, but also draws from the author's review articles of the main physical principles involved. The book will thus combine pedagogical introductory chapters with more advanced ones to survey the cutting-edge advances from the frontier of research. It covers the theory of first star formation, the relation between first stars and dark matter, their impact on cosmology, their observational signatures, the transition to normal star formation as well as the assembly of the first galaxies. It will prepare students for interpreting observational findings and their cosmological implications.

An account of classic and contemporary aspects of astrophysics, with an emphasis on analytical calculations and physical understanding.

Like the Earth and planets, stars rotate. Understanding how stars rotate is central to modelling their structure, formation and evolution, and how they interact with their

environment and companion stars. This authoritative volume, first published in 2000, provides a lucid introduction to stellar rotation and the definitive reference to the subject. It combines theory and observation in a comprehensive survey of how the rotation of stars affects the structure and evolution of the Sun, single stars and close binaries. This book will be of primary interest to graduate students and researchers studying solar and stellar rotation and close binary systems. It will also appeal to those with a more general interest in solar and stellar physics, star formation, binary stars and the hydrodynamics of rotating fluids - including geophysicists, planetary scientists and plasma physicists.

Chemical Evolution from Interstellar Clouds to Star and Planet Formation

Introduction to Galaxy Formation and Evolution

Star Formation

The Story of Star Formation

Stellar Formation

The gas and dust between the stars emit across the electromagnetic spectrum and are found in a range of physical conditions from diffuse plasmas to cold, dense molecules. Through their study we see how quantum processes shape the structure of our Galaxy and fluid mechanics sets the stellar mass scale. The Interstellar Medium is a very broad subject with layers of complexity, a long history and a steady flow of new results. This comprehensive yet accessible textbook provides a self-contained one-semester course for advanced undergraduate or beginning graduate students. It is written in a style that students can follow by themselves and allows instructors to use class time to go deeper into the details or show applications to current research. It makes extensive use of publicly accessible data to illustrate specific points and to encourage students to learn by performing their own analyses.

This book brings together diverse work from many different branches of astronomy and shows clearly the synthesis of ideas that has resulted.

Proceedings of the NATO Advanced Study Institute, The Physics of Star Formation and Early Evolution-II, held in Crete, Greece, 24 May-5 June, 1998

A coherent introduction for researchers in astronomy, particle physics, and cosmology on the formation and evolution of galaxies.

Fundamentals of Galaxy Dynamics, Formation and Evolution
From Primordial Gas to Present-Day Galaxies
Astrophysics of Planet Formation
The Origin of Stars and Planetary Systems
Membrane Filtration

This book is the final one in a series of three texts which together provide a modern, complete and authoritative account of our present knowledge of the stars. It discusses the internal structure and the evolution of stars, and is completely self-contained. There is an emphasis on the basic physics governing stellar structure and the basic ideas on which our understanding of stellar structure is based. The book also provides a comprehensive discussion of stellar evolution. Careful comparison is made between theory and observation, and the author has thus provided a lucid and balanced introductory text for the student. As for volumes 1 and 2, volume 3 is self-contained and can be used as an independent textbook. The author has not only taught but has also published many original papers in this subject. Her clear and readable style should make this text a first choice for undergraduate and beginning graduate students taking courses in astronomy and particularly in stellar astrophysics.

In the hierarchical view of star formation, the densest regions of the interstellar medium (ISM) undergo gravitational collapse to form stars. Typically, many stars

