Divine Creation and “The Big Bang”

In this session we will consider the interaction of ideas about divine creation with present day scientific accounts of the origin of the universe. Besides getting a sense of the current state of the interaction, the aim of this session, as with others, is to explore whether/how science challenges our faith.

What is the basis for Christian belief that God created the universe?

Creation in the Christian tradition is based primarily on Genesis 1:1: “In the beginning God created the heavens and the earth.” Though taken literally by most over the millennia, the Genesis story is seen by many today as theological truth: Creation is ex nihilo, creation from “nothing,” meaning that absolutely nothing, material or immaterial, exists before God’s act. God’s will is absolutely free in the act of creating. Hence the cosmos is absolutely contingent – it does not have to be the way it is or even to exist. God created the cosmos to be separate from Godself, an autonomous entity. But God sees Creation as good and remains intimately involved with it, sustaining it in existence and working redemptive acts within it – Jesus Christ’s incarnation and resurrection. Nonetheless, God remains transcendent with respect to Creation.¹

How has science called into question the biblical view of creation?

Most scientists in the 17th C and 18th C were devout Christians who had no fundamental problem with the Genesis story taken more or less literally, but a number thought God had created and set in motion the universe, then left it to run on its own (Deism). During the 19th C geological evidence and the growing fossil record showed that the earth was far older than a few thousand years, and Darwin’s idea of biological evolution further eroded belief in literal biblical accounts.

During the 18th C and 19th C astronomers thought that the stars and nebulae they saw through their telescopes constituted the entire universe. In the early 1920s the astronomer, Edwin Hubble, discovered that a number of the fuzzy objects they saw were not clouds of dust and gas but huge star systems – galaxies – and that they were extremely far away. At first resisted by most colleagues, his findings were soon confirmed. In 1929 he found that all these galaxies were receding from us and that the further away they were the faster they were receding. The galaxies were not simply moving away in space, space itself was expanding, taking galaxies with it.

¹ Some important contemporary theologies would reject the tradition or accept it only with substantial modification. This would be true of those that view the universe as everlasting, without beginning or end.

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Indeed, the universe as a whole was expanding. (It’s a bit like blowing up a balloon with spots on its surface; as it expands the spots all move away from each other.) It was soon recognized that expansion could be explained by Einstein’s 1915 theory of general relativity (GR). All this seemed a far cry from world of Genesis 1:1. However, many theologians had already gotten comfortable with nonliteral interpretations of Genesis. Moreover, expansion could mean there was a “beginning,” and this might have interesting theological implications.

**What is the Big Bang?**

About the time Hubble made his discovery, physicists showed that by using GR the universe could be traced back in time to its point of origin. Models were developed to describe the evolution of the universe from that point to the present day, a period of about 13.8 billion years. (See Appendix A for a few facts about the universe.) Of course, the further we run the clock back the smaller the universe becomes, and the denser and hotter it gets. Under the standard GR model, we reach a point, called a “singularity,” where all of the matter and energy of the universe “is” at infinite temperature, density, and pressure. Everything burst forth in the “Big Bang” – an event that is the point of origin of the universe and the beginning of its expansion. Pause a moment and reflect with awe. The Big Bang occurs “nowhere” at no time (“t = 0”). (Think rocket launch; t = 0 is when the ignition button is pushed.) There is no “before” t = 0 (no t minus 1), and no space or time or matter or energy. No universe.

**What was the theological response to the Big Bang?**

Many people, aided by the popular press, quickly concluded that the Big Bang fit the creation account in Genesis 1:1 – there was a beginning from nothing, it is unexplained by the standard model, so God must have caused it.² “Design arguments” that attempt to prove God’s existence from the existence of our universe are ancient but have not been persuasive. They also remind us of the long history of failed attempts to find a gap in science’s account of the universe, one that could only be filled by God’s intervention – the “God of the gaps.” Embarrassingly, new discoveries filled the gaps. So theologians are understandably leery of basing their views of creation on a Big Bang model, particularly since that model itself may be superseded, as many scientific models have.

