Dust And Molecules In Evolved Stars 1st Edition

#evolved stars #dust molecules stars #stellar evolution astrochemistry #astronomical dust research #molecular astronomy

Explore the critical role of dust and molecules in evolved stars, delving into their formation, composition, and impact on stellar evolution. This comprehensive 1st edition offers deep insights into astrochemistry and astronomical dust within the stellar lifecycle.

Dust and Molecules in Evolved Stars

Dust and molecules are found in a large variety of astrophysical environments, in particular in the circumstellar material ejected by evolved stars. This book brings together the leading astronomers and astrophysicists in the field of molecular astrophysics and stellar physics to discuss the important issues of dust and molecular formation, the role of solids in circumstellar environments, molecules as probes of circumstellar parameters, the stellar contribution to the enrichment of the Galaxy, and the latest observational data in various wavelength domains, in partiular in the infrared with results from the Infrared Space Observatory. The astrophysical senarios include late-type stars, novae, Wolf-Rayet stars, Luminous Blue Variables and supernovae. Audience: Researchers and graduate students in the fields of stellar physics, stellar evolution and astrochemistry.

Dust and Molecules in Evolved Stars

Dust is widespread in the galaxy. To astronomers studying stars it may be just an irritating fog, but it is becoming widely recognized that cosmic dust plays an active role in astrochemistry. Without dust, the galaxy would have evolved differently, and planetary systems like ours would not have occurred. To explore and consolidate this active area of research, Dust and Chemistry in Astronomy covers the role of dust in the formation of molecules in the interstellar medium, with the exception of dust in the solar system. Each chapter provides thorough coverage of our understanding of interstellar dust, particularly its interaction with interstellar gas. Aimed at postgraduate researchers, the book also serves as a thorough review of this significant area of astrophysics for practicing astronomers and graduate students.

Dust and Chemistry in Astronomy

This volume contains the proceedings of a conference on laboratory astrophysics, which gathered a broad interdisciplinary community of astrophysicists, physicists, chemists, and geophysicists. It

provides an update on outstanding results in this research field, the presentation of new laboratory developments, and the recent and expected to come space missions and other astronomical observatories with their specific needs for laboratory and theoretical studies. Understanding the interplay between dust, ice, and gas during the star lifecycle as well as in planet forming regions and the Solar System is a vast topic in relation with space exploration and astronomical observations. It also strongly relies on laboratory astrophysics activities and chemical modelling in order to simulate the formation and evolution of matter in space. This book provides researchers and graduate students with a valuable account of the current state of this fascinating discipline.

European Conference on Laboratory Astrophysics ECLA2020

This book provides a comprehensive survey of modern molecular astrophysics. It includes an introduction to molecular spectroscopy and then addresses the main areas of current molecular astrophysics, including galaxy formation, star forming regions, mass loss from young as well as highlyevolved stars and supernovae, starburst galaxies plus the tori and discs near the central engines of active galactic nuclei. All chapters have been written by invited authors who are acknowledged experts in their fields. The thorough editorial process has ensured a uniformly high standard ofexposition and a coherent style. The book is unique in giving a detailed view of its wide-ranging subject. It will provide the standard introduction for research students in molecular astrophysics. The book will be read by research astronomers and astrophysicists who wish to broaden the basis oftheir knowledge or are moving their activities into this burgeoning field. It will enable chemists to learn the astrophysics most related to chemistry as well as instruct physicists about the molecular processes most important in astronomy.

The Mineralogy of Dust Around Evolved Stars

This interdisciplinary book consists of the proceedings of the Alexander Ivanovich Oparin lOOth Anniversary Conference, The Third Trieste Conference on Chemical Evolution, which took place at the International Centre for Theoretical Physics from 29 August till 2 September, 1994. A general overview of Oparin's life and work is followed by a review of Alfonso Herera, another pioneer in the studies of the origin of life. The subject matter is organized in ten sections corresponding to various aspects of our current understanding of the subject that was initiated by Oparin. These subjects were covered by fifty three speakers. There were sixty seven participants from a wide geographical distribution; twenty seven countries were represented. We have included the invited lecture of Professor Igor Kulaev, who was unable to be present at the conference for reasons beyond his control. The conference was generously supported by the International Centre for Theoretical Physics, the Commission of the European Communities, the International Centre for Genetic Engineering and Biotechnology, the International Centre for Science and High Technology, and UNESCO. Cyril Ponnamperuma, University of Maryland, U.S.A. Julian Chela-Flores, ICTP, Italy, and IDEA, Venezuela. xi FOREWORD As this volume was going to press we learnt of the untimely death of Cyril Ponnamperuma who died of cardiac arrest on December 20, 1994.

