

Before Before

Stanley Deser

MORE THAN MOST laymen, physicists are floored by the idea of the Big Bang. We know too much not to feel mystified. Let me make sure we all understand what we do not understand. The universe began as an isolated event. So far, so good. But it was not an event *in* either space or time. Time and space began at the Big Bang. There was no time before time began.

Credo quia absurdum.

Once this central absurdity is accepted, there remains another. Why did the universe begin with the structures that it has and the laws that govern those structures? So far as we can tell, special and general relativity set the space-time stage, and, with the exception of gravity, quantum mechanics handles the drama that follows. But relativity and quantum mechanics are a house divided. Attempts at their unification, if not frank failures, are not out and out successes either. The Standard Model is now half a century old.¹ Its modest name belies the sophisticated achievement it represents. The Standard Model organizes the microstructure of our world into a small set of particles or fields. There are six quarks from which protons and neutrons are constituted. Although two quarks would be more than enough, the other four make exotic, short-lived objects. There are also six leptons, four more than required. “Who ordered that?” The last component of the Standard Model comprises the gauge bosons. They do duty in conveying the electromagnetic, the weak and the strong forces. And there remains the Higgs scalar. If this seems inherently baroque, it is because it is. And yet the

Standard Model has met every experimental test, sometimes to a dozen decimal places.

The basic laws of physics are, we now know, only our present layer of understanding. They are basic only to the extent that nothing more basic has yet been discovered. They are subject to drastic revision. That even our most successful laws are almost guaranteed to give way was established by Kenneth Wilson. He explained that any level of understating at a given energy level rests upon integrating away all higher energy excitations.²

Going back, there is no before before; going out, there is no space beyond space; and going down, there is no end.

Stanley Deser is emeritus Ansell Professor of Physics at Brandeis University and a Senior Research Associate in Physics at the California Institute of Technology.



1. See Sheldon Lee Glashow, “The Standard Model,” *Inference: International Review of Science* 4, no. 1 (2018), doi:10.37282/991819.18.15.
2. Kenneth Wilson, “Renormalization Group and Strong Interactions,” *Physical Review D* 3, no. 8 (1971): 1,818–46, doi:10.1103/PhysRevD.3.1818.

DOI: 10.37282/991819.22.31

Published on May 25, 2022

<https://inference-review.com/article/before-before>