

## Quantum Genesis and the First Cause

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Since the dawn of humanity mankind has gazed at the stars in wonder, contemplating our place in the cosmos. As the holiday season draws to a close and the dancing and celebration of Simchat Torah comes to an end, we recommence our routine Shabbat Torah reading with the story of Genesis. These verses raise the most fundamental questions about the nature of our Universe, both physical and metaphysical.

One of the most influential minds that ever graced the ancient world is that of the Greek thinker Aristotle, whose ideas continue to play an important role in modern philosophy. Yet Aristotle is also credited with the epithet of being the first empirical scientist whose assertions caused great consternation to Jewish thinkers.

In particular, Aristotle believed that the Universe was eternal, contradicting the explicit statement relating God's creation of the Universe at the beginning of Genesis. Dismayed that simple Jews could be seduced by Aristotle's provocatively secular ideas, the Medieval Jewish philosopher Maimonides railed against them in his Guide for the Perplexed.

By the mid-20th Century, astronomers such as Edwin Hubble had noticed that galaxies and stars were moving away from Earth at a velocity proportional to their distance. This was the first indication that the Universe was expanding and by logical extension, had had a beginning. In contradiction to the Aristotelian view, everything: space, matter and time, came into being at the same moment and that before that moment there was literally nothing.

In 1964 two scientists, Arno Penzias and Robert Wilson working at the Bell Laboratories in New Jersey, recorded a consistent level of background microwave radiation across all sections of the sky. This turned out to be the ancient echo of the Big Bang, yielding the hard evidence that the Universe had a beginning. While this appeared to vindicate a theological explanation for a created Universe, it simultaneously spawned a cosmological conundrum of galactic proportions.

The physical world appears to be deterministic; every event from the atomic to the cosmic has a prior cause or set of causes. The inevitable question is: if the Universe had a beginning (the Big Bang), what caused the Big Bang in the first place? What changed nothing - no space, no matter and no time - into something? Could there be a scientific explanation as to why there is something rather than nothing?

Quantum mechanics, the branch of physics which deals with physical phenomena at the sub-atomic level is the one area of science that appears to be non-deterministic.

Just as magnets are governed by the strengths of magnetic fields, quantum particles are governed by quantum fields which permeate the Universe. One prediction of quantum field theory is that in a perfect vacuum, where nothing exists, quantum particles will inevitably pop in and out of existence due to the rearrangement of these quantum fields.

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Based on this observation the American physicist Laurence M. Krauss published a book called 'A Universe from Nothing' with a promise to be an 'antidote to outmoded philosophical and religious thinking' by explaining the beginning of the Universe ex nihilo from a purely scientific basis by analysing quantum effects in a perfect vacuum, our equivalent of nothing.

Yet Krauss assumes that the concept of 'nothing' in our post-Big Bang Universe is the same as the 'nothing' prior to the Big Bang. Professor of philosophy at Columbia University, David Albert succinctly points out that Krauss rather undermines his argument by redefining the word 'nothing' to mean almost nothing.

For quantum particles to come in and out of existence, one requires relativistic quantum fields. Where did they come from? Indeed, where did the laws that govern relativistic quantum fields come from? He also fails to explain how any sort of fluctuation (something changing over time) could occur in the absence of time.

Krauss has many followers, usually of the atheist persuasion. Most notably Professor Richard Dawkins writes in his approbation that "even the last remaining trump card of the theologian, 'Why is there something rather than nothing?' shrivels up before your eyes."

I humbly beg to differ. Faith is not, as Dawkins would have us believe, predicated on being unable to answer such mysterious and apparently unfathomable questions. Faith is much deeper.

Maimonides implies that even if Aristotle could be proven correct, faith in God and His Torah would continue unaffected even though hard scientific evidence might persuade us to modify our understanding of those seminal verses.

For the time being though, science cannot answer the question of a First Cause. Nevertheless, Krauss and Dawkins have convinced me of one thing: scientists should stick to science and not colour their conclusions with personal ideologies, whether atheistic or religious. Questions of theology and philosophy are probably best left to theologians and philosophers.

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