



Dark matter to bright faith

Paolo Beltrame SJ, Kensy Joseph SJ and Michael Smith SJ

A forthcoming course at London's Hurtado Jesuit Centre will focus on the much-debated relationship between faith and science. The three Jesuits who will be speaking at the course share their thoughts on how a scientific worldview leads to an understanding of God's place in the world.

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Paolo Beltrame nSJ

Dark matter is a mysterious form of matter, yet to be directly observed, that constitutes 85% of the mass of the known universe. Its existence is affirmed by its gravitational effects, even if it is very difficult to detect it and to understand its nature. It is called 'dark' because it does not undergo electromagnetic interactions with any other particles, and it is such electromagnetic interactions that allow objects to be observed, not necessarily with our eyes, but via experiment.

Fritz Zwicky (a remarkable and interesting Swiss astronomer) first postulated its existence in the early 1930s. After observing the motion of clusters of up to thousands of galaxies, he named this 'invisible' substance, *dunkle Materie* (German for 'dark matter'). Since Zwicky's time, numerous phenomena have been observed that cannot be explained without assuming the presence of dark matter. One of the most compelling came via the Planck artificial satellite in 2013, when it provided the most precise mapping to date of the cosmic microwave background.

Assuming that dark matter exists and that it is a new kind of particle, it was probably 'created' during the first instants of our universe, about 10^{-9} second (0.000000001 second) after the big bang. Therefore, studying it represents a unique way of exploring God's unparalleled creativity and of shedding light on



how He has been designing this universe, what the universe is and how it evolves. Current theories suggest that *all* galaxies were shaped by this dark matter, including our own, in which life has found a hospitable home.

Ignatian spirituality invites us to find God in all things, and so God is surely also in dark matter. The point is not to 'baptise' or to assign metaphysical (or even moral) meaning

to this elusive form of matter, but serenely and profoundly to realise that everything that God has created, continues to create and will create, is there to be potentially 'embraced' in our life. Furthermore, He demands to us to discover His design, both in the depths of the universe and in our own small, but unique and precious lives.

However, faith and scientific endeavour have often been held in tension with one another. So how do they interact in an individual's life – how can one be a person of faith and a person of science?

In some minimal sense, all scientists are 'faithful': there is no scientific reason why the universe should be intelligible to us and describable by mathematical formulae. And so scientists found their studies on an 'act of faith' that our cosmos is rational, and thus get their results accordingly. In a certain sense, every scientist is a 'believer' and therefore can, through their work, find a possible way to glimpse the mind of God – a God that is a creating and ordering supreme intelligence.

This does not mean that to be a religious believer you simply need to be a scientist ... and it is obviously not true the other way around, either. The delicate point is that faith in a personal and loving God, who became human for the love of us, can be quite hard for a scientist. My faith in this paradoxical Christian God was possible only after a real experience, a tender, surprising and personal encounter with the divine – an event that did not prompt me to seek a solution or explanation but rather invited me to an insistent renewal of that encounter, in order to allow Him to find me endlessly.

Starting from this encounter, the whole human person flourishes, including his/her intellectual and scientific activities, which can then be experienced with new colours: they become an enriching and challenging dialogue with God who tells us: 'Understand what you are observing! Discover new natural phenomena! I made you intelligent enough to achieve that!' Perhaps we could see God as the author of a detective story: He will be much happier if we keep reading, understanding and savouring the novel, entering the mystery of it until the last page, rather than being trapped in an incomplete picture by a short-sighted, narrow attitude. Georges Lemaître, who first proposed the theory of the big bang as the beginning of this universe, and who was also a Catholic priest, though that there are two paths to truth, religion and science; and, he said, 'I decided to follow both of them'.

Scientists nowadays are disclosing a God that is more God-like than ever. The cosmos has expanded from just our solar system to the scale of hundreds of billions of galaxies, and God is even bigger than that. The creative action has been moved from a six-day narrative into almost 14 billion years of evolutionary process, and God has even more imagination than that. With a spiritual perspective, one can perceive that the whole cosmic process is sustained with a profound and delicate loving care, which does not coerce nature, but embraces and respects it.

