

**The New York Times** Reprints

This copy is for your personal, noncommercial use only. You can order presentation-ready copies for distribution to your colleagues, clients or customers [here](#) or use the "Reprints" tool that appears next to any article. Visit [www.nytreprints.com](http://www.nytreprints.com) for samples and additional information. [Order a reprint of this article now.](#)

March 23, 2012

# On the Origin of Everything

By DAVID ALBERT

## A UNIVERSE FROM NOTHING

### Why There Is Something Rather Than Nothing

By Lawrence M. Krauss

Illustrated. 202 pp. Free Press. \$24.99.

Lawrence M. Krauss, a well-known cosmologist and prolific popular-science writer, apparently means to announce to the world, in this new book, that the laws of quantum mechanics have in them the makings of a thoroughly scientific and adamantly secular explanation of why there is something rather than nothing. Period. Case closed. End of story. I kid you not. Look at the subtitle. Look at how Richard Dawkins sums it up in his afterword: “Even the last remaining

trump card of the theologian, ‘Why is there something rather than nothing?’ shrivels up before your eyes as you read these pages. If ‘On the Origin of Species’ was biology’s deadliest blow to supernaturalism, we may come to see ‘A Universe From Nothing’ as the equivalent from cosmology. The title means exactly what it says. And what it says is devastating.”

Well, let’s see. There are lots of different sorts of conversations one might want to have about a claim like that: conversations, say, about what it is to *explain* something, and about what it is to be a *law of nature*, and about what it is to be a *physical thing*. But since the space I have is limited, let me put those niceties aside and try to be quick, and crude, and concrete.

Where, for starters, are the laws of quantum mechanics themselves supposed to have come from? Krauss is more or less upfront, as it turns out, about not having a clue about that. He acknowledges (albeit in a parenthesis, and just a few pages before the end of the book) that everything he has been talking about simply takes the basic principles of quantum mechanics for granted. “I have no idea if this notion can be usefully dispensed with,” he writes, “or at least I don’t know of any productive work in this regard.” And what if he did know of some productive work in that regard? What if he were in a position to announce, for instance, that the truth of the quantum-mechanical laws can be traced back to the fact that the world has some other, deeper property X? Wouldn’t we still be

in a position to ask why X rather than Y? And is there a *last* such question? Is there some point at which the possibility of asking any further such questions somehow definitively comes to an end? How would that work? What would that be like?

Never mind. Forget where the laws came from. Have a look instead at what they say. It happens that ever since the scientific revolution of the 17th century, what physics has given us in the way of candidates for the fundamental laws of nature have as a general rule simply taken it for granted that there is, at the bottom of everything, some basic, elementary, eternally persisting, concrete, physical *stuff*. Newton, for example, took that elementary stuff to consist of material particles. And physicists at the end of the 19th century took that elementary stuff to consist of both material particles and electromagnetic fields. And so on. And what the fundamental laws of nature are *about*, and *all* the fundamental laws of nature are about, and all *there is* for the fundamental laws of nature to be about, insofar as physics has ever been able to imagine, is how that elementary stuff is *arranged*. The fundamental laws of nature generally take the form of rules concerning which arrangements of that stuff are physically possible and which aren't, or rules connecting the arrangements of that elementary stuff at later times to its arrangement at earlier times, or something like that. But the laws have no bearing whatsoever on questions of where the elementary stuff came from, or of why the world should have consisted of the particular elementary stuff it does, as opposed to something else, or to nothing at all.

The fundamental physical laws that Krauss is talking about in “A Universe From Nothing” — the laws of relativistic quantum field theories — are no exception to this. The particular, eternally persisting, elementary physical stuff of the world, according to the standard presentations of relativistic quantum field theories, consists (unsurprisingly) of relativistic quantum fields. And the fundamental laws of this theory take the form of rules concerning which arrangements of those fields are physically possible and which aren't, and rules connecting the arrangements of those fields at later times to their arrangements at earlier times, and so on — and they have nothing whatsoever to say on the subject of where those fields came from, or of why the world should have consisted of the particular kinds of fields it does, or of why it should have consisted of fields at all, or of why there should have been a world in the first place. Period. Case closed. End of story.