**What was the response of science?**

Many physicists are troubled by the idea of a singularity at t = 0. For unless some naturalistic explanation can be found, the alternatives seem to be either (1) accepting the Big Bang as a

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² Various speculative ways of harmonizing Genesis with the Big Bang have been suggested, such as: God’s clock is different from ours or God operates in more dimensions than we do.
“brute fact” or “coincidence,” a limit beyond which physics cannot go, or (2) accepting some sort of (divine) agency, undetectable by physics, as the cause of the Big Bang. In the 1950s this led some physicists to reject the Big Bang in favor of a “steady-state” universe – eternal, having no beginning and no end, and thus, they thought, no need for a creator. However, confirmation of the Big Bang came in 1964 with the discovery of very faint radiation coming from all directions in the sky (the “cosmic background radiation” or CBR). Almost all physicists today think CBR is the remnant of radiation from the Big Bang.

Since discovery of CBR, physicists have sought to develop an origination theory using GR, one that would avoid the singularity and $t = 0$. The project is daunting. To be complete, a theory must account for all times back to $t = 0$. But GR math ceases to produce meaningful results at times earlier than approximately $10^{-43}$ seconds after $t = 0$ (Planck time) when the universe was approximately $10^{-35}$ meters in diameter (Planck length). At present, there is no fully developed mathematical and conceptual model for times earlier than Planck time.³

What are physicists up to now?

For several decades most physicists have accepted that an origination theory would have to incorporate elements of both quantum theory (QT) and gravity (GR). QT successfully describes the interactions of matter and energy at the level of subatomic particles.⁴ Unfortunately, because of their very different mathematical structures GR and QT don’t play well together. This leads many physicists to think that an origination theory should unify GR and QT and hopefully avoid the singularity. Attempts at a “grand unification theory” over several decades have not reached this goal.⁵ But vigorous work on a theory continues. Would the hard alternatives be avoided?

The physical universe displays other characteristics that have significance for creation theology. Its habitability for life in general and humans in particular depends on some of its features being

³ There have been a number of proposals for origination without design: (1) spontaneous creation from (a) “nothing,” (b) quantum fluctuations, or (c) other universes through bubbles or black holes; (2) an eternal universe oscillating between bangs and crunches; and (3) multiple isolated domains within a mega-universe that have different characteristics and/or laws of physics. These are generally regarded as untestable speculations. And they do not avoid the question of their own origins.

⁴ These include (1) the particles that make up atoms: protons and neutrons, quarks, and electrons, (2) the particles that carry the forces of nature: photons (electromagnetic force), gluons (the strong nuclear force), the W and Z bosons (weak nuclear force), and (3) the Higgs boson (mass). Some of these, such as photons and gluons, are point particles without any width or mass. It’s a very strange world!

⁵ A leading contender is M theory (incorporating five “superstring” theories). It features one-dimensional strings vibrating in 11 dimensions and things called “branes,” and is exceptionally complex.
almost exactly as we find them. Very slight deviations would make the universe uninhabitable. The universe seems “fine-tuned” for life, intelligent life.

What evidence is there for a fine-tuned universe?

One often cited example is the expansion rate of the universe immediately after the Big Bang. If it had been a little faster stars could never have formed. If it had been a little slower the universe would have collapsed back into a singularity (or something very small) before stars could form or life evolve. To produce our universe, the balance between the pull of gravity and the expansion rate could not have been off by more than one part in a million billion ($10^{15}$). That’s pretty fine tuning.

Other examples include (1) the strong nuclear force (slightly weaker and there would be only hydrogen atoms in the universe, slightly stronger and there would be only helium); (2) the electromagnetic force (slightly stronger or weaker and atoms could not form chemical bonds necessary for substances like water); (3) the weak nuclear force (a little stronger or weaker and stars could not exist), (4) gravity (any weaker and nuclear fusion could not occur in stars and heavier elements (carbon, nitrogen and oxygen) could not form, a little stronger and stars would burn up their hydrogen too quickly for life to evolve in planetary systems).

