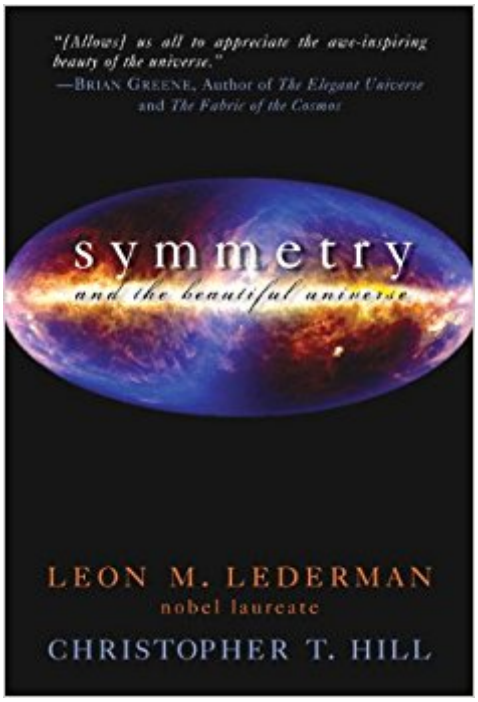
Symmetry And The Beautiful Universe



Synopsis

When scientists peer through a telescope at the distant stars in outer space or use a particle-accelerator to analyze the smallest components of matter, they discover that the same laws of physics govern the whole universe at all times and all places. Physicists call the eternal, ubiquitous constancy of the laws of physics symmetry. Symmetry is the basic underlying principle that defines the laws of nature and hence controls the universe. This all-important insight is one of the great conceptual breakthroughs in modern physics and is the basis of contemporary efforts to discover a grand unified theory to explain all the laws of physics.Nobel Laureate Leon M. Lederman and physicist Christopher T. Hill explain the supremely elegant concept of symmetry and all its profound ramifications to life on Earth and the universe at large in this eloquent, accessible popular science book. They not only clearly describe concepts normally reserved only for physicists and mathematicians, but they also instill an appreciation for the profound beauty of the universeÃ¢â ¬â„¢s inherent design.Central to the story of symmetry is an obscure, unpretentious, but extremely gifted German mathematician named Emmy Noether. Though still little known to the world, she impressed no less a scientist than Albert Einstein, who praised her "penetrating mathematical thinking." In some of her earliest work she proved that the law of the conservation of energy was connected to the idea of symmetry and thus laid the mathematical groundwork for what may be the most important concept of modern physics.Lederman and Hill reveal concepts about the universe, based on NoetherÃ¢â ¬â„¢s work, that are largely unknown to the public and have wide-reaching implications in connection with the Big Bang, EinsteinÃ¢â ¬â„¢s theory of relativity, quantum mechanics, and many other areas of physics. Through ingenious analogies and illustrations, they bring these astounding notions to life. This book will open your eyes to a universe you never knew existed.

Book Information

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Customer Reviews

The concept of symmetry has seen increasing service in science popularizations as a metaphor to convey the intuitive appeal of physics, a vogue that continues in this dense treatise. Nobel Laureate Lederman (The God Particle) and theoretical physicist Hill deploy mathematical symmetry as a unifying theme in a tour of physics from Newton's laws to quarks and superstrings. Sometimes, as in a demonstration that the invariance of physical laws through time implies the law of conservation of energy, this approach yields insights. But usually, as in their confusing exposition of special relativity, symmetry considerations get in the way. The authors keep things readable with lots of physics-for-poets bits, including some tie-ins to environmentalism, comparisons of modern cosmology with ancient Greek myths, and a fictional dialogueÃ¢â ¬â •partly in ItalianÃ¢â ¬â •between two newlywed physicists and Galileo's ghost. Unfortunately, symmetry is a forbiddingly abstract branch of mathematics that was peripheral to the development of much of physics and gives little tangible feel for its substance, and the point where it becomes indispensable to discussions of modern physics is also the tipping point where the book, like many others, topples into total incomprehensibility to laypeople. Readers who think symmetry implies clarity and grace will be disappointed. Photos. Copyright Ã Â© Reed Business Information, a division of Reed Elsevier Inc. All rights reserved. --This text refers to the Hardcover edition.

"AÃ Â tour de forceÃ Â of physics made simple...."Ã¢â ¬â •Ã Â Times Literary SupplementÃ Â Ã¢â ¬Å“Thought-provokingÃ¢â ¬Â¦Ã¢â ¬Â•Ã¢â ¬â •Ã Â DiscoverÃ Â Ã¢â ¬Å“Few books about modern physics are as fascinating, far-ranging, and readable as this. It would be appreciated by anyone interested in the nature of science and the beauty of the universeÃ¢â ¬Â¦"Ã¢â ¬â • NSTA Recommends"A compelling and accessible discussionÃ¢â ¬Â¦Ã¢â ¬Â•Ã¢â ¬â • Science Books & Films

What a wonderful book!Anyone interested in mathematics, modern physics or even abstract art would really love to read this one.The topic of symmetry is important to our lives as human beings and lovers of fine art, as well as a critical method used by modern physicists exploring quantum field theoretical explanations of reality.Lederman begins with a very deliberate and careful exploration of

what symmetry is, before proceding tomany examples of its relevance to science and to physics.Simply put, this is a tour de force on modern physics and no one should miss it, if she or he would like to comprehendmodern quantum field theory.Even apart from its explanations of physics, the book succeeds well as an entertaining romp throughall aspects of symmetry.Don’t miss it!

