The Age of the Universe

by Gerald Schroeder

One of the most obvious perceived contradictions between Torah and science is the age of the universe. Is it billions of years old, like scientific data, or is it thousands of years, like Biblical data? When we add up the generations of the Bible and then add the secular rulers that followed, we come to fewer than 6000 years. Whereas, data from the Hubbell telescope or from the land based telescopes in Hawaii, indicate the number at 15 billion years plus or minus 10%. In trying to resolve this apparent conflict, I use only ancient biblical commentary because modern commentary already knows modern science, and so it is influenced by what science always.

That commentary includes the text of the Bible itself (3300 years ago), the translation of the Torah into Aramaic by Onkelos (100 CE), the Talmud (redacted about the year 400 CE), and the three major Torah commentators. There are many, many commentators, but at the top of the mountain there are three, accepted by all: Rashi (11th century France), who brings the straight understanding of the text, Maimonides (12th century Egypt), who handles the philosophical concepts, and then Nahmanides (13th century Spain), the most important of the Kabbalists.

These ancient commentaries were finalized hundreds or thousands of years ago, long before Hubbell was a gleam in his great-grandparent's eye. So there's no possibility of Hubbell or any other scientific data influencing these concepts. That's a key component in keeping the following discussion objective.

Universe with a Beginning

In 1959, a survey was taken of leading American scientists. Among the many questions asked was, "What is your estimate of the age of the universe?" Now, in 1959, astronomy was popular, but cosmology - the deep physics of understanding the universe - was just developing. The response to that survey was recently republished in Scientific American - the most widely read science journal in the world. Two-thirds of the scientists gave the same answer. The answer that two-thirds - an overwhelming majority - of the scientists gave was, "Beginning? There was no beginning. Aristotle and Plato taught us 2400 years ago that the universe is eternal. Oh, we know the Bible says 'In the beginning.' That's a nice
story; it helps kids go to bed at night. But we sophisticates know better. There was no beginning."

That was 1959. In 1965, Arno Penzias and Robert Wilson discovered the echo of the Big Bang in the black of the sky at night, and the world paradigm changed from a universe that was eternal to a universe that had a beginning. Science had made an enormous paradigm change in its understanding of the world. Understand the impact. Science said that our universe had a beginning. I can't overestimate the import of that scientific "discovery." Evolution, cave men, these are all trivial problems compared to the fact that we now understand that we had a beginning. Exactly as the Bible had claimed for three millennia.

Of course, the fact that there was a beginning does not prove that there was a beginner. Whether the second half of Genesis 1:1 is correct, we don't know from a secular point of view. The first half is "In the beginning;" the second half is "God created the Heavens and the Earth." Physics allows for a beginning without a beginner. I'm not going to get into the physics of that here. "The Science of God," my second book, examines this in great detail.

It All Starts From Rosh Hashana

The question we're left with is, how long ago did the "beginning" occur? Was it, as the Bible might imply, fewer than 6,000 years, or was it the 14 to 15 billions of years that are accepted by the scientific community? The first thing we have to understand is the origin of the Biblical calendar.

The Jewish year is calculated by adding up the generations since Adam. Additionally, there are six days from the creation of the universe to the creation of the first human, that is the first being with the soul of a human (not the first hominid, a being with human shape and intelligence, but lacking the soul of humanity, the neshama). We have a 6000 year clock that begins with Adam. The six days are separate from this clock. The Bible has two clocks. This is no modern rationalization. The Talmud already discussed this 1600 years ago.

The reason the six pre-Adam days were taken out of the calendar is because time is described differently in those Six Days of Genesis. "There was evening and morning" with no relationship to human time. Once we come to the progeny of Adam, the flow of time is totally in human terms. Adam and Eve live 130 years before having Seth. Seth lives 105 years before having Enosh, etc. (Genesis chapter 5). From Adam forward, the flow of time is totally human in concept. But prior to that time, it's an abstract concept: "Evening and
morning.” It's as if you're looking down on events from a viewpoint that is not intimately related to them, a cosmic view of time.

**Looking Deeper into the Text**

In trying to understand the flow of time here, you have to remember that the entire Six Days is described in 31 sentences. The Six Days of Genesis, which have given people so many headaches are confined to 31 sentences! At MIT, in the Hayden library, we had about 50,000 books that deal with the development of the universe: cosmology, chemistry, thermodynamics, paleontology, archaeology, the high-energy physics of creation. Up the river at Harvard, at the Weidner library, they probably have 200,000 books on these same topics. The Bible gives us 31 sentences. Don't expect that by a simple reading of those sentences, you'll know every detail that is held within the text. It's obvious that we have to dig deeper to get the information out.

