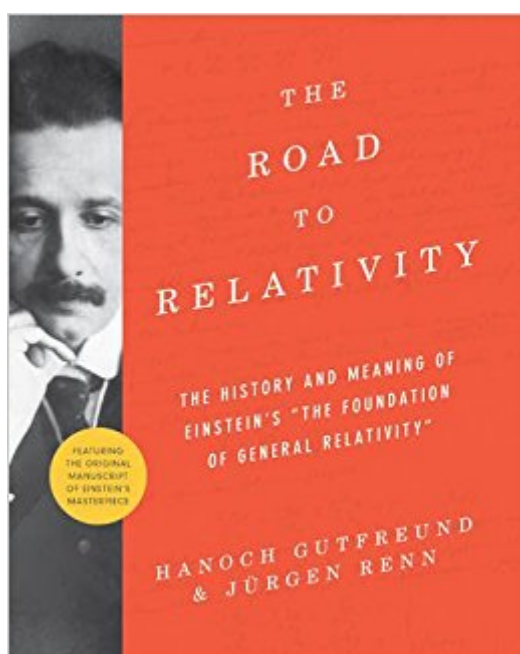


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# The Road To Relativity: The History And Meaning Of Einstein's "The Foundation Of General Relativity", Featuring The Original Manuscript Of Einstein's Masterpiece



## Synopsis

This richly annotated facsimile edition of "The Foundation of General Relativity" introduces a new generation of readers to Albert Einstein's theory of gravitation. Written in 1915, this remarkable document is a watershed in the history of physics and an enduring testament to the elegance and precision of Einstein's thought. Presented here is a beautiful facsimile of Einstein's original handwritten manuscript, along with its English translation and an insightful page-by-page commentary that places the work in historical and scientific context. Hanoch Gutfreund and Jürgen Renn's concise introduction traces Einstein's intellectual odyssey from special to general relativity, and their essay "The Charm of a Manuscript" provides a delightful meditation on the varied afterlife of Einstein's text. Featuring a foreword by John Stachel, this handsome edition also includes a biographical glossary of the figures discussed in the book, a comprehensive bibliography, suggestions for further reading, and numerous photos and illustrations throughout.

## Book Information

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## Customer Reviews

"Any devotee of Einstein will relish the chance to parse this annotated facsimile of the physicist's original manuscript on general relativity. . . . [Gutfreund and Renn's] cogent descriptions and the accompanying illustrations and documents open a fascinating window onto Einstein's otherwise inaccessible opus."--Scientific American "[Gutfreund and Renn] remind us of the charm a manuscript affords: rare glimpses into the working process of a great mind."--New Scientist "The Road to Relativity by Hanoch Gutfreund and Jürgen Renn reproduces the 45 handwritten--and hand-corrected--pages of Einstein's general theory, accompanied by extensive annotations on the science, its historical context and the implications for the future. The volume also includes a

glossary of scientists and philosophers relevant to Einstein's work and some entertainingly lively illustrations--such as one of Einstein pouring coffee on a moving train to demonstrate that motion is relative--by Laurent Taudin."--Nancy Szokan, Washington Post"Gutfreund and Renn dissect every page of the manuscript, explaining the meaning of each passage and describing Einstein's thought processes leading up to it. . . . The Road to Relativity is accessible and engaging."--Tom Siegfried, Science News"[A] wonderful book that combines a facsimile of Einstein's original manuscript, an English translation and a rich annotation."--Bill Condie, Cosmos Magazine

"The feeling a physicist has in reading Einstein's handwritten manuscript on general relativity must be like what a pianist would feel upon seeing a draft of Bach's Goldberg Variations. What kind of human creativity can produce something like this? Gutfreund and Renn provide the context for the paper, and the English translation enables readers not fluent in German to see it as a whole. This book is a little treasure."--Jeremy Bernstein, Aspen Center for Physics"We have in The Road to Relativity an approachable, precise, and riveting account of one of the great intellectual voyages of the last hundred and fifty years. I commend this book to anyone fascinated by gravity and the shape of the universe, to be sure, but also to anyone passionate about one of the great odysseys of modern science."--Peter Galison, Harvard University"Gutfreund and Renn have compiled a wonderful book, a real primer to Einstein's long and complex journey to the general theory of relativity. In this well written distillation of several decades of historical-scientific scholarship, we find not only Einstein's own papers, concisely and clearly explained, but also a rich tapestry of the contextual background to the revolutionary transformations in theoretical physics initiated by an entire generation of scientists in the early twentieth century."--Diana Kormos Buchwald, Einstein Papers Project, Caltech"This book takes you on a wonderful journey of discovery. Its centerpiece is Einstein's handwritten exposition of the general theory of relativity, written shortly after the decisive breakthrough of November 1915. In their splendid introduction and insightful commentary, Gutfreund and Renn tell the story of how Einstein found his new theory of space-time and gravity, making both the theory itself and Einstein's arduous path to it come alive for general readers."--Michel Janssen, University of Minnesota"This is a lovely book and an excellent way to mark the centennial of Einstein's general relativity. The facsimile reproduction of Einstein's manuscript is wonderful to behold, and Gutfreund and Renn have done a superb job of guiding nonspecialists through Einstein's argument and placing the work in a broader intellectual and historical context."--David Kaiser, author of How the Hippies Saved Physics: Science, Counterculture, and the Quantum Revival"The centenary of Einstein's theory of gravitation is a

fitting moment to recommend one of the greatest landmarks in the history of physics. The historical introduction and page-by-page annotations provide a careful narrative of Einstein's path from special to general relativity."--Michael D. Gordin, author of *Five Days in August: How World War II Became a Nuclear War*

