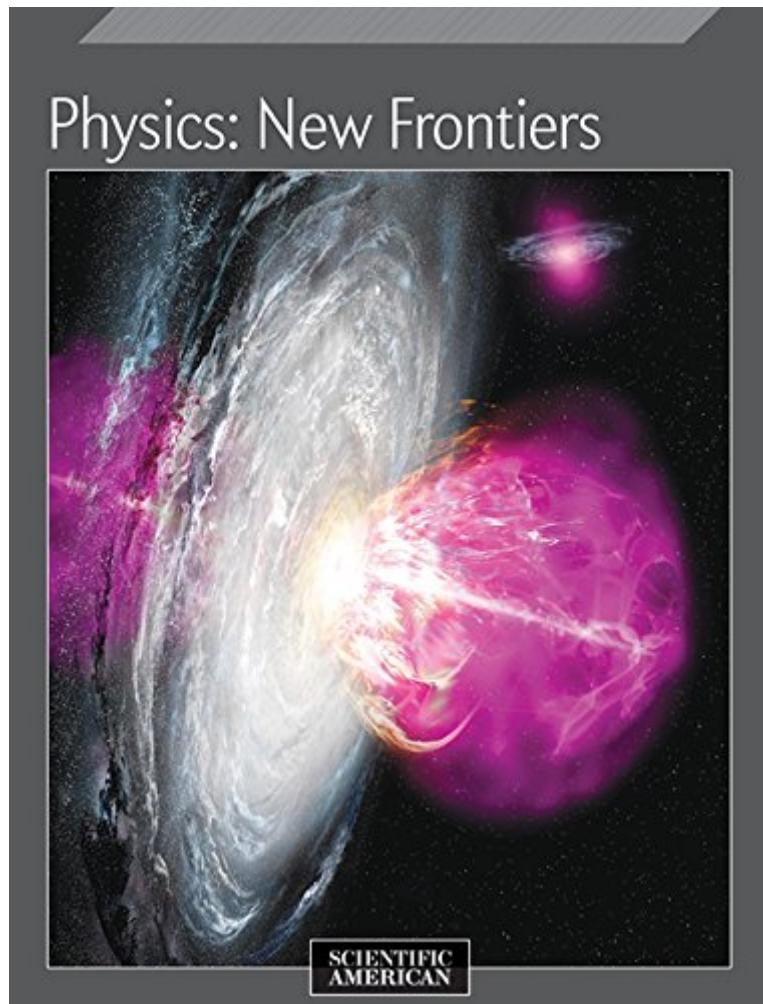


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# Physics: New Frontiers



## Synopsis

In the world of physics, very little in the universe is what it first appears to be. And science fiction has imagined some pretty wild ideas about how the universe could work – from hidden extra dimensions in *Interstellar* to life as a mental projection in *The Matrix*. But these imaginings seem downright tame compared with the mind-bending science now coming out of physics and astronomy, and in this eBook, *Physics: New Frontiers*, we look at the strange and fascinating discoveries shaping (and reshaping) the field today. In the world of astrophysics, the weirdness begins at the moment of creation. In “*The Black Hole at the Beginning of Time*,” the authors discuss theories of what might have come before the big bang. Could our 3-D universe have sprung from the formation of a black hole in a 4-D cosmos? The math says: maybe. Later, in “*The Giant Bubbles of the Milky Way*,” the authors describe massive structures dubbed “*Fermi bubbles*” – at its center “structures that no one noticed until recently. Technological innovations make much of this new science possible, as we see again in “*Neutrinos at the Ends of the Earth*,” where 5,000-odd sensors frozen deep within a cubic kilometer of ice in Antarctica aim to catch neutrinos in order to study distant cosmic phenomena. Scientists are also dissecting molecules with the most powerful x-ray laser in the world, as explored in “*The Ultimate X-ray Machine*.” Even our most fundamental notions of what reality is are up for debate, as examined in “*Does the Multiverse Really Exist?*” and the aptly named “*What Is Real?*” in which the authors question whether particles are indeed material things at all. While all of this abstraction might seem like a fun exercise in mental gymnastics, living things must also abide by the laws of physics, which, according to “*The Limits of Intelligence*,” may prevent our brains from evolving further. Then again, as we’ve learned, things could be different than they appear |

## Book Information

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## Customer Reviews

this approach to a very technical subject, which is to discuss it as if every person can understand it, though most probably they can't forced me to put in some extra hours to proceed nearer to understanding. Thanks a lot.

This collection of essays by leading physicists spans all the interesting topics in current day physics, but unlike single author books, better reveals the considerable diversity of opinion on the usual hot topics such as resolving quantum field theory with general relativity. The unique last chapter on the limits of physical human brain development, and therefore intelligence is itself, is itself worth the price of admission. The great Scientific American illustrations are also a plus.

