

Seldom people can create moments in their lives when they can pose life's most important questions: Where did humans first originate? How did humans end up here? What's the reason behind the way the universe works?

Fortunately, we have had many clever scientists who have throughout their lives posed these questions, and only several of them even authored books responding to these questions, using a language clear for everyone.

In his last work, Professor Stephen Hawking presents his trademark talent to address the cosmos' most significant questions and still creates space and a moment to make guesses on the future of mankind. Combining social problems with the solar system, Hawking shows not only the principal laws of the cosmos but also his dream for the future of humanity.

Chapter 1 - Forces rule our cosmos – however, there isn't any a spiritual being probably among these forces.

What's the reason for us to be here? How did humanity get here? What's the reason for things to be in this fashion?

Science and religion both present responses to these crucial questions, however, their responses are wholly different from those of one other. The latter claims there is intrinsic purpose in human life, the former claims that human existence is something that cannot be just linked to an accident. It doesn't come as a surprise that these two worlds are seen as two opposing creeds.

These questions arise from a common human inclination to comprehend and describe our cosmos – to seek for explanations and sense. Initially, religion gave the first responses. Gods were believed to be the reasons behind lightning, storms, and eclipses. However, today, there is a more reasonable, logical, and provable statement: the cosmos is an enormous device, controlled by a collection of firm natural laws.

Simply consider an easy game of tennis. In this game, the ball constantly goes to precisely where these natural laws – such as gravity and motion – foretell. You can find neither any oddness nor exceptions. Something can change, naturally, such as the player's muscle strength or the wind velocity, however, these things are nothing but trivial data points, processed by these natural laws in a consistent form to determine the result.

Apart from being consistent – these laws are universal as well.

The meaning of this is that the same laws that govern our tennis ball govern the hugest celestial things. The changes in our Earth follow these laws, just as an icy meteor speeding through the interstellar area does. Furthermore, natural laws are impossible to overcome: even God couldn't break them, which forms the opposite view to theology's emphasis on God's power.

However, perhaps we can figure out a method to bring together modern science and the notion of God.

This requires describing God as these essential laws of nature instead of knowing being who built them. This is the way Einstein viewed God – as a reference term for the visible, unchangeable rules of the universe.

Most people will be uncontented with this idea. The reason for this is that most people are accustomed to contemplating God as a conscious being similar to humans – a being whom people can establish an individual relationship. However, if we examine the cosmos in all its awe-inspiring size and contrast it to the small and accidental human life, the possibility of a spiritual creator is very small.

If humanity's conventional answer to the origin of the cosmos is wrong, where did the universe originate then?

Chapter 2 - It is rationally impossible to pose the question “How was it like prior to the Big Bang?”

Many people have some information with regard to the Big Bang – it's a scientific theory that has achieved broad approval when it comes to explaining the creation of the cosmos. The cosmos was nothing but an infinitely dense point; however, in nanoseconds, the cosmos, perhaps tinier than a proton, turned into a swiftly growing body that is still expanding in the present time.

Actually, the finding that the cosmos is growing assisted in the formation of the Big Bang theory. The theory was put forward by a scientist called Edwin Hubble.

In 1929, Hubble thoroughly examined light from remote galaxies. His purpose was to see whether these galaxies were on move and if so, to see at what direction they were moving. What he discovered was some of the most innovative in scientific history.

Hubble demonstrated that invariably every galaxy is going away from each other. Moreover, the farther they are from our planet, the more rapidly those galaxies are moving. Looking at their rapidity, it is within our knowledge that these galaxies were very close to each other approximately 10 to 15 billion years ago. Maybe they were so close that all of them were at the same point in space – a singularity.

Proof underpinning this kind of a theory emerged earliest in 1965 when faint background microwaves in space were found. This firmly implies the cosmos had a highly dense, extremely heated outset. These microwaves are probably residual radiation from the beginning “bang.”

However, the question is still unanswered: What existed prior to the Big Bang?

The response includes Einstein and his radical finding that space and time aren't different entities. Rather, both are weaved into a "fabric" that is known as space-time – the platform where the universe exists.

Moreover, it is possible to distort space-time through the high levels of gravity that very large objects have, almost in the same fashion as putting a bowling ball on a bed. It is a bit difficult to understand, however, the largest objects – such as black holes – have the capacity to warp space-time so fiercely that time itself stops.

Then, we should examine the beginning of the cosmos. The cosmos starts to shrink, arriving at an infinitely little, infinitely dense singularity almost the same as a black hole. At this point, neither space nor time is working anymore, which is how our classical knowledge of them explains it.

