Hilbert Courant

In August 1859 Bernhard Riemann, a little-known 32-year old mathematician, presented a paper to the Berlin Academy titled: "On the Number of Prime Numbers Less Than a Given Quantity." In the middle of that paper, Riemann made an incidental remark â€" a guess, a hypothesis. What he tossed out to the assembled mathematicians that day has proven to be almost cruelly compelling to countless scholars in the ensuing years. Today, after 150 years of careful research and exhaustive study, the question remains. Is the hypothesis true or false? Riemann's basic inquiry, the primary topic of his paper, concerned a straightforward but nevertheless important matter of arithmetic â€" defining a precise formula to track and identify the occurrence of prime numbers. But it is that incidental remark â€" the Riemann Hypothesis â€" that is the truly astonishing legacy of his 1859 paper. Because Riemann was able to see beyond the pattern of the primes to discern traces of something mysterious and mathematically elegant shrouded in the shadows â€" subtle variations in the distribution of those prime numbers. Brilliant for its clarity, astounding for its potential consequences, the Hypothesis took on enormous importance in mathematics. Indeed, the successful solution to this puzzle would herald a revolution in prime number theory. Proving or disproving it became the greatest challenge of the age. It has become clear that the Riemann Hypothesis, whose resolution seems to hang tantalizingly just beyond our grasp, holds the key to a variety of scientific and mathematical investigations. The making and breaking of modern codes, which depend on the properties of the prime numbers, have roots in the Hypothesis. In a series of extraordinary developments during the 1970s, it emerged that even the physics of the atomic nucleus is connected in ways not yet fully understood to this strange conundrum. Hunting down the solution to the Riemann Hypothesis has become an obsession for many â€" the veritable "great white whale" of mathematical research. Yet despite determined efforts by generations of mathematicians, the Riemann Hypothesis defies resolution. Alternating passages of extraordinarily lucid mathematical exposition with chapters of elegantly composed biography and history, Prime Obsession is a fascinating and fluent account of an epic mathematical mystery that continues to challenge and excite the world. Posited a century and a half ago, the Riemann Hypothesis is an intellectual feast for the cognoscenti and the curious alike. Not just a story of numbers and calculations, Prime Obsession is the engrossing tale of a relentless hunt for an elusive proof â€" and those who have been consumed by it.

"It presents a sensitive portrait of a great human being. It describes accurately and intelligibly on a nontechnical level the world of mathematical ideas in which Hilbert created his masterpieces. And it illuminates the background of German social history against which the drama of Hilberts life was played. Beyond this, it is a poem in praise of mathematics." -SCIENCE

This book is a biography of one of the most famous and influential living mathematicians, Peter Lax. He is virtually unique as a preeminent leader in both pure and applied mathematics, fields which are often seen as competing and incompatible. Although he has been an academic for all of his adult life, his biography is not without drama and tragedy. Lax and his family barely escaped to the U.S. from Budapest before the Holocaust descended. He was one of the youngest scientists to work on the Manhattan Project. He played a leading role in coping with the infamous "kidnapping" of the NYU mathematics department's computer, in 1970. The list of topics in which Lax made fundamental and long-lasting contributions is remarkable: scattering theory, solitons, shock waves, and even classical analysis, to name a few. His work has been honored many times, including the Abel Prize in 2005. The book concludes with an account of his most important mathematical contributions, made accessible without heavy prerequisites. Reuben Hersh has written extensively on mathematics. His book with Philip Davis, The Mathematical Experience, won the National Book Award in science. Hersh is emeritus professor of mathematics at the University of New Mexico.

Now in new trade paper editions, these classic biographies of two of the greatest 20th Century mathematicians are being released under the Copernicus imprint. These noteworthy accounts of the lives of David Hilbert and Richard Courant are closely related: Courant's story is, in many ways, seen as the sequel to the story of Hilbert. Originally published to great acclaim, both books explore the dramatic scientific history expressed in the lives of these two great scientists and described in the lively, nontechnical writing style of Contance Reid.