Should this 2017 *Scientific American* article collection, titled *Physics: New Frontiers*, more appropriately be described as alternative, multiple or new frontiers in physics? Especially as the subject matter opens the door to political association with the Kennedy Camelot theme of "New Frontier" compared to the current Conway assertion of "Alternative Facts", both subject to "Multiple" world interpretations. Probably not since Plato have the realms of physics, philosophy and politics been drawn so tightly together in the same cave. Daring to go where they went recently before, the editors at *Scientific American* have assembled another collection of articles about developments in the world of physics. During 2016 they published a very good collection titled *Ultimate Physics* which covered the very small, the very big, the very dense and theoretical considerations, the last notably by Stephen Hawking and Leonard Susskind (here's the link to my review of this collection:

[https://www..com/review/R2L9R6OLCSFQUM/ref=cm\\_cr\\_rdp\\_perm](https://www..com/review/R2L9R6OLCSFQUM/ref=cm_cr_rdp_perm)) As previously, the editors have organized 15 articles by researchers and authorities into four sections reflecting current research

and debates about what current physics thinking is exploring: Amazing Astrophysics (five articles setting forth puzzles of the observed universe and seemingly inexplicable phenomena not easily explained by current theories, be they Newton, Einstein, or quantum approaches, and what the implications are) Extreme Machines (three articles covering the equipment and hoped for observations to provide more insight into the inexplicable phenomena) Hidden Worlds (five articles offering possible theories as explanations for the phenomena as well as attempts to reconcile with or reinterpret current thinking, including multiverses, entangled particles and *spooky action at a distance*) Life at the Limits (two articles raising questions about the objectivity of human observations and human brain capabilities and limits) The first section explains how humans have progressed in their understanding of the forces at work in the universe, especially looking back to the *Big Bang* and the moments shortly thereafter. Seemingly contradictory invisible but measurable forces keep galaxies together, yet, are driving unlimited universe expansion: dark matter (25% of the expected content of the universe), dark energy (70%) as well as visible matter (5%). The impacts of the *dark forces* are in addition to the established electro-magnetic, strong and weak forces and gravity. However, what they are made of and how they operate remains a mystery. This section also presents the attempts to reconcile Einstein's general and special theories of relativity operating over large distances with the probabilistic nature of quantum mechanics as explanations for the mysterious phenomena being observed. It is particularly relevant with interpretations of what might happen in and around black holes, singularities and event horizons - well worth reading and assessing. The next section looks at the equipment being used and created to capture trace evidence of the *dark forces* and their possible impacts in the visible world. These impacts are believed to leave signs such as small and subtle trails of neutrinos, *quintessence* particles, or large gravitational waves - some still to be discovered. The third collection explores the theoretical explanations for the *dark* or *hidden* worlds of the universe. These articles make several good points: our understanding of the universe's history is based on observable light we can see back to about 14 billion years but may be limited by our capabilities, thus, raises the possibility more material may exist moving away faster than the speed of light; application of our understanding of black holes suggests that alternative or parallel universes may exist though we are unlikely to experience them; traveling back in time may be theoretically plausible though how this is achieved (*wormholes*) is more for the creative arts to indulge; whether fundamental matter is formed by particles, waves or strings raises questions about their certainty of

their location, which could exist in multiple places at once, until we collapse the possibilities through observation (the impact of the Heisenberg Uncertainty Principle on the state of Schrodinger's boxed cat thought experiment). Finally, the last section challenges our assumptions in two ways: Is it ever possible to know objectivity in a quantum world (thus, giving rise to theories of multiverses or alternative worlds branching out side-by-side ad infinitum)? Are we physically limited in our capability to exceed our current levels of reasoning and understanding about our world and universe? An interesting tidbit in the last article is the point that human's brain capability was greatly expanded by the discovery of the cooking fire which made the benefits of food more accessible to humans and required less time than other mammals to forage. Once again, I wish the Scientific American editors could update these collections with later articles such as "The Quantum Multiverse" (June 2017) and "Black Holes from the Beginning of Time" (July 2017) to append more recent thinking. On the other hand, maybe we should just chill out in our caves watching TV with reruns of the recent "Fringe" series or the current nightly news.

A customer has pointed out in his comment that the Scientific American beautiful illustrations are a plus! We may wonder how! The illustrations and their captions in the Kindle edition are extra-small and cannot be enlarged or zoomed in to see what they express. They are just as useless as blank spaces. Of course, in a scientific book, you cannot simply ignore the graphs or illustrations. Ironically, the articles which are written in a popular style refer to these tiny and illegible illustrations to clarify what they try to convey. It is as though the book is prepared in a hurry since even the text suffers from many types (mostly broken words). Surely those who were responsible for the digital edition or the Kindle format could have done a better job to produce the same high quality you expect from a credential journal such as the Scientific American.

I would have given this book five stars except for the overlap. This is a collection of different articles by different authors. There was a certain amount of repetition due to the authors' introductions and background information. However, the new ideas in Physics are very compelling and mind-expanding. Great reading for people interested in human knowledge and thinking about the cosmos, infinitesimal particles and everything in between.

It is intense reading one after another, but it is informative and well written. The best way I know to stay afield of a subject not in your field.

If you're a fan of theoretical physics or books new concepts this is 100% for you. It will truly help if you've have a scientific background but even without you will be rewarded by your readings.

Mind boggling stuff, as usual, and presented clearly for the layman. There should be more of the actual math, but you will gather a complete conceptualization of the current state of the art from this great book.

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