The Molecular Astrophysics of Stars and Galaxies

Dust is a ubiquitous feature of the cosmos, impinging directly or indirectly on most fields of modern astronomy and astrophysics. Dust in the Galactic Environment, Second Edition provides a thorough overview of the subject, covering general concepts, methods of investigation, important results and their significance, relevant literature, and some suggestions for promising avenues of future research. Since the publication of the first edition of this popular graduate text, major advances have been made in our understanding of astrophysical dust, especially in the light of exciting new results from space- and ground-based telescopes, together with advances in laboratory astrophysics and theoretical modeling. This new, expanded edition highlights the latest results and provides a context for future research opportunities. The first chapter provides a historical perspective for current research and an overview of interstellar environments and the role of dust in astrophysical processes, followed by a discussion of the cosmic history of the chemical elements expected to be present in dust and an examination of the effect of gas-dust interactions on gas phase abundances. The next several chapters describe the observed properties of interstellar grains, such as their extinction, polarization, absorption, and emission characteristics. Then, the book explores the origin and evolution of dust, tracing its life cycle in a succession of environments from circumstellar shells to diffuse interstellar clouds, molecular clouds, protostars, and protoplanetary disks. The final chapter summarizes progress toward a unified model. Dust in other galaxies is discussed as an integral part of the text rather than as a distinct topic requiring

separate chapters. Containing extensive references and problems to aid understanding and illustrate basic principles, the book is ideally suited for graduate and advanced undergraduate courses. It will also be an invaluable reference for postgraduate students and researchers working in this important field.

Chemical Evolution: Structure and Model of the First Cell

This book contains the elaborated and updated versions of the 24 lectures given at the 43rd Saas-Fee Advanced Course. Written by four eminent scientists in the field, the book reviews the physical processes related to star formation, starting from cosmological down to galactic scales. It presents a detailed description of the interstellar medium and its link with the star formation. And it describes the main numerical computational techniques designed to solve the equations governing self-gravitating fluids used for modelling of galactic and extra-galactic systems. This book provides a unique framework which is needed to develop and improve the simulation techniques designed for understanding the formation and evolution of galaxies. Presented in an accessible manner it contains the present day state of knowledge of the field. It serves as an entry point and key reference to students and researchers in astronomy, cosmology, and physics.

Dust in the Galactic Environment

Our knowledge of the origin, evolution, nature, and distribution of organic matter in space has undergone a revolution in recent years. Insights into various aspects of this material can be found using a variety of different technical approaches. These range from telescopic measurements by observational astronomers over a wide range of wavelengths, to laboratory experiments and simulations by chemists, physicists, and spectroscopists, and analyses of actual extraterrestrial materials. IAU Symposium 251 brought together expertise of scientists from different disciplines, including observational astronomers, laboratory spectroscopists, and solar system scientists, to provide a synthesis of our current understanding of these organics and to identify areas in which additional work and new ideas are required to further our understanding.

Star Formation in Galaxy Evolution: Connecting Numerical Models to Reality

Leading researchers in the area of the origin and evolution of life in the universe contributed to Chemical Evolution: Physics of the Origin and Evolution of Life. This volume provides a review of this interdisciplinary field. In 35 chapters many aspects of the origin of life are discussed by 90 authors, with particular emphasis on the early paleontological record: physical, chemical, biological, and informational aspects of life's origin, instrumentation in exobiology and system exploration; the search for habitable planets and extraterrestrial intelligent radio signals. This book contains the proceedings of the Fourth Trieste Conference on Chemical Evolution that took place in September 1995, in which scientists from a wide geographical distribution joined in a Memorial to Cyril Ponnamperuma, who was a pioneer in the field of chemical evolution, the origin of life, and exobiology, and also initiated the Trieste Conferences on Chemical Evolution and the Origin of Life. This fourth Conference was therefore dedicated to his memory. Audience: Graduate students and researchers in the many areas of basic, earth, and life sciences that contribute to the study of chemical evolution and the origin of life.