Does this show that the universe was designed by God?

Whether fine tuning proves, makes probable, or at least points to the existence of a creator/designer of the universe is argued today by philosophers and theologians as well as scientists. Much of the argument concerns the significance of what is known as the anthropic principle (AP). The “weak” version of AP simply says that the “conditions that are observed in the universe must allow the observer to exist.”6 (Webster’s dictionary) Brandon Carter, who formulated AP noted that it places very stringent restrictions on the fundamental physical characteristics of our universe. There is about all in the way of explanation that can be developed from AP or fine tuning without introducing ideas that are not supported by scientific observation.

One such idea is that our universe may be just one of an infinite number of universes, indeed a “multiverse.” If so, there could be a large number of universes that satisfy AP, and fine tuning would not be all that improbable. Many physicists doubt that the multiverse idea can be tested empirically. Others believe there may be indirect evidence. Nonetheless, multiverse just pushes the question up a level – whence the multiverse? Again there are the three alternatives. Some

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6 The strong version says this is the only universe that exists and is very controversial.
suggest that we may find that at some deep level all these instances of fine tuning are interdependent or derive from a single “beautiful” equation that describes all of physical reality. No candidates yet. And again: Whence the equation and what activates it?

For theologians fine tuning poses the risks inherent in all design arguments – science will fill-in the gaps or facts and accepted theories will change, undermining the credibility of theology. Also the potential payoff is not great. For like Big Bang creation, fine tuning leaves us with a deistic God who seems to have created a mechanistic universe and immediately abandoned it. Many theologians regard the fine tuning argument as largely irrelevant because the heart of Christianity doesn’t rest on speculation about origins. But others would say that both science and theology are dealing with the same reality, so theology should have something to say about the natural world as disclosed by science.

**Do science and theology have anything in common regarding creation?**

As we’ve seen, some in the theological and scientific communities are in dialogue regarding Big Bang creation and fine tuning. Dialogue also occurs at a more fundamental level. Two basic assumptions of scientific inquiry are: (1) the universe is rationally intelligible and (2) we can understand it. (Einstein thought that the most surprising thing about the universe is that it is intelligible to us.) Some scientists would say that intelligibility suggests that there is something like Mind at work. Theologians might agree, believing that the creator of the universe is rational and purposeful. (The physicist-theologian John Polkinghorne thinks that a universe that is intelligible to us is what we should expect from God.) Other basic assumptions of science regarding the universe are its contingent nature and independent status. Again, theology could agree, because these are features of *ex nihilo* creation. The real brute facts of science are its basic assumptions. On the other hand, one might say that the brute facts of theology are its doctrines.

Where does all this leave us? One question, at least, remains for which there can be no naturalistic answer: Why is there anything at all?
General Sources:

Appendix A

Based on data from astronomical observations, physicists’ current models of the universe assume:

(1) The universe is about 13.8 billion years old.
(2) It has been expanding during all that time; at present the rate of expansion is increasing.
(3) It is presently at least 91 billion light years in diameter. (Light travels at 186,000 miles per second or about 6 trillion miles in a year.)
(4) Its contents include normal matter (mostly made of atoms (protons and neutrons)) (4.9%), dark matter (26.8%), and dark energy (68.3%). (We know very little about dark matter and almost nothing about dark energy. The former has mass and thus gravity but does not emit or reflect light, so we can’t see it. The latter drives the increase in the rate of the expansion of the universe.)
(5) It contains about a trillion galaxies (grouped in clusters), many have 100s of millions of stars.

Just so you can say you’ve seen them (Wikipedia):

Einstein’s field equations for gravity (GR): 

$$ R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu} $$

Schrödinger’s wave equation (QT):

$$ i\hbar \frac{\partial}{\partial t} \Psi(r, t) = \hat{H}\Psi(r, t) $$