**What is a "day?"**

The usual answer to that question is let the word ‘day’ in Genesis chapter one be any long period of time. Bend the Bible to match the science. Fortunately, the Talmud in Hagigah (12A), Rashi there and Nahmanides (Gen. 1:3) all tell us that the word day means 24 hours, not sunrise and sun set. The sun is not mentioned till day four and these commentaries all relate to all six days, right from day one. But the commentary continues in Exodus and Leviticus, that the days are 24 hours each (again, not relating to sunrise and sunset, merely sets of 24 hours). There are six of them, and the duration is not longer than the six days of a work week, BUT they contain all the ages of the world. How can six 24 hour days contain all the ages of the world?

**The Flexible flow of time and the stretching of space**

Einstein taught the world that time is relative. That in regions of high velocity or high gravity time actually passes more slowly relative to regions of lower gravity or lower velocity. (One system relative to another, hence the name, the laws of relativity.) This is now proven fact. Time actually stretches out. Were ever you are time is normal for you because your biology is part of that local system.
That is Einstein and gravity and velocity. But there is a third aspect of the universe that changes the perception of time, Not gravity and not velocity. That is the stretching of space. The universe started as a minuscule speck, perhaps not larger that a grain of mustard and stretched out from there. Space actually stretches. The effect of the stretching of space produces the effect that when observing an event that took place far from our galaxy, as the light from that event travels through space and the sequence of events travels through space, the information is actually stretched out. (In The Science of God I give the logic in detail in simple easy to understand terms.)

The Creation of Time

Each day of creation is numbered. Yet Nahmanides points out that there is discontinuity in the way the days are numbered. The verse says: "There is evening and morning, Day One." But the second day doesn't say "evening and morning, Day Two." Rather, it says "evening and morning, a second day." And the Torah continues with this pattern: "Evening and morning, a third day... a fourth day... a fifth day... the sixth day." Only on the first day does the text use a different form: not "first day," but "Day One" ("Yom Echad"). Many English translations that make the mistake of writing "a first day." That's because editors want things to be nice and consistent. But they throw out the cosmic message in the text! That message, as Nahmanides points out, is that there is a qualitative difference between "one" and "first." One is absolute; first is comparative. The Torah could not write “a first day” on the first day because there had not yet been a second day relative to it. Had the perspective of the Bible for the first six days been from Sinai looking back, the Torah would have written a first day. By the time the Torah was given on Sinai there had been hundreds of thousands of "second days." The perspective of the Bible for the six days of Genesis is from the only time in the history of time when there had not been a second day. And that is the first day. From the creation of the universe to the creation of the soul of Adam, the Torah views time from near the beginning looking forward. At the creation of Adam and Eve, the soul of humanity, the Bible perspective switches to earth based time. And therefore the biblical description of time changed.

How we perceive time
We look at the universe, and say, "How old is the universe? Looking back in time, the universe is approximately 15 billion years old." That's our view of time. But what is the Bible's view of time looking from the beginning? How does it see time?

Nahmanides taught that although the days are 24 hours each, they contain "kol yemot ha-olam" - all the ages and all the secrets of the world. Nahmanides says that before the universe, there was nothing... but then suddenly the entire creation appeared as a minuscule speck. He gives a description for the speck: something very tiny, smaller than a grain of mustard. And he says that is the only physical creation. There was no other physical creation; all other creations were spiritual. The Nefesh (the soul of animal life, Genesis 1:21) and the Neshama (the soul of human life, Genesis 1:27) are spiritual creations.

There's only one physical creation, and that creation was a tiny speck. In that speck was all the raw material that would be used for making everything else. Nahmanides describes the substance as "dak me'od, ein bo mamash" - very thin, no substance to it. And as this speck expanded out, this substance, so thin that it has no material substance, turned into matter as we know it.

Nahmanides further writes: "Misheyesh, yitfos bo zman" - from the moment that matter formed from this substance-less substance, time grabs hold. Time is created at the beginning. But time "grabs hold" when matter condenses from the substance-less substance of the big bang creation. When matter condenses, congeals, coalesces, out of this substance so thin it has no material substance, that's when the biblical clock starts.

