THE WONDERS OF THE UNIVERSE
An address given by David Hughes, a member of the MCO Chapel Society, on 12 June 2-11

For as long as human beings have inhabited the Earth, they have gazed out at the night sky and sought to understand the universe. Astronomy was indeed one of the very first sciences as ancient Egyptians and Greek philosophers attempted to explain the seasonal procession of the stars across the heavens. Their endeavour has persisted down the ages, capturing the minds of Islamic philosophers in medieval times, and those of Copernicus, Galileo, Kepler, Newton, and Einstein in the modern West. Today we have Stephen Hawking, string theory, particle accelerators and the Hubble Space Telescope, yet the fundamental project remains the same: to make sense of the biggest questions of all. What laws govern the workings of the universe? Where do the heavenly bodies come from? What is the place of human beings in the cosmos?

For me the fascination of astronomy is that it very quickly blurs into cosmology. The ultimate questions in science in fact prove to be inseparable from the ultimate questions of religion. Both are concerned with the nature and origins of reality, which are inseparable from the nature and purpose of human life. It is telling, in this respect, that before the advent of modern science there was no division between science and religion. Rather, what we now call “natural science” used to be referred to as “natural philosophy.” To understand the design of the heavens, it was thought, was to catch a glimpse into the Mind of the Creator Himself, and in that sense science was an inherently religious enterprise. As Copernicus put it some 500 years ago, “To know the mighty works of God, to comprehend His wisdom and majesty and power; to appreciate, in degree, the wonderful workings of His laws, surely all this must be a pleasing and acceptable mode of worship to the Most High, to whom ignorance cannot be more grateful than knowledge.”

Many of you, no doubt, will have seen Professor Brian Cox’s recent television series The Wonders of the Universe. The concept of wonder, indeed, lies at the heart of Cox’s cosmology, as it has for generations of stargazers throughout human history. As Cox explores such awe-inducing themes as the nature of time, the light-bending effects of gravity, and the birth and death of stars, it is almost impossible to watch his programmes and not feel a sense of wonder, fascination and outright amazement. And yet, Cox’s sense of wonder does not require religion. One need not posit the existence of a Creator God, for example, in order to marvel at the miracle of life on earth. Rather, one need only understand that the precise conditions required for life to exist at all are about as improbable as an archer hitting a one-centimetre-square target 15 billion light years away. Seen in the context of the age of the universe, moreover, those conditions have existed for barely the smallest fraction of time. As Cox puts it, if the universe were one hour old, then human life would only have existed for one billion, billion, billion, billion, billion, billion, billion, billion, billion, billion, billion, billion, billionth of a second. This is a sense of wonder fit for the modern age, bereft of God and yet sublime in its awe-inspiring power.

One of the distinctive features of the history of cosmology is that has progressively dethroned humanity from a privileged position at the centre of the universe. In ancient times, for example, Aristotle theorized that the sun, the moon and the planets all revolved around the earth. Human beings were thus thought, quite literally, to be at the centre of everything – an idea that
held good for an astonishing 1800 years. During the Middle Ages, it found accommodation with the Roman Catholic image of man as occupying a special place in the cosmos somewhere below the angels but above the beasts. Yet it famously came unstuck following the publication of Copernicus’s treatise On the Revolutions of the Heavenly Spheres in 1543. Far from all celestial bodies revolving around the Earth, Copernicus argued, the Earth was in fact just another planet revolving around the sun. At a stroke, human beings lost their privileged centrality in the universe, which was instead assumed by the sun. But as time went by, it was discovered that our sun is itself just one star among hundreds of billions of stars comprising our galaxy. And we now think that the Milky Way is itself only one of several hundred billions of galaxies in the observable universe. Humanity has thus been reduced to a mere grain of sand on a vast cosmic beach.

Modern science, therefore, confronts us with a metaphysical dilemma. On the one hand, as Cox and like-minded physicists tell us, it is a miracle that life on earth exists at all and that we are here, now, with the self-conscious ability to reflect on it. But on the other hand, human life is rendered utterly insignificant in relation to the vastness of the universe. This thought prompted the seventeenth-century French philosopher Blaise Pascal to exclaim in despair “The eternal silence of endless space terrifies me.” His anguish was echoed three centuries later by the biologist Jacques Monod, who wrote: “Man knows at last he is alone in the unfeeling immensity of the universe, out of which he has emerged only by chance.” And the same sentiment was evident again in contemporary physicist Steven Weinberg’s remark that “The more the universe seems comprehensible, the more it also seems pointless.” If we are to believe modern science, in other words, human beings are blessed with the miracle of existence at the same time as they are cursed by its sheer meaninglessness.

One way out of this dilemma is through appealing to what is known as the “anthropic principle,” from the Greek “anthropos,” meaning “person.” This principle states that however insignificant human beings may appear to be in the universe, the universe has nevertheless evolved this way in order to allow us to be here in the first place. The universe, in other words, is fine-tuned precisely in order to produce an intelligent observer capable of appreciating its organization and harmony. On this view, design is everything: the more an intelligible pattern can be discerned that explains the smallest-scale as well as the largest-scale features of the cosmos – or the microcosm and the macrocosm – then the more human beings retain a privileged position as the only known life-form able to make sense of the cosmic Grand Design. This logic was evident in, for instance, Renaissance ideas about the unity of microcosm and macrocosm; in the philosopher Leibniz’s idea of the Monad as a single indivisible form that nevertheless carries all the information of the universe within it; and also in William Blake’s famous line “to see the universe in a grain of sand.” In fact, Blake here implicitly redeems the image of humanity as a grain of sand on an infinite cosmic beach by positing an intelligent design underpinning all of Creation.

