

Alexander A. Friedmann:

the Man who Made the Universe Expand



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Chernin**

Alexander A Friedmann The Man Who Made The Universe Expand:

Alexander A Friedmann Eduard A. Tropp,Viktor Ya. Frenkel,Artur D. Chernin,1993-06-03 Our universe can be described mathematically by a simple model developed in 1922 at Petrograd St Petersburg by Alexander Friedmann 1888 1925 Without the benefit of observational evidence Friedmann predicted that the whole universe would expand and evolve with time This astonishing prediction was confirmed seven years later by Edwin Hubble Its originator unfortunately didn't live to savor this triumph This vivid biography of an outstanding scientist sets his life and work against a wide backdrop of the history of cosmological studies and its major players such as Einstein and others The book is a window on Friedmann's school and university years military service and teaching and research during a seminal period of Soviet history The authors include unique archival material such as Friedmann's letters from the Russian Front as well as contemporary records and reminiscences of colleagues There is a detailed treatment of his work in theoretical cosmology 1922 1924 set in the context of the organization of Soviet science at the time

Alexander A Friedmann Eduard A. Tropp,Viktor Ya. Frenkel,Artur D. Chernin,2006-05-11 Our universe can be described mathematically by a simple model developed in 1922 at Petrograd St Petersburg by Alexander Friedmann 1888 1925 Without the benefit of observational evidence Friedmann predicted that the whole universe would expand and evolve with time This astonishing prediction was confirmed seven years later by Edwin Hubble Its originator unfortunately didn't live to savor this triumph This vivid biography of an outstanding scientist sets his life and work against a wide backdrop of the history of cosmological studies and its major players such as Einstein and others The book is a window on Friedmann's school and university years military service and teaching and research during a seminal period of Soviet history The authors include unique archival material such as Friedmann's letters from the Russian Front as well as contemporary records and reminiscences of colleagues There is a detailed treatment of his work in theoretical cosmology 1922 1924 set in the context of the organization of Soviet science at the time

The World as Space and Time Alexander A. Friedmann,2014-03-25 This is the first English translation of the book *The World as Space and Time* written by the great Russian physicist Alexander Friedmann who first showed in 1922 that Einstein's equations have solutions that describe a non stationary Universe later the experimental evidence did confirm that the Universe is expanding The original Russian publication was in 1923 The book is one of the first introductions to the spacetime physics of the theory of relativity for a wider audience Friedmann had succeeded in both making the book accessible to non experts and providing rigorous explanations

Papers On Curved Spaces and Cosmology Alexander A. Friedmann,2014-01-30 If the talented Russian physicist Alexander Alexandrovich Friedmann had to be introduced with a single sentence the most appropriate sentence would be the title of his biography translated from the Russian Alexander A Friedmann The Man who Made the Universe Expand Indeed he was the first to realize in 1922 that Einstein's equations have solutions which describe not only a stationary Universe as Einstein initially believed but also a non stationary world Friedmann won the debate with Einstein