This book did what I wanted. After reading Green/Kaku/Gribben et al, I felt very fuzzy about what physicists mean by symmetry. Pictures of basketballs, snowflakes, and butterflies weren’t helping. This book really helped give a gut feeling for what symmetry is when a physicist tosses it around with reference only to the darn snowflake. The book is witty with lots of intuitive examples, though parts were a slog. (I need an Idiot’s Guide to gauge invariance, still.) I did find that if I let my mind kind of float over the murkier parts, I was most of the time "almosting" it. But the clear parts did outnumber the murkies.I debated whether to let my thoughts on the Kindle version affect the number of stars, but decided to rate on the contents and just WARN of the Kindle problems. There are more inane typos in the text than you’d find in a world of Tweets. And they are concentrated in the formulas. Yes, the book has formulas, though little math connected with them--just short-hand ways of describing what the author explains in words and examples. But even I, far from a math wizard, could tell that the formulas, particularly sub and superscripts, were nonsensical. It’s hard to describe in a review where there is no way to indicate a sub or superscript, but for example, when using a negative power, instead of a minus sign there were two commas. Over and over. Parts of formulas were just left out: it’s as if a physics text said F=m and forgot the "a" part when describing motion. The book slowed down because whenever I encountered the typos, I found myself writing this review in my head and losing the train of thought of the book.Whoever was in charge of putting this into Kindle format must have left on a long vacation as soon as the scanner stopped whirring and never looked at the text again. The publisher should be ashamed, mortified, to put this into the stream of commerce, and the author should sue the publisher for misrepresentation!! But I guess publisher mortification is limited to the Horrid Things that will happen if it lets set prices for e-books.Get the dead tree version and welcome to the world physicists talk about when they rave about the beauties of symmetry.

Extremely well written explanation of quantum physics at a simple enough level for me to understand, yet complete enough for me to learn a lot that other "simplified quantum physics" books didn’t go into. AND it was published in 2004 yet covers EVERYTHING that I have currently read about in quantum physics (and more). I feel like I have a much better understanding of quantum

physics that I did before (and I've read the equally excellent Feynman's Lectures on Physics (ignoring the math)).

This is an amazing book explaining the remarkably simple "unifying" concept underlying all the fundamentals of physics. This concept is symmetry. Symmetry according to Webster's dictionary starts with a poetic definition "Beauty of form arising from balanced proportions". But it also has a more practical meaning when we say that it is "An expression of equivalence between things". Scientists reformulated these poetic and prosaic meanings of symmetry into the following mathematically precise definition "symmetry is invariance to a transformation". In this book the amazing consequences of the fact that our universe is intrinsically symmetrical in all it defining properties is explained. The laws of physics are invariant to translation, rotation, motion, passage of time, etc. This is a direct and intuitive consequence of the notion that our universe does not have a center. It also does not have a well defined point in space and time from where it all started with the big bang. The remnant of the big bang can only be observed in the Cosmic Microwave Background uniformly surrounding us 13.7 billion light years away. This is what inflation did.A relatively unknown female mathematician has formulated and proven one of the most fundamental theorems in mathematics and physics. I am embarrassed by the fact that the world has ignored, and is still ignoring, Emmy Noether who has proven the following theorem in 1915. "For every continuous symmetry of the laws of physics, there must exist a conservation law, and conversely for every conservation law, there must exist a continuous symmetry". From this all basic concepts like conservation of momentum, conservation of energy, Galilean relativity, inertia, Newton's laws, conservation of angular momentum, Kepler's laws of orbits, etc. can be explained and interlinked. When you subsequently add the ultimate symmetry of the invariance of the speed of light to any frame of reference whether this is moving, rotating, or accelerating, everything changes very fundamentally through Einstein's Special and General Relativity. All of a sudden time is no longer linear and we have to include "singularities" (black holes) into our equations. Still "Time" is the odd one out which becomes clear when we look in the "mirror" and reflection symmetry or parity symmetry is introduced, here things start to fall apart a bit and to maintain time reversal symmetry concepts like entropy and even more foreign notions of anti matter need to be introduced. Richard Feynman already referred to anti particles as particles moving back in time. This in itself creates a new form of particle - anti particle symmetry, also called charge conjugation. It appears that at the subatomic level symmetry is broken. An example is the weak interaction force, which does not obey the rules of reflection or parity symmetry. Later it was assumed that perhaps the combination of

parity symmetry and charge conjugation would be a symmetry which applies to the weak force. Alas, this also appeared through experiments (with a special type of subatomic particles called K-mesons) not to be true. Intriguingly, if it were true there would be the same amount of matter and anti matter in our universe and if that would be true the universe as we know it cannot exist! Our universe was born when, at the moment of the big bang, symmetry was "broken".The only way to construct a symmetry to which the weak force succumbs is when we add a third discrete symmetry transformation, i.e. the reversal of time. This is required to ensure that there is conservation of "probability" in quantum mechanics (All probabilities added together will always have to equal one. Remember Heisenberg's uncertainty principle and Schrodinger's "probability" Wave Equation). Clearly at subatomic level a lot of "tricks" are required! Here the search for "hidden symmetries" begins and the mysterious Gauge Symmetry is slowly revealing itself in the "standard model" and its quarks, leptons and gluons unifying all the basic forces in our universe. Now we only need to find the missing Higgs (or God's) Particle."

(Undergraduate Texts in Mathematics) Symmetry, Group Theory, and the Physical Properties of Crystals (Lecture Notes in Physics)