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# **THE BIBLE AND ASTRONOMY**

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## **The Bible and Astronomy**

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### **1. Introduction**

Many people see a real disharmony between the findings of science and our understanding of the Bible, and conclude that this disharmony prevents the coming together in one overall acceptable understanding of the world we live in without either or both disciplines giving up, or at least substantially modifying, some of their conclusions

The Christian who accepts God as the Author of the Bible and the Creator of Nature, expects that the conclusions drawn from these two disciplines must somehow be able to be reconciled and brought together in an overall view of the world in which we live. However, the results of both biblical interpretation and scientific analysis depend crucially on the worldview, or paradigm, we operate under. I do not believe that the observations of the two disciplines are in contrast when properly interpreted, using appropriate paradigms. Consequently, I believe it must be possible to bridge the gap.

In this discussion I propose to present a scientific and a biblical model of origins and explore how these can be brought into harmony with each other. I also hope to show that the differences between the statements made by these two disciplines are largely a result of differing interpretations based on different paradigms. Because of my background in astronomy, most of the science mentioned will be astronomy/astrophysics/cosmology. I do not intend to deal with questions in geology and biology which, though very important for in overall scenario of creation, are outside my field of expertise.

First, let us remind ourselves of the Genesis account of the creation of the world.

Genesis 1

1-2

First off, nothing. No light, no time, no substance, no matter. Second off, God starts it all up and WHAP! Stuff everywhere! The cosmos in chaos: no shape, no form, no function – just darkness ... total. And floating above it all, God's Holy Spirit, ready for action.

3-5

Day one: Then God's voice booms out, 'Lights!' and, from nowhere, light floods the skies and 'night' is swept off the scene. God gives it the big thumbs up, calls it 'day'.

6-8

Day two: God says, 'I want a dome – call it "sky" – right there between the waters above and the waters below.' And it happens.

9-13

Day three: God says, 'Too much water! We need something to walk on, a huge lump of it – call it "land". Let the "sea" lick its edges.' God smiles, says, 'Now we've got us some definition. But it's too plain! It needs colour! Vegetation! Loads of it. A million shades. Now! And the earth goes wild with trees, bushes, plants, flowers and fungi. 'Now give it a growth permit. 'Seeds appear in every one. 'Yesss!' says God.

14-19

Day four: 'We need a schedule: let's have a "sun" for the day, a "moon" for the night; I want "seasons", "years"; and give us "stars", masses of stars – think of a number; add a trillion; then times it by the number of trees and we're getting there: we're talking huge!'

20-23

Day five: 'OK, animals: amoeba, crustaceans, insects, fish, amphibians, reptiles, birds, mammals ... I want the whole caboodle teeming with *a million* varieties of each – and let's have some fun with the shapes, sizes, colours, textures'" God tells them all, 'You've got a growth permit – use it!' He sits back and smiles, says, 'Result!'

24-31

Day six: Then God says, 'Let's make people – like us, but human, with flesh and blood, skin and bone. Give them the job of caretakers of the vegetation, game wardens of all the animals.' So God makes people, like him, but human. He makes male and female (for the 'how' see later). He smiles at them and gives them their job description: 'Make babies! Be parents, grandparents, great-grandparents – fill the earth with your families and run the planet well. You've got all the plants to eat from, so have all the animals – plenty for all. Enjoy.' God looks at everything he's made, and says, 'Fantastic. I love it!'

2:1-3

Day seven: Job done – the cosmos and the earth complete. God takes a bit of well-earned R&R and just enjoys. He makes an announcement: Let’s keep this day of the week special, a day off – a battery-recharge day: Rest Day.’

This is the story of creation according to “The Street Bible” (1). In what follows I shall frequently use the term ‘Universe’; with a capital U when referring to our Universe, or with a lower case u when referring to universes in general. To define ‘universe’ is not simple. Here I shall deal mostly with our Universe and understand this as ‘the totality of consistently interacting matter’ (2). This definition is about the simplest I have come across. It specifically aims at excluding any alternative or outside universes.

In what follows,

1. I shall assume the existence of God as He is portrayed in the Bible, and that reality, as studied by science, exists and can, largely, be known.
2. I shall accept God as the Creator of all there is, leaving open for discussion *how* He may have gone about His creative acts.
3. I shall accept both science and theology as valid and useful disciplines for arriving at the truth about reality.
4. I shall be mindful of the difficulties of and wide variations in interpreting the data of both science and the Bible.