over the admissibility of such solutions but his life was too short and he could not see the triumph of his views when the experimental evidence fully supported his predictions and demonstrated that the Universe was expanding This book contains three papers by Friedmann On the Curvature of Space On the Possibility of a World with a Constant Negative Curvature of Space and On the Geometry of Curved Spaces The third paper is a 28 page manuscript dated 15 April 1922 which has not been published even in Russian Unlike the existing two English translations of Friedmann s 1922 and 1924 papers done from the German publications now these papers are translated directly from the original Russian texts Relativity: Modern Large-scale Spacetime Structure Of The Cosmos Moshe Carmeli,2008-12-04 This book describes Carmeli s cosmological general and special relativity theory along with Einstein s general and special relativity These theories are discussed in the context of Moshe Carmeli s original research in which velocity is introduced as an additional independent dimension Four and five dimensional spaces are considered and the five dimensional braneworld theory is presented The Tully Fisher law is obtained directly from the theory and thus it is found that there is no necessity to assume the existence of dark matter in the halo of galaxies nor in galaxy clusters The book gives the derivation of the Lorentz transformation which is used in both Einstein s special relativity and Carmeli s cosmological special relativity theory The text also provides the mathematical theory of curved space time geometry which is necessary to describe both Einstein s general relativity and Carmeli s cosmological general relativity A comparison between the dynamical and kinematic aspects of the expansion of the universe is made Comparison is also made between the Friedmann Robertson Walker theory and the Carmeli theory And neither is it necessary to assume the existence of dark matter to correctly describe the expansion of the cosmos **Enchantment Of Urania, The: 25 Centuries Of Exploration Of The Sky** Massimo Capaccioli,2024-03-19 Today we know much about the sky how stars are born how they live and die and how the universe as a whole evolves We have learned of the existence of another type of matter indifferent to light and yet decisive for the formation of galaxies and we have a hint of a dark energy that since the last 4 5 billion years has taken over the control of the cosmos We postulated and then discovered and even photographed black holes and listened to the faint rustle of the space time ripple produced when these monsters devour each other We reached these astonishing results recognized by a bunch of Nobel Prizes and filling every day the media with wonders for the eyes and the mind by the marriage of physics and astronomy that unified the Earth with the sky and then by the leap forward of science and technology in the Twentieth Century This rich heritage has ancient roots It was built by accumulating discoveries with errors observations with fantasies myths and superstitions with flashes of genius over a span of millennia since Homo sapiens turning his eyes to the immutable and perfect sky began to ask questions The book is a narration of the answers to these questions that had evolved over time a progressive path inserted in the general history with some second thoughts and many obstacles This is a saga of men and machines where greatness sometimes mixes with misery and passion often borders on sacrifice and even martyrdom Why should we know it Because our current knowledge is the

result of these efforts and of the preconceptions that accompanied them The challenge has been to present this complex and intricate subject without resorting to any formulas so that it can be accessible to a wide audience of curious people including high school and university students and in general all those who normally keep themselves informed of scientific things A rich bibliography has also been added in the appendix for those wishing to learn more on one or more topics

General Relativity Conflict and Rivalries Galina Weinstein, 2016-01-14 This book focuses on Albert Einstein and his interactions with and responses to various scientists both famous and lesser known It takes as its starting point that the discussions between Einstein and other scientists all represented a contribution to the edifice of general relativity and relativistic cosmology These scientists with whom Einstein implicitly or explicitly interacted form a complicated web of collaboration which this study explores focusing on their implicit and explicit responses to Einstein's work This analysis uncovers latent undercurrents indiscernible to other approaches to tracking the intellectual pathway of Einstein to his general theory of relativity The interconnections and interactions presented here reveal the central figures who influenced Einstein during this intellectual period Despite current approaches to history presupposing that the efforts of scientists such as Max Abraham and Gunnar Nordström which differed from Einstein's own views be relegated to the background this book shows that they all had an impact on the development of Einstein's theories stressing the limits of approaches focusing solely on Einstein As such **General Relativity Conflict and Rivalries** proves that the general theory of relativity was not developed as a single coherent construction by an isolated brooding individual but rather that it came to fruition through Einstein's conflicts and interactions with other scientists and was consolidated by his creative processes during these exchanges

The Evolving Universe and the Origin of Life Pekka Teerikorpi, Mauri Valtonen, Kirsi Lehto, Harry Lehto, Gene Byrd, Arthur Chernin, 2019-09-04 Regarding his discoveries Sir Isaac Newton famously said If I have seen further it is by standing upon the shoulders of giants **The Evolving Universe and the Origin of Life** describes complete with fascinating biographical details of the thinkers involved a history of the universe as interpreted by the expanding body of knowledge of humankind From subatomic particles to the protein chains that form life and expanding in scale to the entire universe this book covers the science that explains how we came to be This book contains a great breadth of knowledge from astronomy and physics to chemistry and biology The second edition brings this story up to date chronicling scientific achievements in recent years in such fields of research as cosmology the large scale architecture of the universe black holes exoplanets and the search for extraterrestrial life With over 250 figures this is a non technical easy to read textbook at an introductory college level that is ideal for anyone interested in science as well as its history