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 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; and Paul Ehrenfest, who was witness to it all. Pascual Jordan, the ardent Aryan nationalist, came uninvited. 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.

Historian David E. Rowe captures the rich tapestry of mathematical creativity in this collection of essays from the “Years Ago” column of The Mathematical Intelligencer. With topics ranging from ancient Greek mathematics to modern relativistic cosmology, this collection conveys the impetus and spirit of Rowe’s various and many-faceted contributions to the history of mathematics. Centered on the Göttingen mathematical tradition, these stories illuminate important facets of mathematical activity often overlooked in other accounts. Six sections place the essays in chronological and thematic order, beginning with new introductions that contextualize each section. The essays that follow recount episodes relating to the section’s overall theme. All of the essays in this collection, with the exception of two, appeared over the course of more than 30 years in The Mathematical Intelligencer. Based largely on archival and primary sources, these vignettes offer unusual insights into behind-the-scenes events. Taken together, they aim to show how Göttingen managed to attract an extraordinary array of talented individuals, several of whom contributed to the development of a new mathematical culture during the first decades of the twentieth century.

David Hilbert (1862-1943) was the most influential mathematician of the early twentieth century and, together with Henri Poincaré, the last mathematical universalist. His main known areas of research and influence were in pure mathematics (algebra, number theory, geometry, integral equations and analysis, logic and foundations), but he was also known to have some interest in physical topics. The latter, however, was traditionally conceived as comprising only sporadic incursions into a scientific domain which was essentially foreign to his mainstream of activity and in which he only made scattered, if important, contributions. Based on an extensive use of mainly unpublished archival sources, the present book presents a totally fresh and comprehensive picture of Hilbert’s intense, original, well-informed, and highly influential involvement with physics, that spanned his entire career and that constituted a truly main focus of interest in his scientific horizon. His program for axiomatizing physical theories provides the connecting link with his research in more purely mathematical fields, especially geometry, and a unifying point of view from which to understand his physical activities in general. In particular, the now famous dialogue and interaction between Hilbert and Einstein, leading to the formulation in 1915 of the generally covariant field-equations of gravitation, is adequately explored here within the natural context of Hilbert’s overall scientific world-view. This book will be of interest to historians of physics and of mathematics, to historically-minded physicists and mathematicians, and to philosophers of science.

The classic introduction to the fundamentals of calculus Richard Courant's classic text Differential and Integral Calculus is an essential text for those preparing for a career in physics or applied math. Volume 1 introduces the foundational concepts of "function" and "limit", and offers detailed explanations that illustrate the "why" as well as the "how". Comprehensive coverage of the basics of integrals and differentials includes their applications as well as clearly-defined techniques and essential theorems. Multiple appendices provide supplementary explanation and author notes, as well as solutions and hints for all in-text problems.

The last one hundred years have seen many important achievements in the classical part of number theory. After the proof of the Prime Number Theorem in 1896, a quick development of analytical tools led to the invention of various new methods, like Brun's sieve method and the circle method of Hardy, Littlewood and Ramanujan; developments in topics such as prime and additive number theory, and the solution of Fermat’s problem. Rational Number Theory in the 20th Century: From PNT to FLT offers a short survey of 20th century developments in classical number theory, documenting between the proof of the Prime Number Theorem and the proof of Fermat's Last Theorem. The focus lays upon the part of number theory that deals with properties of integers and rational numbers. Chapters are divided into five time periods, which are then further divided into subject areas. With the introduction of each new topic, developments are followed through to the present day. This book will appeal to graduate researchers and student in number theory, however the presentation of main results without technicalities will make this accessible to anyone with an interest in the area.