Organic Matter in Space (IAU S251)

This book represents the Proceedings of the NATO Advanced Study Insti tute on Formation and Evolution of Low Mass Stars held from 21 September to 2 October 1987 at Viana do Castelo, Portugal. Holding the meeting in Portugal recognized both the historical aspects and the bright future of astronomy in Portugal. In the early sixteenth century, the Portugese played an important role in the critical diffusion of classical and medieval knowledge which formed so large a part of scientific activity at that time. Navigation and course setting, brought to a high level by Portugese explorers, relied on mathematics and astronomy to produce precise tables of solar positions. In contemporary Portu gal, astronomy is the focus of renewed interest and support at the universities. It is thus particularly appropriate that the NATO Advanced Study Institute was held on the coast of the Atlantic Ocean in the friendly surroundings of the Costa Verde.

Chemical Evolution: Physics of the Origin and Evolution of Life

Stellar Formation brings together knowledge about the formation of stars. In seeking to determine the conditions necessary for star formation, this book examines questions such as how, where, and why stars form, and at what rate and with what properties. This text also considers whether the formation of a star is an accident or an integral part of the physical properties of matter. This book consists of 13 chapters divided into two sections and begins with an overview of theories that explain star formation as well as the state of knowledge of star formation in comparison to stellar structure and evolution. The places in which stars are forming are then analyzed by focusing on the distributions of very young stars, globules, and cloud fragments. The relationship between the distributions of stars and interstellar clouds is also considered. The chapters that follow explore the frequency distribution of stellar masses as well as the masses of aggregates of stars and interstellar clouds. The reader is also introduced to the rate and environment of star formation; the cloud-like structure of the interstellar gas; the ordering of interstellar clouds into spiral arms; and the conditions under which a cloud will contract until it is set inevitably on the route to becoming a star. The remaining chapters examine the fragmentation of clouds into protostars and the evolution of galaxies. This text will be of interest to students and practitioners of astronomy.

Formation and Evolution of Low Mass Stars

Without interstellar dust, the Universe as we see it today would not exist. Yet at first we considered this vital ingredient merely an irritating fog that prevented a clear view of the stars and nebulae in the Milky Way and other galaxies. We now know that interstellar dust has essential roles in the physics and chemistry of the formation of stars and planetary systems, the creation of the building blocks of life, and in the movement of those molecules to new planets. This is the story in this book. After introducing the materials this interstellar dust is made of, the authors explain the range of sizes and shapes of the dust grains in the Milky Way galaxy and the life cycle of dust, starting from the origins of dust grains in stellar explosions through to their turbulent destruction. Later on we see the variety of processes in interstellar space involving dust and the events there that cause the dust to change in ways that astronomers and astrobiologists can use to indirectly observe those events. This book is written for a general audience, concentrating on ideas rather than detailed mathematics and chemical formulae, and is the first time interstellar dust has been discussed at an accessible level.

Science, the Departments of State, Justice, and Commerce, and Related Agencies Appropriations for 2006

Astromineralogy deals with the science of gathering mineralogical information from the astronomical spectroscopy of asteroids, comets and dust in the circumstellar environments in general. This field has received a tremendous boost with the reliable identification of minerals by the Infrared Space Observatory. The first edition of this book, published in 2003, was the first comprehensive and coherent account of this exciting field. Data obtained in the meantime with the Spitzer Infrared Space Telescope, the stardust mission to the comet 81P / Wild 2, and with the Cassini mission, together with progress in ground-based observations and laboratory astrophysics form the basis for this updated and widely extended second edition.Beyond addressing the specialist in the field, the book is intended as a high-level but readable introduction to astromineralogy for both the nonspecialist researcher and the advanced student.

Stellar Formation

Praise for Craig Crossen and Gerald Rhemann's, Sky Vistas Astronomy "This is a practical and stunningly beautiful guide whose core is a descriptive tour of the best celestial sights: open and globular clusters, nebulae, galaxies, and large areas of sky. The photos in black and white and color, are magnificent. The text goes beyond ordinary descriptions to tell the reader something about each object's nature." Sky & Telescope "Packed with information that I have encountered nowhere else in amateur-astronomy literature. Sky Vistas also includes 48 full-page color astrophotos by Gerald Rhemann, most of which are magnificent."

