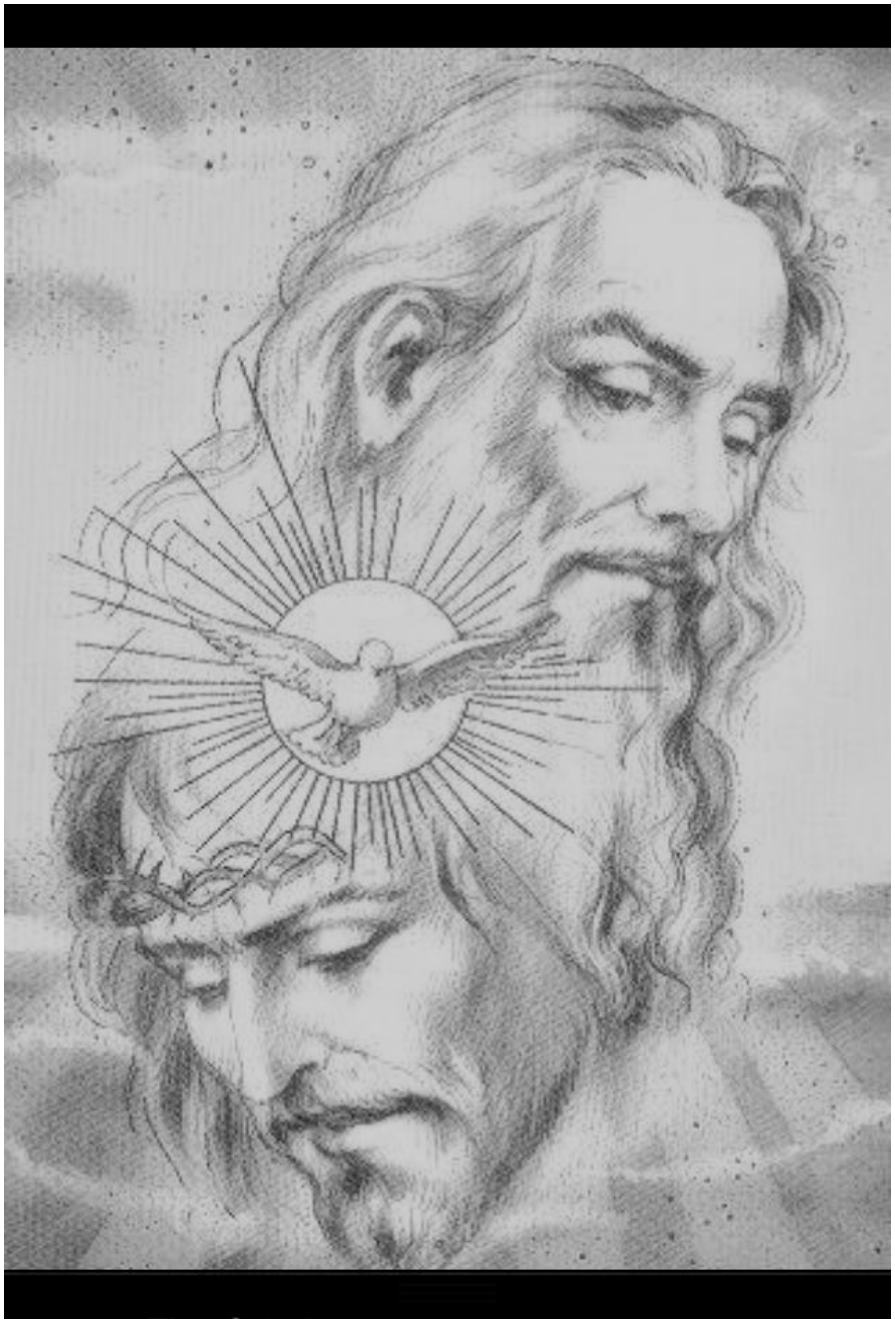
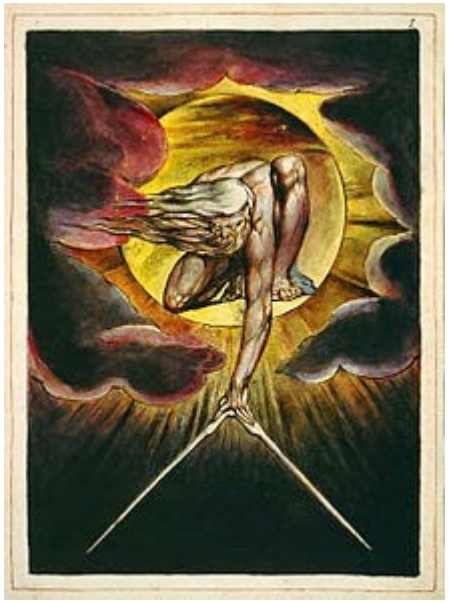


