

THE HIGGS BOSON – "THE GOD PARTICLE" – AND GOD

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Abstract

Scientists from the Large Hadron Collider (LHC) in Switzerland confirmed and publically announced the probable discovery of the "Higgs boson" particle, also known as "The God Particle" in July 2012, and confirmed the discovery in March 2013 based on all data from 2012. This lecture first presents a brief review of the 16 particles of the Standard Model of elementary particles, which form the building blocks of all material particles except the Higgs itself. We explain why the Higgs boson was believed to exist for the last 48 years, why the LHC was built, and why 1.000 physicists were part of the Higgs search.

But, how did the Higgs get the name "The God Particle", and why is it treated so mystically in the media? Is there some spiritual reality involved? Does the Higgs play a godlike role in the universe in place of an actual deity? Why is very abstract mathematics trusted so fully in expecting the Higgs? How can we clarify the difference between descriptive physical law and effective cause? All of these questions are discussed. Finally, we examine what spiritual implications the Higgs may have, and how it is related to traditional religious beliefs, like those of Judaism or Christianity.

Key words: Higgs boson, God particle, particle physics standard model, supersymmetry, spontaneously broken symmetry, philosophy of science

1. Brief Review of the Standard Model of Particle Physics

Since Newton's day scientists have understood that a very weak force, that of gravitational attraction, acts between particles of matter. In 1905 J. J. Thompson discovered the electron, which experiences much stronger electromagnetic forces from other charged particles. As the century passed, physicists identified a total of twelve elementary particles, each with an antiparticle, out of which all other particles are built. They also identified the electromagnetic force produced by an

$u - 0.0025$, $d - 0.0049$, $s - 0.11$, $c - 1.4$, $b - 4.5$, $t - 182$. The largest mass top quark was found last, in 1999, at the Tevatron, the only accelerator then running with high enough collision energy. This mass is about that of the quite heavy Tungsten atom! Also shown in Fig. 1 are the vector mesons whose exchanges between particles give rise to the three basic forces.

A great deal of symmetry had also been found, including the symmetry groups $SU(2)$ and $SU(3)$. What was known, and became the Standard Model, was the set of particles that can be built from nuclear, electromagnetic, and weak forces of interaction between particles. A set of simple rules govern how these force interactions must work, like conservation of charge and baryon number, and the fact that the g only exchanges between quarks, the γ only exchanges between charged particles, and the (Z^0, W^+, W^-) mesons only exchange between the six leptons and their anti-particles. Because the other three forces are produced by the exchange of a meson, physicists expect some day to observe a graviton, which would need to be a spin-2 meson. It has not yet been observed, and has not yet even been fitted into the Standard Model theoretically. Therefore, the Standard Model obeys special relativistic, but not general relativistic, invariance.

Since about 1980 the "Standard Model" of elementary particles has dominated theoretical particle physics. But key puzzles and questions arose already during the first few years after its general acceptance.

2. Grand Unified Theory and Its Problems

The most important puzzle was why the three forces had very different strengths for low energy events, but seemed to approach a single common strength as collision energies became very large. Also, in the high-energy limit, the particle masses appeared all to tend to zero. To include this behavior, Grand Unified

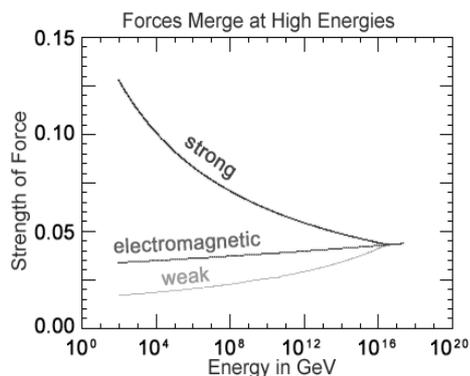


Fig. 2: Force strength vs. collision.

