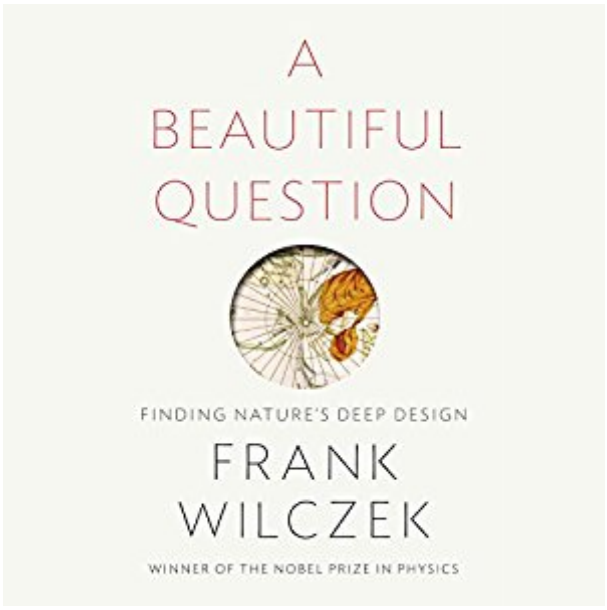
A Beautiful Question: Finding Nature's Deep Design



Synopsis

Does the universe embody beautiful ideas? Artists as well as scientists throughout human history have pondered this "beautiful question". With Nobel laureate Frank Wilczek as your guide, embark on a voyage of related discoveries, from Plato and Pythagoras up to the present. Wilczek’s groundbreaking work in quantum physics was inspired by his intuition to look for a deeper order of beauty in nature. In fact, every major advance in his career came from this intuition: to assume that the universe embodies beautiful forms, forms whose hallmarks are symmetry - harmony, balance, proportion - and economy. There are other meanings of "beauty", but this is the deep logic of the universe - and it is no accident that it is also at the heart of what we find aesthetically pleasing and inspiring. Wilczek is hardly alone among great scientists in charting his course using beauty as his compass. As he reveals in A Beautiful Question, this has been the heart of scientific pursuit from Pythagoras, the ancient Greek who was the first to argue that "all things are number", to Galileo, Newton, Maxwell, Einstein, and into the deep waters of 20th century physics. Though the ancients weren’t right about everything, their ardent belief in the music of the spheres has proved true down to the quantum level. Indeed, Wilczek explores just how intertwined our ideas about beauty and art are with our scientific understanding of the cosmos. Wilczek brings us right to the edge of knowledge today, where the core insights of even the craziest quantum ideas apply principles we all understand. The equations for atoms and light are almost literally the same equations that govern musical instruments and sound; the subatomic particles that are responsible for most of our mass are determined by simple geometric symmetries. The universe itself, suggests Wilczek, seems to want to embody beautiful and elegant forms.

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Customer Reviews

This is a rumination on beauty in the world. Nobel Laureate Frank Wilczek who is one of the most acclaimed theoretical physicists of his times brings us a chronicle of what beauty in science means. He focuses mainly on physics but does not neglect other sciences. The book is thoughtfully written and is beautifully illustrated with images from art, science and history. It reveals a mind that is as comfortable probing the deep mysteries of the cosmos as it is pondering the everyday objects of our world.Wilczek's approach is roughly chronological and one of his goals is to reveal the seamless unification of beauty in many different contexts. For instance he starts with an account of Pythagoras's theorem which pointed to a crucial connection between numbers and geometric figures. But Pythagoras also discovered simple and pleasing relationships between musical frequencies and the length of various string instruments. Remarkably, these relationships also mirror some of the relationships found in the wavelike nature of subatomic particles. Thus beauty in sound is connected to beauty at the microscopic level. Similarly Wilczek dwells on Goethe's intriguing ruminations on color. While some of these ruminations were scientifically flawed, Wilczek explores how they connect to our modern understanding of color based on the physics and biology of vision.It is when Wilczek starts talking about beauty in physics that he is really in his element. How does one define beauty in science in general and physics in particular? As we all know, beauty is in the eye of the beholder, but Wilczek convincingly provides some criteria that have guided physicists' search for this elusive but still familiar concept through the ages. One very important criterion is symmetry, and Wilczek tells us how assumptions of symmetry in equations and the behavior of subatomic particles underlie almost every concept of modern physics, from relativity to the Higgs boson. The second criterion is economy: many of the most profound equations of physics can fit on a napkin. The third is unification which, as pointed out before, leads to pleasing similarities between the mundane (musical sound, color) and the deep (cosmology, quantum mechanics) as well as between many branches of physics itself. In fact Wilczek's account demonstrates why the mundane is actually deeper than we think. Stunning examples of unification in physics include Maxwell's marriage of electricity with magnetism and Einstein's marriage of space with time.The later parts of the book which talk about concepts like the standard model of particle physics, gauge symmetry, Noether's theorem and quantum electrodynamics can get a bit hairy, but even if you are not a physicist you can still appreciate how these concepts embody the core concepts of beauty that Wilczek mentions. Things get a bit trickier when Wilczek starts talking about complex systems which