Ioan James celebrates the extraordinary contribution made by Jewish people in mathematics and physics, from the mathematician Norbert Wiener, the founder of cybernetics, to distinguished nuclear physicist and Nobel Prize-winner Niels Bohr. He tells the life-stories of thirty-five men and women, born in the nineteenth century, who were at the forefront of research in the closely related fields of mathematics and physics, often in the face of various kinds of anti-Semitism. Some were caught up in the trauma of the Nazi accession to power in Germany and the Second World War. Wolfgang Pauli, described as 'greater than Einstein' by his contemporary Max Born, became a German national following the Nazi annexation of Austria in 1938 but was able to escape to the United States for the duration of the war. Already hampered by anti-Semitism in his native Poland, logician and mathematician Alfred Tarski found himself stranded in the USA at the outbreak of war and did not see his wife and sons until the war's end. The Italian mathematician Vito Volterra publicly opposed Mussolini's Fascist regime at considerable personal risk. Others such as George Pólya and Emmy Noether found that their left-wing political beliefs hindered their careers.

Based on archival sources that have never been examined before, the book discusses the preeminent emigrant mathematicians of the period, including Emmy Noether, John von Neumann, Hermann Weyl, and many others. The author explores the mechanisms of the expulsion of mathematicians from Germany, the emigrants' acculturation to their new host countries, and the fates of those mathematicians forced to stay behind. The book reveals the alienation and solidarity of the emigrants, and investigates the global development of mathematics as a consequence of their radical migration.

With breathtaking detail, Maria Georgiadou sheds light on the work and life of Constantin Carathéodory, who until now has been ignored by historians. In her thought-provoking

book, Georgiadou maps out the mathematician’s oeuvre, life and turbulent historical surroundings. Descending from the Greek élite of Constantinople, Carathéodory graduated from the military school of Brussels, became engineer at the Assiout dam in Egypt and finally dedicated a lifetime to mathematics and education. He significantly contributed to: calculus of variations, the theory of point set measure, the theory of functions of a real variable, pdes, and complex function theory. An exciting and well-written biography, once started, difficult to put down.

Ioan James introduces and profiles sixty mathematicians from the era when mathematics was freed from its classical origins to develop into its modern form. The subjects, all born between 1700 and 1910, come from a wide range of countries, and all made important contributions to mathematics, through their ideas, their teaching, and their influence. James emphasizes their varied life stories, not the details of their mathematical achievements. The book is organized chronologically into ten chapters, each of which contains biographical sketches of six mathematicians. The men and women James has chosen to portray are representative of the history of mathematics, such that their stories, when read in sequence, convey in human terms something of the way in which mathematics developed. Ioan James is a professor at the Mathematical Institute, University of Oxford. He is the author of Topological Topics (Cambridge, 1983), Fibrewise Topology (Cambridge, 1989), Introduction to Uniform Spaces (Cambridge, 1990), Topological and Uniform Spaces (Springer-Verlag New York, 1999), and co-author with Michael C. Crabb of Fibrewise Homotopy Theory (Springer-Verlag New York, 1998). James is the former editor of the London Mathematical Society Lecture Note Series and volume editor of numerous books. He is the organizer of the Oxford Series of Topology symposia and other conferences, and co-chairman of the Task Force for Mathematical Sciences of Campaign for Oxford.

The breathtakingly rapid pace of change in computing makes it easy to overlook the pioneers who began it all. Written by Martin Davis, respected logician and researcher in the theory of computation, The Universal Computer: The Road from Leibniz to Turing explores the fascinating lives, ideas, and discoveries of seven remarkable mathematicians. It tells the stories of the unsung heroes of the computer age – the logicians. The story begins with Leibniz in the 17th century and then focuses on Boole, Frege, Cantor, Hilbert, and Gödel, before turning to Turing. Turing’s analysis of algorithmic processes led to a single, all-purpose machine that could be programmed to carry out such processes—the computer. Davis describes how this incredible group, with lives as extraordinary as their accomplishments, grappled with logical reasoning and its mechanization. By investigating their achievements and failures, he shows how these pioneers paved the way for modern computing. Bringing the material up to date, in this revised edition Davis discusses the success of the IBM Watson on Jeopardy, reorganizes the information on incompleteness, and adds information on Konrad Zuse. A distinguished prize-winning logician, Martin Davis has had a career of more than six decades devoted to the important interface between logic and computer science. His expertise, combined with his genuine love of the subject and excellent storytelling, make him the perfect person to tell this story.