Theory (GUT) models were developed as an extension of the Standard Model. A GUT is formulated so that at high energy, the three gauge interactions of the Standard Model which define the electromagnetic, weak, and strong interactions, are merged into one single interaction characterized by one larger gauge symmetry with one unified coupling constant as in Fig. 2. In contrast, the experimentally supported Standard Model of particle physics is based on three independent interactions, symmetries and coupling constants.

When GUTs were used to calculate processes for experimental measurement, the mathematics gave infinity for the answer for some properties. Also, a mechanism was needed to break the symmetry for low energy processes

and generate the measured values of rest masses for all 16 particles and their antiparticles at low energy.

3. Symmetry Breaking and Goldstone Bosons

Other fields of physics, such as ferromagnetism, offer the same puzzle. The equations have parity symmetry, but a magnet has a magnetic direction, breaking the symmetry. Certain particle theories, like the simpler Yang-Mills theory, showed the same property. In both cases, when they assumed an extra meson of integral spin, thus a boson, the infinite answers became finite, and the solutions could break the symmetry. The boson introduced was called a Goldstone boson, because Goldstone first suggested this symmetry breaking mechanism.

On Wikipedia a concise explanation of the introduction of the Higgs boson describes it as follows:

In the Standard Model, the Higgs particle is a boson with no spin, electric charge, or color charge. It is also very unstable, decaying into other particles almost immediately. It is a quantum excitation of one component of the four component Higgs field – a scalar field with two neutral and two electrically charged components that forms a complex doublet of the weak isospin SU(2) symmetry. The field has a "Mexican hat" shaped potential with nonzero strength everywhere (including otherwise empty space) which in its vacuum state breaks the weak isospin symmetry of the electroweak interaction. When this happens, three components of the Higgs field are "absorbed" by the SU(2) and U(1) gauge bosons (the "Higgs mechanism") to become the longitudinal components of the now-massive W and Z bosons of the weak force. The remaining electrically neutral component separately couples to other particles known as fermions (via Yukawa couplings), causing these to acquire mass as well. [1]

In other words, because of the formula for the resulting potentials, three of the components of the Higgs field (giving rise to the weak force mesons) have zero expectation values in the vacuum everywhere, while the fourth, the actual Higgs boson, has a nonzero vacuum expectation value everywhere. Theoretically the mathematical structure is considered aesthetically beautiful and elegant, as foreign as such words may seem to mathematics.

This Goldstone boson for the Standard Model was proposed in 1964 by Peter Higgs among five other physicists. Its necessary properties (spin 0, electric charge 0, and mass in the range 115 - 180 GeV/c²) and its interaction equation were worked out in the next few years. So the search began 48 years ago to find the Higgs boson with these properties.



Fig. 3: View of the Tevatron main ring.

Physicists realized that a higher energy accelerator would have to be built. The existing U.S. Tevatron (Fig. 3) could observe the Higgs in its expected high mass range in proton-antiproton collisions, but it would take too long to see enough events. A few Higgs bosons were probably seen before the shutdown of the Tevatron on 30.9.11, but not enough to provide statistical proof.

4. The Large Hadron Collider (LHC), Geneva, Switzerland

The second highest energy accelerator to the Tevatron was a European machine called CERN near Geneva, Switzerland. European nations and the USA who cooperated to build and operate the CERN machine joined to build a higher energy machine that could observe the Higgs among other phenomena. So the construction of the Large Hadron Collider (LHC) began in about 1998. Figure 4 shows the multistage acceleration of protons at the LHC to a speed of 0.999999 times the speed of light. A public explanation appeared in *Discover Magazine* four years ago:

In fact, the goal of the LHC is at once simple and grandiose: It was created to discover new particles. One of the most sought of these is **the Higgs boson**, also known as the God particle because, according to current theory, it **endowed all other particles with mass**. [2]

Many physicists were troubled by the "God particle" synonym for the Higgs, and the very active nature attributed to it by the powerful word "endowed".

The LHC took 14 years and 10 billion US\$ to build. The proton-proton collision experiments are VERY DIFFICULT at the LHC! At energies above 1 TeV, when two protons collide, many particles are produced, often in "jets".