are formed in tandem to produce a star cluster. In turn, these star clusters are grouped together to form larger associations of clusters and these form together to shape the large-scale galactic structures like spiral arms. Charting the connection between the star formation at small-scales and the large-scale galactic properties is crucial for understanding the evolution of galaxies. We begin this dissertation in Chapter 1 with an introduction to the current understanding of star formation, the cold gas of the ISM, and how the two are related. We also outline the big-picture questions we seek to answer in this dissertation and the tools needed in these studies. In Chapter 2, we discuss the first step in a joint analysis of Hubble Space Telescope (HST) observations and Atacama Large Millimeter/submillimeter Array (ALMA) dust continuum maps. This study aims to correlate the emission from young star clusters with the properties of the observed dust. Chapter 3 sets up the spectral energy distribution modeling effort for the Physics at High Angular Resolutions in Nearby GalaxieS-HST (PHANGS-HST) star cluster data pipeline. This chapter goes into great detail on testing, validating, and characterizing how well we can model the star clusters. This modeling provides estimates of the physical properties of the star clusters which are critical for the analysis presented in Chapter 4. In this study, we utilize the PHANGS-HST star cluster catalogs in 11 nearby galaxies combined with the PHANGS--ALMA giant molecular cloud (GMC)

catalogs in order to spatially correlate the star clusters with their natal gas clouds. With this correlation, we constrain the timescale for dissipation of the GMCs after the onset of star formation.

An elementary university text about stars for introductory courses in astronomy and astrophysics.

Galaxies, along with their underlying dark matter halos, constitute the building blocks of structure in the Universe. Of all fundamental forces, gravity is the dominant one that drives the evolution of structures from small density seeds at early times to the galaxies we see today. The interactions among myriads of stars, or dark matter particles, in a gravitating structure produce a system with fascinating connotations to thermodynamics, with some analogies and some fundamental differences. Ignacio Ferreras presents a concise introduction to extragalactic astrophysics, with emphasis on stellar dynamics, and the growth of density fluctuations in an expanding Universe. Additional chapters are devoted to smaller systems (stellar clusters) and larger ones (galaxy clusters). Fundamentals of Galaxy Dynamics, Formation and Evolution is written for advanced undergraduates and beginning postgraduate students, providing a useful tool to get up to speed in a starting research career. Some of the derivations for the most important results are presented in detail to enable students appreciate the beauty of maths as a tool to understand the workings of

galaxies. Each chapter includes a set of problems to help the student advance with the material.

Galaxy Formation and Evolution

Protostars and Planets VI

An Introduction to Modern Astrophysics

Introduction to the Interstellar Medium

Stellar Rotation

"This volume integrates the cross-disciplinary aspects of this broad field. Covering a wide range of scales, from the formation of large clouds in our Milky Way galaxy down to small chondrules in our solar system, it takes an encompassing view with the goal of highlighting what we know and emphasizing the frontiers of what we do not know"--

The diverse forms that stars assume in the course of their lives can all be derived from the initial conditions : the mass and the original chemical composition. In this textbook Stars and Stellar Evolution the basic concepts of stellar structure and the main roads of stellar evolution are described. First, the observable parameters are presented,

which are based on the radiation emerging from a stellar atmosphere. Then the basic physics is described, such as the physics of gases, radiation transport, and nuclear processes, followed by essential aspects of modelling the structure of stars. After a chapter on star formation, the various steps in the evolution of stars are presented. This leads us to brown dwarfs, to the way a star changes into the red-giant state and numerous other stages of evolution and ultimately to the stellar ashes such as white dwarfs, supernovae and neutron stars. Stellar winds, stellar rotation and convection all influence the way a star evolves. The evolution of binary stars is included by using several canonical examples in which interactive processes lead to X-ray binaries and supernovae of type Ia. Finally, the consequences of the study of stellar evolution are tied to observed mass and luminosity functions and to the overall evolution of matter in the universe. The authors aim at reaching an understanding of stars and their evolution by both graduate students and astronomers who are not

themselves investigating stars. To that end, numerous graphs and sketches, among which the Hertzsprung-Russell diagram is the dominant one, help trace the ways of stellar evolution. Ample references to specialised review articles as well as to relevant research papers are included.

The book begins with a historical introduction, "Star Formation: The Early History", that presents new material of interest for students and historians of science. This is followed by two long articles on "Pre-Main-Sequence Evolution of Stars and Young Clusters" and "Observations of Young Stellar Objects". These articles on the fascinating problem of star formation from interstellar matter give a thorough overview of present-day theories and observations. The articles contain material so far unpublished in the astronomical literature. The book addresses graduate students and can be used as a textbook for advanced courses in stellar astrophysics.