While man’s curiosity about the when, how, what, why and who of creation may not be fully satisfied in the biblical account, the first verse of the Bible does give us a very short answer to four of these five questions. When we read the Bible as a whole, it becomes apparent that it has much to say about who created the Universe, something to say about what was created and why, little to say about how He created it, and next to nothing about when He created it. In the absence of much information on most of these questions, it is no surprise to find that it did not take man long to start wondering about possible answers. Human observation and reasoning began to be employed long ago in an effort to understand more, especially about the how and when of creation. This human effort is what we call science – natural science in this case. I shall not say much about the why of creation and, thus, try to avoid possible philosophical excursions.

## **2. The Scientific Model**

Early ‘astronomers’ came up with various theories about the structure of the Universe (3). Most of these placed the Earth in the centre of the Universe which, as far as its dynamically interesting objects were concerned, was limited to the Sun and its brighter planets. The quest for more knowledge gained momentum with the invention of the telescope at the beginning of the 17<sup>th</sup> century (4). Applying this new instrument to the study of the heavens, it soon became clear that the models that had the Earth in the centre of the Solar System and, indeed, of the Universe, could no longer be maintained. With the passing years, the Earth was relegated to an increasingly modest position in the immensities of the Universe that opened to our vision.

Towards the end of the 19<sup>th</sup> century, new observational techniques – in the early years photography and spectroscopy foremost among them – began to be applied with great effect to the study of the Universe. In the 1920s, new observational evidence bearing upon the Universe as a whole became available. The recognition that galaxies are large conglomerations of stars outside our own Milky Way Galaxy (5) greatly expanded our ideas about the structure of the Universe.

After this, further developments towards understanding how the Universe originated and functions were rapid. As the study of the Universe (literally) skyrocketed, it seemed that we were able to understand much of what was happening out there by simply applying terrestrial natural science, especially physics, to the phenomena we were observing. Charmed with our own understanding of what seemed to be happening in the Universe today, we began to forget the biblical account of our own and the world’s origin, considering it a myth born out of ignorance and superstition.

It is necessary to understand that the transition from a Bible-based model to a science-based one involves an important paradigm shift. The picture of a cosmos under the ultimate control of an all-powerful God is exchanged for a cosmos where natural forces determine every process. In science, every observed phenomenon is considered to have a natural, observable cause. If the nature of that cause is not immediately apparent, we console ourselves with the hope that further research will bring everything to light. It is the great triumph of modern science that it has indeed been able to formulate answers to many of the most baffling questions the Universe poses. And, where present knowledge is insufficient to suggest a good model, there are always the more theoretically oriented scientists who come up with

theoretical models that hold out a promise of one day being able to be verified.

One of the situations in which present knowledge and the ability to observe phenomena that occurred long ago found it difficult to come up with a reliable model, was precisely on the question of the earliest history of the Universe. Concerning this question, we are both helped and hampered by the vastness of the Universe itself. Hampered, because the enormous cosmic distances prohibit us from investigating distant matter *in situ*. Helped, because the finite speed of light allows us to 'look back' in time. Thus, we see far-away objects in the condition they were in many years ago, when the light reaching us today was first emitted. This capability is subject to the assumption that natural processes throughout the Universe obey the same physical laws as those we know from our terrestrial experiments. This is an essential part of the so-called Cosmological Principle which postulates that, local inhomogeneities apart, the Universe looks the same from every location within it and at whatever time it is observed (6). Obviously, this postulate is essential for our understanding the Universe. We must realise, however, that it cannot be rigorously verified and is, therefore, more a statement of belief than a scientific fact. This is not necessarily a weakness for those who believe that God is consistent in the management of His creation.

How science was finally able to claim a breakthrough in understanding on the question of the origin and further development of the Universe, is one of the most fascinating chapters in the history of modern cosmology. It shows both how ingenious man can be when it comes to tackling difficult problems and how woefully inadequate our knowledge is when the Author of all knowledge is not consulted.

### **2.1. The Big Bang Theory**

The story starts with the observation, in the late 1920s, that almost all galaxies beyond our own Milky Way galaxy show a so-called 'redshift': the light received from those galaxies is redder than it was at the time of emission from its source. The easiest way to understand this is through the Doppler effect: light sources moving away from the observer will be reddened (7). We must not forget that there are other effects that can produce redshifts, but these present their own difficulties. Anyhow, the simplest explanation of the redshifts is that the galaxies are moving away from each other and that the Universe is expanding.

Therefore, in the past the Universe must have been smaller than today. The story of how the Universe grew from very small beginnings to its vastness of today is the theme of the Big Bang theory. To a brief outline of the theory with both its positive and negative aspects, I will now turn.

Assuming that the correct interpretation of the observed redshifts of the galaxies is that the Universe expands, one can go back in time to a point when the Universe was of minimal size. Here, one is helped by what is often called the 'look-back time'. The faintest observable galaxies are some 13.5 billion light years away; i.e. the Universe must be at least this old. However, the beginning of the expansion is not necessarily also the beginning of the Universe itself. Unfortunately, our look-back time only takes us back to the epoch when the Universe was already about 300,000 years old. It is simply impossible to see anything at larger look-back times. Even more powerful telescopes will not solve this problem.

