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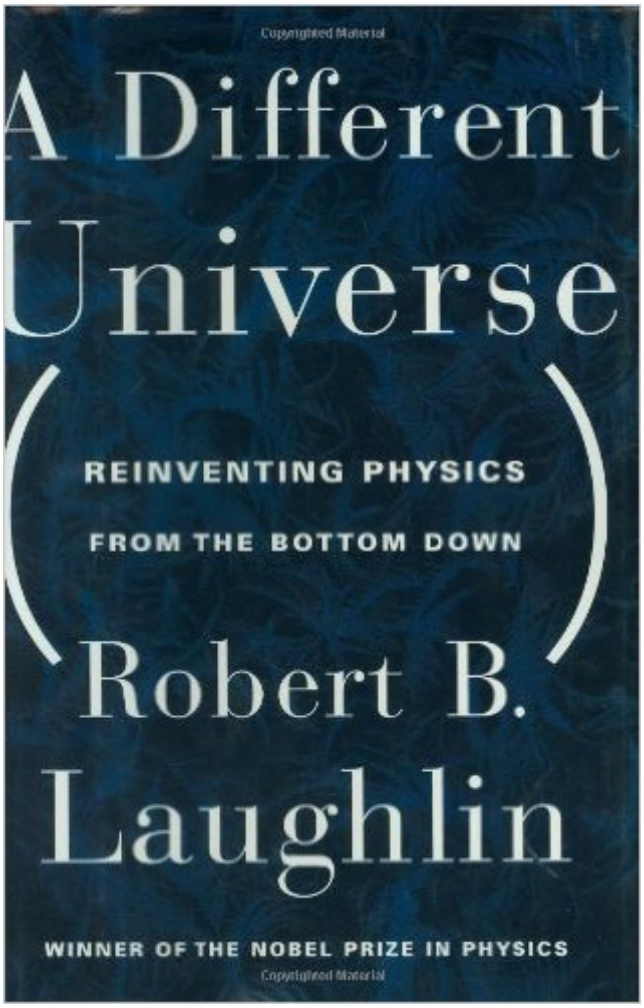
A Different Universe: Reinventing Physics From The Bottom Down



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Synopsis

Not since Richard Feynman has a Nobel Prize-winning physicist written with as much panache as Robert Laughlin does in this revelatory and essential book. Laughlin proposes nothing less than a new way of understanding fundamental laws of science. In this age of superstring theories and Big-Bang cosmology, we're used to thinking of the unknown as being impossibly distant from our everyday lives. The edges of science, we're told, lie in the first nanofraction of a second of the Universe's existence, or else in realms so small that they can't be glimpsed even by the most sophisticated experimental techniques. But we haven't reached the end of science, Laughlin argues-only the end of reductionist thinking. If we consider the world of emergent properties instead, suddenly the deepest mysteries are as close as the nearest ice cube or grain of salt. And he goes farther: the most fundamental laws of physics-such as Newton's laws of motion and quantum mechanics -are in fact emergent. They are properties of large assemblages of matter, and when their exactness is examined too closely, it vanishes into nothing.A Different Universe takes us into a universe where the vacuum of space has to be considered a kind of solid matter, where sound has quantized particles just like those of light, where there are many phases of matter, not just three, and where metal resembles a liquid while superfluid helium is more like a solid. It is a universe teeming with natural phenomena still to be discovered. This is a truly mind-altering book that shows readers a surprising, exquisitely beautiful and mysterious new world.

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Customer Reviews

Anyone interested in the direction of physical science should read this book. Laughlin opens his

heart in an attempt to open the minds of his target audience: students and the laity. Unhampered by `professional correctness', the Nobel Prize-winning physicist lobs a stream of barbed-wit grenades at the dogmas of 20th-century physics. This book may irritate readers who believe that quantum field theory or multidimensional descendents of string theory are on the threshold of providing a `Theory of Everything'. Conversely, it will reward readers who are interested in the conceptual advances of the last few decades that are both testable and important to 21st-century technology. Laughlin's writing style is straightforward, laced with personal insight and a delightful humor; "A Different Universe" is fun to read.Laughlin's major thesis is that `Reductionism', the highly successful paradigm of 20th-century physics, is approaching the end of its usefulness. Exact, highly reproducible experimental results have led to a dichotomy: the reductionist view - we can learn sufficient detail about the primitive physical parts to theoretically deduce the experimental result; or the emergentist view - there is a principle of physical organization, which is rarely deducible from lower-level components, that causes the collective effect. Only the latter view is practical now. Laughlin states in the final paragraph, "We live not at the end of discovery but at the end of Reductionism, a time in which the false ideology of human mastery of all things through microscopics is being swept away by events and reason." This opinion is not inconsistent with his statement in the preface, "I do not wish to impugn reductionism so much as establish its proper place in the grand scheme of things.

... and deliberately provocative, as several other reviewers failed to realize. If I were a good deal younger, I'd describe Prof. Laughlin's humor as "snarky", but since that adjective isn't yet in my vocabulary I'll have to go with "sm*rt-*ssed". It's perhaps a sort of humor that tickles the funny-bones of science nerds most, rather like 'viola jokes' amongst us musicians, and the anecdotes almost certainly offend those readers who find they are the butts of Laughlin's humor. He is unrepentantly scornful of those he perceives as fools. But how can you resist his description of String Theory: "a textbook case of a Deceitful Turkey, a beautiful set of ideas that will always remain just out of reach. Far from a wonderful technological hope for tomorrow, it is instead the tragic consequence of an obsolete belief system..." Yeah! I happen to think of String Theory, if I have to, as Sudoku for Metaphysicians.The unifying theme of A Different Universe is that physical sciences have "stepped firmly out of the age of reductionism into the age of emergence." I won't attempt to parse that statement; it would be like giving away the end of a suspense novel.There are also moments of homiletic wisdom to be found, sauced with humor. In his chapter about nuclear science vs. applied nuclear engineering (think Hiroshima), Laughlin writes: "... self deception has

consequences. Most of the time the effect is not as dire as warfare, but simply a degradation of the quality of life. These degradations include such happy institutions as road rage, divorce court, and excessively long faculty meetings." Make of that sermon what you will! It’s not unamusing to find a Nobel-winning tenured professor at Stanford still picturing himself as Peck’s Bad Boy or James Dean.

A Different Universe is a condensed matter physicist’s answer to the stack of popular works high energy physicists have been writing since the 1990s promising us that once they get to that final theory just over the horizon, the rest is chemistry. These books are notorious for their arrogance, condescension, and bluster. It is valuable to have the other perspective available in an accessible form. It turns out, however, that arrogance, condescension, and bluster are no more palatable coming from a condensed matter physicist than they are coming from a high energy physicist.Laughlin’s argument is essentially the same as the one Phil Anderson made in an article entitled "More Is Different" (Science 177 (1972): 393-396). Namely, he believes that fundamental physical insight can occur at any level of complexity, and that the laws governing higher-level phenomena are compatible with, but not predictable from, the laws governing lower-level phenomena. This debate between reduction and emergence has crucial relevance for how science is structured in a society that spends buckets of money on it. Laughlin’s argument deserves a broad hearing, so it is disappointing that this expression of it is so inarticulate.I’m rating this book poorly, not because I disagree with the point it makes, but because, by conforming to the same pattern established by reductionist treatises, it does little to advance that view. By expressing himself just as dogmatically as his opponents do, Laughlin does his argument a disservice.My other complaint is that Laughlin frequently lapses into anecdotes and parables to explain his points, many of which obfuscate, rather than clarify.

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