Astoundingly complex detectors have to look at billions of collisions per second and find the key ones that occur maybe once per day. The detection apparatus for one of the Higgs experiments is shown in Fig. 5 with a worker standing in the foreground for scale. Over 1,000 physicists participated in the CMS and ATLAS Higgs searches combined. The LHC was designed to produce a higher rate of higher energy collisions to increase the likelihood of observing the Higgs.

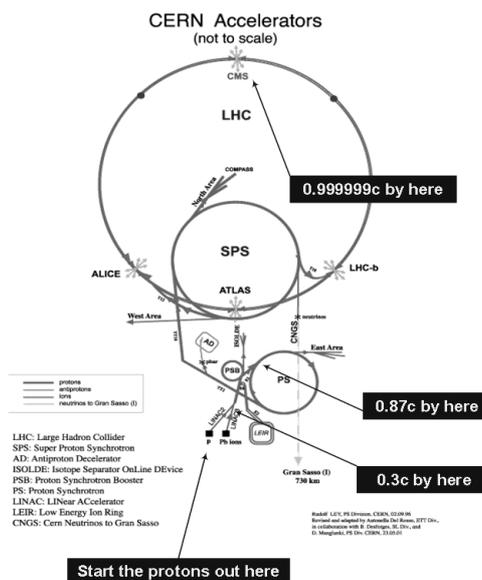


Fig. 4: Schematic of the LHC multi-stage accelerator.

5. Success at the LHC!

Midway in its first year of operation, July 2012, they announced probable discovery of a meson at $125 \text{ GeV}/c^2$, 48 years after Higgs suggested it. It has 0 spin and electric charge and a mass of $125 \text{ GeV}/c^2$, five standard deviations above background. This level of significance is considered scientific proof that a particle that is probably the Higgs has been found! The reports would have been definite if the branching ratios (the relative frequencies of the different ways a Higgs can decay) were what was expected. The rest of the 2012 data has now been analyzed and LHC physicists confirmed in March 2013 that the meson is the Higgs.

6. The Higgs and Culture

Next we discuss the cultural impact of the Higgs boson in light of the actual scientific description summarized above. Called "The God particle", it has gained a strong cultural mystique for many, and an apparent spiritual role that may compete with traditional religion. How did this happen?

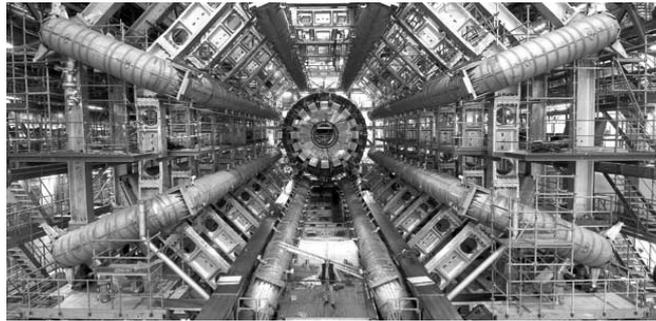


Fig. 5: A worker stands in front of one of the LHC's enormous particle detectors.

In 1993 Dr. Leon Lederman (Nobel Laureate for finding the muon neutrino) wrote the book *"The God Particle: If the Universe is the Answer, What is the Question?"* [3] In the first pages of his book, Lederman explains how the name was chosen from his viewpoint as an experimental particle physicist. He says because the Higgs was so hard to detect, he wanted to title the book "That God D*** Particle". In English this mild obscenity is often used to express frustration. His publisher rejected the title as bad for marketing. They suggested just "The God Particle". Lederman agreed, probably to get on to more important matters and because he saw it could increase sales. It did not arise from spiritual feelings he had for the Higgs or its role in explaining mass. The media have taken this name for the particle and emphasized its role as mystical and spiritual.

7. Media Transformation of Higgs Discovery

In 2011 an article appeared in the British Daily Mail titled *"'God' particle found: Atom smasher reveals Higgs boson, the key to the universe."* [4]

It begins,

The 'God particle', hailed as the holy grail of physics, may have been glimpsed for the first time.

