

Quantum Mechanics The Theoretical Minimum 2 Leonard Susskind

From the bestselling author of *The Theoretical Minimum*, a DIY introduction to the math and science of quantum physics. First he taught you classical mechanics. Now, physicist Leonard Susskind has teamed up with data engineer Art Friedman to present the theory and associated mathematics of the strange world of quantum mechanics. In this follow-up to *The Theoretical Minimum*, Susskind and Friedman provide a lively introduction to this famously difficult field, which attempts to understand the behavior of sub-atomic objects through mathematical abstractions. Unlike other popularizations that shy away from quantum mechanics' weirdness, *Quantum Mechanics* embraces the utter strangeness of quantum logic. The authors offer crystal-clear explanations of the principles of quantum states, uncertainty and time dependence, entanglement, and particle and wave states, among other topics, and each chapter includes exercises to ensure mastery of each area. Like *The Theoretical Minimum*, this volume runs parallel to Susskind's eponymous Stanford University-hosted continuing education course. An approachable yet rigorous introduction to a

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famously difficult topic, Quantum Mechanics provides a tool kit for amateur scientists to learn physics at their own pace.

"First published by Cappella Archive in 2008."

String theory made understandable. Barton Zwiebach is once again faithful to his goal of making string theory accessible to undergraduates. He presents the main concepts of string theory in a concrete and physical way to develop intuition before formalism, often through simplified and illustrative examples. Complete and thorough in its coverage, this new edition now includes AdS/CFT correspondence and introduces superstrings. It is perfectly suited to introductory courses in string theory for students with a background in mathematics and physics. New sections cover strings on orbifolds, cosmic strings, moduli stabilization, and the string theory landscape. Now with almost 300 problems and exercises, with password-protected solutions for instructors at www.cambridge.org/zwiebach.

What happens when something is sucked into a black hole? Does it disappear? Three decades ago, a young physicist named Stephen Hawking claimed it did—and in doing so put at risk everything we know about physics and the fundamental laws of the universe. Most scientists didn't recognize the import of Hawking's claims, but Leonard Susskind and Gerard 'tHooft realized the threat,

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and responded with a counterattack that changed the course of physics. THE BLACK HOLE WAR is the thrilling story of their united effort to reconcile Hawking's revolutionary theories of black holes with their own sense of reality-effort that would eventually result in Hawking admitting he was wrong, paying up, and Susskind and t'Hooft realizing that our world is a hologram projected from the outer boundaries of space. A brilliant book about modern physics, quantum mechanics, the fate of stars and the deep mysteries of black holes, Leonard Susskind's account of the Black Hole War is mind-bending and exhilarating reading.

- A unique exposition of the foundations of the quantum theory of black holes including the impact of string theory, the idea of black hole complementarity and the holographic principle bull; Aims to educate the physicist or student of physics who is not an expert on string theory, on the revolution that has grown out of black hole physics and string theory

"The standard work in the fundamental principles of quantum mechanics, indispensable both to the advanced student and to the mature research worker, who will always find it a fresh source of knowledge and stimulation." --Nature
"This is the classic text on quantum mechanics. No graduate student of quantum theory should leave it unread"--W.C Schieve, University of Texas

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Learning classical mechanics doesn't have to be hard. What if there was a way to learn classical mechanics without all the usual fluff? What if there were a book that allowed you to see the whole picture and not just tiny parts of it? Thoughts like this are the reason that No-Nonsense Classical Mechanics now exists. What will you learn from this book? Get to know all fundamental mechanics concepts — Grasp why we can describe classical mechanics using the Lagrangian formalism, the Newtonian formalism, or the Hamiltonian formalism and how these frameworks are connected. Learn to describe classical mechanics mathematically — Understand the meaning and origin of the most important equations: Newton's second law, the Euler-Lagrange equation and Hamilton's equations. Master the most important classical mechanics systems — Read fully annotated, step-by-step calculations and understand the general algorithm we use to describe them. Get an understanding you can be proud of — Learn about beautiful and deep insights like Noether's theorem or Liouville's theorem and how classical mechanics emerges in a proper limit of special relativity, quantum mechanics and general relativity. No-Nonsense Classical Mechanics is the most student-friendly book on classical mechanics ever written. Here's why. First of all, it's nothing like a formal university lecture. Instead, it's like a casual conversation with a more experienced student. This also means that nothing is assumed to be “obvious”