Catholic Physics - Reflections of a Catholic Scientist - Part 26
Philosophic Issues in Cosmology--I
Introduction

- 1200's
- Authority on physics, geography, astronomy, mineralogy, chemistry, zoology, and physiology
- "The aim of natural science is not simply to accept the statements of others, but to investigate the causes that are at work in nature"
- He understood that the Church is not opposed to study of nature
- Patron Saint of Scientists

Philosophic Issues in Cosmology--I - Introduction



"The Ancient of Days", William Blake

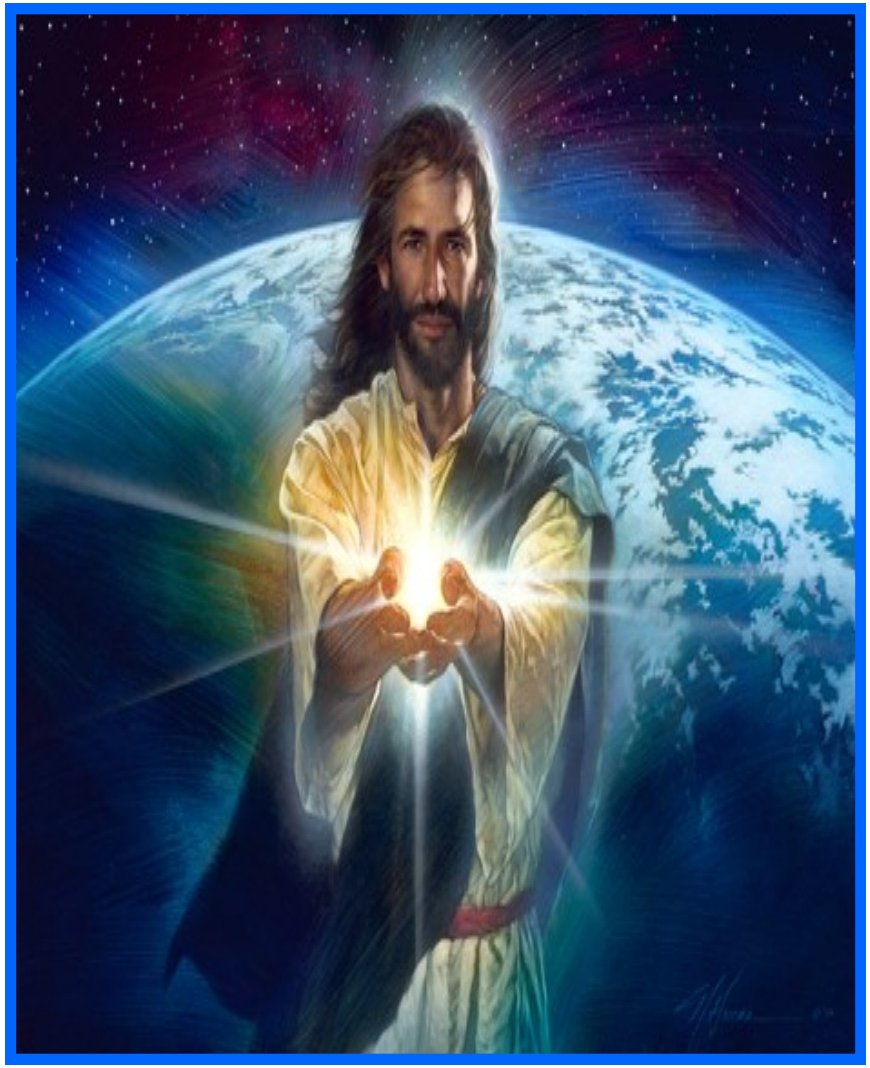
"The heavens declare the glory of God; and the firmament sheweth his handywork." Psalm 19A (KJV).

