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“All truth leads us to God”

Ricardo is a professor of physics at the University of Minho in Portugal. In this interview he talks about the relationship between science and faith, the Big Bang theory, Galileo, and the recent Nobel Prize in physics.

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He has authored dozens of publications in international journals, including a long article in *Science Magazine*. A professor in the

Department of Physics at the University of Minho and a member of the Iberian International Laboratory of Nanotechnology, Ricardo is carrying out research in Solid State Theoretical Physics, especially in two-dimensional materials such as graphene. And recently he authored the book *Physics XXI*.

Ricardo is a native of Porto and lives in Braga, Portugal, a city where he has made many friends. We took advantage of one of his breaks to ask him about the relationship between science and faith and other current issues.

Who won the Nobel Prize in Physics this year?

The 2020 Nobel Prize in Physics was won by Roger Penrose, Reinhard Genzel and Andrea Ghez for their studies on black holes.

And what practical applications can this discovery have on our daily lives?

I think the question reveals a somewhat utilitarian view of science. It is clear that a better knowledge of the Universe and what it contains may lead to something practical for our daily life. For example, the mathematical models developed in these areas of fundamental physics can then be applied in the materials that are used in advanced devices, and even in economic models.

However I think it is important to value knowledge for itself, regardless of its immediate usefulness. Knowledge helps us grow intellectually; it leads us to contemplate the beautiful; it stimulates the imagination and has its own excellence.

How can God help you be a better physicist in your day-to-day life?

I think the question is backwards. It should be, how does physics help me be a better Christian. And it helps in many ways. Nature and its laws participate in and show forth the beauty of God, who created them. Studying them helps me contemplate God and love Him for the wonderful world He has given us.

On the other hand, a physicist needs to have a love for the truth. It doesn't matter if I like an idea or not; what matters is whether it corresponds to reality. All truth leads us to God, and makes us grow in humility.

We need to be aware that the knowledge we uncover is a gift to humanity. Physicists need the social sense that what they discover is not meant only for themselves, but rather for enriching many others, who can start from a little higher up on the ladder of knowledge. This

selfless mindset brings God closer to us.

How do you view the Big Bang theory?

The Big-Bang is an extraordinary theory, with a lot of experimental evidence. It is a scientific theory that a Christian like myself immediately associates with the act of creation by God: the Universe had a beginning. Of course, God doesn't need a Big Bang to create the Universe, and if that theory is overturned (I find it difficult to imagine this, given the amount of experimental results supporting it), this fact will be of little importance to Christians.

Christianity says that God created the Universe for mankind. Isn't this disproportionate – such an immense reality for tiny beings in a small corner of the Universe?

The amazing thing is not that the Universe is immense; the amazing thing is that we can know it with our human intellect. We can understand how it works at such remote distances and times from us.

It's not just that we can understand how things work around us. That would be impressive. But to be able to describe the evolution of the Universe from 13.7 billion years ago to now – it's absolutely fabulous.

That's why I'm convinced that the Universe was really made in an act of love for us men and women. It is immense and beautiful, but also intelligible and knowable by us. What good would it do us if we couldn't know it, understand it, and explore it? It's a huge act of love.

Is science compatible with faith?

When we talk about science and theology we have to keep in mind

that they are two distinct disciplines that have quite different methods and objects.

For example, the existence of God, who is a spiritual being, cannot be proved or denied by the scientific method, which is experimental and therefore refers to material realities.

We cannot be exclusive and affirm that the only way to know reality is through the experimental method, when there are many other ways of knowing. The more points of view we have for grasping the truth of what exists, the richer our understanding of it will be.

One way to know is by faith, both human and supernatural faith. It's the one we use the most. I've never seen the wall of China, but I believe and am convinced that it exists, I trust the people who have described it (whom I've never met, because I

don't personally know anyone who has seen it).

Science does not have God as its object and the experimental method is not apt for getting to know God. I can't use a voltmeter on God or any spiritual being. So any statement about God's existence is not a scientific statement.

Physicists sometimes say that God isn't needed to explain the Universe, since physics already explains it fully. Is that true?

Science cannot reach God as the cause of the Universe as its Creator, because God is outside the objects of science, which are material things. Maybe that's what they mean when they say there is no need for the hypothesis of God to explain the appearance of the Universe. But it isn't true that science explains everything about the origin of the Universe.