Starbursts and Galaxy Evolution

The origin of stars is one of the principle mysteries of nature. During the last two decades advances in technology have enabled more progress to be made in the quest to understand stellar origins than at any other time in history. The study of star formation has developed into one of the most important branches of mod ern astrophysical research. A large body of observational data and

a considerable literat ure now exist concerning this topic and a 1arge community of international astronomers and physicists devote their efforts attempting to decipher the secrets of stellar birth. Yet, the young astronomerjphysicist or more advanced researcher desiring to obtain a basic background in this area of research must sift through a very diverse and sometimes bewildering literature. A literature which includes research in many discip1ines and sub discip1ines of classical astrophysics from stel lar structure to the interstellar medium and encompasses the entire range of the electromagnetic spectrum from radio to gamma rays. Often, the reward of a suc cessfu1 foray through the current literature is the realization that the results can be obsolete and outdated as soon as the ink is dry in the journal or the conference proceeding in which they are published.

Dust in Galaxies

This book explores the mechanics of star formation, the process by which matter pulls together and creates new structures. Written for science enthusiasts, the author presents an accessible explanation of how stars are born from the interstellar medium and giant molecular clouds. Stars produce the chemicals that lead to life, and it is they that have enabled the conditions for planets to form and life to emerge. Although the Big Bang provided the spark of initiation, the primordial universe that it sired was born hopelessly sterile. It is only through the continued recycling of the interstellar medium, star formation, and stellar evolution that the universe has been animated beyond a chaotic mess of elementary atomic particles, radiation, dark matter, dark energy, and expanding spacetime. Using the Milky Way and the Eagle Nebula in particular as case studies, Beech follows every step of this amazing process.

Astromineralogy

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.

Molecular Biology of Evolution

Science journalist Govert Schilling takes the reader on a whirlwind journey through time by describing the evolution of the cosmos, from the beginning of space and time fourteen billion years ago, to the creation of the Earth and humankind. Ending with a glance into the distant future of the universe, the book's combination of compelling text and breathtaking photographs provides an impressive vision of the place of man in the cosmos. Govert Schilling is a Dutch science writer and astronomy publicist. He is a contributing editor of Sky and Telescope magazine, and regularly writes for the news sections of Science and New Scientist. Schilling is the astronomy writer for de Volkskrant, one of the largest national daily newspapers in The Netherlands, and frequently talks about the Universe on Dutch radio broadcasts. He is the author of more than twenty popular astronomy books, including Flash! (Cambridge, 2002), and hundreds of newspaper and magazine articles on astronomy.

Sky Vistas

New stars form in the dense turbulent gas clouds of galaxies, and the formation of these clouds is the subject of the IAU S237. This book is the most up-to-date review of all aspects of cloud and star formation, and one of the few compendiums available on ISM turbulence.

The Physics of Star Formation and Early Stellar Evolution

Publisher description

The Pillars of Creation

This publication, in two volumes, includes most of the scientific papers presented at the first meeting of the International Society for the Study of the Origin of Life (ISSOL), held on June 25-28, 1973 in Barcelona, Spain. The first volume contains the invited articles and the second volume the contributed papers, which also appear in the 1974 and 1975 issues, respectively, of the new journal Origins of Life, published by D. Reidel. A relatively large number of meetings on the subject of the origin of life have been held in different places since 1957. In terms of its organization, scope, and number and nationality of participants, the Conference celebrated last year in Barcelona closely followed the three international conferences held earlier in Moscow, U.S.S.R., 1957, Wakulla Springs, U.S.A., 1963, and Pont-a-Mousson, France, 1970. For this reason the first ISSOL meeting was also named the 4th International Conference on the Origin of Life.

Physics, Formation and Evolution of Rotating Stars

The fundamental role that Astrochemistry plays into regulating the processes that in interstellar clouds lead to the formation of stars, and how these processes concur into affecting the shape and the dynamics of galaxies and hence into showing the Universe in the way it appears to us is well established. Together with those occurring in the gas phase a special relevance is recognized to processes that involve interstellar dust grains, the solid component of matter diffused among stars. The school on "Solid State Astrochemistry\

Evolving Cosmos

Currently under construction in Northern Chile, the Atacama Large Millimeter Array (ALMA) is the most ambitious astronomy facility under construction. This book describes the enormous capabilities of ALMA, the state of the project, and most notably the scientific prospects of such a unique facility. The book includes reviews and recent results on most hot topics of modern astronomy. It looks forward to the revolutionary results that are likely to be obtained with ALMA.