It says further,

The Higgs boson is regarded – by those who know about such things – as the key to understanding the universe. Its job is, apparently, to give the particles that make up atoms their mass. Without this mass, these particles would zip through the cosmos at the speed of light, unable to bind together to form the atoms that make up everything in the universe, from planets to people.

In this quote, words like "key to the universe", "holy grail", "give ... particles ... their mass", and the last sentence elevate the Higgs mystically. The description suggests an impersonal God substitute that carries spiritual appeal.

After this article in *The Mirror*, the first blog entry is more sober-minded, but thoroughly postmodern [5]:

The scientists involved in this study hate the term 'God particle' and insist that there's no religious meaning in the Higgs. The media just calls it that. You can believe that God created the particle, or that He is the particle or that there never was any god involved in this at all. If you do believe in God, why not just come to terms with the fact that He is beyond human comprehension? There's no point in arguing about the 'definition' of God or whether he is a particle or not. We are all entitled to our own beliefs.

Karachi is correct in saying that scientists hate the "God particle" terminology, as reflected in writing by a number of the 1000 physicists who did the LHC experiments. This author has found the same point often made in articles and letters to the editor published in *Physics Today*, the monthly trade journal for US physicists. Karachi is also saying, however, that any spiritual meaning we might attach to a particle or anything else is a matter of personal opinion, but not a truth claim about the real world. In fact statements about the mystical or spiritual sides of human existence cannot be dismissed so easily. Some of them may be true, but this will not be decided by scientific study.

On the lighter side of the media, in a popular U.S. comic strip (Fig. 6), Dilbert finds the Higgs:



Fig. 6: Dilbert comic strip from 21.2.12

One good blog response by James F. McGrath on <www.patheos.com> [6] reads,

Today's Dilbert is subtle. It serves as a nice illustration of the confusion created when physicists talk about the 'God particle' – they are not using God in the sense of a personal deity liable to add hassles to one's life by issuing awkward commandments...

The convenient thing about the Higgs as a God substitute is illustrated in this Dilbert strip. If the Higgs should try to make an uncomfortable claim on a human, the human could just "switch off" the source of the Higgs creation. It is a god safely under human control! It is not a God who is Creator and rightful Owner of the whole universe, including us!

8. Questions Raised by the Cultural Response

- Why are human logic, very abstract mathematics, and observations such an incredible key to unlock the laws governing cause and effect in physics?
- Are the Standard Models a mathematical description of cause and effect in particle interactions, or are these laws the causal agents themselves? (i.e. "The Higgs endows the other particles with mass.")
- Is scientific truth the only valid truth about reality, as often assumed by the culture and its media, or are there other sources of valid truth about reality?

Let us consider these questions one at a time.

- **Why is Science Possible?**

Why can we describe Nature rationally using logic, mathematics, and experimental observation? The answer given by *metaphysical naturalism* is that it's just the way things are. Mathematics and logic work. To learn to think this way was needed for survival and evolved by blind chance and the accidents of environmental selection. This answer really leaves unexplained the unbelievable match between human mind and nature.

For unbiased evidence of the importance of this question consider a famous article by agnostic [7] Dr. E. Wigner, Nobel laureate in mathematical physics, titled "*The Unreasonable Effectiveness of Mathematics in the Natural Sciences.*" [8] On p. 1 Wigner argues:

The first point is that the enormous usefulness of mathematics in the natural sciences is something bordering on the mysterious and that there is no rational explanation for it.

Although he generally accepts Darwin's theory of evolution, on p. 2 he pointedly rejects an evolutionary explanation:

The great mathematician fully, almost ruthlessly, exploits the domain of permissible reasoning and skirts the impermissible. That his recklessness does not lead him into a morass of contradictions is a **miracle** in itself: certainly it is hard to believe that our reasoning power was brought, by Darwin's process of natural selection, to the perfection which it seems to possess.