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or “easy to see”. Each chapter, each section, and each page focuses solely on the goal to help you understand. Nothing is introduced without a thorough motivation and it is always clear where each equation comes from. The book contains no fluff since unnecessary content quickly leads to confusion. Instead, it ruthlessly focuses on the fundamentals and makes sure you’ll understand them in detail. The primary focus on the readers’ needs is also visible in dozens of small features that you won’t find in any other textbook. In total, the book contains more than 100 illustrations that help you understand the most important concepts visually. In each chapter, you’ll find fully annotated equations and calculations are done carefully step-by-step. This makes it much easier to understand what’s going on in. Whenever a concept is used that was already introduced previously there is a short sidenote that reminds you where it was first introduced and often recites the main points. In addition, there are summaries at the beginning of each chapter that make sure you won’t get lost.

The untold story of the heretical thinkers who dared to question the nature of our quantum universe. Every physicist agrees quantum mechanics is among humanity's finest scientific achievements. But ask what it means, and the result will be a brawl. For a century, most physicists have followed Niels Bohr's Copenhagen interpretation and dismissed questions about the reality underlying

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quantum physics as meaningless. A mishmash of solipsism and poor reasoning, Copenhagen endured, as Bohr's students vigorously protected his legacy, and the physics community favored practical experiments over philosophical arguments. As a result, questioning the status quo long meant professional ruin. And yet, from the 1920s to today, physicists like John Bell, David Bohm, and Hugh Everett persisted in seeking the true meaning of quantum mechanics. *What Is Real?* is the gripping story of this battle of ideas and the courageous scientists who dared to stand up for truth.

The clearest, simplest e-guide to quantum physics ever published. Discovering quantum physics has never been easier. Combining bold graphics with easy-to-understand text, *Simply Quantum Physics* is an essential introduction to the subject for those who are short on time but hungry for knowledge. It's a perfect beginner's e-guide to a strange and fascinating world that at times seems to conflict with common sense. Covering more than 80 key ideas from the uncertainty principle to quantum tunneling, it is divided into pared-back, single- or double-page entries that explain concepts simply and visually. Assuming no previous knowledge of physics, it demystifies some of the most groundbreaking ideas in modern science and introduces the work of some of the most famous physicists of the 20th and 21st centuries, including Albert Einstein, Neils Bohr, Erwin Schrödinger, and Richard Feynman. Whether you are studying physics at

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school or college, or simply want a jargon-free overview of the subject, this essential guide is packed with everything you need to understand the basics quickly and easily. A Wall Street Journal Best Book of 2013 If you ever regretted not taking physics in college--or simply want to know how to think like a physicist--this is the book for you. In this bestselling introduction, physicist Leonard Susskind and hacker-scientist George Hrabovsky offer a first course in physics and associated math for the ardent amateur. Challenging, lucid, and concise, *The Theoretical Minimum* provides a tool kit for amateur scientists to learn physics at their own pace.

As Kenneth W. Ford shows us in *The Quantum World*, the laws governing the very small and the very swift defy common sense and stretch our minds to the limit. Drawing on a deep familiarity with the discoveries of the twentieth century, Ford gives an appealing account of quantum physics that will help the serious reader make sense of a science that, for all its successes, remains mysterious. In order to make the book even more suitable for classroom use, the author, assisted by Diane Goldstein, has included a new section of Quantum Questions at the back of the book. A separate answer manual to these 300+ questions is available; visit [The Quantum World website](#) for ordering information. There is also a cloth edition of this book, which does not include the Quantum Questions included in this paperback edition.