We know how the Universe evolved from immediately after (0.000000000001 seconds) – what we could call “instant zero.” We know because we can see what happened with our telescopes: the farther we look, the older the things are that we observe, since the light takes more time to get here.

The oldest thing we can observe is cosmic background radiation, which emerged 380,000 years after instant zero. We know how it evolved from that time on because we can see it (and we use a lot of deduction and induction).

But beyond that we know physics and we can extrapolate to the past what should have happened to bring about cosmic background radiation. So we can say that we know what happened since the “instant zero” mentioned above. What happened before is pure conjecture with no

scientific basis (in the proper sense) of any kind.

The fact that we know how to describe the evolution of the Universe doesn't tell us anything about where and how it came into existence. First of all, why do we have these laws of physics and not others? The laws of physics explain the evolution of the Universe very well, but they do not explain themselves.

It didn't have to be like this. There is no reason for these particles to exist with these properties and not others, nor for the fundamental constants of nature to have the values they have.

Couldn't the laws of physics have come about by chance, by a kind of trial and error?

Chance is not an explanation, it is the absence of an explanation. Resorting to it is as valid as resorting to elves. It

means returning to the irrationality of the mythological gods.

But some physicists argue for this. And that this would give rise to an infinity of 'parallel' universes, the 'multiverses.'

I think it's important to distinguish carefully between what is properly proven scientific data and what are the more or less interesting fanciful theories that physicists can make up about the Universe and its origins.

We can imagine an infinite number of universes each with its own laws, but this is pure imagination. There is not even the slightest evidence for it.

Furthermore, if these supposed universes are totally inaccessible, then it does not even qualify as a scientific hypothesis, which by definition has to be experimentally provable.

Couldn't the universe have its origin in a vacuum?

In fact, a vacuum is a state of matter; we cannot say that it is absolutely empty. This means that a vacuum (in the physical sense) does not explain the origin of the Universe because it does not explain itself: it is already something. It has nothing to do with absolute nothingness. What it might be is a step in the evolution of the Universe, but this is pure speculation at this point.

It should be noted that a vacuum, in its current physical conception, already has laws, with defined values of universal constants. So there is already something that exists that can't be explained by the methods of science.

What does it mean to say that God created the world?

God's creation of the world has a much deeper meaning than what science conceives of, since it means keeping things in being, in existence.

It's an uninterrupted, constant act, not making something appear and then forgetting about it. God is indeed everywhere and holds things in existence; if God stopped doing so, they would simply cease to exist. There would be no energy, or charge, or any physical quantity left; it would be a return to absolute nothingness, not to a physical vacuum, which is in fact a state of matter that already exists.

The nothingness before creation is an absolute nothingness, without laws, or rules, or values of constants, and from which nothing can emerge. That is why a Being is needed not only with the capacity to make matter appear, but also to give it the laws with which it functions.

Can there be dialogue between science and faith?

I see them as quite disparate realities and I don't think there necessarily has to be a dialogue, as long as each one remains in its specific field.

When a scientist states that God doesn't exist, he or she isn't speaking as a scientist, but from their own personal convictions; when theologians try to find scientific explanations for supernatural realities, like miracles, they are making a big mistake.

Now, faith has a lot to say about ethics, about the use of scientific knowledge. I often see scientists defending the progress of science regardless of the ethical consequences of what they are doing, particularly with regard to experimentation with human beings. Then faith can make an important

contribution by defending the dignity of every human being.

What about Galileo?

It was an unnecessary and unjustifiable conflict. In a nutshell, Galileo was wrong on the scientific side because his justifications for defending his astronomical model were wrong, and those who judged him were wrong because they thought that an astronomical model might have something to do with theology.

Is quantum mechanics relevant to a scientific understanding of the mind-brain problem?

Quantum mechanics is the current theory that explains how matter works, with absolutely extraordinary evidence of being consistent with reality. Any problem involving matter necessarily involves quantum mechanics; there is no turning back.

Now, just because some who are accustomed to thinking within the paradigm of classical physics find this theory “unintuitive” doesn’t mean that quantum mechanics is something esoteric, or spiritual, or capable of miracles. It’s a physical theory that applies to matter.