In the article Wigner uses the word "miracle" twelve times and asks us to "be thankful" or "expresses gratitude" four times. Wigner's materialism has no causal agent to "do the miracle" or "receive the gratitude."

Other Noble laureate scientists comment on the same puzzle:

Richard Feynman:

The fact that there are rules at all to be checked is a kind of **miracle**; that it is possible to find a rule, like the inverse square law of gravitation, is some sort of **miracle**. It is not understood at all, but it leads to the possibility of prediction – that means it tells you what you would expect to happen in an experiment you have not yet done. [9]

Albert Einstein:

... everyone who is seriously involved in the pursuit of science becomes convinced that a spirit is manifest in the laws of the Universe – a spirit vastly superior to that of man, and one in the face of which we with our modest powers must feel humble. [10]

Alan Sandage:

Science cannot answer the deepest questions. As soon as you ask why is there something instead of nothing, you have gone beyond science. I find it quite improbable that such order came out of chaos. There has to be some organizing principle. God to me is a mystery, but is the explanation for the miracle of existence, why there is something instead of nothing. (Crawford Prize ~ Nobel Prize for astronomers.) [11]

The world views of Christianity and Judaism have a Personal causal agent who is intelligent, eternal, powerful, and shared the rationality He used in creation with the human mind.

In the beginning, God created the heavens and the earth. The earth was without form and void, and darkness was over the face of the deep. And the Spirit of God was hovering over the face of the waters. And God said, "Let there be light", and there was light. (Genesis 1:1-3, ESV) [12]
So God created man in his own image, in the image of God he created him; male and female he created them. (Genesis 1:27, ESV)

This simple concept gives a completely rational and understandable account of why and how science is possible, whereas materialism has no believable answer. The logic, mathematics, and observation powers that the Creator used were shared with humans to allow them to build a successful but limited understanding of the workings of the Creation.

Is a Personal Creator possible as a fact about reality? Is God really there? Is there a grand design? These questions address the truth about reality, but science itself has no ability, due to its assumptions and methods, to confirm or deny the reality of such a Creator.

- **Are Mathematical Models of Nature Causal Agents?**

Philosophers have long discussed the chain or web of cause and effect found in the natural world that progresses toward the future. Prediction of future effects from present causes is a major goal of science. One school of thought holds that looking backwards in time the web of cause and effect is finite, proceeding from an original cause that itself had no cause. Some versions of "Big Bang" cosmology represent this position. Another main school of thought holds that the web of cause and effect extends infinitely backwards in time, a view consistent with other current theories of "Big Bang" cosmology. In the first case there is an original uncaused cause; in the second there is no original uncaused cause, but infinitely many previous causes.

The famous cosmologist Stephen Hawking thinks the uncaused cause of all else is a set of mathematical laws that govern the material universe, which is all that exists. This expresses the world view of materialism's answer. Hawking [13] says: "Because there is a law of gravity, the universe can and will create itself out of nothing."

The problem with his view is that no one can verify that mathematical laws create anything. They describe the behavior of what already exists, and a Higgs field everywhere is not "nothing". These laws accurately describe the web of cause and effect. But, to say that the laws created themselves and all of matter-energy-space-time is a very large leap of faith and cannot be proven by the methods of science. It must be regarded as a primitive axiom or faith assertion. Many find this belief dissatisfying and unreasonable. A universe without any personal structure or purpose in which humans and their intelligence arose by accident seems empty and meaningless. Nobel laureate Sir Francis Crick [14] explains this view by saying,

You, your joys and sorrows, your memories and ambitions, your sense of personal identity and free will are in fact no more than the behavior of a vast assembly of nerve cells and their associated molecules.

On the contrary, a monotheistic world view, such as the biblical world view, gives a simple, rational, believable summary of all the issues raised by the Higgs discovery and the media commentary. The uncaused cause of all things is an intelligent, eternal, powerful, personal being called "The Creator". The Creator

shared a reflection of His Mind with human creatures, which guarantees the validity and success of the pursuit of scientific knowledge of the world.