Quantum Physics For Dummies, Revised Edition helps make quantum physics understandable and accessible. From what quantum physics can do for the world to

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understanding hydrogen atoms, readers will get complete coverage of the subject, along with numerous examples to help them tackle the tough equations. Compatible with classroom text books and courses, Quantum Physics For Dummies, Revised Edition lets students study at their own paces and helps them prepare for graduate or professional exams. Coverage includes: The Schrodinger Equation and its Applications The Foundations of Quantum Physics Vector Notation Spin Scattering Theory, Angular Momentum, and more Your plain-English guide to understanding and working with the micro world Quantum physics — also called quantum mechanics or quantum field theory — can be daunting for even the most dedicated student or enthusiast of science, math, or physics. This friendly, concise guide makes this challenging subject understandable and accessible, from atoms to particles to gases and beyond. Plus, it's packed with fully explained examples to help you tackle the tricky equations like a pro! Compatible with any classroom course — study at your own pace and prepare for graduate or professional exams Your journey begins here — understand what quantum physics is and what kinds of problems it can solve Know the basic math — from state vectors to quantum matrix manipulations, get the foundation you need to proceed Put quantum physics to work — make sense of Schrödinger's equation and handle particles bound in square wells and harmonic oscillators Solve problems in three dimensions — use the full operators to handle wave functions and eigenvectors to find the natural wave functions of a system Discover the latest research — learn the cutting-edge quantum physics

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theories that aim to explain the universe itself

From the bestselling author of *The Theoretical Minimum*, a DIY introduction to the math and science of quantum mechanics. First he taught you classical mechanics. Now, physicist Leonard Susskind has teamed up with data engineer Art Friedman to present the theory and associated mathematics of the strange world of quantum mechanics. In this follow-up to the New York Times best-selling *The Theoretical Minimum*, Susskind and Friedman provide a lively introduction to this famously difficult field, which attempts to understand the behavior of sub-atomic objects through mathematical abstractions. Unlike other popularizations that shy away from quantum mechanics' weirdness, *Quantum Mechanics* embraces the utter strangeness of quantum logic. The authors offer crystal-clear explanations of the principles of quantum states, uncertainty and time dependence, entanglement, and particle and wave states, among other topics, and each chapter includes exercises to ensure mastery of each area. Like *The Theoretical Minimum*, this volume runs parallel to Susskind's eponymous Stanford University-hosted continuing education course. An approachable yet rigorous introduction to a famously difficult topic, *Quantum Mechanics* provides a tool kit for amateur scientists to learn physics at their own pace.

'Quantum mechanics for real. This is the good stuff, the most mysterious aspects of how reality works, set out with crystalline clarity. The place to start' Sean Carroll, physicist, California Institute of Technology, author of *The Particle at the End of the*

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Universe This is the ultimate practical introduction to quantum mechanics. World-renowned physicist Leonard Susskind and data engineer Art Friedman give you the basic skills you need to tackle this famously difficult topic yourself. They provide clear, lively explanations of basic concepts, introduce the key fields of quantum mechanics and include step-by-step exercises. Making a complex subject 'as simple as possible, but no simpler', this is a practical toolkit for amateur scientists that you won't find anywhere else.

A concise, lucid development of the fundamental structure of quantum mechanics from a thoroughly modern perspective. Focusing on physical and mathematical understanding, with over 60 problems, this compact introduction is invaluable for students and researchers in physics and other fields where quantum mechanics plays an important role

Introductory text for graduate students in physics taking a year-long course in quantum mechanics in which the third quarter is devoted to relativistic wave equations and field theory. Answers to selected problems. 1972 edition.

Quantum field theory provides the theoretical backbone to most modern physics. This book is designed to bring quantum field theory to a wider audience of physicists. It is packed with worked examples, witty diagrams, and applications intended to introduce a new audience to this revolutionary theory.

