

2. COSMOS, GOD AND US

The myths of science

Myth, religion and science have more often than not proved inseparable in addressing the eternal imponderable: why something rather than nothing?

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Since the dawn of civilization, humankind has marvelled at the skies and at Nature's myriad creations. This sense of wonder was deeply interwoven with a sense of fear: Nature's dual role as creator and destroyer has puzzled and polarized our perceptions of the cosmos. As a way of establishing a degree of control over the apparent unpredictability of natural phenomena, gods were held responsible for these conflicting manifestations. In short, Nature was deified.

The question of why there is something rather than nothing was a crucial part of this process. All cultures have attempted to provide an answer to the mystery of creation, and our modern scientific tradition is no exception. Perhaps more surprisingly, there is an intriguing correspondence between answers suggested by mythic narratives and those suggested by scientific research. The crucial difference, of course, is that the scientific process is capable of weeding out explanations which do not measure up to observations, while those based on myth are held true on the basis of faith alone.

Greece and reason

Creation myths can be divided conveniently into two kinds: either the cosmos appeared at a specific moment in time marking the beginning of history, or it has always been "there." Myths with a creation event describe time in a linear fashion, with a beginning, middle and, as in the Christian narrative, an end. Myths without a creation event may consider time to be either unimportant or cyclic. Within these two sets, we encounter an enormous variety. Starting with the "no creation myths," the two possibilities are: an eternal, uncreated cosmos, as in the narrative of the Jains of India, or a cyclic cosmos, continuously created and destroyed, as beautifully represented in the Hindu tradition by the dance of Shiva.

The first and by far the most common "myth with creation" invokes a deity or deities who create the world, as in the Judaeo-Christian myth of Genesis. A second possibility is that the world was

created out of nothing, without the interference of a god; this is what the Maori people of New Zealand have in mind when they sing, "from nothing the begetting, from nothing the increase. . . ." A final possibility is that the world appeared spontaneously from a primordial Chaos, where order coexists with disorder, Being with Non-Being.

The religious nature of the creation event has permeated scientific thought since its origins in Ancient Greece in the sixth century BC. As the Greek philosophers pondered the physical mechanisms that created the world and controlled its motions, many assumed an organizational principle based on rational design, attributed to a "Demiurge" by Plato or to the "Unmoved Mover" by Aristotle. Plato was a true heir of the Pythagorean tradition, which saw the world as a manifestation of Number, arranged and combined to create the

harmonies perceived by the senses. The emphasis on a creation event was somewhat left aside, being substituted by the importance of reason in understanding the workings of Nature. The philosopher, in his search for rational meaning, was in effect elevating himself to a higher level of existence—that of the Demiurge's mind. To understand Nature was to understand God, or, in an oft-

quoted aphorism, to understand the mind of God.

This tradition reappeared in the West during the birth of modern science in the Renaissance. The great natural philosophers that spearheaded the so-called Copernican Revolution were all, to a greater or lesser degree, deeply religious men, who saw their scientific work as an integral part of their religious beliefs. Thus, Copernicus himself was a canon of the cathedral in Frauenberg, a reluctant revolutionary who sought to reconcile the arrangement of the celestial spheres with the Platonic ideal of circular motions with constant velocities. His model of the solar system was an elegant compromise between the old and the new, looking back at Plato and forward at the aesthetic principles of his time. His great opus, *On the*

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Revolutions of the Heavenly Orbs, was dedicated to Pope Paul III, in the hope that the Church would recognize the need for a reinterpretation of the Scriptures based on the new astronomical thought.

It was through the work of Giordano Bruno and, more importantly, Johannes Kepler and Galileo Galilei, that the Copernican Revolution was enacted. Kepler was deeply influenced by the Pythagorean tradition, a number mystic who believed geometry to be the key to the cosmic harmony. His three laws of planetary motion are a powerful illustration of how the scientific output of a great mind can be a byproduct of a belief system tempered by the analysis of data.

