

M. Dresden

# H.A. Kramers

Between Tradition and  
Revolution

*H.A. Kramers*



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# Ha Kramers Between Tradition And Revolution

**David Kaiser**



## Ha Kramers Between Tradition And Revolution:

**H.A. Kramers Between Tradition and Revolution** Max Dresden, 2012-12-06 It is now a little more than 11 years since the idea of writing a personal and scientific biography of H A Kramers took hold of me A few days earlier I had been lecturing in a course on field theory on the renormalization procedures of relativistic quantum field theory Since the students had considerable trouble understanding the physical basis of the procedure at the end of the lecture I explained that renormalization is not an exclusive quantum or relativistic procedure A careful treatment of classical electron theory as started by Lorentz and developed in detail by Kramers also requires renormalization The students appeared quite interested and I promised them that I would explain all this in more detail in the next lecture I could have looked up this material in Kramers book but I remembered that Kramers had stressed this idea in a course I had attended in Leiden in 1938 1939 I did dig up some of these old notes and although they were considerably less transparent than my recollection seemed to indicate they reminded me forcefully of the thrilling days I had spent in Leiden with Kramers Kramers deep insight and originality were apparent even when distorted by my opaque notes The students had never heard of these ideas of Kramers and were totally unaware of his work in field theory

**Physics and Necessity** Olivier Darrigol, 2014-05-22 Can we prove the necessity of our best physical theories by rational means without appeal to experience This book recounts a few ingenious attempts to derive physical theories by reason only beginning with Descartes geometric construction of the world and finishing with recent derivations of quantum mechanics from natural axioms Deductions based on theological metaphysical or transcendental arguments are worth remembering for the ways they motivated and structured physical theory even though we would now criticize their excessive confidence in the power of the mind Other deductions more modestly relied on criteria for the comprehensibility of nature including forms of measurability causality homogeneity and correspondence The central thesis of this book is that such criteria when properly applied to idealized systems effectively determine some of our most important theories as well as the mathematical character of the laws of physics The relevant arguments are not purely rational because only experience can tell us to which extent nature is comprehensible in a given way Nor do they block the possibility of ever more varied forms of comprehensibility They nonetheless suggest the inevitability of much of our theoretical physics

*Erwin Schrodinger* Michel Bitbol, O. DARRIGOL (Ed), 1992 *QED and the Men Who Made It* S. S. Schweber, 2020-05-05 In the 1930s physics was in a crisis There appeared to be no way to reconcile the new theory of quantum mechanics with Einstein's theory of relativity Several approaches had been tried and had failed In the post World War II period four eminent physicists rose to the challenge and developed a calculable version of quantum electrodynamics QED probably the most successful theory in physics This formulation of QED was pioneered by Freeman Dyson Richard Feynman Julian Schwinger and Sin Itiro Tomonaga three of whom won the Nobel Prize for their work In this book physicist and historian Silvan Schweber tells the story of these four physicists blending discussions of their scientific work with

fascinating biographical sketches Setting the achievements of these four men in context Schweber begins with an account of the early work done by physicists such as Dirac and Jordan and describes the gathering of eminent theorists at Shelter Island in 1947 the meeting that heralded the new era of QED The rest of his narrative comprises individual biographies of the four physicists discussions of their major contributions and the story of the scientific community in which they worked Throughout Schweber draws on his technical expertise to offer a lively and lucid explanation of how this theory was finally established as the appropriate way to describe the atomic and subatomic realms

**Quantum Mechanics** Peter Galison, Michael Gordin, David Kaiser, 2013-09-13 Modern science has changed every aspect of life in ways that cannot be compared to developments of previous eras This four volume set presents key developments within modern physical science and the effects of these discoveries on modern global life The first two volumes explore the history of the concept of relativity the cultural roots of science the concept of time and gravity before during and after Einstein's theory and the cultural reception of relativity Volume 3 explores the impact of modern science upon global politics and the creation of a new kind of war and Volume 4 details the old and new efforts surrounding the elucidation of the quantum world as well as the cultural impact of particle physics This reprint collection pools the best scholarship available collected from a large array of difficult to acquire books journals and pamphlets Each volume begins with an introductory essay written by one of the top scholars in the history of science Students and scholars of modern culture science and society will find these volumes a veritable research gold mine

