



Subatomic Weirddness

The Bizarre, Baffling, Beautiful Design of Nothing (& Everything) by Ken Pedersen

What scientists have discovered about physical reality over the last 100 years is so bizarre that we cannot begin to visualize, let alone comprehend, the magically weird essence of our existence. Everything is made up of just three different quantum fields: the electron, the up quark, and the down quark. The up and down quarks combine to make protons and neutrons, which then combine with electrons to make atoms. Atoms combine to make molecules that then make everything else. Everything you see, feel, hear, taste, and smell, including you, is made of vast, amazingly intricate patterns of these three quantum fields

It is almost impossible to comprehend how tiny quantum fields are. If quantum fields were the size of marbles, your brain would be over ten million times larger than our entire solar system out to Pluto, and there would be trillions of trillions of trillions of these marble-sized

fields just within the neurons in your brain. Somehow, the information flow among the vast, unbelievably complex network created by these tiny fields supports the emergence of consciousness and the mental dimension of reality. All the layers of reality are assembled using just these three quantum fields, yet the "top layer" walks and talks and laughs and loves. It is an amazingly elegant design, an engineering masterpiece orders of magnitude more sophisticated and complex than anything we can imagine.

Ghostly Clouds of "Nothing"

So quantum fields are the mysterious building blocks used to make everything, but what are these tiny fields made of? This is where our common-sense understanding totally fails us, because quantum fields are made of nothing. That is, we have found no physical substance, nothing solid at all, in the composition of these tiny fields. Since

everything is made of quantum fields, does this mean that reality is made of nothing? Well, yes and no.

The bizarre part of all this is that quantum fields somehow are composed of two nonmaterial entities: energy and information. Here the essence of reality starts to sound like magic. We simply cannot visualize how these immaterial things could be real, let alone how they could be the basis of the entire design of reality. We do not understand *what* this immaterial system is, *how* it was created, or *how* it maintains its power over billions of years or longer.

Quantum States, Fields & Information Processing

Scientists have also found that the three quantum fields are effectively digital computing devices that form the foundation of an extremely sophisticated, multi-layered information-processing system. Each of the three quantum fields has a small set of characteristics that defines its current state and what it can do next. We call these characteristics “quantum states,” and a quantum state can only be one of a very small set of discrete values. For instance, the electrical state can be +1, 0, or -1 (positive, neutral, or negative).

The fields execute logic functions that exchange discrete bundles of energy and information in precise obedience to specific, state-changing rules. In other words, they behave like the digital information-processing components we use in designed systems today, except for the fact that we’re talking about tiny fields of “nothing,” instead of physical components. There are no physical registers, no storage devices, no logic gates, no stored programs, and no central processor—nothing we would think of as physically “real.”

All of reality is built from these tiny clouds of energy exchanging tinier discrete packets of information and energy via a relatively small set of allowable interactions. To our minds, these fields appear to be magical, immaterial, logic components. They are capable of being networked together into an extremely fast, digital information-processing flow, but how these information-based rules are encoded and executed is a complete mystery. As Nobel laureate Richard Feynman said, “All we can do is model the traffic flow.”

The Foundation of Reality

All the mystery aside, as an engineer, I marvel at the elegance of this digital design. If you are trying to design repeatable patterns like those we find in atoms and molecules, you must avoid the mathematical chaos of too many possible interactions. If you have too many quantum states, or if each state has too many possible discrete values, or worse yet has continuous, non-discrete values, then a chaos of interactions would be certain; all hope of designing families of repeatable patterns into atoms, amino acids, and proteins would be lost.

But somehow, all of reality emerges from and stands upon this elegantly designed digital information processing that takes place in the quantum world. The design perfectly anticipates and supports creation of the more complex information-processing functions that comprise our marvelously complex, multi-layered reality. This is all made even more amazing in that the very top, most complex layer of this design is the extremely sophisticated, digital information-processing system within your head. Reality may not be supported on the backs of turtles all the way down, but it is supported by layers and layers of digital information processing—all the way down to the elemental processing of tiny fields of “nothing.”