The Bible makes these primitive assumptions by saying,

In the beginning was the Word, and the Word was with God, and the Word was God. He was in the beginning with God. All things were made through him, and without him was not any thing made that was made. (John 1:1-3, ESV)

The Greek word for "Word" in this quote is λογος, from which we get the concept of logic which can imply a law of nature. Furthermore, the stability and continuing operation of the laws of nature is explained in another passage, which says,

For by him all things were created, in heaven and on earth, visible and invisible, whether thrones or dominions or rulers or authorities – all things were created through him and for him. And he is before all things, and in him all things hold together. (Colossians 1:16-17, ESV)

In the biblical world view, then, these laws are a permanent speaking of "Word" or logic into the world, and are momentarily imposed by God everywhere. The lawful structure is "upheld" by the Creator.

Finally, in the Pentateuch book of Exodus, a famous exchange takes place between God, the Creator, and Moses when God appears to him in a bush that appears to be burning without burning up. God is giving Moses the assignment to go back to Egypt and lead the Jews to freedom from their slavery. Moses does not want the job and keeps trying to refuse. Finally, he asks God a question in desperation:

Then Moses said to God, "If I come to the people of Israel and say to them, 'The God of your fathers has sent me to you,' and they ask me, 'What is his name?' what shall I say to them?" God said to Moses, "I AM WHO I AM." And he said, "Say this to the people of Israel, 'I AM has sent me to you.'" (Exodus 3:13-14, ESV)

In the Old Testament a name is assumed to capture the essence of a person. Therefore, in giving his name as "I AM" to Moses, God clearly claims to be the uncaused cause of all else. Only that cause can be named simply, "I AM". Jesus Christ antagonized a group of Jews who were inclined to believe his words by repeating this claim about himself in the New Testament in John 8:58 in dialogue with the Pharisees. Their response of picking up stones in the next verse shows that they understood him to be making the same claim that God made to Moses. They considered this statement to be a claim to divinity amounting to blasphemy, which is punishable in Jewish law by stoning to death.

- **Is Science "The Only Way" of Knowing Truth about Reality?**

The claim that only scientific knowledge is a valid way of knowing truth about reality is an aspect of the world view of materialism. The "new atheists", like Prof. Richard Dawkins of Cambridge, usually make this point in their speeches and books. Dawkins says only empirical science used to understand the natural world leads to any kind of reliable knowledge. Another scientist who agrees with Dawkins is Nobel laureate Stephen Weinberg, who regards any thoughts of supernatural causes or immaterial reality as a disease of the human mind. He correctly expresses where his views lead as follows [15]:

Worse, the worldview of science is rather chilling. Not only do we not find any point to life laid out for us in nature, no objective basis for our moral principles, no correspondence between what we think is the moral law and the laws of nature, of the sort imagined by philosophers from Anaximander and Plato to Emerson. We even learn that the emotions that we most treasure, our love for our wives and husbands and children, are made possible by chemical processes in our brains that are what they are as a result of natural selection acting on chance mutations over millions of years. And yet we must not sink into nihilism or stifle our emotions. At our best we live on a knife-edge, between wishful thinking on one hand and, on the other, despair.

Materialists all agree on a strong "yes" to the claim that only scientific knowledge is valid and true.

Monotheists do not agree with this claim. They agree in accepting scientific knowledge as valid and true knowledge of the real world. However, believing in a personal Creator who is the uncaused cause of all things, they also allow for communication of additional truth from that Creator to His human creatures.

Culture today believes that lifestyle is a set of choices, and no one set of moral values seems self-evident in the created world. But, if the Creator set up a moral design in His world for the well-being of human life, the communication of this to us would be very helpful. Another important element could be the purpose for the world and human life, and a third could be the character of the Creator.

9. Another Reliable Truth Source About Our Creator in Addition to Science?

In many different passages the Hebrew/Christian Bible claims to be the self-revelation of our Creator and to be completely reliable and true. Like any truth claim this can be tested by appropriate means for validity. Over time it has been able to stand up to many of the challenges to its truthfulness that have been raised against it, although some questions will probably always remain that have not been resolved. In support of this assertion, a few examples are now given in each of

seven important truth categories that have been tested. Space will not permit a more complete presentation of examples.