Teaching Science with Context Maria Elice de Brzezinski Prestes, Cibelle Celestino Silva, 2018-07-25 This book offers a comprehensive overview of research at interface between History Philosophy and Sociology of Science HPSS and Science Teaching in Ibero America It contributes to research on contextualization of science for students teachers and researchers and explains how to use different episodes of history of

science or different themes of philosophy of science in regular science classes through diverse pedagogical approaches The chapters in this book discuss a wide range of topics under different methodological epistemological and didactic approaches reflecting the richness of research developed in Spanish and Portuguese speaking countries Latin America Spain and Portugal The book contains chapters about historical events topics of philosophy and sociology of science nature of science applications of HPSS in the classroom instructional materials for students and teacher training courses and curriculum

Discovering the Expanding Universe Harry Nussbaumer, Lydia Bieri, 2009-03-26 This book explores the history of the discovery of the expanding universe one of the most exciting exploits in astronomy *The True Story of Modern Cosmology* Emilio Elizalde, 2021-08-19 This book tells the story of how over the past century dedicated observers and pioneering scientists achieved our current understanding of the universe It was in antiquity that humankind first attempted to explain the universe often with the help of myths and legends This book however focuses on the time when cosmology finally became a true science As the reader will learn this was a slow process extending over a large part of the 20th century and involving many astronomers cosmologists and theoretical physicists The book explains how empirical astronomical data e g Leavitt Slipher and Hubble were reconciled with Einstein's general relativity a challenge which finally led Friedmann De Sitter and Lemaître and eventually Einstein himself to a consistent understanding of the observational results The reader will realize the extraordinary implications of these achievements and how deeply they changed our vision of the cosmos From being small static immutable and eternal it became vast and dynamical originating from almost nothing and yet now nearly 14 billion years later undergoing accelerated expansion But as always happens as well as precious knowledge new mysteries have also been created where previously absolute certainty had reigned

Stalin's Great Science A. B. Kozhevnikov, 2004 World class science and technology developed in the Soviet Union during Stalin's dictatorial rule under conditions of political violence lack of international contacts and severe restrictions on the freedom of information Stalin's Great Science The Times and Adventures of Soviet Physicists is an invaluable book that investigates this paradoxical success by following the lives and work of Soviet scientists including Nobel Prize winning physicists Kapitza Landau and others throughout the turmoil of wars revolutions and repression that characterized the first half of Russia's twentieth century The book examines how scientists operated within the Soviet political order communicated with Stalinist politicians built a new system of research institutions and conducted groundbreaking research under extraordinary circumstances Some of their novel scientific ideas and theories reflected the influence of Soviet ideology and worldview and have since become accepted universally as fundamental concepts of contemporary science In the process of making sense of the achievements of Soviet science the book dismantles standard assumptions about the interaction between science politics and ideology as well as many dominant stereotypes mostly inherited from the Cold War about Soviet history in general Science and technology were not only granted unprecedented importance in Soviet society but they also exerted a crucial formative influence on the Soviet political system

itself Unlike most previous studies Stalin's Great Science recognizes the status of science as an essential element of the Soviet polity and explores the nature of a special relationship between experts scientists and engineers and communist politicians that enabled the initial rise of the Soviet state and its mature accomplishments until the pact eroded in later years undermining the communist regime from within

Space François Penz, Gregory Radick, Robert Howell, 2004-03-25 What is space This fascinating journey of exploration begins in our own minds the space within our brains We discover how space is used in sign language and in architecture before moving on to the virtual space created in an imaginary computer generated world The delineation of space has been important throughout human history and we look at how boundaries have been mapped in the past and how they remain politically important today Finally we travel into outer space to look at human exploration and the ultimate nature of space and the universe