This perspective is the grounding of both my Jesuit life and my research. It is pivotal for a Jesuit to nurture a personal and honest relationship with God, that frees him from service to his own passions, ambitions and sometimes even skills in order to have his whole self integrated into the service of others. Physics, or any scientific research, can be a unique

tool for building bridges to a wider community, who might think of science as 'the religion of the future'. The true freedom to which a Jesuit aspires also requires the capacity to learn from others, as scientists constantly do.

Curiosity should be at the core of every good Christian life, and of Jesuits in a special way – you cannot seek God in everything if you do not dare to look for Him with an open and 'soundly curious' mind. And, of course, curiosity is also crucial in a scientist. Sincere curiosity also entails a compassionate approach towards the realities of all people, and therefore a desire to make the kingdom of God flourish.

Faith embraces the totality of one's life – from its most inner and intimate aspects to the most social and global of actions. Scientific interest, therefore, can find a comfortable home within a life of faith, as it has in mine.

Paolo Beltrame nSJ spent 15 years investigating the dark matter content of our universe in various international research centres. He is now in the Jesuit novitiate in Birmingham.

'To an Unknown God': How religion proclaims what science worships

Kensy Joseph SJ

Having fallen into trouble at the synagogue in Thessalonica, St Paul is sent to Athens to wait for his companions, Silas and Timothy, to join him (Acts 17:1–15). While there, he starts to reason with the various groups of people he encounters there: Jews, Greeks, Epicurean and Stoic philosophers, and so on. Eventually, he is taken to a meeting of city elders at the Areopagus (Mount of Ares), where he begins a public address:

People of Athens! I see that in every way you are very religious. For as I walked around and looked carefully at your objects of worship, I even found an altar with this inscription: 'To an unknown God' [Greek: *agnostos theos*]. So you are ignorant of the very thing you worship – and this is what I am going to proclaim to you. (Acts 17:22–23)

He then goes on to quote the philosophers Epimenides and Aratus as he proclaims the gospel of Jesus Christ to the Athenians (Acts 17:24–31). This masterfully constructed speech has been called the climax to the Acts of the Apostles. It has also long been recognised by the Church as a model of mission (see the Second Vatican Council’s Decree on the Mission Activity of the Church, *Ad gentes*, §3). Writing of the Church’s missionary mandate today, Pope St John Paul II said:

We must also mention the immense ‘Areopagus’ of culture, scientific research, and international relations which promote dialogue and open up new possibilities. We would do well to be attentive to these modern areas of activity and to be involved in them. People sense that they are, as it were, travelling together across life’s sea, and that they are called to ever greater unity and solidarity. (*Redemptoris Missio*, §37)

But the ‘Areopagus’ of science today is often seen as one hostile to the faith, thanks in part to the commercial success of the ‘New Atheists’. The movement known as New Atheism came to public attention in 2006–07 when critiques of religion were published by biologist Richard Dawkins (*The God Delusion*), neuroscientist Sam Harris (*Letter to a Christian Nation*), philosopher Daniel Dennett (*Breaking the Spell*) and writer Christopher Hitchens (*God is not Great*). Together, they were nicknamed the ‘Four Horsemen of New Atheism’. *The God Delusion* has sold over 3 million copies worldwide, been translated into 35 languages and had a special tenth anniversary edition republished. Faith has come to be seen by many as, in Dawkins’ words, a ‘virus of the mind’.

How, then, is a modern day St Paul to proclaim the Good News with respect to science? To do this, he would have to locate the *agnostos theos* of the scientist. In place of Epimenides and Aratus, he would need to familiarise himself with the work of contemporary philosophers of science.

The popular view of science is that it has four characteristics:-

1. Science does not start with preconceptions.
2. Science starts with evidence and scientists build theories based on this.
3. Evidence is obtained from observation and/or experimentation. This evidence is treated as fact.

4. Theories are proved/disproved according to whether they correspond to the facts or not.

This view was crystallised in the ‘positivist philosophy’ movement of the 19th century, especially with the work of August Comte (1798–1857). However, writing a century earlier, Scottish philosopher David Hume (1711–76) pointed out that this kind of evidence-based reasoning (called inductive reasoning) is not rationally justified. Our observations and experiences only reveal the tiniest fraction of all possible experiences; and there is no reason to think that the future must be like the past. We cannot even rely on the past experience of making predictions that have been verified.