Few problems in mathematics have had the status of those posed by David Hilbert in 1900. Mathematicians have made their reputations by solving some of them like Fermat's last theorem, but several remain unsolved including the Riemann Hypotheses, which has eluded all the great minds of this century. A hundred years later, this book takes a fresh look at the problems, the man who set them, and the reasons for their lasting impact on the mathematics of the twentieth century. In this fascinating book, the authors consider what makes this the pre-eminent collection of problems in mathematics, what they tell us about what drives mathematicians, and the nature of reputation, influence and power in the world of modern mathematics. It is written in a clear and entertaining style and will appeal to anyone with interest in mathematics or those mathematicians willing to try their hand at these problems.

Publisher description

About Felix Klein, the famous Greek mathematician Constantin Carathéodory once said: It is only by illuminating him from all angles that one can come to understand his significance. The author of this biography has done just this. A detailed study of original sources has made it possible to uncover new connections; to create a more precise representation of this important mathematician, scientific organizer, and educational reformer; and to identify misconceptions. Because of his edition of Julius Plücker's work on line geometry and due to his own contributions to non-Euclidean geometry, Klein was already well known abroad before he received his first full professorship at the age of 23. By exchanging ideas with his most important cooperation partner, the Norwegian Sophus Lie, Klein formulated his Erlangen Program. Various other visionary programs followed, in which Klein involved mathematicians from Germany and abroad. Klein was the most active promoter of Riemann's geometric-physical approach to function theory, but he also integrated the analytical approaches of the Weierstrass school into his arsenal of methods. Klein was a citizen of the world who repeatedly travelled to France, Great Britain, Italy, the United States, and elsewhere. Despite what has often been claimed, it must be emphasized that Klein expressly opposed national chauvinism. He promoted mathematically gifted individuals regardless of their nationality, religion, or gender. Many of his works have been translated into English, French, Italian, Russian, and other languages; more than 300 supporters from around the world made it possible for his portrait to be painted by the prominent impressionist Max Liebermann. Inspired by international developments, Klein paved the way for women to work in the field of mathematics. He was instrumental in reforming mathematical education, and he endorsed an understanding of mathematics that affirmed its cultural importance as well as its fundamental significance to scientific and technological progress.

Biographical account of mathematician, Richard Courant, who had been removed by the Nazis from his position as director of the internationally famous mathematics institute in Göttingen and emigrated to the United States and built another mathematics institute in New York.

The name Emmy Noether is one of the most celebrated in the history of mathematics. A brilliant algebraist and iconic figure for women in modern science, Noether exerted a strong influence on the younger mathematicians of her time and long thereafter; today, she is known worldwide as the "mother of modern algebra." Drawing on original archival material and recent research, this book follows Emmy Noethers career from her early years in Erlangen up until her tragic death in the United States. After solving a major outstanding problem in Einsteins theory of

relativity, she was finally able to join the Göttingen faculty in 1919. Proving It Her Way offers a new perspective on an extraordinary career, first, by focusing on important figures in Noethers life and, second, by showing how she selflessly promoted the careers of several other talented individuals. By exploring her mathematical world, it aims to convey the personality and impact of a remarkable mathematician who literally changed the face of modern mathematics, despite the fact that, as a woman, she never held a regular professorship. Written for a general audience, this study uncovers the human dimensions of Noethers key relationships with a younger generation of mathematicians. Thematically, the authors took inspiration from their cooperation with the ensemble portraittheater Vienna in producing the play "Diving into Math with Emmy Noether." Four of the young mathematicians portrayed in Proving It Her Way - B.L. van der Waerden, Pavel Alexandrov, Helmut Hasse, and Olga Taussky - also appear in "Diving into Math.".