Quantum Mechanics The Theoretical Minimum Basic Books

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A beloved introductory physics textbook, now including exercises and an answer key, explains the concepts essential for thorough scientific understanding. In this concise book, R. Shankar, a well-known physicist and contagiously enthusiastic educator, explains the essential concepts of Newtonian mechanics, special relativity, waves, fluids, thermodynamics, and statistical mechanics. Now in an expanded edition—complete with problem sets and answers for course use or self-study—this work provides an ideal introduction for college-level students of physics, chemistry, and engineering; for AP Physics students; and for general readers interested in advances in the sciences. The book begins at the simplest level, develops the basics, and reinforces fundamentals, ensuring a solid foundation in the principles and methods of physics. In his first book ever, the father of string theory reinvents the world's concept of the known universe and man's unique place within it. Line drawings.

This advanced undergraduate-level text presents the quantum theory in terms of qualitative and imaginative concepts, followed by specific applications worked out in mathematical detail.

A funny, insightful, and self-contained guide to Einstein's relativity theory and classical field theories—including electromagnetism. Physicist Leonard Susskind and data engineer Art Friedman are back. This time, they introduce readers to Einstein's special relativity and Maxwell's classical field theory. Using their typical brand of real math, enlightening drawings, and humor, Susskind and Friedman walk us through the

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complexities of waves, forces, and particles by exploring special relativity and electromagnetism. It's a must-read for both devotees of the series and any armchair physicist who wants to improve their knowledge of physics' deepest truths. In studying classical mechanics, students are often helped by the fact that intuitions developed in everyday life can give one a good idea of the behavior of the idealized objects dealt with in introductory courses. In addition, equations encountered are sufficiently simple to solve even in relatively complex situations that students can further develop their intuition by solving problems. In learning quantum theory, however, intuitions developed for the classical world fail, and the equations to be solved are sufficiently complex that they can readily be solved without a computer only for the simplest situations. This book represents an attempt to jump the hurdle to an intuitive understanding of wave mechanics by using illustrations profusely to present the time evolution and parameter dependence of wave functions in a wide variety of situations. Most of the illustrations are computer-generated solutions of the Schrödinger equation for one- and three-dimensional systems. The situations discussed range from the simple particle in a box through resonant scattering in one dimension to the hydrogen atom and Regge classification of resonant scattering. This edition has been thoroughly revised and expanded to include a discussion of spin and magnetic resonance. Four concise, brilliant lectures on mathematical methods in quantum mechanics from Nobel Prize-winning quantum pioneer build on idea of visualizing quantum theory

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through the use of classical mechanics.

Examines the effort to discover the Higgs boson particle by tracing the development and use of the Large Hadron Collider and how its findings are dramatically shaping scientific understandings while enabling world-changing innovations.

Famous explorer Bob and his dog Rick have been around the world and even to the Moon, but their travels through the quantum universe show them the greatest wonders they've ever seen. As they follow their tour guide, the giddy letter h (also known as the Planck constant), Bob and Rick discover that the universe is bouncy, have crepes with Max Planck, talk to Einstein about atoms, visit Louis de Broglie in his castle, and hang out with Heisenberg on Heligoland. On the way, we find out that a dog - much like a cat - can be both dead and alive, the gaze of a mouse can change the universe, and a comic book can actually make quantum physics fun, easy to understand and downright enchanting.

This didactically unrivalled textbook and timeless reference by Nobel Prize Laureate Claude Cohen-Tannoudji separates essential underlying principles of quantum mechanics from specific applications and practical examples and deals with each of them in a different section. Chapters emphasize principles; complementary sections supply applications. The book provides a qualitative introduction to quantum mechanical ideas; a systematic, complete and elaborate presentation of all the mathematical tools and postulates needed, including a discussion of their physical

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content and applications. The book is recommended on a regular basis by lecturers of undergraduate courses.