Today, scientists have come up with an answer: After tracking the "chain of causality" back to its most distant point, it is possible to corroborate the Big Bang couldn't possess any cause since time didn't exist. There didn't exist any time for a cause to be.

Try to grasp this for a while and then we are going to examine something as puzzling as the formation of the universe: alien life.

Chapter 3 - We can't give a simple response to the question of alien life.

People have been wondering about aliens for many long years. You can see them in films, in sci-fi novels, and annihilated them in video games. There are also people who say they have seen them. However, how high are the odds for intelligent life to exist somewhere except our planet?

Well, should we examine the sole instance at hand – our planet– it appears to be likely that aliens have come into being.

The reason for this is that there is fossil evidence of primary life on Earth from 3.5 billion years ago – only 500 million years later when the planet became livable. Furthermore, when our planet started to exist, the universe had been seven billion years old already. Numerous extraterrestrial cultures could have emerged, learned about space travel, and settled all across their galaxy prior to our discovery of fire!

Then, the time frame apparently backs this point – however, what can we say about livable planets?

To all appearances, we can say their existence makes sense. Scientists guess that two-tenth of every star possesses planets similar to that of our orbiting them in the Goldilocks Zone – an area where life can flourish since it's not much far from its star to be an icy desert and not much close to grill its residents.

Then, let's make a guess based on this information. There are about 200 billion stars in the Milky Way, the galaxy where we live. This means it's likely there are forty billion planets similar to our planet only in our galaxy.

However, should extraterrestrial life sound likely, then what's the reason for not having been visited by them?

One theory discusses that extraterrestrial life may be prevalent, however, smart lifeforms are highly extraordinary.

Let's examine our planet again. 2.5 billion years have passed to go from single- to multi-celled organisms, which are necessary for smart lifeforms to exist. This is a very huge bulk of the time that is ready for us prior to the explosion of our star, the sun. Therefore, a lot of habitable planets might have existed but might have been destroyed by a sullen aged star.

There are other perils for extraterrestrial life: 66 million years ago, a little asteroid or comet crashed into Earth. As a result of this crash, every dinosaur died out – which were formerly the ruling species on Earth.

This was the final huge collision that affected Earth and humanity has been lucky ever since. A rational guess for these impacts is about once each 20 million years. Should this guess be correct, our existence may just be of pure luck and another impact is long-delayed. Other extraterrestrial life may not have had this kind of chance.

Chapter 4 - It may be probable to foretell the future – however, it's not going to happen.

Think about how it would be were you to be able to say what will happen in the future. It would be possible to purchase a winning ticket to following week's lottery, see the questions on your imminent exam, or even evade approaching death. It's a fascinating dream – however, can we do it?

In this traditional way, it is impossible. However, we can count one scenario, though unlikely, in which we can perhaps do this.

Scientist Pierre-Simon Laplace from France discussed that were we to know the locations and rapidity of every particle in the cosmos, it would be possible to assess their future behavior. Were you to know the location of your vehicle at a particular time and that your vehicle was going at 60 km per hour, it would be possible for you to effortlessly measure where your vehicle would be in 30 minutes now.

Laplace's notion is really a fundamental principle of classical science – the idea that how our universe is at a specific moment defines its states in the prospect. This enables people to foretell what will take place in the future, albeit in theory.

In the previous century, though, physicist Werner Heisenberg from Germany refuted Laplace's notion.

Heisenberg revealed that because of how light waves are packaged into separate units known as quanta, it is impossible to calculate both the velocity and position of a particle at the same time; the more precisely you calculate one, the more distortedly you can calculate the other. This law started to be called the uncertainty principle, and it required that physics find a novel method of viewing the world.

This view came into existence from the 1900s to 1950, in the frame of the infamous intricate theory of quantum mechanics.

In quantum mechanics, particles don't have clearly-seen positions and velocities. Instead, these two things are defined by something known as a wave function. A wave function is a collection of numbers, all of them symbolizing a separate point of space. The hugeness of the wave function foretells the possibility that the particle will be seen in every point of space. When it comes to saying what the speed of the particle at any given point will be, it is possible to achieve through calculation how much the wave function changes from one point to another in space.

Quantum mechanics gives us various issues as well. To begin with, scientists can predict just half as much information regarding a particle within the classical view of science, which indicates it is solely probable to work out its wave function, instead of its position and velocity. Furthermore, the theory of quantum mechanics appears to be unfeasible in extreme conditions in which space-time is warped – such as the interiors of black holes.

Chapter 5 - It is even impossible for light to escape a black hole – however, there is one thing that can achieve this.