New in the recently launched Courant Lecture Notes series, this book presents a key lecture held at the Courant Institute of Mathematical Sciences at New York University.

I am very pleased that my books about David Hilbert, published in 1970, and Richard Courant, published in 1976, are now being issued by Springer Verlag in a single volume. I have always felt that they belonged together, Courant being, as I have written, the natural and necessary sequel to Hilbert the rest of the story. To make the two volumes more compatible when published as one, we have combined and brought up to date the indexes of names and dates. U nfortu nately we have had to omit Hermann Weyl's article on "David Hilbert and his mathematical work," but the interested reader can always find it in the hard back edition of Hilbert and in Weyl's collected papers. At the request of a number of readers we have included a listing of all of Hilbert's famous Paris problems. It was, of course, inevitable that we would give the resulting joint volume the title Hilbert-Courant.

The Golden Age of Theoretical Physics brings together 37 selected essays. Many of these essays were first presented as lectures at various universities in Europe and the USA, and then published as reports or articles. Their enlarged, final versions were published in the joint work of Jagdish Mehra and Helmut Rechenberg, The Historical Development of Quantum Theory, while the other essays were published as articles in scientific journals or in edited books. Here they are published together as a tribute to the Mehra-Rechenberg collaboration sustained for several decades, and cover various aspects of quantum theory, the special and general theories of relativity, the foundations of statistical mechanics, and some of their fundamental applications. Two essays, ‘Albert Einstein's “First” Paper’ (Essay 1) and ‘The Dream of Leonardo da Vinci’ (Essay 37), lie outside the major themes treated in this book, but are included here because of their historical interest. The origin of each essay is explained in a footnote.This book deals with the most important themes developed in the first 40 years of the twentieth century by some of the greatest pioneers and architects of modern physics. It is a vital source of information about what can veritably be described as ‘the golden age of theoretical physics’.

This book explores facets of Otto Neugebauer's career, his impact on the history and practice of mathematics, and the ways in which his legacy has been preserved or transformed in recent decades, looking ahead to the directions in which the study of the history of science will head in the twenty-first century. Neugebauer, more than any other scholar of recent times, shaped the way we perceive premodern science. Through his scholarship and influence on students and collaborators, he inculcated both an approach to historical research on ancient and medieval mathematics and astronomy through precise mathematical and philological study of texts, and a vision of these sciences as systems of knowledge and method that spread outward from the ancient Near Eastern civilizations, crossing cultural boundaries and circulating over a tremendous geographical expanse of the Old World from the Atlantic to India.

'Sidney Coleman was the master teacher of quantum field theory. All of us who knew him became his students and disciples. Sidney’s legendary course remains fresh and bracing, because he chose his topics with a sure feel for the essential, and treated them with elegant economy.' Frank WilczekNobel Laureate in Physics 2004 Sidney Coleman was a physicist's physicist. He is largely unknown outside of the theoretical physics community, and known only by reputation to the younger generation. He was an unusually effective teacher, famed for his wit, his insight and his encyclopedic knowledge of the field to which he made many important contributions. There are many first-rate quantum field theory books (the venerable Bjorken and Drell, the more modern Itzykson and Zuber, the now-standard Peskin and Schroeder, and the recent Zee), but the immediacy of Prof. Coleman's approach and his ability to present an argument simply without sacrificing rigor makes his book easy to read and ideal for the student. Part of the motivation in producing this book is to pass on the work of this outstanding physicist to later generations, a record of his teaching that he was too busy to leave himself.

This unique collection contains extensive and in-depth interviews with mathematicians who have shaped the field of mathematics in the twentieth century. Collected by two mathematicians respected in the community for their skill in communicating mathematical topics to a broader audience, the book is also rich with photographs and includes an introdu

Introduction to numerical analysis combining rigour with practical applications. Numerous exercises plus solutions.