The Mystery of the Four Forces

Now let us consider the quantum fields’ relationship to the four forces: electromagnetism, the strong nuclear force, the weak nuclear force, and gravity. The nuclear forces are tightly bound to the up and down quarks with a very tiny effective range. These forces apparently emanate from quarks exchanging discrete energy bundles. The mystery of how quantum fields are related to the four forces is a bit like the chicken-and-egg problem. Which came first? Does one create the other? Are they really separate things? Do quarks create the nuclear forces, or is it the other way around? We simply do not know.

Gravity, too, is a unique mystery. Whether you think of it as a force or a distortion of space, gravity appears to be caused by mass, and mass is one of the properties of quantum fields. At the quantum level, mass is barely detectable, but put enough quantum field together, and gravity becomes a dominant force shaping stars, planets, solar systems, and galaxies—the entire universe. So, do quantum fields create gravity? We don’t know that either.

The electromagnetic force causes atoms to form and then binds them together into molecules. Electromagnetism also floods the universe with radiant energy traveling at the speed of light, with the energy and information contained within its photons fueling the information-based interactions between quantum fields, atoms, molecules, living cells, and conscious minds.

The four forces are effectively nonmaterial fields with rules that guide the behavior of quantum fields entering their range of influence. In what physicists call the Standard Model of the sub-atomic world, quantum fields are constantly exchanging packets of energy and information in concert with these forces. Clearly, the quantum fields and the four forces were perfectly designed to interact in the marvelously bizarre way that they do, but the incredible complexity of it all is a complete mystery. Calling it an intelligent design does the Designer a huge disservice; this is an incredibly ingenious design.

Bizarre, Baffling & Beautiful

So these tiny fields of “nothing” not only create this amazing, multi-layered, digital information-processing system that results in conscious living creatures, but somehow, they are the only participants in the dance of energy and information choreographed by the four forces that shape and animate reality.

And we will not even try to discuss the most bizarre features of quantum fields, like quantum tunneling or quantum entanglement, or their weird behavior in the two slit experiments and the fact that their actions appear to manifest probabilistically, without a cause-and-effect type relationship. These fantastically bizarre features further befuddle our common-sense expectations and tangle our minds into knots. If you think that somewhere there must be at least one brilliant physicist who understands the essence and actions of quantum fields, you would be wrong. Consider that for the last thirty years, thousands of physicists have spent major portions of their careers exploring the multi-dimensional math of string theory in the hope of discovering the true nature of quantum fields and their behavior, but there is a growing sentiment that the string-theory quest has failed.

Despite the tremendous efforts of the physics community, there has been no advancement in our understanding of the essence of quantum fields. To say we do not understand them is a monumentally gross understatement. The bizarre weirdness of this design is virtually impossible for our minds to comprehend. Yet the fact that the interactions of quantum fields result in this beautiful planet with conscious intelligent minds

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capable of free will and emotions should lead us to see in it all a purposeful design. It is the height of arrogance to look at these miraculous tiny entities and the beautiful designs they have created and then preach to the world that it is all obviously a random accident. Those who do so pretend that they comprehend the mystery of the design. They do not. No one does. To quote Feynman again, “When it comes to subatomic physics, we are like traffic engineers monitoring traffic flow on a busy freeway system. We can create detailed elaborate mathematical models about traffic behavior without ever once understanding the true nature of the vehicles creating the traffic.

Furthermore, any serious mathematical analysis of the complexity and precision of the design of the physical world, as well as the DNA code that directs all our cells and the amazingly ordered systems within us, leads to the conclusion that it is impossible for all this to arise by a series of lucky accidents happening at precisely the right times and places. The simplistic belief that it is a massive, meaningless series of accidents is wrong on all counts.

Only One Conclusion

Most physicists concede that they do not understand all this subatomic weirdness. There is no scientific explanation for any of it—a universe designed out of tiny field of nothing, immortal forces with no batteries, radiant energy fueling everything at the speed of light, and a precisely layered set of mysterious information-processing systems that cooperate perfectly to produce the information flow of life, love, and laughter.

If we are intellectually honest and humble about what has been discovered, we can only conclude that the Designer operates at a level way above our ability to understand or even imagine. We are the result of a bizarre, purposeful, ingenious design that no one on this planet comprehends. ☺