The reason for our inability to look farther back lies in the density of the Universe at the age of 300,000 years. If, as most models of the Universe assume, all its matter and energy originated at moment zero, then its density in the beginning must have been enormous. Even after thousands of years of expansion, a photon could not traverse such a universe but would be bounced off – scattered from – one particle after another. This gives the effect of looking at a thick bathroom window where the light shines through but the shapes are lost. Three hundred thousand years out of a total of fourteen billion is a very small proportion. It compares with only eight minutes in the life of a 50-year old person, but it leaves us far from moment zero.

This is where theoretical physics take over. Extrapolating back from the age of 300,000 years, one can calculate the likely conditions at the start of the expansion and the physical processes that governed what happened in those early years. This exercise is not without problems because in the very early Universe, the conditions of matter and energy were very extreme with pressures and densities far beyond anything that can be simulated in the laboratory (8). This is where all laws of physics break down and one can only do mathematical extrapolations. Who is to say that such extrapolations are still able of describing accurately what happened?

And if that is not enough trouble, within the very first fraction of a second nothing works anymore because at very small distances quantum effects and gravity are of equal strength. This, so-called Planck length corresponds to

the Planck time of  $5 \times 10^{-44}$  seconds. What happened within this short time span after moment zero is hidden from our investigations because we do not have a theory of quantum gravity. Although this is a very small fraction of the first second, it is not quite zero. Here we encounter a fundamental barrier. It is not a matter of more observations with a bigger telescope or of more complicated calculations with a supercomputer. The secret of the origin of the Universe may forever remain beyond our scientific view (9).

There are other problems with the Big Bang theory of the origin and evolution of the Universe. For the Universe to possess the right characteristics for bringing forth and maintaining life, it seems that for a very short time during the first second the Universe must have expanded at a speed many times larger than the speed of light and grew from a less than microscopically small size to something  $10^{29}$  times larger. And, this would have happened in the short time of  $10^{-35}$  seconds. This so-called 'inflation' phase is an interesting theoretical idea that is capable of explaining many details of the Universe we observe today (10). However, although inflation does solve several problems with the Big Bang, it is impossible to test it against reality. There may well be other, completely different, models that have the same explanatory power. For instance, what if – to adopt another paradigm for a moment – the conditions for the formation of galaxies and stars were fine-tuned by God as a part of His plan to populate the Earth and, who knows how many, other planets in the Universe with intelligent life? This may well be another example of the crucial importance of the choice of paradigm we adopt for our interpretative exercise.

After the hectic events of the first few seconds since the beginning of the expansion of the Universe, the simple atoms of hydrogen and helium were formed in the first three minutes. By then the initial, high temperature had dropped so far that no further chemical elements could be synthesised. After 300,000 years the Universe became transparent and matter began to dominate the proceedings. Galaxies formed and in them stars. Here, in my opinion, we find the more reliable chapters of the Big Bang story. This is the era accessible to our observation. This is where it becomes possible to construct models than can be tested by observation. The way stars are formed out of density inhomogeneities in the galactic gas, how they shine through nuclear processes, and produce a whole variety of more complex chemical elements – essential for the creation of life based on biochemistry – is the well-established domain of astrophysics.



So, the Big Bang theory has both positive and negative aspects. Many processes that happened after the Universe was more than 300,000 years old, are now well understood. The best models of what happened earlier seem to explain the Universe as we know it today. However, since they cannot be verified observationally, they remain in the area of speculative model building.

The greatest difficulty with the purely scientific model lies in the fact that science can be done only in so-called closed systems; i.e. systems which are not influenced by anything outside the space and time wherein they operate. How, though, can the assumption that the Universe is a closed system be verified? Does it not seem that there are a number of well-observed phenomena for which the indications of a force acting upon the universe from outside are very strong? Consider such events as floating axe-heads (11), feeding well over 5000 people from five loaves and two fish (12), resurrection from death (13), and a virgin giving birth (14). Can we really hope that science will one day be able to explain exactly how these happened?

The answer to this question is important. Seemingly equally baffling questions were asked a few centuries ago. In many cases it seemed that the only reasonable answer was to ascribe certain phenomena to God's direct intervention. However, in many of these cases, time and further research revealed new aspects of science that helped to explain how or why certain events happened. In such cases, one might conclude that ascribing those events to divine intervention was too simplistic an idea. Science was, after all, able to offer a satisfying explanation and God would be considered redundant in the explanatory process.