Cosmology and Controversy Helge Kragh, 2021-03-09 For over three millennia most people could understand the universe only in terms of myth religion and philosophy Between 1920 and 1970 cosmology transformed into a branch of physics With this remarkably rapid change came a theory that would finally lend empirical support to many long held beliefs about the origins and development of the entire universe the theory of the big bang In this book Helge Kragh presents the development of scientific cosmology for the first time as a historical event one that embroiled many famous scientists in a controversy over the very notion of an evolving universe with a beginning in time In rich detail he examines how the big bang theory drew inspiration from and eventually triumphed over rival views mainly the steady state theory and its concept of a stationary universe of infinite age In the 1920s Alexander Friedmann and Georges Lemaître showed that Einstein's general relativity equations possessed solutions for a universe expanding in time Kragh follows the story from here showing how the big bang theory evolved from Edwin Hubble's observation that most galaxies are receding from us to the discovery of the cosmic microwave background radiation Sir Fred Hoyle proposed instead the steady state theory a model of dynamic equilibrium involving the continuous creation of matter throughout the universe Although today it is generally accepted that the universe started some ten billion years ago in a big bang many readers may not fully realize that this standard view owed much of its formation to the steady state theory By exploring the similarities and tensions between the theories Kragh provides the reader with indispensable background for understanding much of today's commentary about our universe

Untangling General Relativity Simon Sherwood, 2025-12-15 An easy to read introduction to Einstein's theory of general relativity In Untangling General Relativity Simon Sherwood explains the details of general relativity with clarity enthusiasm and a sense of fun Designed to be accessible to non experts the book combines intuitive explanations with the essential mathematics needed for a deep understanding of the subject Sherwood introduces that maths gradually and clearly in a step by step program designed to expand your appreciation and grasp of general relativity Untangling General Relativity serves as an effective springboard for more in depth studies It lays the groundwork for mastering the advanced topics covered in relativity textbooks and university

physics courses Readers will find A thorough introduction to general relativity including the interpretation of gravity as curved spacetime and a full derivation of Einstein's field equations Comprehensive explanations of the spacetime metric the equivalence principle the geodesic equation and the energy momentum and curvature tensors Vacuum curvature the Schwarzschild and Kerr metrics black holes white holes event horizons and gravitational waves Cosmology the Friedmann equations dark matter and energy the Big Bang inflation and an overview of current efforts to develop a quantum theory of gravity Perfect for undergraduate students preparing to take a university level physics course dealing with general relativity for the first time Untangling General Relativity will also benefit students of the natural sciences and instructors and educators with a professional or academic interest in the subject

Cosmos John North, 2008-07-15 The definitive history of humanity's search to find its place within the universe North charts the history of astronomy and cosmology from the Paleolithic period to the present day

The Universe of General Relativity A.J. Kox, Jean Eisenstaedt, 2006-09-10 A century ago in 1905 Albert Einstein published *On the Electrodynamics of Moving Bodies* in which the foundations were laid for the Special Theory of Relativity Ten years later his relativistic theory of gravitation and the General Theory of Relativity appeared Fifty years ago Einstein passed away in Princeton In the 1980s John Stachel then Editor of the *Collected Papers of Albert Einstein* brought together a group of historians philosophers physicists and mathematicians who had one thing in common a lively interest in the history and foundations of the theories of relativity At a meeting in 1986 at Osgood Hill this group met for the first time to discuss the prehistory development reception and other aspects of relativity It was the beginning of a valuable tradition Since then every three or four years a meeting has been organized during which historical and foundational issues in general and special relativity have been discussed Osgood Hill was followed by Luminy in 1988 Then came Johnstown 1991 Berlin 1995 Notre Dame 1999 and finally Amsterdam 2002 the proceedings of which are presented in this volume supplemented with some papers from the preceding meeting Once again these articles clearly show that an historical approach can lead to new insights into the development and elaboration of relativity The prehistory of special relativity and an early attempt at a relativistic theory of gravitation are covered in papers by John Stachel and Shaul Katzir respectively

Journal for the History of Astronomy, 1994

The Sky at Einstein's Feet William C. Keel, 2006-08-29 Specifically traces the impact of Einstein's ideas on astronomy including the way we interpret observations of stars and galaxies Includes comments from principals in important discoveries illuminating the processes behind these results Presents many applications of relativity that have not been shown in earlier popular level books and illustrates how deeply physics permeates the way we interpret many astronomical phenomena Highlights light travel delays in cosmic jets using gravitational lensing to trace cosmic mass distribution Illustrations employ new and archival data from ground and space based observatories