During the Seven Years' War (1755-63), a number of independent light-infantry outfits served under British

command and dedicated light companies were added to the British Army's regular infantry battalions. The light companies were disbanded after the war but the prominent role played by light infantry was not forgotten, and in 1771-72 light-infantry companies were reinstated in every regiment in the British Isles. Although William Howe formed a training camp at Salisbury in 1774 specifically to practise light-infantry doctrine, the outbreak of the American Revolution in 1775 found the British Army wanting, and the light companies were no different. After evacuating Boston in March 1776, Howe began to remodel and drill his army at Halifax, standardizing lighter uniform and emphasizing more open-order tactics. He also brigaded his light companies together into composite battalions, which went on to fight in almost every major engagement during the American Revolution. They spearheaded British assaults, using night-time surprise and relying upon the bayonet in engagements such as Paoli and Old Tappan. They also matched their regular and irregular opponents in bush-fighting, and

at times fought in far-flung detachments alongside Native American and Loyalist allies on the frontier. Featuring specially commissioned full-colour artwork, this book offers a comprehensive guide to the formation, uniform, equipment, doctrines and tactics of these elite light infantry companies and battalions, and considers how, over the course of the war they developed a fearsome reputation, and exemplified the psychological characteristics exhibited by crack military units across history.

Physics, Formation and Evolution of Rotating Stars

Principles of Star Formation

Physics of Star Formation in Galaxies

The Tai Chi in Star Formation

Essential Astrophysics

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.

In an illustrated, accessible text, the author explains the life cycle of stars, from dense molecular clouds to the enigmatic nebulae some stars leave behind in their violent ends.

This concise textbook covers all aspects of the

interstellar and intergalactic medium, for graduate students and advanced undergraduates.
A comprehensive examination of nearly fourteen billion years of galaxy formation and evolution, from primordial gas to present-day galaxies.
Astrophysics of the Interstellar Medium
Probing the Environments of Star Formation Using Star Clusters in Nearby Galaxies
An Introduction to Stellar Astrophysics
Saas-Fee Advanced Course 29. Lecture Notes 1999. Swiss Society for Astrophysics and Astronomy
International Series in Natural Philosophy

Guiding the reader through all the stages that lead to the formation of a star such as our Sun, this advanced textbook provides students with a complete overview of star formation. It examines the underlying physical processes that govern the evolution from a molecular cloud core to a main-sequence star, and focuses on the formation of solar-mass stars. Each chapter combines theory and observation, helping readers to connect with

and understand the theory behind star formation. Beginning with an explanation of the interstellar medium and molecular clouds as sites of star formation, subsequent chapters address the building of typical stars and the formation of high-mass stars, concluding with a discussion of the by-products and consequences of star formation. This is a unique, self-contained text with sufficient background information for self-study, and is ideal for students and professional researchers alike.

Click here for the online version of this book! This title, out of print in 2008, is now available free of charge, in it's entirety, online through the University of Arizona Press! Both a textbook and a status report for every facet of research into the formation of stars and planets, Protostars and Planets IV brings together 167 authors who report on the most significant advances in the field since the publication of the previous volume in 1993. Protostars and Planets IV reflects improvements in observational techniques and the availability of new facilities such as the Infrared Space Observatory, the refurbished Hubble Space Telescope, and the 10-m Keck telescopes. Advances in computer technology and modeling methods