Picture yourself as part of an interstellar space flight with a novice captain. In her eagerness and fervor, the captain has gotten off course – and you're going into the orbit of a black hole. Its gravity is pulling your space vessel closer to unescapable death, however, perhaps you'll feel relieved by the truth that you'll be the earliest human to live past the event horizon of a black hole – prior to being pulverized into stardust near its core, that is.

Black holes came into being after stars collapse. This takes place since these massive spheres of gas have an unbelievable volume of mass – and as the mass increases, so does the gravity.

Then, for example, what's the reason for our sun not collapsing at this moment?

The reason for this is that during a star's life, it holds itself against its own gravity by means of the formation of thermal pressure. Inside all of the stars, a large quantity of energy is being produced by means of nuclear processes where hydrogen is turned into helium. These processes repel implosion – however, not infinitely.

Ultimately, there won't be any nuclear fuel left. If this transpires, many stars pull every surrounding matter inward and shrink to an infinitely dense, infinitely little point or singularity – a black hole.

Sadly, it is impossible to conduct studies on singularities. There is such strength around a black hole that, inside a specific boundary, it is improbable even for light to escape. We call that boundary the event horizon.

You can imagine the event horizon as sailing a ship over Niagara Falls. When you approach closer, the current gains much more strength – however, you can still not fall down if there is enough power. However, after your ship reaches that cliff, you can no longer expect to escape. You are at the point of no return.

Therefore considering that the cosmos has existed for billions of years, and it is impossible for any object to escape a black hole, why is the universe not pulled inside them?

Well, we learned that there are things that can evade a black hole.

In 1974, Stephen Hawking found that black holes emit particles at a constant rate – and why this happens rests again in quantum mechanics. His theory discusses that space is replete with particles and antiparticles. Both of them are in a never-ending process of connecting, separating, and then destroying one another. The intricate interaction of these two with black holes – especially if particles are separated due to the event horizon – leads black holes to lose mass, contract, and ultimately disappear.

Relax for a while. We'll answer some questions regarding humankind in the next chapter.

Chapter 6 - If humanity wants to keep living on Earth, it has to take prompt action.

By now, we've been talked about the most important questions the cosmos can give; let's now talk about problems in our home planet Earth.

Earth is under peril in so numerous various forms that you may be overcome by them. To be honest, the situation doesn't appear to be bright for our home planet. Typically, it is possible to split menaces into two classes: those we cannot control, and those we can. We are going to examine each of them.

As you've read above, based on the principles of both physics and probability, we can say a next asteroid impact is long-delayed for our planet. And maybe this is the most terrifying of

menaces we confront – with the present technology humanity has, humanity is wholly powerless to avert annihilation.

However, this can help us make comparisons with something else. Humanity doesn't need to worry about something that will happen in the future; rather, humanity should concentrate its energy on mendable problems.

The most urgent of our menaces is climate change. Considering Earth's ecology, the present worldwide emissions of humanity are utterly unsustainable. Increasing ocean temperatures will emit more carbon dioxide into the air and thaw the polar ice caps. As a result, these tinier ice caps decrease the quantity of solar energy bounced back into space, warming Earth even more.

This is the best example of the greenhouse effect, and humanity promptly has to develop technological and political solutions to decrease our carbon footprint before we lose our grip on the effects of greenhouse gases. Unless humanity takes action, Earth could eventually resemble the surface of Venus – which is notorious for its unwelcoming conditions. Were a weatherman to be able to stay alive there, he'd talk about temperatures of 250 degrees Celsius and night rainfalls of sulphuric acid.

Global warming may be our planet's most urgent peril, however, there is also a bigger danger ahead: nuclear annihilation.

The extreme discourse around nuclear war may have mitigated after the Cold War came to an end, however, this is just a monster in sleep. The world's geopolitical atmosphere is not even close to being stable, and instability raises the possibility of more states acquiring nuclear weapons. One other probability is that terrorists may find a way to obtain some nuclear weapons. At the moment, the worldwide nuclear weapons are numerous enough to annihilate Earth a few times.

In the current situation of Earth, we can certainly claim that Earth will either be destroyed by nuclear war or environmental disaster in the upcoming 1,000 years. Until that moment comes, however, we hope that humanity will have developed the means to flee Earth and avert a tragedy.

Chapter 7 - Humanity has to begin colonizing other planets.

Once Christopher Columbus decided to sail west in 1492, critics got in line to claim what Columbus was after was a huge waste of money. However, only several decades later, all planet had been irreversibly transformed thanks to his “discovery.”

The situation nowadays resembles the situation five hundred years ago. Due to the world's present political and financial atmosphere, as a percentage of GDP space agencies' budgets are in decline for many years. Politicians and the general community think there are better things to waste money on.