Taking up Hume’s baton, Austrian philosopher Karl Popper (1902–94) argued that no scientific theory can ever be proved – it can only be falsified. Every scientific theory is tentative until a counter-observation is found. (This is, in fact, the most popular view among scientists today – which would put them at odds with their 19th century counterparts.)

There came a further attack on the popular view of science in the 1960s, when Thomas Kuhn (1922–96) and Paul Feyerabend (1924–94) challenged the idea that science makes steady, incremental progress. Kuhn showed how the development of science occurs through ‘paradigm shifts’, periods of uncertainty when even fundamental presuppositions are challenged. Two good examples of this in the last century were Einstein’s theory of relativity and quantum theory. Relativity challenged the idea that time and space were absolutes, while quantum theory challenged the notion that observation does not affect the system being studied. One of the features of a paradigm shift is that advocates of different paradigms disagree not only about the theories, but even about the evidence that underpins them. There is no such thing as a ‘fact’ – all data is theory-laden.

Feyerabend was even more revolutionary. Scientific progress, he said, is ‘anarchic’ – it involves actively ‘breaking the rules’ of good science. For instance, one may posit a theory that runs counter to the evidence, or simultaneously postulate contradictory hypotheses. Even political interference (usually the bane of academics) can lead to scientific progress. An example here is the politically-motivated research in herbal medicine in China after 1954.

All of this has led to the current stance of non-foundationalism in the philosophy of science: what makes science ‘scientific’ is not reliance on evidence or observation or experimentation, but rather adherence to a ‘tradition’ of good practice and virtues such as curiosity, integrity, cooperation and transparency. But the same could be said of any academic field at all, or indeed, ordinary life. This points to a fundamental tension at the heart of science: the scientific enterprise seeks to study the inner workings of nature; but that enterprise defines itself according to principles that lie outside of the parameters of its study. The *agnostos theos* of science, then, is an alignment of scientific reason with order in the universe.

Perhaps it is here that a present day St Paul could proclaim the gospel. In the words of Pope Emeritus Benedict XVI:

Christian philosophy and theology, [has the] notion of participated being, in which each individual creature, possessed of its proper perfection, also shares in a specific nature and this within an ordered cosmos originating in God’s creative Word [Greek: *Logos*]. It is precisely this inbuilt ‘logical’ and ‘analogical’ organization of nature that encourages scientific research and draws the human mind to discover the horizontal co-participation between beings and the transcendental participation by the First Being. ([Address to the Pontifical Academy of Sciences](#), 2012).

Kensy Joseph SJ is studying for an MA in biblical studies and the theology of science. He holds a BTech in Computer Science and Engineering and an MA in Philosophy.

A scientist finding God

Michael Smith SJ

Pierre Teilhard de Chardin would have been puzzled if anyone had suggested a problem with linking faith and science – they both provide a coherent model of the reality we see, the former perhaps more complete than the latter.

Teilhard’s life’s work was in palaeontology and geology. He spent many years examining the fossils found in various geological layers, mainly in China. As each layer could be approximately dated, he could trace the evolution of the various phyla in the animal kingdom over time.

Not many years before he did this work, two scientists had altered the way we view the cosmos. In 1859, Charles Darwin, in *On the Origin of Species by Means of Natural Selection*, had shown how natural selection could refine random variations in the reproductive process to produce organisms of increasing complexity, exploiting more fully the habitats they lived in, leading eventually to humans. In 1929, Edwin Hubble analysed the red shifts of various galaxies, and showed that the universe is expanding from a single point and evolving from that point into the complex and varied universe we know today. In fact, a Catholic priest, Georges Lemaître, had mooted this possibility a few years before, but lacked the observations needed to establish it.

