Science and the Bible

A Search for Meaning & Significance

The Anthropic Principle – Part 3

Welcome/Opening Notes/Prayer/Video

Foundational Principle for the Entire Study: **Test everything. Hold on to the good.**

The Premise of this Study: **The Facts of Nature and the Bible are the same.**

Edwin Hubble: "The history of astronomy is a history of receding horizons."

Introductory Comments

The Copernican Principle (16th Century): Initially, the Copernican Principle was simply the theory Copernicus presented in the 1500's stating that the Sun is at the center of the Universe (Heliocentrism), instead of the Earth (Geocentrism). This represented a radical change in perspective for both the Science and Christian communities, but was confirmed 100 years later by Galileo.

The Copernican Principle (20th Century): However, beginning in the mid-1900's, the Copernican Principle began to be used as an indication of the Earth simply being one of a countless number of ordinary planets throughout the universe. This concept was presented as undeniable fact in TV presentations by agnostic astronomers Robert Jastrow and Carl Sagan in the late-1900's. (also ≈ Principle of Mediocrity)

The Anthropic Principle: The belief and observation that the universe is expressly designed and created for the benefit of Earthly human life. (*anthropos*: man)

Psalm 8:3-6 *When I consider your heavens, the work of your fingers, the moon and the stars, which you have set in place, what is man that you are mindful of him, the son of man that you care for him?*
You made him a little lower than the heavenly beings and crowned him with glory and honor.
You made him ruler over the works of your hands; you put everything under his feet.

Breakthroughs of 2006: Scientific Discoveries that Affirm Creation

"Everyone is a moon, and has a dark side which he never shows to anybody." Mark Twain

Big Collision, Beautiful Moon Dr.Jeff Zweerink

About 50 million years after the formation of the solar system, a finely-tuned collision between the Earth and a Mars-sized body occurred. However, instead of destroying the Earth, the collision provided raw materials for the formation of Earth's moon. The collision ejected debris into orbit that eventually coalesced into the Moon. Recent high-resolution simulations of the impact event[1] confirm the fine-tuning of the impact to insure the survival of Earth, the formation of the Moon and the transformation of Earth's atmosphere.[2] The simulations show that the debris ejected from Earth must have consisted primarily of solid or liquid material – not gas – or else the debris disk would have dissipated too quickly to coalesce into a Moon-sized satellite. A larger impactor would have generated more energy during the collision and, consequently, more vaporized, gaseous material in the debris disk. However, a smaller impactor would not have enriched Earth with the necessary heavy elements to drive long-standing plate tectonics nor provide sufficient energy to completely eject Earth's life-suffocating primordial atmosphere into space. Thus, if the impactor were larger or smaller, the capacity of Earth to support advanced complex life (like humans) or abundant, long-standing microbial life would have been greatly diminished. The Moon-forming impact required a just-right-sized impactor striking Earth at the just-right speed, at the just-right location, with the just-right angle and the just-right time.

1. Keiichi Wada, Eiichiro Kokubo, and Junichiro Makino, "High-Resolution Simulations of a Moon-Forming Impact and Postimpact Evolution," Astrophysical Journal 638 (2006): 1180-86.
2. Kevin Zahnle, "Being There," Nature 433 (2005): 814-15; H. Genda and Y. Abe, "Enhanced Atmospheric Loss on Protoplanets at the Giant Impact Phase in the Presence of Oceans," Nature 433 (2005): 842-44.

"If the whole universe has no meaning, we should never have found out that it has no meaning: just as, if there were no light in the universe and therefore no creatures with eyes, we should never know it was dark. Dark would be without meaning." C.S. Lewis

Detailed Map of Cosmic Background Radiation Confirms Biblical Creation Model Dr.Hugh Ross

A team of American and Canadian astronomers dramatically strengthened the case for the big bang (Biblical[1]) creation, when they released the latest map of radiation left over from the cosmic origin event.[2] The team made public their analysis based on three years of continuous observations of the cosmic background radiation via satellite: the Wilkinson Microwave Anisotropy Probe (WMAP). This analysis, by far the most thorough and detailed to date, yielded five independent confirmations of the hot big bang creation model.[3]