For the Christian researcher, an act of God as the explanation of an observed phenomenon should not lead to God being considered redundant when a more natural, scientific explanation is found. Christians do not use God as a magician who is able to answer the questions for which we cannot find a scientific answer. For the Christian, God's existence is a given and scientific events are seen as our description of what God is doing in His creation. God is not in competition with science when it comes to offering an explanation for observed phenomena. In a very real sense, God is the author of those phenomena through His acts in nature as described by the laws of nature. That is, in this view, the laws of nature are our description of how God goes about His business.

On the other hand, a scientist who considers the Universe a closed system without any influence from outside, may postulate that God never had, has or ever will have anything to do with the Universe. In that case, the Universe must have been eternal: there never was a time when there was no universe. This amounts to ascribing to the Universe a characteristic – eternal existence – that in religious circles is a most essential part of the definition of God. In other words, those who prefer an entirely materialistic explanation for the origin and operation of the Universe have thereby elevated it to the status of a god. Such a god is not the personal, loving, merciful God we encounter in Jesus Christ and in the Bible. It robs life of its most vital elements of sense, purpose, and destination. These vital elements are found only in the Bible.

Before we turn to the Bible, however, we need to look at an aspect of the Universe that seems quite capable of supporting a more biblical approach to answering the questions the Universe poses. Interestingly, the evidence in favour of the existence and activity of a god with a personal interest in the living beings in the Universe comes from science itself.

## **2.2. Cosmic Coincidences**

Consider the origin and evolution of human life. Science could describe human beings as some kind of biochemical organism. However, before one can talk about the way life operates, i.e. about biochemistry, it is necessary to explain where the molecules involved in life came from. Before one can discuss the origin of complex organic molecules, one must explain the origin of atoms. Finally, it is necessary to discuss the origin of the chemical elements and the physics that made them possible. This, too, is one of the positive aspects of the Big Bang theory of the origin of the Universe. It starts with particle and nuclear physics, then proceeds via inorganic and organic chemistry to biochemistry and life.

In his book “The Creator and the Cosmos”, Hugh Ross lists thirty-five cases of physical quantities that need to assume values within certain very narrow ranges for life to be possible (15). Here I shall give only a few examples.

1. For life to find a habitat, it is necessary that there be enough energy to maintain life. Planets that harbour life receive their energy from the star they revolve about – the Sun in our case. Stars, as our Sun, are known to form in galaxies. Thus, in the purely scientific view, galaxies, stars and planets must exist for life to be able to be maintained. Furthermore, a planet can only be habitable if its distance from its energy-providing star – its ‘sun’ – falls within certain fairly narrow limits.

2. Organic molecules are constructed out of a collection of more than forty different chemical elements. Their bonding depends on two physical factors: the strength of the force of electromagnetism and the ratio of the masses of the electron and the proton. For instance, if the electromagnetic force is too strong, atoms will not share their electrons with other atoms, and molecules cannot form. If, on the other hand, the electromagnetic force were too weak, atoms would not be able to hang on to their electrons and would, again, have none to share for molecule formation.
3. Organic molecules need to be available in sufficient quantities and varieties. This requires a range of different atoms to form first. For this to happen, the strong and weak nuclear forces of physics, the force of gravity, and the nuclear ground-state energy must all be precisely balanced. Especially important are sufficient quantities of carbon and oxygen which are essential for life. E.g., in this case the strong nuclear force needs to have a value within 0.5% of its present-day value.
4. Atoms are made from nucleons – protons and neutrons – whose quantities must also fall within narrow limits. Since neutrons are slightly more massive than protons, the Big Bang forms larger numbers of the latter. If the neutron were just 0.1% more massive, not enough of them would form to produce the necessary atoms. If the neutron were 0.1% less massive, so many would be formed that all stars in the Universe would have collapsed into neutron stars and black holes long ago.
5. Unless the number of electrons is equal to the number of protons to an accuracy of one part in  $10^{37}$ , electromagnetic forces would have overcome gravitational forces to the extent that galaxies, stars and planets could never have formed.
6. For galaxies and stars to form, the Universe must not expand too rapidly – for that would tear stars apart before they are formed – nor too slowly – for that would cause the collapse of the Universe long before stars have had time to produce the more massive chemical elements. Therefore, the cosmic expansion needs to be fine-tuned to the tune of one in  $10^{60}$ !

The number and the precision of the fine-tuning of the various physical and cosmic parameters are so incredible that one must consider the possibility that our Universe does not harbour life – at least on Earth – by pure coincidence. It seems as if there is a purpose to this Universe: it was made with the express purpose of being able to support human life. This, then, is good evidence for the existence, not only of design, but also of a Designer. This is the argument from design for the existence and activity of God. He reveals Himself not only in His love letter to humanity, the Bible, but also in the work of His hands, nature (16).