Quantum Reality, Relativistic Causality, and Closing the Epistemic Circle Wayne C. Myrvold, Joy Christian, 2009-01-29 In July 2006 a major international conference was held at the Perimeter Institute for Theoretical Physics Canada to celebrate the career and work of a remarkable man of letters Abner Shimony who is well known for his pioneering contributions to foundations of quantum mechanics is a physicist as well as a philosopher and is highly respected among the intellectuals of both communities In line with Shimony's conviction that philosophical investigation is not to be divorced from theoretical and empirical work in the sciences the conference brought together leading theoretical physicists experimentalists as well as philosophers This book collects twenty three original essays stemming from the conference on topics including history and methodology of science Bell's theorem probability theory the uncertainty principle stochastic modifications of quantum mechanics and relativity theory It ends with a transcript of a fascinating discussion between Lee Smolin and Shimony ranging over the entire spectrum of Shimony's wide ranging contributions to philosophy science and philosophy of science

**Quantum Generations** Helge Kragh, 2020-06-16 At the end of the nineteenth century some physicists believed that the basic principles underlying their subject were already known and that physics in the future would only consist of filling in the details They could hardly have been more wrong The past century has seen the rise of quantum mechanics relativity cosmology particle physics and solid state physics among other fields These subjects have fundamentally changed our understanding of space time and matter They have also transformed daily life inspiring a technological revolution that has

included the development of radio television lasers nuclear power and computers In Quantum Generations Helge Kragh one of the world s leading historians of physics presents a sweeping account of these extraordinary achievements of the past one hundred years The first comprehensive one volume history of twentieth century physics the book takes us from the discovery of X rays in the mid 1890s to superstring theory in the 1990s Unlike most previous histories of physics written either from a scientific perspective or from a social and institutional perspective Quantum Generations combines both approaches Kragh writes about pure science with the expertise of a trained physicist while keeping the content accessible to nonspecialists and paying careful attention to practical uses of science ranging from compact disks to bombs As a historian Kragh skillfully outlines the social and economic contexts that have shaped the field in the twentieth century He writes for example about the impact of the two world wars the fate of physics under Hitler Mussolini and Stalin the role of military research the emerging leadership of the United States and the backlash against science that began in the 1960s He also shows how the revolutionary discoveries of scientists ranging from Einstein Planck and Bohr to Stephen Hawking have been built on the great traditions of earlier centuries Combining a mastery of detail with a sure sense of the broad contours of historical change Kragh has written a fitting tribute to the scientists who have played such a decisive role in the making of the modern world

Nico Bloembergen Rob Herber,2019-11-25 This biography is a personal portrait of one of the best known Dutch physicists Nicolaas Bloembergen Born in 1920 in Dordrecht Bloembergen studied physics in Utrecht leaving after World War II for the United States where he became an American citizen in 1958 At Harvard University he pioneered nuclear magnetic resonance NMR used in chemistry and biology for structure identification moreover leading to MRI laser theory and nonlinear optics In 1978 he was awarded the Lorentz Medal for his contribution to the theory of nonlinear optics used in fiber optics and in 1981 he received the Nobel Prize for physics along with Arthur Schawlow and Kai Siegbahn The book is based on numerous conversations with Nicolaas Bloembergen himself his wife Deli Brink his family and colleagues in science It describes his childhood and study in Bilthoven and Utrecht the first postwar years at Harvard the discoveries of masers and lasers and the award of the Nobel Prize It also delves into Bloembergen s involvement in American politics particularly his role in Ronald Reagan s controversial Star Wars program