Teilhard’s work on the fossil record showed how, over the millennia of biological time, living organisms had indeed evolved as evolutionary theory predicted, progressing always towards greater complexity and a closer adaptation to their environment; until one phylum – the primates – evolved into organisms which were reflective, of which one species has survived until today. But, although both are based on observed data and the production of models that systematise these observations, there are crucial differences between evolutionary theory as commonly understood today, and the evolution that Teilhard described.

His understanding of evolution began right at the start, at the moment of the big bang. From the fundamental particles from which the universe began, through the atoms and molecules, minerals, primitive living cells, plants, animals and humans, it continues into the future, until the moment at which creation reaches its fulfilment, which will be the time when Christ returns.

Teilhard detected a positive drive towards increasing complexity in this evolutionary process. Contemporary biologists reject the idea that evolution is ‘going anywhere’; it is based entirely on random genetic variations – a stochastic process making ‘progress’ only through the survival of those species best

adapted to their environment. But for Teilhard, this drive towards increasing complexity continues into the future until evolution reaches what he calls the 'Omega Point'.

Central to Teilhard's understanding of evolution is what he calls 'the law of complexity-consciousness'. Consciousness is present in every being, becoming more significant with increasing complexity, though in simpler molecules and organisms it cannot actually be detected. Eventually in the evolution of the primates, a radical change occurred, and the consciousness became reflective – humans are aware of our own consciousness, and we became what we usually describe as 'thinking beings'.

Two important developments flow from this.

Firstly, reflective beings begin to link up with each other, forming a new sphere (following on from minerals in the lithosphere, and living things in the biosphere) which Teilhard called the noosphere. The reflective beings in the noosphere communicate with each other, and grow in increasing cooperation and unity. It is clear that this has still some way to go, as the cosmos continues to develop towards its final destiny.

The second development from our transition into reflective beings within the noosphere is that we are now becoming able to control evolution, including our own. As well as an ability to control our environment to limit the further evolutionary changes, such as the provision of adequate food, medical care and education, we are developing the potential to intervene in evolution directly through such processes as gene editing. Sadly, we are also using our power to control evolution to degrade and contaminate our environment.

Teilhard's model takes the idea that evolution is driving towards an end point even further. He argues that the process of creative union – the constant evolution towards greater complexity and consciousness – is God's chosen way of creating the universe. This was not an original idea of Teilhard's – under the name 'creative evolution' it had been described before – but he brings it to the fore as the way in which God is creating, from the first moments until the final coming of Christ when the cosmos is brought to perfection. Creation is not therefore a past event that took place at the beginning of time, but a continuing process and, moreover, one in which we are all involved.

We are reflective beings who can manage the process of evolution, and so we are co-creators with God, and we now have a responsibility to help to bring everything to the final perfection that God intends. But of course as sinful beings we can refuse to work for this; we can disrupt the progress which others are making.

He also broadens the narrowly scientific models by showing that, in the noosphere, Christ is present. In the Nicene Creed we assert that, 'through [Jesus Christ] all things were made' – Teilhard developed this idea, showing that the Omega Point towards which evolution is making progress is identical with the presence of Christ in creation. Tentatively, he wonders whether this could even be a third nature of Christ – truly God, truly human, and truly matter (matter, for Teilhard, being a revelation of God).

Teilhard died in 1955, and concerns about what we are doing to our environment had not yet come to the fore. But the importance of his insights is that the data on which science is built also support a model of the evolution of the universe that makes clear God's role in still-continuing creation. And Teilhard's work is also relevant to Pope Francis' encyclical, *Laudato si'* (2015), in which the pope develops the idea of an integral ecology, which includes not just the environment but also how we are using our resources, and how economic systems impact on the people of the world. We – the noosphere – are developing economic systems that can enhance or severely damage our life together in the world, and we all, as co-creators with God of the cosmos, can enhance or severely damage – even destroy – the world we live in.

Michael Smith SJ is a physics graduate, now working in the Jesuit Refugee Service and in adult education. He is currently working on the place of God in creation – including in the social structures in the world.

Living Theology: Dark Matter to Bright Faith will take place at the Hurtado Jesuit Centre, Wapping, on 5-6 May 2018. For further details and booking information, please visit: <https://www.jesuit.org.uk/living-theology-dark-matter-bright-faith>