The essential beginner's guide to string theory The Little Book of String Theory offers a short, accessible, and entertaining introduction to one of the most talked-about areas of physics today. String theory has been called the "theory of everything." It seeks to describe all the fundamental forces of nature. It encompasses gravity and quantum mechanics in one unifying theory. But it is unproven and fraught with controversy. After reading this book, you'll be able to draw your own conclusions about string theory. Steve Gubser begins by explaining Einstein's famous equation $E = mc^2$, quantum mechanics, and black holes. He then gives readers a crash course in string theory and the core ideas behind it. In plain English and with a minimum of mathematics, Gubser covers strings, branes, string dualities, extra dimensions, curved spacetime, quantum fluctuations, symmetry, and supersymmetry. He describes efforts to link string theory to experimental physics and uses analogies that nonscientists can understand. How does Chopin's Fantasia-Impromptu relate to quantum mechanics? What would it be like to fall into a black hole? Why is dancing a waltz similar to contemplating a string duality? Find out in the pages of this book. The Little Book of String Theory is the essential, most up-to-date beginner's guide to this elegant, multidimensional field of physics. What is quantum mechanics? Learn from the experts in the ALL-NEW LADYBIRD EXPERT SERIES A clear, simple and entertaining introduction to the weird, mind-

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bending world of the very, very small. Written by physicist and broadcaster Professor Jim Al-Khalili, Quantum Mechanics explores all the key players, breakthroughs, controversies and unanswered questions of the quantum world. You'll discover: - How the sun shines - Why light is both a wave and a particle - The certainty of the Uncertainty Principle - Schrodinger's Cat - Einstein's spooky action - How to build a quantum computer - Why quantum mechanics drives even its experts completely crazy 'Jim Al-Khalili has done an admirable job of condensing the ideas of quantum physics from Max Planck to the possibilities of quantum computers into brisk, straightforward English' THE TIMES Learn about other topics in the Ladybird Experts series including The Big Bang, Gravity, Climate Change and Evolution. Written by the leading lights and most outstanding communicators in their fields, the Ladybird Expert books provide clear, accessible and authoritative introductions to subjects drawn from science, history and culture. For an adult readership, the Ladybird Expert series is produced in the same iconic small format pioneered by the original Ladybirds. Each beautifully illustrated book features the first new illustrations produced in the original Ladybird style for nearly forty years.

Original publication and copyright date: 2009.

Authored by an acclaimed teacher of quantum physics and philosophy, this textbook pays special attention to the aspects that many courses sweep under the carpet. Traditional courses in quantum mechanics teach students how to use the quantum

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formalism to make calculations. But even the best students - indeed, especially the best students - emerge rather confused about what, exactly, the theory says is going on, physically, in microscopic systems. This supplementary textbook is designed to help such students understand that they are not alone in their confusions (luminaries such as Albert Einstein, Erwin Schroedinger, and John Stewart Bell having shared them), to sharpen their understanding of the most important difficulties associated with interpreting quantum theory in a realistic manner, and to introduce them to the most promising attempts to formulate the theory in a way that is physically clear and coherent. The text is accessible to students with at least one semester of prior exposure to quantum (or "modern") physics and includes over a hundred engaging end-of-chapter "Projects" that make the book suitable for either a traditional classroom or for self-study.

Masterful exposition develops important concepts from experimental evidence and theory related to wave nature of free particles. Topics include classical mechanics of point particles and problems of atomic and molecular structure. 1957 edition.

One of the field's most respected introductory texts, Modern Physics provides a deep exploration of fundamental theory and experimentation. Appropriate for second-year undergraduate science and engineering students, this esteemed text presents a comprehensive introduction to the concepts and methods that form the basis of modern physics, including examinations of relativity, quantum physics, statistical physics,

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nuclear physics, high energy physics, astrophysics, and cosmology. A balanced pedagogical approach examines major concepts first from a historical perspective, then through a modern lens using relevant experimental evidence and discussion of recent developments in the field. The emphasis on the interrelationship of principles and methods provides continuity, creating an accessible “storyline” for students to follow. Extensive pedagogical tools aid in comprehension, encouraging students to think critically and strengthen their ability to apply conceptual knowledge to practical applications. Numerous exercises and worked examples reinforce fundamental principles.