Strange Matters: Tom Siegfried, 2002-08-09 Scientists studying the universe find strange things in two places out in space and in their heads This is the story of how the most imaginative physicists of our time perceive

strange features of the universe in advance of the actual discoveries It is almost a given that physics and cosmology present us with some of the grandest mysteries of all What weightier questions to ponder than How does the universe work or What is the universe made of There are any number of bizarre phenomena that could provide clues or even answers to these queries The strangeness ranges from unusual forms of matter and realms of existence to wild ideas about how time and space are related to one another Many of these proposals may well turn out to be wrong But how many will be proven to be right This book speaks for the scientific theorists who are bold enough to imagine and predict the impossible New ideas are percolating in their heads every day One physicist may dream of subatomic particles that could resolve a variety of cosmological conundrums while another may study the likes of funny energy which may explain how rapidly the universe is expanding This is the stuff of Strange Matters In broad terms this book is about a variety of discoveries that theorists of the past imagined before the observers and experimenters actually saw them Moreover it is about the things that today s are now imagining but haven t yet been discovered or confirmed by the observers Strange Matters artfully mixes the present with the past and future reporting from the frontiers of research where history is in the process of being made Each chapter examines a different step along the twisted path we ve walked to gain our rudimentary understanding of the universe incorporating historical examples of successful prediscoversies with current stories that relate brand new ideas We come to see the universe not only in terms of what has already been discovered but also in terms of what has yet to be observed Strange Matters is a guide to the discoveries of the twenty first century a series of visions dreamt by the most imaginative scientists of our time merged with the achievements of the past to point the way towards even greater accomplishments of the future

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Table of Contents Alexander A Friedmann The Man Who Made The Universe Expand

1. Understanding the eBook Alexander A Friedmann The Man Who Made The Universe Expand
 - The Rise of Digital Reading Alexander A Friedmann The Man Who Made The Universe Expand
 - Advantages of eBooks Over Traditional Books
2. Identifying Alexander A Friedmann The Man Who Made The Universe Expand
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Alexander A Friedmann The Man Who Made The Universe Expand
 - User-Friendly Interface
4. Exploring eBook Recommendations from Alexander A Friedmann The Man Who Made The Universe Expand
 - Personalized Recommendations

- Alexander A Friedmann The Man Who Made The Universe Expand User Reviews and Ratings
- Alexander A Friedmann The Man Who Made The Universe Expand and Bestseller Lists
- 5. Accessing Alexander A Friedmann The Man Who Made The Universe Expand Free and Paid eBooks
 - Alexander A Friedmann The Man Who Made The Universe Expand Public Domain eBooks
 - Alexander A Friedmann The Man Who Made The Universe Expand eBook Subscription Services
 - Alexander A Friedmann The Man Who Made The Universe Expand Budget-Friendly Options
- 6. Navigating Alexander A Friedmann The Man Who Made The Universe Expand eBook Formats
 - ePub, PDF, MOBI, and More
 - Alexander A Friedmann The Man Who Made The Universe Expand Compatibility with Devices
 - Alexander A Friedmann The Man Who Made The Universe Expand Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Alexander A Friedmann The Man Who Made The Universe Expand
 - Highlighting and Note-Taking Alexander A Friedmann The Man Who Made The Universe Expand
 - Interactive Elements Alexander A Friedmann The Man Who Made The Universe Expand
- 8. Staying Engaged with Alexander A Friedmann The Man Who Made The Universe Expand
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Alexander A Friedmann The Man Who Made The Universe Expand
- 9. Balancing eBooks and Physical Books Alexander A Friedmann The Man Who Made The Universe Expand
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Alexander A Friedmann The Man Who Made The Universe Expand
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Alexander A Friedmann The Man Who Made The Universe Expand
 - Setting Reading Goals Alexander A Friedmann The Man Who Made The Universe Expand
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Alexander A Friedmann The Man Who Made The Universe Expand
 - Fact-Checking eBook Content of Alexander A Friedmann The Man Who Made The Universe Expand

- Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
- 14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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