In some ways, the anthropic principle is really just the modern, scientific name for what theologians have long since referred to as the “argument from design.” The idea that the universe possesses a design which gives human existence meaning and purpose remains the same, only modern scientists tend to see no need for a Creator God in the traditional Judeo-Christian sense. Albert Einstein, for instance, thought that “The religion of the future will be a cosmic religion. It
will have to transcend a personal God and avoid dogma and theology. Encompassing both the
catural and the spiritual, it will have to be based on a religious sense arising from the experience
of all things, natural and spiritual, considered as a meaningful unity.” For Einstein, Buddhism
answered that description, but I personally think that Unitarianism does so just as well.

The attempt to discern a design to the universe has always been at the heart of
cosmology, and it still is today. The main problem faced by contemporary scientists is that they
have one model for understanding the microcosm – i.e. quantum physics – and another model for
understanding the macrocosm – i.e. Einstein’s theory of relativity – but they have no way of
unifying the two models. You cannot use quantum physics to explain the movement of stars, and
you cannot use the theory of relativity to explain the behaviour of sub-atomic particles. What
scientists are hoping to do, therefore, is to arrive at a single model that incorporates both
quantum physics and relativity. This is sometimes referred to as the “Grand Unifying Theory” or
“Theory of Everything.” In essence, their aim is to discern a design to the universe that can be
read in both microcosm and macrocosm.

Amazingly, modern scientists are tantalizingly close to success in this endeavour. They
actually already have their “Theory of Everything” – it is known as the Standard Model of
particle physics. But so far, they have not been able to prove the validity of that model. In order
to do so, they need to detect a particle whose existence is presupposed by their model but which
has never before been observed. Some refer to that particle as the “God Particle” on the grounds
that its discovery would, allegedly, give human beings an insight into the Mind of God and his
Grand Design for the universe. Scientists are hoping to find the God Particle using the most
powerful particle accelerator ever built, the Large Hadron Collider, which is currently nearing
completion in Switzerland. Much will hinge on the outcome of the experiments using the Large
Hadron Collider, for not only will a scientific paradigm stand or fall, but humanity’s ability to
assign itself a meaningful place within a cosmos governed by design and purpose will also be
tested.

Yet, even if the God Particle is discovered in the next few years, I wonder how much that
would really tell us. Would human beings finally have unlocked the hidden design of the
universe after all these centuries? Or, would they just think they had done so? After all,
cosmologists since the earliest times have thought that they have understood the universe. They
have modelled it with the Earth at the centre, the sun at the centre, and in terms of the Big Bang,
yet science has always moved on: new observations have been made that confound the old
theory, and new paradigms have evolved. Admittedly, we do not yet have a better paradigm than
the Big Bang, but even the Big Bang rests on surprisingly flimsy theoretical foundations. What
began as a persuasively simple model – boom! – has, in time, become a complex, unwieldy
collection of theories, each introduced to explain away new observations that didn’t fit the
original hypothesis. To give just one example, if the Big Bang were true, then the universe
should have been flying apart from a central point at enormous speed from the beginning of time,
meaning that galaxies in the furthest reaches of outer space should be invisible to us. Yet, when
scientists focused the Hubble Space Telescope on the distant reaches of outer space expecting to
see nothing, they were amazed to behold a mesmerizingly beautiful, and by now iconic, image of
thousands of galaxies. The Big Bang theory was therefore amended: scientists now tell us that
the universe began with the Big Bang but has since moved in a kind of ripple effect, pulsing
outwards in a series of expansions and contractions. Who knows, they may even be right, but the more amendments that are made to the Big Bang model – and there have been many – the less plausible that model begins to look.

Now, I am not a scientist and I have no desire to become embroiled in disputes about the validity of scientific paradigms. However, as a historian of science it seems obvious to me that no scientific paradigm has ever been final. Even Newtonian physics, which once appeared to offer laws that were universally valid, was superseded in the twentieth century by quantum theory and general relativity. In which case, the thought that human beings will ever actually uncover the design of the universe seems rather hubristic to me. In fact, it is the peculiar hallmark of cosmology that there will always be, by definition, staggeringly more that exists in the universe than we will ever be able to observe. Current estimates are, for instance, that we can only detect about 1% of the universe – the other 99% consists of so-called “dark matter” and “dark energy” that we cannot see. In which case, we are almost literally feeling our way in the dark, and whatever we choose to assert about the nature of the universe must, to a very large extent indeed, be an act of faith.

This is by no means to suggest that scientists are wasting their time trying to make sense of the universe. After all, the urge to understand our place in the cosmos is as old as humankind itself. But it is to suggest that seeking to satisfy that urge through science and reason alone is not necessarily the most appropriate response. Human beings have always intuited a sense of beauty, harmony and organization to the cosmos, yet never have they been able to fathom its Grand Design. New scientific advances have revealed new Wonders of the Universe – new planets, stars and galaxies, supernovae, light bending around massive objects, time slowing down at high speeds, and so on. And yet, we are as uncertain about our place in the cosmos now as we ever were. Despite modern science’s obsession with progress, we may very well be no closer to answering the most important questions about the universe than our ancestors were thousands of years ago. In spite of all our endeavours, there are still no words to capture the Ultimate Reality, no system of knowledge capable of making sense of it. We can but admire its secretly unfolding beauty, and place our trust in the Eternal Spirit that pervades everything that exists.