Science has shown that there's only one "substanceless substance" that can change into matter. And that's energy. Einstein's famous equation, E=MC2, tells us that energy can change form and take on the form of matter. And once it changes into matter, time grabs hold. Nahmanides has made a phenomenal statement. I don't know if he knew the Laws of Relativity. But we know them now. We know that energy - light beams, radio waves, gamma rays, x-rays - all travel at the speed of light, 300 million meters per second. At the speed of light, time does not pass. The universe was aging, time was passing, but time only grabs hold when matter is present. This moment of time before the clock of the Bible begins lasted less than 1/100,000 of a second. A miniscule time. But in that time, the universe expanded from a tiny speck, to about the size of the Solar System. From that moment on we have matter, and biblical time flows forward. The Biblical clock begins here.
Day One and not a first day: seeing time from the beginning

Now the fact that the Bible tells us there is "evening and morning Day One", comes to teach us time from a Biblical perspective, from near the beginning looking forward.

If the Torah were seeing time from the days of Moses on Mount Sinai - 2448 years after Adam - the text would not have written Day One. Because by Sinai, hundreds of thousands of days already passed. It would have said "a first day." By the second day of Genesis, the Bible says "a second day," because there was already the first day with which to compare it.

We look back in time, and say the universe is 15 billion years old. But as every scientist knows, when we say the universe is 15 billion years old, there's another half of the sentence that we rarely bother to say. The other half of the sentence is: The universe is 15 billion years old as seen from the time-space coordinates of the earth.

The key is that the Torah looks forward in time, from very different time-space coordinates, when the universe was small. Since then, the universe has expanded out. Space stretches, and that stretching of space totally changes the perception of time. Imagine in your mind going back billions of years to the beginning of time. Now pretend way back at the beginning of time, when time grabs hold, there's an intelligent community. (It's totally fictitious.) Imagine that the intelligent community has a laser, and it's going to shoot out a blast of light every second. Every second -- pulse. Pulse. Pulse. And on each pulse of light the following formation is printed (printing information on light, electro-magnetic radiation, is common practice): "I'm sending you a pulse every second." Billions of years later, way far down the time line, we here on Earth have a big satellite dish antenna and we receive that pulse of light. And on that pulse of light we read "I'm sending you a pulse every second."

Light travels 300 million meters per second. So at the beginning, the two light pulses are separated by a second of travel or 300 million meters. Now they travel through space for billions of years until they reach the Earth. But wait a minute. Is the universe static? No. The universe is expanding. The universe expands by space stretching. So as these pulses travel through space for billions of years, space is stretching. What's happening to these pulses? The space between them is also stretching. So the pulses get further and further apart. Billions of years later, when the first pulse arrives, we read on it "I'm sending you a pulse every second." A message from outer space. You call all your friends, and you wait for the next pulse to arrive. Does it arrive second later? No! A year later? Maybe not. Maybe billions of years later. Because the amount of time this pulse of light has traveled through space will determine the amount of space stretching that has occurred, and so how much
space and therefore how much time there will be between the arrival of the pulses. That's
standard cosmology.

15 billion years or six days?

Today, we look back in time and we see approximately 15 billion years of history. Looking
forward from when the universe is very small - billions of times smaller - the Torah says six
days. In truth, they both may be correct. What's exciting about the last few years in
cosmology is we now have quantified the data to know the relationship of the "view of
time" from the beginning of stable matter, the threshold energy of protons and neutrons
(there nucleosynthesis), relative to the "view of time" today. It's not science fiction any
longer. A dozen physics textbooks all bring the same number. The general relationship
between nucleosynthesis, that time near the beginning at the threshold energy of protons
and neutrons when matter formed, and time today is a million million. That's a 1 with 12
zeros after it. So when a view from the beginning looking forward says "I'm sending you a
pulse every second," would we see a pulse every second? No. We'd see it every million
million seconds. Because that's the stretching effect of the expansion of the universe.

The Talmud tells us that the soul of Adam was created at five and a half days after the
beginning of the six days. That is a half day before the termination of the sixth day. At that
moment the cosmic calendar ceases and an earth based calendar starts. How would we
see those days stretched by a million million? Five and a half days times a million million,
gives us five and a half million million days. Dividing that by 365 days in a year, that comes
out to be 15 billion years. NASA gives a value of about 14 billion years. Considering the
many approximations, and that the Bible works with only six periods of time, the agreement
to within a few percent is extraordinary. The universe is billions of years old from one
perspective and a mere six days old from another. And both are correct!