have benefited theoretical studies of molecular clouds, star formation, and jets and disks, while recent analyses of meteorites yield important insights into conditions and processes within our Sun's early protoplanetary disk. The 49 chapters describe context and progress for observational and theoretical studies of the structure, chemistry, and dynamics of molecular clouds; the collapse of cores and the formation of protostars; the formation and properties of young binary stars; the properties of winds, jets, and molecular outflows from young stellar objects; the evolution of circumstellar envelopes and disks; grain growth in disks and the formation of planets; and the properties of the early Solar nebula. Protostars and Planets IV is also the first book to include chapters describing the discoveries of extrasolar planets, brown dwarfs, and Edgeworth-Kuiper Belt objects, and the first to include high-resolution optical and near-infrared images of protoplanetary disks. Protostars and Planets IV is an unsurpassed reference not only for established researchers but also for younger scientists whose imagination and work will lead to tomorrow's discoveries. This book provides a modern introduction to the study of star

formation, at a level suitable for graduate students or advanced undergraduates in astrophysics. The first third of the book provides a review of the observational phenomenology and then the basic physical processes that are important for star formation. The remainder then discusses the major observational results and theoretical models for star formation on scales from galactic down to planetary. The book includes recommendations for complementary reading from the research literature, as well as five problem sets with solutions. Request Inspection Copy
This thesis presents a pioneering method for gleaning the maximum information from the deepest images of the far-infrared universe obtained with the Herschel satellite, reaching galaxies fainter by an order of magnitude than in previous studies. Using these high-quality measurements, the author first demonstrates that the vast majority of galaxy star formation did not take place in merger-driven starbursts over 90% of the history of the universe, which suggests that galaxy growth is instead dominated by a steady infall of matter. The author further demonstrates that massive galaxies suffer a gradual decline in their star formation activity, providing an alternative path for galaxies

to stop star formation. One of the key unsolved questions in astrophysics is how galaxies acquired their mass in the course of cosmic time. In the standard theory, the merging of galaxies plays a major role in forming new stars. Then, old galaxies abruptly stop forming stars through an unknown process. Investigating this theory requires an unbiased measure of the star formation intensity of galaxies, which has been unavailable due to the dust obscuration of stellar light.

Introduction to Astrochemistry

An Introduction to the Theory of Stellar Structure and Evolution

The Life and Death of Stars

An Introduction to the Sun and Stars

An Introduction to Astronomy and Astrophysics

Focusing on the application of membranes in an engineering context, this hands-on computational guide makes previously challenging problems routine. It formulates problems as systems of equations solved with MATLAB, encouraging active learning through worked examples and end-of-chapter problems. The detailed treatments of dead-end filtration include novel approaches to constant rate filtration and filtration with a centrifugal pump. The discussion of crossflow microfiltration includes the use of kinetic and force balance models. Comprehensive coverage of ultrafiltration and diafiltration processes employs both limiting flux

and osmotic pressure models. The effect of fluid viscosity on the mass transfer coefficient is explored in detail, the effects of incomplete rejection on the design and analysis of ultrafiltration and diafiltration are analysed, and quantitative treatments of reverse osmosis and nanofiltration process analysis and design are explored. Includes a chapter dedicated to the modelling of membrane fouling.

Understanding star formation is one of the key fields in present-day astrophysics. This book treats a wide variety of the physical processes involved, as well as the main observational discoveries, with key points being discussed in detail. The current star formation in our galaxy is emphasized, because the most detailed observations are available for this case. The book presents a comparison of the various scenarios for star formation, discusses the basic physics underlying each one, and follows in detail the history of a star from its initial state in the interstellar gas to its becoming a condensed object in equilibrium. Both theoretical and observational evidence to support the validity of the general evolutionary path are presented, and methods for comparing the two are emphasized. The author is a recognized expert in calculations of the evolution of protostars, the structure and evolution of disks, and stellar evolution in general. This book will be of value to graduate students in astronomy and astrophysics as well as to active researchers in the field.