Explains the principles of relativity, profiling leading minds such as Albert Einstein, Brian Greene, and Stephen Hawking to simplify their theories on time dilation, extra dimensions, and relative motion.

Do you want to know the principles that govern everything around you? Have you always been curious about quantum physics and its mysteries but you don't know where to begin? You have found the right place, your journey to learn quantum physics starts now! In this book you will find: What quantum physics is, the history and most famous experiments and achievements in quantum mechanics. Wave-particle duality dilemma. Heisenberg uncertainty principle. Schrodinger's equation. Quantum fields theory. Introduction to string theory. Real-world applications: Quantum computing, Quantum key distribution... And much more! Even if this is the first time that you are

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hearing these terms don't be scared by the big words. ?This book makes quantum physics easy, accessible and interesting for everyone.? Are you ready? Let's deep dive into quantum physics today! Click ?BUY NOW? and start your journey!

'Beautifully clear explanations of famously "difficult" things ... It almost makes you think you could have been a Newton yourself' John Gribbin Here is the ultimate master class in modern physics. World-class physicist and father of string theory Leonard Susskind and citizen-scientist George Hrabovsky combine forces in a primer that teaches the skills you need to do physics yourself. Combining crystal-clear explanations of the laws of the universe with basic exercises (including essential equations and maths), the authors cover the minimum that readers should master. They introduce the key concepts of modern physics, from classical mechanics to general relativity to quantum theory, and provide a practical toolkit that you won't find in any other popular science book. 'A good and noble book' Sunday Times 'A wonderful and unique resource. For anyone who is determined to learn physics for real, looking beyond conventional popularizations, this is the ideal place to start' Sean Carroll, physicist and author of The Particle at the End of the Universe 'Very readable ... provides a clear description of advanced classical physics concepts, and gives readers who want a challenge the opportunity to exercise their brain' Physics World

A string theorist and a citizen scientist instruct lay readers on elementary principles of physics and associated math that amateur enthusiasts should know in order to study

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more advanced topics, in a reference that covers such topics as classical mechanics, electromagnetic fields and chaos theory.

2012 Reprint of 1955 Edition. Exact facsimile of the original edition, not reproduced with Optical Recognition Software. Dirac is widely regarded as one of the world's greatest physicists. He was one of the founders of quantum mechanics and quantum electrodynamics. His early contributions include the modern operator calculus for quantum mechanics, which he called transformation theory, and an early version of the path integral. His relativistic wave equation for the electron was the first successful attack on the problem of relativistic quantum mechanics. Dirac founded quantum field theory with his reinterpretation of the Dirac equation as a many-body equation, which predicted the existence of antimatter and matter-antimatter annihilation. He was the first to formulate quantum electrodynamics, although he could not calculate arbitrary quantities because the short distance limit requires renormalization. Dirac discovered the magnetic monopole solutions, the first topological configuration in physics, and used them to give the modern explanation of charge quantization. He developed constrained quantization in the 1960s, identifying the general quantum rules for arbitrary classical systems. These lectures were given delivered and published during his tenure at Princeton's Institute for Advanced Study in the 1930's.

Cosmological Koans invites the reader into an intellectual adventure of the highest order. Through more than fifty Koans—pleasingly paradoxical vignettes following the

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ancient Zen tradition—leading physicist Anthony Aguirre takes the reader across the world from West to East, and through ideas spanning the age, breadth, and depth of the Universe. Using these beguiling Koans (Could there be a civilization on a mote of dust? How much of your fate have you made? Who cleans the universe?) and a flair for explaining complex science, Aguirre covers cosmic questions that scientific giants from Aristotle to Galileo to Heisenberg have grappled with, from the meaning of quantum theory and the nature of time to the origin of multiple universes. A playful and enlightening book, *Cosmological Koans* explores the strange hinterland between the deep structure of the physical world and our personal experience of it, giving readers what Einstein himself called “the most beautiful and deepest experience” anyone can have: a sense of the mysterious.

Takes students and researchers on a tour through some of the deepest ideas of maths, computer science and physics.

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