The five and a half days of Genesis are not of equal duration. Each time the universe
doubles in size, the perception of time halves as we project that time back toward the
beginning of the universe. The rate of doubling, that is the fractional rate of change, is very
rapid at the beginning and decreases with time simply because as the universe gets larger
and larger, even though the actual expansion rate is approximately constant, it takes longer
and longer for the overall size to double. Because of this, the earliest of the six days have
most of the 15 billion years sequestered with them. For the duration of each day and the
CORRECTION TO THE CALCULATION OF THE AGE OF THE UNIVERSE

Following a talk I gave at AZUSA Pacific University, February 2011, a participant noted that when calculating the expansion ratio of space [that is, by what fraction space had stretched] from the era of nucleosynthesis to our current time, I had neglected to correct for the effect that the increase in the rate of universal expansion has on the current cosmic microwave radiation background. This increase introduces a non-linear effect. [That is, the rate of expansion is not constant, rather the rate is increasing.] The correction is in the order of 10%. Had the expansion been linear [and not super-linear resulting from the increased rate], the CMRB would be, not the currently observed 2.76 K, but 3.03 K. Introducing this correction into the exponential equation that details the duration of the six 24 hour days of Genesis Chapter One results in an age of the universe from our perspective of 14 billion years [14, 000,000,000 years]. From the Bible’s perspective of time for those six evocative days of Genesis, the number of our years held compressed within each of those six 24 hour days of Genesis, starting with Day One, would be, in billions of years, respectively, 7.1; 3.6; 1.8; 0.89; 0.45; 0.23.

http://geraldschroeder.com/AgeUniverse.aspx

Gerald Schroeder is a scientist with over thirty years of experience in research and teaching. He earned his Bachelor's, Master's, and Doctorate degrees all at the Massachusetts Institute of Technology, with his doctorate thesis being under the supervision of physics professor Robley D. Evans. This was followed by five years on the staff of the MIT physics department prior to moving to Israel, where he joined the Weizmann Institute of Science and then the Volcani Research Institute, while also having a laboratory at The Hebrew University. His Doctorate is in two fields: Earth sciences and physics.

Schroeder's formal theological training in biblical, talmudic and kabalistic interpretation includes fifteen years of study under the late Rabbi Herman Pollack, Rabbi Chaim Brovender and Rabbi Noah Weinberg, of blessed memory.

The scientific career that Schroeder chose has given him varied and often unusual experiences. In his work with nuclear disarmament, he has been present at the detonation of six atomic bombs. Work in control of radioactivity has put him hundreds of meters below ground in U.S. and foreign uranium mines. Within this research, he invented and had patented the first real time monitor for airborne alpha beta gamma emitters. The government of the People’s Republic of China, during the decade before it established direct contacts with Israel, was willing to overlook his Jerusalem address and had him as a frequent advisor. He also has consulted for agencies of the governments of Philippines, Malaysia, Singapore, Canada, USA. Invitations for him to lecture have come from around the world. He has over 60 publications in the world's
leading scientific journals on topics ranging from the radon atmosphere of the moon (in Science) to the metabolism of mother’s milk (in Nutrition Reports International). The results of Schroeder’s work have been reported in Time, Newsweek, Scientific American and in newspapers as far apart as Boston and Adelaide. His formal training in chemistry, physics and the Earth and planetary sciences provides the basis for the broad scientific perspective he brings to his books and lectures.

For the past twenty-five years, Dr. Schroeder has also pursued a study of ancient biblical interpretation. An ability to handle the biblical material in the original languages allows him to tap the subtle depths contained in the original texts. These nuances are often missed when working with translations. The uniqueness and success of Schroeder’s approach integrating biblical and scientific knowledge is demonstrated by the success of his first book, Genesis and the Big Bang (published by Bantam Doubleday), and the wide acclaim for his second book The Science of God (published by The Free Press of Simon & Schuster and Broadway Books of Bantam Doubleday) which was on the Barnes & Noble list of non-fiction best sellers and was Amazon.com’s best selling book in the field of physics/cosmology for all of 1998. This was followed by The Hidden Face of God, discovering the unity that binds all existence (published by The Free Press of Simon & Schuster). His book, God According to God, A scientist proves we've been wrong about God all along, was published in May 2009 with HarperOne and has enthusiastic endorsements by leading theologians, both Jewish and Christian, and a Noble Laureate scientist.

His books appear in 10 languages.

Gerald Schroeder lives in Jerusalem with his wife (the author, Barbara Sofer). They've had five children with a changing number of grandchildren. He moved to Israel from the USA in 1971. In addition to his current work in radiation control, he teaches at Aish HaTorah College of Jewish Studies, writes and lectures on the extraordinary confluence of modern science and ancient biblical commentary.

http://geraldschroeder.com/About.aspx