**Léon Rosenfeld** Anja Skaar Jacobsen,2012 L on Rosenfeld 1904 1974 was a remarkable many sided physicist of exceptional erudition He was at the center of modern physics and was well known as Niels Bohr s close collaborator and spokesman Besides he reflected deeply on the history and philosophy of science and its social role from a leftist perspective As both actor and acute spectator of modern physics and as a polyglot cosmopolitan whose life crossed those of many important people in both the East and West as well as by virtue of his close collaboration and friendship with Bohr Rosenfeld was an important figure in twentieth century physics His biography illuminates the development popularization and reception of quantum physics and its interpretation in addition to the development of the political Left The book draws extensively from previously untapped unpublished sources in more than five

languages      The Making of Modern Physics in Colonial India Somaditya Banerjee, 2020-05-14 This monograph offers a cultural history of the development of physics in India during the first half of the twentieth century focusing on Indian physicists Satyendranath Bose 1894 1974 Chandrasekhara Venkata Raman 1888 1970 and Meghnad Saha 1893 1956 The analytical category bhadrak physics is introduced to explore how it became possible for a highly successful brand of modern science to develop in a country that was still under colonial domination The term Bhadrak refers to the then emerging group of native intelligentsia who were identified by academic pursuits and manners Exploring the forms of life of this social group allows a better understanding of the specific character of Indian modernity that as exemplified by the work of bhadrak physicists combined modern science with indigenous knowledge in an original program of scientific research The three scientists achieved the most significant scientific successes in the new revolutionary field of quantum physics with such internationally recognized accomplishments as the Saha ionization equation 1921 the famous Bose Einstein statistics 1924 and the Raman Effect 1928 the latter discovery having led to the first ever Nobel Prize awarded to a scientist from Asia This book analyzes the responses by Indian scientists to the radical concept of the light quantum and their further development of this approach outside the purview of European authorities The outlook of bhadrak physicists is characterized here as cosmopolitan nationalism which allows us to analyze how the group pursued modern science in conjunction with and as an instrument of Indian national liberation      **Revisiting the Foundations of Relativistic Physics** Ashtekar, 2011-06-28 This book is for physicists historians and philosophers of physics as well as students seeking an introduction to ongoing debates in relativistic and quantum physics This title is unique in that it comprises contributions by leading physicists philosophers and historians of science it covers the recent debates on the emergence of relativity and quantum theory it includes chapters with an introductory character comprehensible to students and science teachers it can be used in graduate level courses in the history and philosophy of science it strengthens the bonds between the communities of scientists historians and philosophers      **Photons** Klaus Hentschel, 2018-08-16 This book focuses on the gradual formation of the concept of light quanta or photons as they have usually been called in English since 1926 The great number of synonyms that have been used by physicists to denote this concept indicates that there are many different mental models of what light quanta are simply finite quantized packages of energy or bullets of light Atoms of light or molecules of light Light corpuscles or quantized waves Singularities of the field or spatially extended structures able to interfere Photons in G N Lewis s sense or as defined by QED i e virtual exchange particles transmitting the electromagnetic force The term light quantum made its first appearance in Albert Einstein s 1905 paper on a heuristic point of view to cope with the photoelectric effect and other forms of interaction of light and matter but the mental model associated with it has a rich history both before and after 1905 Some of its semantic layers go as far back as Newton and Kepler some are only fully expressed several decades later while others initially increased in importance then diminished and finally vanished In conjunction with these

various terms several mental models of light quanta were developed six of them are explored more closely in this book It discusses two historiographic approaches to the problem of concept formation a the author's own model of conceptual development as a series of semantic accretions and b Mark Turner's model of conceptual blending Both of these models are shown to be useful and should be explored further This is the first historiographically sophisticated history of the fully fledged concept and all of its twelve semantic layers It systematically combines the history of science with the history of terms and a philosophically inspired history of ideas in conjunction with insights from cognitive science

*The Quantum Vacuum* Peter W. Milonni, 2013-10-22 In modern physics the classical vacuum of tranquil nothingness has been replaced by a quantum vacuum with fluctuations of measurable consequence In *The Quantum Vacuum* Peter Milonni describes the concept of the vacuum in quantum physics with an emphasis on quantum electrodynamics He elucidates in depth and detail the role of the vacuum electromagnetic field in spontaneous emission the Lamb shift van der Waals and Casimir forces and a variety of other phenomena some of which are of technological as well as purely scientific importance This informative text also provides an introduction based on fundamental vacuum processes to the ideas of relativistic quantum electrodynamics and quantum field theory including renormalization and Feynman diagrams Experimental as well as theoretical aspects of the quantum vacuum are described and in most cases details of mathematical derivations are included Chapter 1 of *The Quantum Vacuum* published in advance in *The American Journal of Physics* 1991 was later selected by readers as one of the Most Memorable papers ever published in the 60 year history of the journal This chapter provides an excellent beginning of the book introducing a wealth of information of historical interest the results of which are carefully woven into subsequent chapters to form a coherent whole Does not assume that the reader has taken advanced graduate courses making the text accessible to beginning graduate students Emphasizes the basic physical ideas rather than the formal mathematical aspects of the subject Provides a careful and thorough treatment of Casimir and van der Waals forces at a level of detail not found in any other book on this topic Clearly presents mathematical derivations