- Historically:

The Bible is full of historical references to geography, human habitation, and past events. Are these historical accounts accurate and true descriptions? The first question is whether the actual words of the authors have come down to us and were the authors reliable witnesses? The discipline of textual criticism deals with these questions.

We have over 5000 Greek manuscripts of all or part of the New Testament. The early church Fathers quoted extensively from the Bible text in their writings. The British writer Sir David Dalrymple said, "I possessed all the existing works of the Fathers of the second and third centuries. I commenced to search, and up to this time I have found the entire New Testament, except eleven verses." [16] Also referring to the quotations of the Fathers, Bruce Metzger of Princeton Theological Seminary concurs, "They would be sufficient alone for the reconstruction of practically the entire New Testament." [17]

The Old Testament text is not as fully supported by early copies, but was transmitted with only minor changes for over 1000 years, from the Dead Sea scrolls in 100 BC to a complete Hebrew manuscript from 900 AD. The Greek translation, the Septuagint, extends our knowledge to about 200 BC.

In 1958 the author took a university class in the New Testament where the professor referred to the six historical references given by the gospel writer Luke, a physician who was a traveling companion of St. Paul, in Luke 3:1-2. He claimed that several of the references were wrong, having no support in ancient history and using the wrong titles for rulers. The author decided to adopt a "wait and see" attitude to these error claims. Today it is known from subsequent historical discoveries that Luke was completely accurate in all six references. He even expresses subtle variations in the actual power carried by the ruler, like "acting tetrarch" rather than "tetrarch". The precision of Luke's references has proved to be stunning!

Testing biblical narratives historically means comparing them with the writings of other ancient historians, limiting its usefulness to times after the onset of wide use of written languages in human history. Josephus, for example, confirms many Old Testament accounts and has a paragraph on Jesus Christ that confirms some of the facts written about him. Other ancient historians confirmed parts of the biblical narrative.

- Archaeologically:

Testing the Bible archaeologically means finding concrete objects in understandable arrangements and correct locations and times that are either consistent with or contradictory to the narratives. Archaeology provides many partial written fragments and language inscriptions that can also help test biblical historical accounts and supplement writings of ancient historians.

The Bible book of Genesis describes a period from at least 4000 to 1700 B.C. Over the author's sixty years as a student of the Bible and reader of archaeological findings, a steady stream of finds confirming elements of personal names, cultural practices, and geographical places have emerged. The list continues to grow as this article is written. None has clearly proven any element of the Genesis accounts to be false. All relevant finds have been consistent with the biblical history, although some dating issues remain unresolved at present.

The conquest of Canaan by the Israelites is described historically in the book of Joshua, and is of particular interest to this author. Again, in a university course on the Old Testament in 1958 the professor mentioned above claimed that the first city conquered, Jericho, had been excavated, and there was no evidence of the falling of the walls or the complete destruction by fire described in Joshua 6:1-27. This professor was correctly describing the archaeology of Jericho as known at that time, but subsequent results have confirmed the story completely. The fallen walls, the burned layer, and abundant stored burned grain indicating harvest time as in the original account, have all been documented. In addition, the site was found to be unoccupied for at least 200 years afterwards in accord with Joshua's curse on it in Joshua 6:26. Difficulties remain reconciling the apparent date of the destruction with that of the Exodus from Egypt, but the research goes on! Current detailed knowledge of this case and the two other cities said to have been destroyed by Joshua's army, as well as many other examples from antiquity, are well discussed by James Hoffmeier [18].

- Psychologically

Another test is whether the Bible promotes behavioral principles that can be shown to increase human psychological health. One strong example would be the emphasis by Jesus Christ reported in the four Gospels and the other New Testament writings on forgiving others their offenses against us. Holding bitterness because of an offense instead of extending forgiveness to the offender is known to carry long term negative psychological effects. Replacing constant anxiety and worry about the affairs of life and the future with basic trust in God's promises to care for His people, gives another example of good psychology. Many other examples can be given, and principles that give truly negative psychological results are absent from the biblical teaching.

