UNIVERSAL CONSERVATION

The conservation of energy is the cornerstone of modern physics, yet is blatantly violated by a universal origin from nothing - *ex nihilo*. There are four ways to address this problem:

- Vacuum fluctuations. Many cosmologists believe that the universe's origin did not violate energy conservation because gravitational energy is intrinsically negative and all of the universe's matter/light energy is balanced by its total negative gravitational energy. This is an interesting idea, but *there is absolutely no evidence to support it*. If it were possible to produce matter from empty space and account for the difference with negative gravitational energy, why has this never been observed? Why is it not happening now? What limits the process? Why can't matter vanish and take a comparable gravitational potential with it? And there is a more basic inconsistency to consider. The Big Bang allegedly produces space through expansion. How can there be vacuum fluctuations without a vacuum?

- Not in effect. In this scenario, energy conservation came into existence *after* the universe emerged. While it is true that conservation is meaningless in the absence of something to conserve, it is just as true that the two are inseparable.

- Approximation. Perhaps energy conservation is only an approximation of the true situation, and the total energy in any interaction varies by a tiny, currently undetectable amount. But even if this were the case, it has no bearing on the salient issue. Energy conservation has been documented with sufficient precision to preclude the spontaneous emergence of even the smallest traces of matter, and the material scattered across deep space constitutes far more than a trace amount.

- Eternal energy, periodic universal renewal. Here the energy of which the universe is composed is eternal, and the Big Bang is just the latest cosmic renovation. This satisfies energy conservation but fails to explain why the universe exists *instead of nothingness*. Philosophers attack this issue with the disingenuous counter argument that "somethingness" could well be the universe's *natural* state, and we have no way of knowing otherwise. The last time this line of reasoning was used to mask a general ignorance of a phenomenon was when Archimedes explained gravitational attraction as an object's innate tendency to return to its *natural* place. This was over 2200 years ago! We ought to be able to do better by now.

Speculation about exceptions to fundamental physical laws is entertaining, but *the universe exists now, there is a reason why this is the case, and no violation of energy conservation has ever been observed.* Although physicists have only documented a small part of the universe, they have measured it carefully. Electromagnetic spectra from distant regions of space indicate our

corner of reality is much the same as the rest of the universe. The signatures of elements are the same in ancient light, billions of years old, as they are in the light from our sun, only minutes old. This means the laws of physics *have not changed in billions of years*. If this isn't a good enough track record for their stability, it is difficult to envision a better one. The machinery of existence everywhere, in the form of particles, photons, and interactions, depends on energy conservation. It's what keeps the universe's stars burning.

Origin ideas attempt to explain the universe of today (the conserved universe; the isotropic universe) in terms of various incarnations of the universe of yesterday. Whenever these narrations fail to explain a characteristic of the current universe, changes are made to the primordial universe, which by its very nature is inaccessible. The true solution to the universe problem is to *explain* the universe of today constrained by the rules of today.

*** Preview ***

At no moment in the universe's history has energy conservation been violated in any way - not a billion years ago, not a trillion years ago, never. It is the quantification of existence. Like immense size, energy conservation is a vital universal characteristic.

TIME BEFORE TIME

The idea that the universe came into being in the distant past is as perplexing as how it emerged from nothingness in the first place. If it began at some particular moment, what transpired prior to this? If no events preceded the Big Bang, how could time be reckoned at all? This is the *time before time* problem. If time predates the universe, energy emerged at some time t_0 in what will be called the *post-time model*:

SPACE-TIME → t_0 → SPACE-TIME-ENERGY

This doesn't really make the time before time problem any easier. When was primordial space-time born in this model? Does it even *need* an origin? Either primordial space-time has been around forever or it had an origin itself. If the latter is true, space-time begins at t_0 and energy follows at t_1, yielding the *two-stage model*:

NOTHING → t_0 → SPACE-TIME → t_1 → SPACE-TIME-ENERGY

As noted earlier, universal origin theories often take the case of $t_0 = t_1$, consolidating all of the time-related dilemmas into a single transition, the *single-stage model*:

NOTHING → t_0 → SPACE-TIME-ENERGY