"...a story of great mathematicians and their achievements, of practical successes and failures, and of human perfidy and generosity...this is one of the still too rare occasions in which mathematicians are shown as frail, flesh-and-blood creatures...a very worthwhile book." -CHOICE

Hilbert-CourantSpringer Science & Business Media

David Hilbert is one of the outstanding mathematicians of the twentieth century and probably the most influential. This book highlights Hilbert’s contributions to mathematics, putting them in their historical, social and cultural context. In doing so, particular attention is paid to Hilbert’s axiomatic method and his proposal for the foundations of mathematics, the so-called Hilbert’s program. The book also discusses the development of algebraic number theory, the theory of integral equations, modern algebra and the structural image of mathematics. In addition, it considers the famous list of Mathematical Problems presented in Paris in 1900, the mathematical tradition of the University of Göttingen, the great debate on the foundations of mathematics in the twenties between formalists and intuitionists, and, finally,

Hilbert’s work on the theory of relativity and the foundations of quantum mechanics. The book will primarily appeal to an academic audience, although it will also be of interest to general-interest science readers.

In 1924 the firm of Julius Springer published the first volume of Methods of Mathematical Physics by Richard Courant and David Hilbert. In the preface, Courant says this: Since the seventeenth century, physical intuition has served as a vital source for mathematical problems and methods. Recent trends and fashions have, however, weakened the connection between mathematics and physics; mathematicians, turning away from the roots of mathematics in intuition, have concentrated on refinement and emphasized the postulational side of mathematics, and at times have overlooked the unity of their science with physics and other fields. In many cases, physicists have ceased to appreciate the attitudes of mathematicians. This rift is unquestionably a serious threat to science as a whole; the broad stream of scientific development may split into smaller and smaller rivulets and dry out. It seems therefore important to direct our efforts toward reuniting divergent trends by clarifying the common features and interconnections of many distinct and diverse scientific facts. Only thus can the student attain some mastery of the material and the basis be prepared for further organic development of research. The present work is designed to serve this purpose for the field of mathe matical physics . . . . Completeness is not attempted, but it is hoped that access to a rich and important field will be facilitated by the book. When I was a student, the book of Courant and Hilbert was my bible.

The editorial board for the History of Mathematics series has selected for this volume a series of translations from two Russian publications, Kolmogorov in Remembrance and Mathematics and its Historical Development. This book, Kolmogorov in Perspective, includes articles written by Kolmogorov's students and colleagues and his personal accounts of shared experiences and lifelong mathematical friendships. The articles combine to give an excellent personal and scientific biography of this important mathematician. There is also an extensive bibliography with the complete list of Kolmogorov's works--including the articles written for encyclopedias and newspapers. The book is illustrated with photographs and includes quotations from Kolmogorov's letters and conversations, uniquely reflecting his mathematical tastes and opinions.

Since the first volume of this work came out in Germany in 1924, this book, together with its second volume, has remained standard in the field. Courant and Hilbert's treatment restores the historically deep connections between physical intuition and mathematical development, providing the reader with a unified approach to mathematical physics. The present volume represents Richard Courant's second and final revision of 1953.

In this volume, Einstein aims to give a field-theoretic foundation for the electron's equations of motion as he embarks on a new approach to unified field theory founded on teleparallel geometry. Einstein attends the historic 1927 Solvay meeting on the new quantum mechanics, and publishes a patent for a novel refrigerator. While less politically en

Profiles more than 150 mathematicians from around the world who made important contributions to their field, including Rene Descartes, Emily Noether and Bernhard Riemann.

A companion publication to the international exhibition "Transcending Tradition: Jewish Mathematicians in German-Speaking Academic Culture", the catalogue explores the working lives and activities of Jewish mathematicians in German-speaking countries during the period between the legal and political emancipation of the Jews in the 19th century and their persecution in Nazi Germany. It highlights the important role Jewish mathematicians played in all areas of mathematical culture during the Wilhelmine Empire and the Weimar Republic, and recalls their emigration, flight or death after 1933.