**The Britannica Guide to Relativity and Quantum Mechanics** Erik Gregersen Associate Editor, Astronomy and Space Exploration, 2011-01-15 Explores relativity and quantum mechanics as well as the lives of those individuals who helped advance these fundamental areas of physics

**The Quantum Ten** Sheilla Jones, 2014-03-31 Theoretical physics is in trouble At least that's the impression you'd get from reading a spate of recent books on the continued failure to resolve the 80 year old problem of unifying the classical and quantum worlds The seeds of this problem were sewn eighty years ago when a dramatic revolution in physics reached a climax at the 1927 Solvay conference in Brussels It's the story of a rush to formalize quantum physics the work of just a handful of men fired by ambition philosophical conflicts and personal agendas Sheilla Jones paints an intimate portrait of the ten key figures who wrestled with the mysteries of the new science of the quantum along with a powerful supporting cast of famous and not so famous colleagues The Brussels conference was the first time so many of the quantum ten had been in the

same place Albert Einstein the lone wolf Niels Bohr the obsessive but gentlemanly father figure Max Born the anxious hypochondriac Werner Heisenberg the intensely ambitious one Wolfgang Pauli the sharp tongued critic with a dark side Paul Dirac the silent Englishman Erwin Schrödinger the enthusiastic womanizer Prince Louis de Broglie the French aristocrat Pascual Jordan the ardent Aryan nationalist who was not invited and Paul Ehrenfest who was witness to it all This is the story of quantum physics that has never been told an equation free investigation into the turbulent development of the new science and its very fallible creators including little known details of the personal relationship between the deeply troubled Ehrenfest and his dear friend Albert Einstein Jones weaves together the personal and the scientific in a heartwarming and heartbreaking story of the men who struggled to create quantum physics a story of passion tragedy ambition and science

More Than Nothing Aaron Sidney Wright,2024 Across decades and disciplines More than Nothing offers a scoping history of the vacuum as a lens into the development of modern physics *Constructing Quantum Mechanics* Anthony Duncan,Michel Janssen,2019-08-29 Constructing Quantum Mechanics is the first of two volumes on the genesis of quantum mechanics This volume traces the early contributions by Planck Einstein and Bohr all showing the need for drastic changes to the physics of their day It examines the efforts by Sommerfeld and others to develop a new theory now known as the old quantum theory After some striking successes this theory ran into serious difficulties and ended up serving as the scaffold on which the arch of modern quantum mechanics was built This volume breaks new ground both in its treatment of the work of Sommerfeld and his associates and by offering new perspectives on classic papers by Planck Einstein Bohr and others Paying close attention to both primary and secondary sources Constructing Quantum Mechanics provides an in depth analysis of the heroic struggle to come to terms with the wealth of mostly spectroscopic data that eventually gave us modern quantum mechanics

Selected Papers of J. M. Burgers F.T. Nieuwstadt,J.A. Steketee,2012-12-06 J M Burgers 1895 1981 is regarded as one of the leading scientists in the field of fluid mechanics contributing many important results a number of which still bear his name However the work of this outstanding scientist was mostly published in the Proceedings and Transactions of The Royal Netherlands Academy of Sciences of which he was a distinguished member Nowadays this work is almost impossible to obtain through the usual library channels Therefore the editors have decided to reissue the most important work of J M Burgers which gives the reader access to the original papers which led to important results now known as the Burgers Equation the Burgers Vector and the Burgers Vortex Further the book contains a biography of J M Burgers which provides the reader with both information on his scientific life as well as a rounded impression of the many activities which J M Burgers performed or was involved in outside his science **Drawing Theories Apart** David Kaiser,2009-11-15 Winner of the 2007 Pfizer Prize from the History of Science Society Feynman diagrams have revolutionized nearly every aspect of theoretical physics since the middle of the twentieth century Introduced by the American physicist Richard Feynman 1918 88 soon after World War II as a means of simplifying lengthy calculations in quantum electrodynamics they soon gained