### 3. The Biblical Model

The Bible is a book of revelation. Through His Holy Spirit God inspired people chosen by Him to write parts of this book. The Bible is open to investigation by whoever wants to learn from it. The nature of its origin, however, requires that its students need to allow the same Holy Spirit to guide them in forming their conclusions. It is mostly about God, especially how He copes with the problem of sin and how to restore fallen mankind to its former glory.

In the Bible, the basic, inspired account of the origin of the Universe is found in its first chapter. In fact, the very first verse of the Bible answers four of the five basic questions of when, who, how, what, and why. 'When?' is answered with 'In the beginning'. 'Who?' is answered with 'God'. 'How?' is answered by 'created'. 'What?' is answered by 'the heavens and the earth'. The 'why?' question is answered in the rest of the book.

When one tries to build a biblical model of the origin of the Universe, some attention must be given to the possible scientific implications of such a model. As far as matters astronomical are concerned, one encounters the following questions that require an answer:

1. Does Gen.1:1, 2 constitute an account of something that was created at some time other than during the six\* days, or is it an introductory summary to the rest of the chapter?
2. Whatever the answer to the question under 1., **what** was created during the six days?
3. What is the time frame during which creation took place, and when was "In the beginning"?
4. What was the nature of the light on Day 1 before the Sun was created, apparently on Day 4?

In what follows, I shall try to deal with these questions one by one as far as this is possible. After that, I shall give an overall synthesis.

#### 1. Genesis 1: 1, 2.

Richard Davidson has argued on literal, linguistic, stylistic, theological, and other grounds that verses 1 and 2 of Genesis 1 cannot be considered an introductory summary to the rest of the chapter, nor the account of an initial creation that was destroyed as a result of sin (17). He defends the view that the first two verses describe the initial creation, by God, of matter before Day 1 of creation week, and that the state of that earlier creation was one of

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\* Here we shall not consider the creation of special time on the seventh day.

*tohu* and *bohu*. This is the traditional view of the majority of Christian and Jewish interpreters, also called the ‘initial unformed-unfilled’ view. I accept this view as the one that has greatest promise of understanding the Bible’s account of the origin of the Universe.

In this view, the first two verses of Genesis 1 are to be separated from the rest of the chapter because they describe what happened at an earlier, ‘in-the-beginning’, epoch or era. I consider this an essential element in our understanding of the origin of all things, and an indispensable ingredient for the harmonisation between the scientific and biblical views.

The account of the origin of the world as we know it on our planet is then given in Genesis 1:3-31, the account of the Creation Week.

## 2. What was created during the Creation Week?

According to the traditional view, God always existed – He is from eternity – and His creative work began at a determined moment in time. This ‘in the beginning’ is some – maybe considerable – time before the start of Creation Week. There is, therefore, time for the creation of matter in whatever form before Day 1 of verse 3. In fact, there may be ample time for the creation of a variety of things.

Can we determine what was created before Day 1 and what after?

In his book *The Age of the Universe: What are the Biblical limits?* (18), Gordon Gray presents an interesting and novel way of looking at the creation account in Genesis 1. He suggests what he calls the ‘subtraction method’ as a valuable tool in determining what was created during the six days of creation. By starting at the end of Genesis Chapter 1 and going back in time, eliminating things as they were created, one arrives at what, if anything, was already in existence at the beginning of Day 1.

This reading of Genesis 1 in reverse goes as follows:

Starting on the sixth day at sunset, we find ourselves on a planet with land(s) and sea(s), vegetation, animals, man. Going back in time, and eliminating created things from the last created to those created earlier, we first eliminate Eve, then Adam, followed by the creatures that lived on land. Going back through the fifth day, we eliminate the water and air creatures, fish and birds. Then, at some time during the fourth day, the separation between day and night (vs. 14) brought about by the Sun, Moon and stars, is eliminated – but note that there is still some (other) mechanism for making that separation because day and night were initially separated on Day 1. On the third day, all vegetation is removed, and the separation between land and sea is

eliminated by submerging the land under the water. At the beginning of the third day, the earth is void of all life, human, animal and plant, and is covered with water. Then, going back through Day 2, the expanse that separates the water under it from the water above it is removed. One assumes that the waters from above fall down and that the land is now deeply submerged. Finally on Day 1 the separation between day and night is no longer there when the light goes out.

What do we find on the eve of the first day? What has not yet been eliminated from that beautiful world we started from at the end of the sixth day? At no time during our backward journey did we read about the creation of planet Earth, or of water. Planet Earth is still there, but it is completely unrecognisable. There is no longer any life. It is a dark place covered under a global sea. This is exactly the description we find in verse 2: “Now the earth was formless and empty, darkness was over the surface of the deep, ....” The same thought is expressed by God himself when He talks to Job about His creation. In Job 38: 8-9 we find a description of the Earth that seems to suggest there was only water, and that the water was covered by heavy clouds that wrapped it in deep darkness.