TO NUCLEAR ASTROPHYSICS The Formation and the Evolution of Matter in the Universe JEAN AUDOUZE lnstitut d'Astrophysique de Paris, France and SYLVIE VA UCLAI R DAPHE, Ohservatoire de Meudon, France and lnstitut d'Astrophysique, Paris D, REIDEL PUBLISHING

COMPANY DORDRECHT: HOLLAND/BOSTON: U. S. A. LONDON: ENGLAND Library of Congre~ Cataloging in Publication Data Audouzc. Jean An introduction to nuclear astrophysics. (Geophysics and astrophysics monographs; v. 18) En!. and updated translation of L'Astrophysique nuclt\aire. Includes bibliographies and index. \. Nuclear astrophysics. I. Vauclair, Sylvie, joint author. II. Title. III. Series. QB464. A9313 1979 523. 01'9'7 79-20752 ISBN-13: 978-90-277-1053-6 e-ISBN-13: 978-94-009-9477-5 DO I: 10. 1007/978-94-009-9477-5 Published by D. Reidel Publishing Company, P. O. Box 17. Dordrecht, Holland Sold and distributed in the U. S. A. , Canada, and Mexico by D. Reidel Publishing Company, Inc. Lincoln Building. 160 Old Derby Street, Hingham, Mass. 02043, U. S. A. TABLE OF CONTENTS IX FOREWORD INTRODUCTION xi XXI ACKNOWLEDGEMENTS CHAPTER I / THE OBSERVATIONAL BASIS OF NUCLEAR ASTROPHYSICS 1. 1. The Importance of the Four Fundamental Interactions 1 1. 2.

An Introduction to Modern Astrophysics is a comprehensive, well-organized and engaging text covering every major area of modern astrophysics, from the solar system and stellar astronomy to galactic and extragalactic astrophysics, and cosmology. Designed to provide students with a

working knowledge of modern astrophysics, this textbook is suitable for astronomy and physics majors who have had a first-year introductory physics course with calculus. Featuring a brief summary of the main scientific discoveries that have led to our current understanding of the universe; worked examples to facilitate the understanding of the concepts presented in the book end-of-chapter problems to practice the skills acquired; and computational exercises to numerically model astronomical systems, the second edition of An Introduction to Modern Astrophysics is the go-to textbook for learning the core astrophysics curriculum as well as the many advances in the field.

An introduction

The Origin of Stars

British Light Infantry in the American Revolution

Structure and Evolution of Single Stars

A Statistical and Multi-wavelength Study of Star Formation in Galaxies

Rotation is ubiquitous at each step of stellar evolution, from star formation to the final stages, and it affects the course of evolution, the timescales and nucleosynthesis. Stellar rotation is also an essential prerequisite for the occurrence of Gamma-Ray Bursts. In this book the author thoroughly examines the basic mechanical and thermal effects of rotation, their influence on mass loss by stellar winds, the effects of differential rotation and its associated instabilities, the relation with magnetic fields and the evolution of the internal

and surface rotation. Further, he discusses the numerous observational signatures of rotational effects obtained from spectroscopy and interferometric observations, as well as from chemical abundance determinations, helioseismology and asteroseismology, etc. On an introductory level, this book presents in a didactical way the basic concepts of stellar structure and evolution in "track 1" chapters. The other more specialized chapters form an advanced course on the graduate level and will further serve as a valuable reference work for professional astrophysicists.

Stellar Formation focuses on the properties, distributions, characteristics, and formation of stars and galaxies. The manuscript first offers information on locations of star formation, as well as the distribution of interstellar gas, clouds, and globules; spatial relationships between young stars and interstellar matter; and distribution of young stars. The book also tackles frequency distribution of stellar masses and aggregates of stars. The text ponders on the frequency distribution of cloud masses, rate and environment of star formation, and cloud structure in the interstellar gas. The publication also examines the fragmentation of clouds into protostars and the frequency distribution of protostar masses, rate of formation of stars, and evolution of galaxies. Discussions focus on random fragmentation, gravitational turbulence, and fragmentation

induced by molecule formation. The manuscript is a vital reference for scientists and readers interested in stellar formation.