adherents in many branches of the discipline Yet as new physicists adopted the tiny line drawings they also adapted the diagrams and introduced their own interpretations Drawing Theories Apart traces how generations of young theorists learned to frame their research in terms of the diagrams and how both the diagrams and their users were molded in the process Drawing on rich archival materials interviews and more than five hundred scientific articles from the period Drawing Theories Apart uses the Feynman diagrams as a means to explore the development of American postwar physics By focusing on the ways young physicists learned new calculational skills David Kaiser frames his story around the crafting and stabilizing of the basic tools in the physicist s kit thus offering the first book to follow the diagrams once they left Feynman s hands and entered the physics vernacular

**Theology and Modern Physics** Peter E. Hodgson, 2017-09-08 The new discoveries in physics during the twentieth century have stimulated intense debate about their relevance to age old theological questions Views range from those holding that modern physics provides a surer road to God than traditional religions to those who say that physics and theology are incommensurable and so do not relate At the very least physics has stimulated renewed theological discussions In this critical introduction to the science theology debate Peter E Hodgson draws on his experience as a physicist to present the results of modern physics and the theological implications Written for those with little or no scientific background Hodgson describes connections between physics philosophy and theology and then explains Newtonian physics and Victorian physics the theories of relativity astronomy and quantum mechanics and distinguishes the actual results of modern physics from speculations The connections with theology are explored throughout The concluding section draws discussions together and makes an important new contribution to the debate

Ha Kramers Between Tradition And Revolution: Bestsellers in 2023 The year 2023 has witnessed a remarkable surge in literary brilliance, with numerous captivating novels enthralling the hearts of readers worldwide. Lets delve into the realm of popular books, exploring the engaging narratives that have charmed audiences this year. The Must-Read : Colleen Hoover's "It Ends with Us" This heartfelt tale of love, loss, and resilience has captivated readers with its raw and emotional exploration of domestic abuse. Hoover skillfully weaves a story of hope and healing, reminding us that even in the darkest of times, the human spirit can prevail. Uncover the Best : Taylor Jenkins Reids "The Seven Husbands of Evelyn Hugo" This spellbinding historical fiction novel unravels the life of Evelyn Hugo, a Hollywood icon who defies expectations and societal norms to pursue her dreams. Reids captivating storytelling and compelling characters transport readers to a bygone era, immersing them in a world of glamour, ambition, and self-discovery. Discover the Magic : Delia Owens "Where the Crawdads Sing" This mesmerizing coming-of-age story follows Kya Clark, a young woman who grows up alone in the marshes of North Carolina. Owens crafts a tale of resilience, survival, and the transformative power of nature, captivating readers with its evocative prose and mesmerizing setting. These bestselling novels represent just a fraction of the literary treasures that have emerged in 2023. Whether you seek tales of romance, adventure, or personal growth, the world of literature offers an abundance of captivating stories waiting to be discovered. The novel begins with Richard Papen, a bright but troubled young man, arriving at Hampden College. Richard is immediately drawn to the group of students who call themselves the Classics Club. The club is led by Henry Winter, a brilliant and charismatic young man. Henry is obsessed with Greek mythology and philosophy, and he quickly draws Richard into his world. The other members of the Classics Club are equally as fascinating. Bunny Corcoran is a wealthy and spoiled young man who is always looking for a good time. Charles Tavis is a quiet and reserved young man who is deeply in love with Henry. Camilla Macaulay is a beautiful and intelligent young woman who is drawn to the power and danger of the Classics Club. The students are all deeply in love with Morrow, and they are willing to do anything to please him. Morrow is a complex and mysterious figure, and he seems to be manipulating the students for his own purposes. As the students become more involved with Morrow, they begin to commit increasingly dangerous acts. The Secret History is a brilliant and suspenseful novel that will keep you speculating until the very end. The novel is a cautionary tale about the dangers of obsession and the power of evil.

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