No final truths

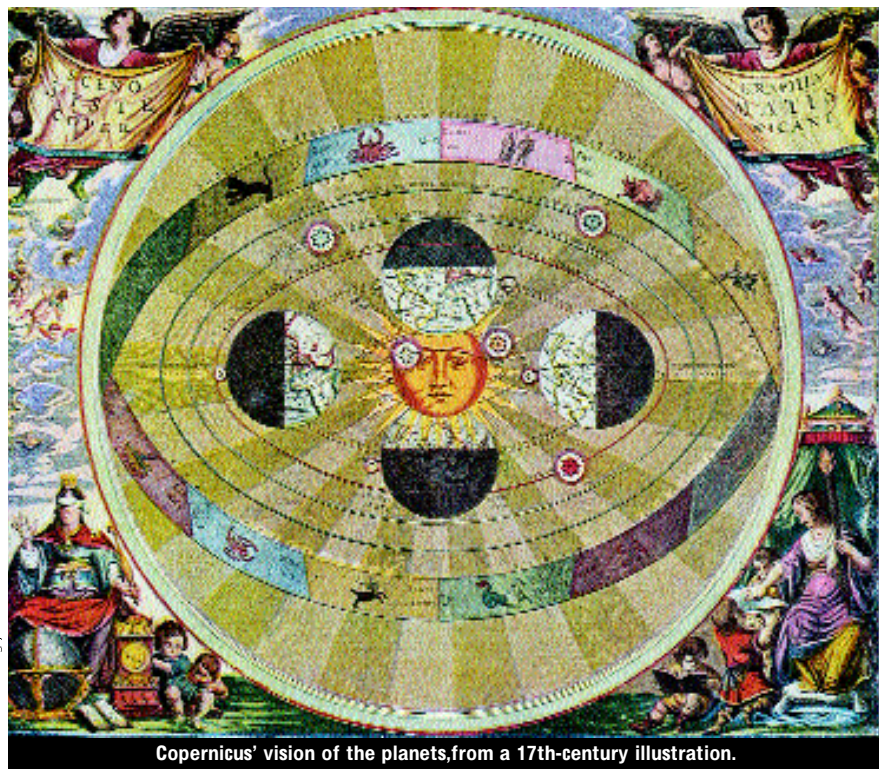
Galileo's now famous tribulations with the Church were also a product of his beliefs. A pious (and overconfident) man, Galileo took as his personal mission to reset the course of Christian theology, preaching to the Church leaders the importance of accepting the new cosmic design. The clash was unavoidable, and in 1633 Galileo was forced to abjure his conviction in the Copernican system. Not for long, though, for soon after Isaac Newton put forward his three laws of motion and his universal theory of gravity in 1687, the sun-centered cosmos became widely accepted. To Newton, the cosmos was a manifestation of God's glory, infinite in extent and sublime in design.

During the twentieth century, the Newtonian universe was substituted by a curved Einsteinian universe: Einstein showed how matter and energy can bend space and alter the flow of time, endowing them with an unprecedented plasticity. Nowhere is this more spectacularly displayed than in the expansion of the universe itself, discovered by Edwin Hubble in 1929. Once again, the question of origins came back to haunt scientists: if the universe is expanding, there was a moment in time when all matter was squeezed into a very small volume. Astronomy was proclaiming that the universe did have an origin, after all. A cry of dissent emerged from Cambridge University via the proposal of the "steady-state model," where the universe never had a beginning in time. With the discovery that the whole cosmos is immersed in a bath of microwave radiation in the 1960s, the steady-state model was abandoned by most cosmologists; the "big-bang model" has since been accepted as the one which best fits the data.

Can science "explain" the age-old question of Creation? Certainly, physical models describing the origin of the cosmos can and have been proposed, at least since the 1970s. But these models face a serious technical obstacle: the lack of a proper theory to describe physical processes at the enormous energy scales prevalent during the first moments of cosmic history. They could be called scientific creation

narratives, at least until they can be placed on more solid theoretical ground. We see old themes coming back, dressed in scientific jargon. In some models the universe was born out of "nothing," a quantum vacuum populated by all sorts of ephemeral energy fluctuations; others see the beginning as essentially chaotic, with an ordered cosmos emerging homogeneously in three dimensions.

Some of these models of creation make predictions about measurable properties of the universe, which can be used to test and refine them. Yet it may be hard to rule out all alternative models, which may also be compatible with these measurements. The best that we can hope for is a



Copernicus' vision of the planets, from a 17th-century illustration.

workable model of cosmic origins, compatible with observations but open to changes. Scientific inquiry is after all an ongoing process—there is no final truth, only approximations to the truth. Furthermore, science, at least as it is formulated at present, cannot answer questions concerning its own origin: we do not know why the universe operates according to the laws we have uncovered and not others. This essential incompleteness of science suggests a new form of complementarity between science and religion; religion does not exist to cover the holes of our scientific knowledge, but as a driving force behind scientific inspiration. Through our search for knowledge we uncover our true nature, fuelled by the same sense of mystery which filled our ancestors with awe.