The Interplay Between Massive Star Formation, the ISM and Galaxy Evolution

This volume presents lectures of the XI Canary Islands Winter School of Astrophysics written by experts in the field.

Triggered Star Formation in a Turbulent Interstellar Medium (IAU S237)

Galaxies have a history. This has become clear from recent sky surveys showing that distant galaxies, formed early in the life of the Universe, differ from the nearby ones. This book contains the proceedings of a 2000 conference addressing observational clues in this area.

The Birth of Stars and Planets

This volume presents the most complete and up-to-date accounts of our understanding of the Magellanic Clouds and the astrophysical processes within them. Observations of these nearby dwarf galaxies continue to advance, calibrate and challenge our knowledge of the cosmos. They are rich in gas, they have been actively forming stars throughout their history, and they display a wealth of dynamical features. Poor in metals, they serve as a stepping stone towards understanding the high-redshift Universe. In IAU Symposium 256, scientists from vastly different fields of research discuss galactic dynamics, the physics of the interstellar medium and star formation, and the fundamental properties and evolution of stars. New insight was gained by crossing the traditional boundaries of these fields, placing the findings in the context of the structure and evolution of this interacting pair of galaxies uniquely available to our ever more powerful telescopes and computational machinery.

Physics of Stellar Evolution and Cosmology

`Are there other planetary systems like ours? Other planets like ours? Is there life elsewhere in the Universe?' So asks Dr. Lew Allen Jr. in the Foreword. In December of 1992, theorists, observers, and instrument builders gathered at the California Institute of Technology to discuss the search for answers to these questions. The International Conference, entitled `Planetary Systems: Formation, Evolution, and Detection' and supported through NASA's newly formed TOPS (Toward Other Planetary Systems) program, was the first of a series of conferences uniting researchers across disciplines and political boundaries to share thoughts and information on planetary systems. The conference was sponsored by NASA, hosted by JPL at Caltech, and endorsed by the 1992 International Space Year Association.

These proceedings include discussions of topics ranging from stellar, disk, and planetary formation to new ways of searching for other stellar systems containing planets. The authors represent a wide range of nationalities, disciplines, and points of view. The second international conference took place in December of 1993.

Cosmochemical Evolution and the Origins of Life

The Workshop “Science with the VLT in the ELT Era” held in Garching from 8th to 12th October 2007 was organised by ESO, with support from its Scienti c and Technical Committee, to provide a forum for the astronomical community to debate the long term future of ESO’s Very Large Telescope (VLT) and its interferometric mode (VLTI). In particular it was considered useful for future planning to evaluate how its science use may evolve over the next decade due to competition and/or synergy with new facilities such as ALMA, JWST and, hopefully, at least one next generation 30–40 m extremely large telescope whose acronym appears in the title to symbolise this wider context. These discussions were also held in the fresh light of the Science Vision recently developed within ASTRONET as the rst step towards a 20 year plan for implementing astronomical facilities—the rst such attempt within Europe. Speci c ideas and proposals for new, second generation VLT/I instruments were also solicited following a tradition set by several earlier Workshops held since the start of the VLT development. The programme consisted of invited talks and reviews and contributed talks and posters. Almost all those given are included here although, unfortunately not the several lively but constructive discussion sessions.

Solid State Astrochemistry

The Cosmos Explained pinpoints where you are in space and time, charting the life of our universe from the Big Bang to the future of our galaxy and beyond.

Science with the Atacama Large Millimeter Array:

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.

Galaxies at High Redshift

This book recounts results obtained via the Infrared Space Observatory (ISO) on comets, in the close environment of pre-main sequence stars, in the interstellar medium, and in the final stages of stellar life, using molecular hydrogen, ubiquitous crystalline silicates, water and ices. ISO has enabled investigation of the fuelling mechanism of galaxies, and new understanding of luminous infrared galaxies and their role in shaping present galaxies and in producing the cosmic infrared background.

The Evolution of Galaxies

Recent years have witnessed the expansion and multiplication of the observations of star formation and fragmentation accompanied by a consequent growth in the study of the underlying physical processes, the chemistry, the sites, the times, etc. Moreover, recent studies have shown that the formation of stars is likely to share many features with the formation of other self-gravitating objects. The present volume, therefore, discusses the formation of such objects in a systematic and comparative manner.

The Magellanic System (IAU S256)

Planetary Systems: Formation, Evolution, and Detection