It seems as if this unformed and unfilled Earth has been created before Day 1, and that the very short account of that creation and the condition in which it was then left, are given in verses 1 and 2.

3. What was the time frame of creation, and when was ‘in the beginning’? As far as the creative work of the six days is concerned, I believe that that was accomplished in six literal 24-hour days. Others have provided ample evidence that the way the Hebrew language numbers the days in Genesis 1, can only be understood as denoting periods of 24 hours (19). What about the time frame preceding Creation Week, the time between ‘in the beginning’ and Day 1? Apart from the interpretation that verses 1 and 2 refer to something that happened before Day 1, there is no indication how far back one has to go to arrive at ‘the beginning’. However, this is an area where science has much to say.

Looking back in time to the faintest galaxies at the largest distances from Earth, we are looking back in time over some 13.5 billion years. The Universe must be at least that old. In scientific terms, 13.5 billion years BP would be the latest possible epoch of ‘in the beginning’. Can we also say something about the earliest possible date for the ‘beginning’? From there

back to the beginning of the cosmic expansion is a matter of only 300,000 years. To what extent the beginning of the expansion of the Universe coincides with ‘the beginning’ of Genesis 1, is difficult to say. According to science, it is a matter of another fraction of a second. There may be no basis for answering this question until the Creator will have told us when and how He did it.

#### 4. What was the nature of the light on Day 1?

This question concerns the creation of the Sun, Moon and stars on Day 4. There are several possibilities for resolving the apparent problem.

- a. The Sun, Moon and stars were created on Day 4 as the text seems to imply. During the first three days the light was provided by God whose presence means light because He is ‘the light of the world’ (20).
- b. The Sun, Moon and stars were created together with the other objects in the Universe, ‘in the beginning’. The darkness mentioned in verse 2 was caused by a thick cloud cover as suggested in Job 38:9. Then, on Day 1, the dark clouds were lifted sufficiently to allow the difference between night and day to be perceived – much like a completely overcast sky today – while the Sun, Moon and stars themselves remained invisible. Then, on Day 4, the clouds were lifted further and these luminaries could be seen by an observer on the surface of the Earth.

Note the following interesting details:

- i) The emphasis on Day 4 is on the function of separating the day from the night. Whereas on the first three days this function was fulfilled either by God (a. above) or by as yet invisible luminaries (b.), now this function is clearly given to the Sun, Moon and stars. ‘Separation’ is a function we find on every one of the first four days. Day 1: light from dark, day from night; Day 2: water above from water below; Day 3: land from sea; Day 4: day from night by visible functionaries.
- ii) The Hebrew construction in verse 16, “... the lesser light to govern the night. He also made the stars”, can also be translated, “... the lesser light to govern the night together with the stars”. This reading would eliminate the argument for believing that the stars were made on the fourth day.

There is one further observation I want to make. Genesis 1 uses two different Hebrew words for the manufacture of things and creatures. The verb *bara* is used when God creates without recourse to pre-existing matter, something only He can do. Therefore, in most Bible versions, *bara* is translated 'created'. The verb *asah* is used on those other occasions when God did use pre-existing material, sometimes in a way man can also make things. Therefore, *asah* is most properly translated as 'made'.

There are only five instances of the use of *bara*. In vs.1 it signals God's initial creative act(s) when He created all matter and energy out of nothing. In that creative work God was not dependent on pre-existing matter and energy. On the first four days, most of the work was in acts of separation: day from night, water above from water below, and land from sea. The land produced the vegetation which was 'only' a different form of presenting the atoms and molecules already present. The next time *bara* is used is on Day 5. After forming the fish and the birds, God adds a new element to these creatures, something that was not already present: life (21). The final use of *bara* is found in verses 26 and 27. In the first instance, in vs.26, God says, "Let us make (*asah*) man in our image ....." as if this new creature is going to have the same life as the animals. But, then, in vs.27, when He is actually creating man, the word *bara* is used three times. Now God adds something to the life of man that the animals do not possess: His image. And He uses the word *bara* three times to indicate that man is given the image of each of the three persons of the Godhead, Father, Son and Holy Spirit.

With the scientific and biblical models now in place, we ask, Would it be possible to reconcile the results of scientific investigation with a proper understanding of the Word of God? For the Christian, God is the Creator. He is both the Author of the Bible and the Creator of the natural world. These two aspects of reality are often called 'God's two books'. Having two books authored by a God who does not lie or contradict Himself must necessarily lead to the conviction that there must be common elements in the two accounts and that some – one hopes, complete – harmony must be possible.

This paper is not a claim that such harmony has finally been found. Rather, it offers some suggestions that may be useful building blocks in the construction of a more definitive model.