Tai Chi, a Chinese martial art developed based on the laws of nature, emphasises how 'to conquer the unyielding with the yielding.' The recent observation of star formation shows that stars result from the interaction between gravity, turbulence and magnetic fields. This interaction again follows the natural rules that inspired Tai Chi. For example, if self-gravity is the force that dominates, the molecular cloud will collapse isotropically, which compresses magnetic field lines. The density of the yielding field lines increases until magnetic pressure reaches the critical value to support the cloud against the gravitational force in directions perpendicular to the field lines (Lorentz force). Then gravity gives way to Lorentz force, accumulating gas only along the field lines till the gas density achieves the critical value to again compress the field lines. The Tai Chi goes on in a self similar way.

Astronomy is the field of science devoted to the study of astronomical objects, such as stars, galaxies, and nebulae. Astronomers have gathered a wealth of knowledge about the universe through hundreds of years of painstaking observations. These observations are interpreted by the use of physical and chemical laws familiar to mankind. These interpr

The First Stars
In Darkness Born
The Formation of Stars
Stars & Stellar evolution
The Formation and the Evolution of Matter in the Universe

This book takes a reader on a tour of astronomical phenomena: from the vastness of the interstellar medium, to the formation and evolution of stars and planetary systems, through to white dwarfs, neutron stars, and black holes, the final objects of the stellar graveyard. At its heart, this book is a journey through the evolutionary history of the birth, life, and death of stars, but detours are also made to other related interesting topics. This highly accessible story of the observed contents of our Galaxy includes intuitive explanations, informative diagrams, and basic equations, as needed. It is an ideal guide for undergraduates with some physics and mathematics background who are studying astronomy and astrophysics. It is also accessible to interested laypeople, thanks to its limited equations. Key features: Includes coverage of some of the latest exciting research from the field, including star formation, exoplanets, and black holes Can be utilised as a stand-alone textbook for a one-term course or as a supplementary textbook for a more comprehensive course on astronomy and astrophysics Authored by a team respected for research, education, and outreach Shantanu Basu is an astrophysicist and

a professor at The University of Western Ontario, Canada. He is known for research contributions on the formation of gravitationally-collapsed objects in the universe: stars, planets, brown dwarfs, and supermassive black holes. He is one of the originators of the migrating embryo scenario of episodic accretion onto young stars. He has been recognized for his teaching excellence and his contributions to the astronomical community include organizing many conferences and training schools. Pranav Sharma is an astronomer and science historian known for his work on the history of the Indian Space Program. He has curated the Space Museum at the B. M. Birla Science Centre (Hyderabad, India). He is in-charge of the history of Indo-French scientific partnership project supported by the Embassy of France in India. He is a national-award-winning science communicator and has extensively worked on the popularization of astronomy education in India.

This important book describes the basic principles of astrochemistry—an interdisciplinary field combining astronomy, physics, and chemistry—with particular emphasis on its physical and chemical background. Chemical processes in diffuse clouds, dense quiescent molecular clouds, star-forming regions, and protoplanetary disks are discussed. A brief introduction to molecular spectroscopy and observational techniques is also presented. These contents provide astronomers with a comprehensive understanding of how interstellar matter is evolved and brought into stars

and planets, which is ultimately related to the origin of the solar system. The subject matter will also be understandable and useful for physical chemists who are interested in exotic chemical processes occurring in extreme physical conditions. The book is a valuable resource for all researchers beginning at the graduate level.

Whre do stars come from and how do they form? These are profound questions which link the nature of our Universe to the roots of mankind. Yet, until a recent revolution in understanding, the proposed answers have been raw speculation. Now, accompanying penetrating observations, a new picture has come into prominence. This book presents the latest astounding observations and scientific ideas covering star formation, star birth and early development. It encompasses all aspects, from the dramatic stories of individual objects, to the collective influence of entire stellar systems. The very first stars to come into existence and the nurturing of planets are discussed to provide the reader with a comprehensive overview. Presenting background information with only the essential mathematics, this book will appeal to scientists wishing to expand their horizons, students seeking solid foundations, and general readers with enquiring minds.

Interstellar Medium to Stellar Remnants

Lectures on Astrophysics

Introduction to Stellar Astrophysics: Volume 3