- Sociologically

The social moral values taught in Scripture are proving statistically much better for positive individual and family outcomes. Increasingly, studies in social science have studied behaviors like reserving sexual expression to couples who are married, keeping child bearing within marriage, and avoiding divorce. For one example, children of divorce show more aggressive behavior with others. [19] They have more depression and delinquency. [20] They are less likely to finish high school or university. [21]

- Scientifically

Comparing Scripture with scientific results where it touches on scientific matters has been done for many years. Questions of origins and astronomy are well known examples. The Bible speaks of a universe created out of nothing at a point in time, fully consistent with the currently accepted scientific picture, "The Big Bang". It speaks of "the circle of the Earth" (Isaiah 40:22, ESV) and "He [God] hangs the Earth on nothing", (Job 26:7, ESV) two millennia before these pictures were widely accepted by science.

The Bible has stood every scientific test the author has witnessed in sixty years and has never proven false. But we must remember there is some flexibility in interpreting the words of the Bible. Science has also often changed its conclusions in a major way over time. Some unresolved areas remain, but we do not have space here to go into more detail in this article.

- Philosophically

The Bible offers remarkably simple, direct, rational answers to the large questions of our existence. It answers the question of existence of an uncaused cause of all else in a simple and rational way. It identifies the main purposes of human life. It sets a framework for all other human intellectual endeavors. It provides guidelines for responsible community and responsible use of Earth's natural resources for technology. It provides a moral basis for family life and for successful and honest commerce.

- Power to Change

A primary emphasis of the whole Bible is an appeal to come into a relationship of forgiveness with God by accepting the sacrifice Jesus Christ made of himself for our failures (sins) and agreeing to a process of transformation toward the character of Jesus. It promises those who do this that they will receive supernatural power to change their lives for the better. Nowhere has this been more evident than within the prison population in the USA, where a group called Prison Fellowship has been working with prisoners for 40 years. Positive outcomes are seen in very low rates of new criminal activity among those who take the steps outlined above. By now this population provides hundreds of thousands of well documented cases.

Many practicing Christians who never went to prison have the same experience, and find freedom from addictions, dishonesty, and destructive family relationships. No other approach to life change has produced better results. Effective power to change is a strong argument for the Bible being an accurate message from the Creator to help us follow his design for our lives.

10. Conclusion

The postulation of the Higgs boson and its experimental observation provide a clear example of how science and biblical Christianity fit together in a harmonious system to understand our world and human life. The process of doing science by trusting human logic, mathematics, and observational powers fits together seamlessly with the biblical teaching of the nature of the Creator and Creation. They strongly reinforce one another.

The Higgs is the handiwork of a Personal God, not a god itself. Its existence and its effects emerge from the mathematical and logical structure the Creator imposed on the Creation. Existence of that structure that we can understand and observe supports the idea that we are made in the image of God. God is the uncaused or primary cause of all else, and the laws themselves are effects. Nature, which obeys those laws, is a web of secondary causes progressing in time. The Higgs boson is one of the secondary causes, without which particles and the universe would have a very different character, which would rule out our existence.

The apparent validity of the physical laws over long times past testifies to the faithfulness of God over long time periods, a common biblical theme. We do not know what new physics will emerge in the future, or whether a version of the Standard Model will describe all of the building blocks of nature and their behaviors. Additional building blocks may be found and require an expanded mathematical description. But the basic relationship of God and creation will not change as a result.

This author is one who has experienced the supernatural life-changing power of a relationship with God through Jesus Christ based on the Bible. The author encourages everyone to examine the evidence for the Bible as an accurate and true revelation of God and the design for human life, and recommends it to anyone as a reliable guide for coming into a personal relationship with the Person who created everything, including the "God particle". Science and the Bible work together, not against one another.

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