What on earth, then, can Krauss have been thinking? Well, there is, as it

happens, an interesting difference between relativistic quantum field theories and every previous serious candidate for a fundamental physical theory of the world. Every previous such theory counted material particles among the concrete, fundamental, eternally persisting elementary physical stuff of the world — and relativistic quantum field theories, interestingly and emphatically and unprecedentedly, do not. According to relativistic quantum field theories, particles are to be understood, rather, as specific arrangements of the fields. Certain arrangements of the fields, for instance, correspond to there being 14 particles in the universe, and certain other arrangements correspond to there being 276 particles, and certain other arrangements correspond to there being an infinite number of particles, and certain other arrangements correspond to there being *no particles at all*. And those last arrangements are referred to, in the jargon of quantum field theories, for obvious reasons, as “vacuum” states. Krauss seems to be thinking that these vacuum states amount to the relativistic-quantum-field-theoretical version of there *not being any physical stuff at all*. And he has an argument — or thinks he does — that the laws of relativistic quantum field theories entail that vacuum states are unstable. And that, in a nutshell, is the account he proposes of why there should be something rather than nothing.

But that’s just not right. Relativistic-quantum-field-theoretical vacuum states — no less than giraffes or refrigerators or solar systems — are particular arrangements of *elementary physical stuff*. The true relativistic-quantum-field-theoretical equivalent to there not being any physical stuff at all isn’t this or that particular arrangement of the fields — what it is (obviously, and ineluctably, and on the contrary) is the simple *absence* of the fields! The fact that some arrangements of fields happen to correspond to the existence of particles and some don’t is not a whit more mysterious than the fact that some of the possible arrangements of my fingers happen to correspond to the existence of a fist and some don’t. And the fact that particles can pop in and out of existence, over time, as those fields rearrange themselves, is not a whit more mysterious than the fact that fists can pop in and out of existence, over time, as my fingers rearrange themselves. And none of these poppings — if you look at them aright — amount to anything even remotely in the neighborhood of a creation from nothing.

Krauss, mind you, has heard this kind of talk before, and it makes him crazy. A century ago, it seems to him, nobody would have made so much as a peep about referring to a stretch of space without any material particles in it as “nothing.” And now that he and his colleagues think they have a way of

showing how everything there is could imaginably have emerged from a stretch of space like that, the nut cases are moving the goal posts. He complains that “some philosophers and many theologians define and redefine ‘nothing’ as not being any of the versions of nothing that scientists currently describe,” and that “now, I am told by religious critics that I cannot refer to empty space as ‘nothing,’ but rather as a ‘quantum vacuum,’ to distinguish it from the philosopher’s or theologian’s idealized ‘nothing,’ ” and he does a good deal of railing about “the intellectual bankruptcy of much of theology and some of modern philosophy.” But all there is to say about this, as far as I can see, is that Krauss is dead wrong and his religious and philosophical critics are absolutely right. Who cares what we would or would not have made a peep about a hundred years ago? We were *wrong* a hundred years ago. We know more now. And if what we formerly took for nothing turns out, on closer examination, to have the makings of protons and neutrons and tables and chairs and planets and solar systems and galaxies and universes in it, then it *wasn't* nothing, and it *couldn't* have been nothing, in the first place. And the history of science — if we understand it correctly — gives us no hint of how it might be possible to imagine otherwise.

And I guess it ought to be mentioned, quite apart from the question of whether anything Krauss says turns out to be true or false, that the whole business of approaching the struggle with religion as if it were a card game, or a horse race, or some kind of battle of wits, just feels all wrong — or it does, at any rate, to me. When I was growing up, where I was growing up, there was a critique of religion according to which religion was cruel, and a lie, and a mechanism of enslavement, and something full of loathing and contempt for everything essentially human. Maybe that was true and maybe it wasn't, but it had to do with important things — it had to do, that is, with history, and with suffering, and with the hope of a better world — and it seems like a pity, and more than a pity, and worse than a pity, with all that in the back of one's head, to think that all that gets offered to us now, by guys like these, in books like this, is the pale, small, silly, nerdy accusation that religion is, I don't know, *dumb*.

*David Albert is a professor of philosophy at Columbia and the author of “Quantum Mechanics and Experience.”*