Here we must remember that, though the books of Nature and the Bible were both authored by God, they come in different contexts and for different purposes. The book of Nature is open for every person to see, to observe, to meditate upon and to learn from. It studies nature by applying the laws of the natural sciences to our observations and builds models of nature which are tested and, often, re-tested to establish the reliability of the model in all circumstances. In modern science, the study of nature excludes the use of hypotheses that contain an element of belief in the existence of an unverifiable force. More precisely, it excludes from the investigation any influence that is not attributable to any law of natural science. Natural science does not speak about God. It has much to say about when and how the Universe originated, but nothing about who made it or why it came into being.

To be able to integrate the scientific and biblical pictures, there must be a common element in these two. In my opinion, the scientific model can only give correct results when God is given His proper place in the Universe. This brings science outside its customary boundaries. To remain inside the usual scientific boundaries means accepting that science should not deal with elements of faith or belief. Science thus practised denies the reality of God as the most important force in the Universe. Such science the Bible calls 'falsely called knowledge' (22). The alternative, surrendering the clear meaning of the Genesis account which mentions God as the Creator, is unacceptable to Christians. Therefore, in our synthesis, I shall include God as an active agent in the course of affairs.

#### **4. Synthesis**

We are now in a position to gather all the foregoing into an overall description of how the creation process unfolded.

At some unspecified time 'in the beginning', possibly some 14 billion years BP, God created all matter and energy the Universe contains today. In doing so, He was not indebted to matter already present, and His word was sufficient to speak everything into existence (23). Science suggests this happened in an instant and in a very small space. The initial density and temperature of matter was enormously high. As a result, this primordial matter expanded and cooled rapidly. What happened between time zero 'in the beginning' and Day 1 on Creation Week could be as proposed by an appropriate version of the Big Bang theory.

God worked with the primordial matter to form, first, elementary particles and, then, the simple atoms of mainly hydrogen and helium in the first three minutes. Of course, God could have created all the chemical elements all together in one instant. However, there have been other occasions when God first created the materials He used later to make something new. Plants, composed of the elements found in the ground, came forth out of that ground. The land produced living creatures. Man was formed from the pre-existing dust. In all these cases, God used materials He had created before and gave them other forms, sometimes adding other, vital, ingredients: life, His image.

The early Universe continued to expand and cool until it was about 300,000 years old. At that time it became transparent and the radiation-dominated era was replaced by the matter-dominated era in which we live today. After the first 300,000 years, galaxies began to form and, in those galaxies, stars. In the Universe, it seems God had a special role for the stars to play. They were the cooking pots where He prepared most of the chemical elements He later used in the formation of the Earth. Terrestrial matter was then used to produce other things. The early stars consisted of hydrogen and helium but were able to shine by using these simple atoms as nuclear fuel. The result of the stellar nuclear burning was a whole array of more complex chemical elements. Among these were all the elements necessary for the creation and maintenance of life. Together with the stars, planets formed.

Some 5 billion years ago, this led to the formation of the Sun and its planets. Planet Earth was composed mainly of the more complex chemical elements important for life. However, the Earth was unformed and unfilled and enveloped in water and dark clouds.

Then, some 6,000 years or somewhat longer ago, God visited the Earth to accomplish His plan for creating human beings whom He destined to take the place of the angels who had sided with Lucifer/Satan in his rebellion against God and had been removed from heaven (24). God took six literal days to form and fill the Earth so that it would be a good habitat for life. The firmament, vegetation, fish, birds and land animals were brought forth. Some of these were brought forth from terrestrial matter, others were treated in a more specialised manner when they were imbued with special characteristics. The difference between the Hebrew words 'bara' and 'asah' became clear. Finally, God created man in His image, after His likeness.

Man was given the image of the whole of the Godhead, Father, Son and Holy Spirit.

Of course, the above scenario is only one possibility. It is neither definitive nor complete. There are too many unanswered questions simply because we were not present to witness what happened. Furthermore, even when science allows us to understand something of what went on, we cannot be sure that that is the only possible alternative to explain what we see today. In all this, the overriding importance of a correct paradigm is clear. The conclusions scientists draw from their observations of nature change radically when a different paradigm is used. God makes a difference to the Universe! This is no surprise, because He is not only the Creator, but also the Sustainer (25). Not only does God make a difference to the material Universe, He asks for the privilege to make a difference to our lives as well. Comparing the eternal future with God with the limited lifetime of the Universe, it cannot be too difficult to decide to say 'Yes!'