This isn't what human nature wants. Humans as a kind have an exceptional curiosity that isn't observed in any other living being; humans are urged by a desire to go, to see, to be knowledgeable. Remaining in the same place would resemble a crowd of people who found themselves on an island and not making any effort to escape their wasteland island.

In order to inject a desire for space exploration into humans again, we have to get tangible deadlines – in the same fashion as President Kennedy's proclamation in 1962 where he says that America will realize a manned moon landing before the 1960s end. This drew the public's attention, encouraging a lot of kids to later turn into scientists. With the present technology, the aims of establishing a moon base until 2050 and a manned Mars landing until 2070 can be realized and would inflame interest in space programs again.

We don't need to stay put.

Excluding the planets outside the solar system, it could be possible for people to travel to the other planets in 100 years. Europa, a moon of Jupiter, might even possess oceans of water that may be supporting life below its ice surface.

However, humanity won't be able to leave this solar system until a very long time.

The reason for this is that the most proximate solar system, Alpha Centauri, is 4.5 light-years away from us. The present technology of chemical rockets renders going there in human life improbable. There are other energy forms that could drive our rockets more rapidly – such as nuclear fusion or matter-antimatter annihilation – however, we won't be able to create them for centuries.

One thing that we can do is an unmanned craft. These would go to solar systems a lot earlier.

Consider the great Starshot project, for example. This aims the production of one thousand nanocraft space probes only several centimeters in dimension. These nanocraft are appended to small, lightweight sails and propelled into orbit. And on Earth, a group of potent lasers turns its attention on a specific point above the atmosphere, hitting all sails with gigawatts of power.

There exist a lot of engineering problems to solve with Project Starshot, however, these problems aren't unbeatable. Actually, projects such as the Starshot project makes us remember how intelligent humankind's is.

Chapter 8 - Humanity has to be cautious of runaway AI.

Everyone is familiar with the story. A very progressed artificial intelligence network known as Skynet attains self-awareness, launching a nuclear genocide against those who developed it. There are people who remain alive and create the Resistance, and Skynet assigns Arnold

Schwarzenegger, a machine, back to 1984 to decimate the head of the Resistance. However, this is nothing but one of Hollywood's brilliant ideas, isn't it?

Well, this isn't as impossible as it might sound.

What is funny about it is that sci-fi, in displaying the threats of this scenario, has caused it to appear absurd and unlikely as well. However, unless humanity takes the likelihood of superintelligent machines earnestly, it could make the most important error.

Consider it like this: Currently, our brains are a lot improved compared to even the most developed computers – actually, present computers are not even as intricate as the brain of an earthworm. However, this situation won't continue as it is today. Should intelligence be listed as the capacity to adjust depending on conditions, a self-ameliorating AI system might cause to an intelligence blast, putting us in the condition of the earthworms.

This is a genuine threat, however, it is better that people are cautious of fear-mongering as well. Equipped in the right way, AI possesses the potential to enhance virtually every field of human life, from the elimination of disease and poverty to advantages we may not be able to think of. Screenwriters wrote the Terminator script in the 1980s, however, there wasn't anyone who managed to guess the rapid growth of the internet.

Presently, there are objects such as self-driving cars and computers that are able to win a game of Go. We consider these as highly innovative at the moment, however, the pace, power, and potential of computers are expediting more and more.

A principle exists for this: Moore's Law. It proposes that computers have the ability to enhance their speed and capacity by two for every one and a half years. Should our devices continue to obey Moore's law, AI might transcend human intelligence in the following hundred years, rendering the likelihood of a self-aware Skynet more probable.

Then, how can we solve this problem?

Well, people are conscious of this threat, which is reassuring. In 2015, Elon Musk, Stephen Hawking, and a group of AI specialists signed an open letter reminding of the perils of unchecked superintelligence. AI ethics has turned into one of the most rapidly-growing areas of academic study. The most crucial point to keep in mind while advancing, however, is that future protection should guarantee machines will never go out of human control.

Brief Answers to the Big Questions by Stephen Hawking Book Review

Since the earliest history, people have had an urge to pose the most essential questions and tell where humanity originated and the reason behind its existence. The finding of the unchangeable laws of the cosmos has enabled us to unveil a portion of its secret; today,

humanity should tackle more intricate questions, from the functioning of remote black holes to humanity's pushing problems on our planets.

Observe AI with a cynical eye.

It's straightforward to perceive the imminent advent of self-driving cars as a bold novel technological age. Actually, though, humanity is at risk of ignoring the ramifications of runaway artificial intelligence. Rather than being influenced by the novel computational fad, make efforts to pose yourself questions regarding how these improvements will affect us – not just for yourself but also for future generations.

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