Appearing in time to commemorate the centennial of the publication of the covariant field equations of gravitation, the centrepiece of this handsome volume is an annotated facsimile reproduction of Einstein's 1916 manuscript which provides a pedagogic description of the General Theory of Relativity. The thrill in reading through the manuscript, noting Einstein's corrections, is palpable. However, the photographs are not all that clear and Einstein's handwriting is a bit tough to decipher. Because of this, and because this volume was intended for an English speaking audience, it would have been better to annotate the English translation that follows. No matter. The book is rounded out by an introductory, condensed description of the path from the special to the general theory, some brief biographies of mathematicians and physicists connected with that development and English translations of two of the most important papers, one, as noted, the 1916 overview, which still provides the best introduction to General Relativity. All in all, a very nice tribute.

Authors have provided an excellent discussion of the context and evolution of Einstein's development of the General Theory. Reading this account has stimulated my return to review my tensor analysis notes from grad school. My only critique is Einstein's written text is very hard to read--

You need some background to understand it. If you are familiar with physics and math up to tensor calculus, it's a great read.

Very interesting compilation! A nice reminder and possibly you might pick up a new perspective.

Nicely done presentation.

Recommended!

In 1915 Albert Einstein submitted a 46 page review of his newly developed general theory of relativity to the journal *Annalen der Physik*. This manuscript was the first complete distillation of his

theory and it marked a watershed not just in the history of science but in the history of ideas. General relativity is not just one of the most profound and beautiful theories of nature but it suddenly opened up to understanding vast stretches of the cosmos that had previously been conjectured at best. The manuscript is a very rare one since Einstein discarded most of his original ones after they were published. Hanoch Gutfreund and Jürgen Renn now bring us a line-by-line description of this very important paper in a fine coalition of science, history and art that is a fitting tribute to the one hundredth anniversary of Einstein's theory. Their goal is to not just explain the essentials of the manuscript to reasonably scientific laymen but also to set the writing in its proper context, giving both the scientific background of Einstein's amazing work as well as his own unique method of thinking that allowed him to successfully reach that juncture. After a prelude that lays out a brief historical exposition of Einstein's personal and professional life from the years 1905 (when he published his five famous papers including the one on special relativity) to 1915, the authors give a page by page description of the manuscript, with facsimiles on the left hand side and commentary on the right. Along the way we are treated to many things including the basic foundations of special and general relativity, the mathematics of tensors that underlies the theory, the evolution of Einstein's thinking as he struggled to combine known principles with flashes of insight and the mathematical help that he received from his friends and colleagues, most notably Marcel Grossman. I was especially glad to see the book emphasize Grossman's contribution since it is clear that Einstein's intellectual development regarding relativity might have been delayed for at least a few years had he not learnt the key Riemannian geometry and tensor analysis that served as the bedrock of his theory from Grossman. There is also a smattering of details about Einstein's personal life during this time scattered throughout the book; his peripatetic wanderings, his gradual recognition by stalwarts of the German establishment like Planck and von Laue, his difficult relationship with his old wife Mileva and his newfound love for his new wife Elsa in Berlin. The format of the scientific background is also quite pleasing, with key concepts being formulated as questions followed by succinct answers: for instance, "What is the role of coordinates in general relativity?", "What do we mean by general covariance?", "What is the Ricci tensor?". In addition both the historical and the scientific parts are enlivened by delightful hand-drawn cartoons and illustrations, both of Einstein and of the mathematical fundamentals. The last part of the volume contains a brief mention of the wonderful topics that relativity has illuminated; black holes, the Big Bang, supernovae. The appendix contains an English translation of the manuscript for serious physicists. Overall this is a very nice introduction not just to the essentials of general relativity but to Einstein's thinking as seen through the lens of the 1916 manuscript. It's definitely not a textbook or a

comprehensive introduction to the theory and it probably helps to remember some basics of linear algebra and calculus, but even without the scientific background you can get a delightful feel for Einstein and his great creation. The volume should serve as an entertaining and informative dive, even if a relatively short-lived one, and should once again reinforce to us why Einstein matters.

If you are hoping that this book will finally offer an explanation of GR for the general reader, this is not the book for you. It is lacking the overall historical and scientific context and explanations for a non-physicist reader that several other books offer (such as those written by Eric Greene). It is unclear for what audience this book is intended? The authors use many technical terms without explaining them or giving a context. More importantly, if you have not already read other historical accounts of Einstein and the physics of this period, you will miss the significance of many references throughout this book. Additionally, the real meat of the book is an annotation of Einstein's GR paper. However, this annotation is placed on facing pages opposite of pages containing barely readable photographs of the original handwritten German manuscript, while the English translation of Einstein paper is in the back of the book. Typically, an "annotation" is alongside of the text it refers to. Since the annotation is in English, it would seem to me that this book would have been organized much better if the annotation and the English translation were side by side, and the photographs placed elsewhere. Instead, for this annotation to be useful, the reader will need to constantly flip back and forth between the annotation and the translated paper in the back. In summary, it is unfortunate that there was not more careful thought placed into the organization of the book. Perhaps this was rushed out to get it published in the anniversary year of 2015, but a few months more effort could have resulted in a much more useful volume for a larger audience.

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