"The laws of nature themselves tells us that not only can the universe have popped into existence like a proton and have required nothing in terms of energy but also that it is possible that nothing caused the big bang," Professor Steven Hawking (Discovery Channel broadcast).

"But contrary to what Hawking claims, physical laws can never provide a complete explanation of the universe. Laws themselves do not create anything, they are merely a description of what happens under certain conditions." Professor John Lennox (Mathematics and Philosophy of Science, Oxford University).

"I think that only an idiot can be an atheist! We must admit that there exists and incomprehensible power or force with limitless foresight and knowledge that started the whole universe going in the first place." Professor Christian Anfinsen (Nobel Prize for Chemistry), quoted in Cosmos, Bios and Theos.

There has been much heat, and only some light after the publication of Hawking's and Mlodinow's The Grand Design, a work that claimed the universe started from nothing because of gravity. I'm not going to recapitulate the excellent rebuttals of the Hawking/Mlodinow thesis (including a fine one by Stacy Trasancos) , but rather expand on the proposition given in the quote by Professor Lennox above. What can science tell us about Creation, and what can it not?



Let's first inquire what science is about. Fr. Stanley Jaki maintains in "The Limits of a Limitless Science" that science requires quantitative, empirical verification (or rejection) of predictions based on theory. Although this restricts true science to the so-called "hard" discipline (physics in particular, chemistry and other sciences insofar as they are quantitative), I concur. This quantitative verification requirement then puts assertions that cannot be empirically verified (or falsified) into the realm of metaphysics--thus M-theory, most interpretations of quantum mechanics and many assertions about creation should be judged as propositions in philosophy/ metaphysics.

This condition applies especially to cosmology--the scientific discipline that deals with our Universe as an entity. I will expand on this, taking material from an article previously posted on the Magis Facebook site,* which in turn summarized a review article by George F.R. Ellis .

What are the conditions that require cosmology to have a philosophic base?

Intrinsic limitations on scientific cosmology studies:

We can't step outside the universe or duplicate it as an experimental object;

We explore the universe by electromagnetic radiation (from radio to gamma rays), which limits the distance out and, correspondingly, the past time for which measurements can be made. This limitation is of two types.

The first is a time horizon due to the coupling of matter and radiation at times before the universe was about 380,000 years old, giving an opaque barrier at distances/times corresponding to less than 380,000 years from the beginning. This means that there is a time horizon--we cannot see further back in time than 380,000 years after the origin.

The second limitation is a distance horizon—if the universe expansion is uniform, such that the further a point is from us (and, correspondingly, the further back in time), the faster it is moving—then there will be a distance d, such a star at that distance d will be moving away from us at the speed of light, or faster. This means that we cannot communicate at distances greater than d, since communication can only take place at the speed of light.

An important consequence of the time horizon is that we have to infer what happened before the 380,000 years from the properties of the universe we determine after that time. So theories about singularities, quantum origins, inflation can only be tested (if at all) by predictions about the state of our universe at times greater than or equal to 380,000 years from the origin.

An important consequence of the distant horizon has to do with causality. Two events cannot influence each other (since interactions cannot travel faster than the speed of light) if they are further apart than the distance horizon. This is one of the reasons that "inflation" is invoked in the very early life of the universe. (See below.) The early universe was larger than the horizon distance d (speed of light times age of the universe), so the question is how was a causal relation retained between different parts of the early universe to give the same temperatures and densities (approximately) for parts of the universe that were not causally connected.

There is also a practical limitation, a physics horizon. The energies in the early stages of the Big Bang are so high that there is no way that these could be duplicated in the laboratory, despite occasional claims of popular science writers to the contrary.

Thus, as George Ellis emphasizes "Testable Physics cannot explain the initial state and hence the specific nature of the universe." (Issues in the Philosophy of Cosmology) Accordingly, cosmology rests on philosophy, on metaphysical assumptions. Two of the most important of these assumptions are, according to Ellis:

THESIS A1: The universe itself cannot be subjected to physical experimentation. We cannot re-run the universe with the same or altered conditions to see what would happen if they were different , so we cannot carry out scientific experiments on the universe itself.

THESIS A2: The universe cannot be observationally compared with other universes. We cannot compare the universe with any similar object, nor can we test our hypotheses about it by observations determining statistical properties of a known class of physically existing universes. George Ellis, Issues in the Philosophy of Cosmology

We'll explore these issues in greater detail in further pamphlets.