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- (3) Michael Zeilik, *Astronomy, the Evolving Universe*, 7<sup>th</sup> Ed., John Wiley & Sons, Inc., 1994, pp. 28-35.
- (4) Zeilik, p. 60.
- (5) Zeilik, pp. 433-435.
- (6) See Zeilik, p. 482 for an alternative wording.
- (7) Zeilik, pp. 190, 440-442.
- (8) Densities of more than  $10^{75}$  g/cm<sup>3</sup> and temperatures of  $10^{27}$  K; see also Zeilik (6).
- (9) See also Robert Jastrow, *God and the Astronomers*, W.W.Norton & Co., 1978, pp. 115, 116.
- (10) Andrei Linde, *The Universe: Inflation Out Of Chaos*, in: Physical Cosmology and Philosophy, John Leslie (Ed.), Macmillan Publ. Co., 1990, pp. 244-247; Matts Roos, *Introduction to Cosmology*, John Wesley & Sons, 1994, p.166.
- (11) 2 Kings 6:1-7.
- (12) John 6:1-13.
- (13) John 11:38-44.
- (14) Luke 1:26-38.
- (15) Hugh Ross, *The Creator and the Cosmos*, Navpress, 2001, pp. 154-157.
- (16) Psalm 19:1. See also Isaiah 40:26 and note that the text says 'who', not 'how' – a simple but very significant anagram!
- (17) Richard M. Davidson, *In the Beginning: How to Interpret Genesis 1*, in: Christianity and Science, Amicus, 2002, pp. 73ff.
- (18) Gorman Gray, *The Age of the Universe: What are the Biblical Limits?*, Morning Star Publications, 2002, pp. 28-30.
- (19) Gerhard F. Hasel, *The "Days" of Creation in Genesis 1: Literal "Days" or Figurative "Periods/Epochs" of Time?*, in: Creation Catastrophe & Calvary, J.T. Baldwin (Ed.), 2000, pp. 40ff.
- (20) Psalm 104:2; 1 Tim. 6:16; John 8:12.
- (21) I am indebted to Dr. Carlos Steger for the initial suggestion about the uses of *bara* and *asah* in Genesis 1.
- (22) 1 Tim. 6:20.
- (23) Psalm 33: 6, 9. Ellen G. White, *Testimonies for the Church*, **8**, 258, Pacific Press Publ. Assn., 1948, pp. 258/9 reads, "In the formation of

Our world, God was not indebted to pre-existing matter.... The Heavens and all the host of them, the earth and all things therein, are not only the work of His hand: they came into existence by the breath of His mouth.”

- (24) EGW comments on Gen.2: 16, 17 in SDABC, 1, 1082. See also Luke 20:34-36; Matthew 22:30; Ephesians 3:15, and Hebrews 2:11.
- (25) Hebrews 1: 2, 3

## **Paradigms**

Since Genesis 1 has so little to say about the when and how – two questions science has much to say about – it is easy to ignore altogether what the Bible says about these two questions and rely (almost) wholly upon the results of science for answers to these questions. We must bear in mind, though, that the Bible is not entirely silent on the when and the how, and that its pronouncements on these two have to be taken into account in the final picture.

Thus, we detect an interaction between the two disciplines which obliges us to decide which to take more serious when there seems to be no complete harmony between the two. Of course, we can only compare those statements from both disciplines that are free from bias and have been arrived at by proper rules of research; i.e. they must both be ‘reliable’. It is not always easy to evaluate the reliability of biblical and scientific statements and conclusions. There are cases in which statements from the two disciplines seem contradictory and it cannot be proved that there is a reliability problem with the one or the other. In such cases I will give the greater weight to the biblical statement because I perceive God as having a greater influence in the interpretation of Scripture than He is usually given in the interpretation of science. In other words, I believe that the word of inspiration should have preference over the word of nature. Furthermore, when both disciplines return reliable statements, the comparison is not so much concerned with how these are arrived at, but primarily how sound the underlying statements, the worldview, the paradigms, are.

*While, in principle, a wide spectrum of paradigms for the interpretation of natural phenomena and/or biblical statements are available, my discussion will be limited mostly to two possible positions. The first of these is the position taken by Ontological Naturalism: matter, energy, motion and the natural laws by which they interact are all there is, has ever been or ever will be. There is no force outside of nature that can influence it in any way ( ). A number of scientists use this paradigm as the reference point for their scientific endeavour. Whether this paradigm provides an accurate description of reality is not easily verified: it is mostly a belief or dogma, and atheistic in nature.*

*The other position is that of Methodological Naturalism: Matter, energy, motion and the laws of nature are not all there is. There is a force outside nature that can influence it ( ). There are limits to naturalistic presuppositions; events like the feeding of the 5000, resurrection, and many*

*others were real events. Miracles are either an alternative way in which God operates, or belong to His normal laws of operation as He only knows them. This paradigm cannot be verified either, i.e. not in the rigorous scientific sense. But it does allow for divine influence and, thus, ascribes some authority to the biblical account.*