Origin of the Universe – Asking the Right Questions

Bruce M. Boman
University of Delaware

Many theories have been put forth to explain the origin of the Universe. The prevailing one is the Big Bang theory that hypothesizes that the Universe expanded from a primordial singularity of high temperature and density. Although we don't have any proof that the Big Bang happened, there is a broad range of observed phenomena such that many physicists believe occurrence of Big Bang is irrefutable. Evidence supporting the Big Bang includes the abundance of light elements, the cosmic microwave background (CMB) radiation, and large-scale structure. It is also theorized that during the early Universe a sudden and rapid expansion of space occurred. This so-called "cosmic inflation" is consistent with the overall uniformity of the universe.

The concept that the Universe started from a singularity state comes from the observation that the current Universe is expanding and the expansion may even be accelerating. Extrapolation backwards in time from this cosmic expansion led to the notion of an increasingly concentrated cosmos preceded by a singularity state. Actually, the idea of the singularity is predicted by rewinding Einstein's Theory of Relativity backwards to time equals zero.

While the Big Bang explains what happened right after the moment of creation, it doesn't explain the first moment of creation. Moreover, recent evidence from the Dark Energy Spectroscopic Instrument (DESI), which measures the effect of dark energy on expansion of the Universe, indicates that dark energy is not constant and may change over time. This information that the Universe may not be expanding could make us reexamine the mechanisms that physicists use to explain the creation of the Universe. So, perhaps it might be best to take a step back to see if the right questions are being asked that are relevant to the problem. In other words, what is it that we really need to know to unveil the origin of the Universe?

My take on the question is to question two of the basic assumptions that were used to derive evidence supporting the Big Bang.

1. One assumption was that time flows from *past to present to future*.
2. A second assumption was that expansion of the Universe occurred because it was preceded by a singularity state.

Modeling of spacetime based on transition state theory (TST) challenges these two assumptions. My model is designed as a kinetic reaction and the direction of the reaction is assumed to progress from *future* to *present* to *past* events. Thus, the progression of events that are coming to be and then passing away is modeled like the generation of products from reactants in a chemical reaction. In this way, the present (time now) is considered to be an instantaneous transition state in the progression of future to past.

Based on TST modeling, the Universe exists as a network whereby an equilibrium exists between every time now event at each point of reference and all other events happening throughout the Universe. This equilibrium establishes a superposition-like state whereby time fluctuates forward and backward between future time (t_F) and now time (t_N) events. Thus, time doesn't change in the equilibrium between t_F and t_N events. If this is the case, it doesn't make sense to ask when time started or consider the possibility that time is zero.

In particle physics, the notion that the Universe consists of a network is not new. Indeed, several physicists have put forth ideas that spacetime can be viewed as a network in which the

nodes are particles or entangled particles and these nodes are all connected by quantum entanglement. In complex systems, the network of interactions leads to growth of the system due to an increase in connections between nodes and hubs in the network. Thus, if the Universe is a dynamic network, it could provide another explanation for why the Universe is expanding.