cannot be pithily described with simple equations. These systems are more amenable to models than fundamental laws, and the challenges of defining beauty in such cases is illustrated by a collaboration Wilczek had with a fellow scientist in which a model that they came up with had so many moving parts that ultimately it was hard to see where exactly one could search for beauty or elegance in the construction. This discussion tantalizingly hints at the existence of so-called emergent systems like the weather, the stock market and consciousness which are not reducible to the sum of their individual parts. I would have appreciated a more detailed discussion of beauty in the context of these systems since science is likely going to focus more on them in the upcoming years.Nevertheless, this is a fine meld of ruminations on beauty across science, art, music and many other aspects of the human and natural world. Wilczek is a clear guide on this journey, and although he may not answer all our questions on beauty, he certainly makes us question and think, which should be the hallmark of a good teacher. Almost two hundred years ago John Keats said, "Beauty is truth, truth is beauty." Wilczek shows us how Keats's utterance is largely true.

A beautiful question begins naturally by posing a question to the reader - Does the world embody beautiful ideas? With this question in mind nobelaureate Frank Wilczek goes on to discuss beauty in nature and the intellectual history of physics. I found aspects of the book enjoyable and illuminating and there is much that a wide range of readers can learn. That being said the book isn't that original in concept and seems to have some overlap with "Fearful Symmetry" by Zee. In particular the associating of symmetry and beauty and how nature is defined by symmetries and therefore one should see nature as beautiful is a much discussed idea by admirers of science.The book is primarily split into topics chronologically. The author starts with Pythagoras and gives an extremely elegant proof of the theorem. The author discusses the history of Pythagoras and the myths surrounding the man. He also goes into some music theory and discusses how pleasant sounds are heard when notes whose frequencies are in simple integer ratios are played. The author throughout provides interesting anecdotes about the subject matter being discussed providing the reader with an appreciation of how nature can be beautiful. The author then goes into Plato and aspects of his teachings put beautiful ideas on a pedestal. Properties of platonic solids are discussed as well as Euclid and how the elements was a book structured methodically to reach a final result about the shape and number of platonic solids. The author discusses how ideas about how nature embodies beautiful ideas can often be far off the mark and uses Kepler's early planetary model to illustrate. The author discusses the limits of human perception in appreciating reality using Plato's cave as analogy and the author gets into ideas in projective geometry to illustrate how opportunities to

appreciate perspective are all around us and waiting to be admired. The author discusses the ideas of Newton in both optics and then dynamics. The author highlights a lot in the history of science and how various instruments gave indications of the nature of the world like the prism for understanding light. The author spends a lot of time on Maxwell as Maxwell wrote probably the most influential work of mathematical physics of all time. Maxwell's equations are highlighted as how nature embodies beautiful ideas and the author spends some time detailing how electromagnetic waves self-propogate and have a solution whose speed is the speed of light. The details of the discovery of the electromagnetic theory of light are remarkable. The author moves into more modern times and discusses the similarities of quantum mechanics with acoustic wave theory and the normal nodes of strings. The author spends a bit of time on Einstein and how symmetry was at the center of all of his work. The author then spends time on newer fields like quantum chromodynamics; such fields are really unapproachable to a casual reader but the flavor of some of the ideas followed are presented in an interpretable manner. The author finally gets back into symmetry and ends with some of the ideas that have been so important for his career. In particular the author spends time on super symmetry and discusses what makes the theory special and an example of beauty.All in all i found the book reasonably enjoyable with some chapters being quite illuminating. I have to say the book has its down moments as well. I don't think the organization is particularly great and there seem to be some random parts which don't achieve much. After reading the book i feel like i understand a few things better but i don't feel like i will remember the book for anything specific.

Beautiful Girls) House Beautiful The Home Book: Creating a Beautiful Home of Your Own (House Beautiful Series) Georgia Nature Weekends: 52 Adventures in Nature (Nature Weekend Series) Solace: The Art of Asking the Beautiful Question A More Beautiful Question: The Power of Inquiry to Spark Breakthrough Ideas Why?: The Best Ever Question and Answer Book about Nature, Science and the World around You Accessing the Deep Web & Dark Web with Tor: How to Set Up Tor, Stay Anonymous Online, Avoid NSA Spying & Access the Deep Web & Dark Web Deep Calls unto Deep: Answering Questions about the Prophetic Raggedy Ann in the Deep Deep Woods: Classic Edition My Will or Thine: An Inspiring True Story About LDS Priesthood Blessings and Deep Questions Surrounding Beliefs (Understanding Mormon Church Doctrine and Deep Religion Questions of Mormonism Book 2) Home-cooked Deep Fry: Deep Fried Recipes to Make Your Mouth Water