The hot big bang model proposes that the continuous and relatively constant expansion of the universe from an actual beginning of space, time, matter and energy was interrupted by a very brief period of extremely rapid expansion when the universe was less than a quadrillionth of a quadrillionth of a second old. This hyper-inflation of the early universe explains how the universe remains thermally connected. Because of its ability to provide the first-ever full-sky picture of the background radiation's polarization, the WMAP was able to determine with remarkable certainty that early, rapid inflation did indeed occur.[4]

According to the hot big bang creation model, a certain fraction of the universe's hydrogen fused into helium during the first four minutes after the beginning. The WMAP data allowed astronomers to calculate what that fraction would be if the hot big bang creation model is correct. This fraction was then compared with the measured abundance of helium in the universe's first-born stars. The measured amount of helium in the first-formed stars is 0.249 ± 0.009 [5], and the figure from the WMAP is 0.24815 ± 0.00033 [3]. This amazing fit between the expected and the observed abundances makes for a potent proof of the model.

"Quintessence" is a catchall term for as yet unknown constants or laws of physics or for yet unseen variations in one or more of the constants of physics. Astronomers tend to invoke these as a way around (or at least to reduce) the phenomenal level of design required by their findings about cosmic mass density and dark energy density. Astronomers proposed a way to determine the "possible" level of quintessence, and that way was to measure something they called the "w parameter". The new WMAP data have permitted the first accurate measurement of the w parameter. If quintessence does not exist, the w parameter should = 1.0. If quintessence does exist, the w parameter will diverge significantly from 1.0. According to the WMAP results, $w = 0.97 \pm 0.08$ [3]. This measurement allows little room to escape the extraordinary level of design in the cosmic mass density and dark energy density.

In big bang cosmology, hot spots in the radiation left over from the cosmic creation event are thought to serve as the "seeds" around which galaxies and galaxy clusters form. The new WMAP results are so detailed that astronomers have been able to closely compare, for the first time, the locations of hot spots in the radiation with the locations of galaxies and galaxy clusters, as observed in such studies as the recent Sloan Digital Sky Survey.
These comparisons reveal a precise match.

The WMAP results also allow the most accurate measure to date of how much time has passed since the cosmic creation event. That figure is 13.73 ± 0.15 billion years[3]. The extension of decimal places and the shrinking error bar

confirm the prediction of big bang cosmology: that ongoing research will yield increasing consistency and decreasing disparity among the various cosmic age measurements.

By these five independent tests, the new WMAP results potently challenge speculative attempts to escape the conclusion that an Agent beyond space and time created the universe and exquisitely designed it so that humans can exist. Like so many other breakthrough discoveries in astronomy, the latest WMAP findings support the premise that scientific advance is an ally, not an enemy, to the Christian's faith.

1. See Hugh Ross, "Big Bang-The Bible Taught It First", in The Creator and the Cosmos, 3rd ed. (Colorado Springs: NavPress, 2001), 23-29.
2. Christopher Wanjek, "Ringside Seat to the Universe's First Split Second", Goddard Space Flight Center Press Release, March 16, 2006, http://www.nasa.gov/vision/universe/starsgalaxies/wmap_pol.html.
3. D. N. Spergel et al., "Wilkinson Microwave Anisotropy Probe (WMAP) Three Year Results: Implications for Cosmology", Astrophysical Journal Supplement (2006), in press.
4. The polarization results allowed the WMAP team to calculate the "scalar spectral index" for the universe. For a universe without inflation this index would be greater than or equal to 1.0. For a universe with inflation the index would be 0.95. The WMAP answer was 0.951 ± 0.017.
5. Keith A. Olive and Evan D. Skillman, "A Realistic Determination of the Error on the Primordial Helium Abundance: Steps Toward Nonparametric Nebular Helium Abundances", Astrophysical Journal 617 (2004): 29-49.

Breakthroughs of 2007: Scientific Discoveries that Affirm Creation

"Freedom is the oxygen of the soul." Moshe Dayan

The Greatness Behind Earth's Oxygenation Events Dr.Hugh Ross

Radiation from the Sun breaks down oxygen in Earth's atmosphere, while minerals in the crust gobble it up, making oxides or rust. Unless the rate of oxygen production from photosynthesis exceeds the rate of breakdown from radiation and the absorption by minerals, oxygen cannot accumulate in the atmosphere.

Although photosynthetic life existed on Earth as far back as 3.8 billion years ago, not until 2.4 billion years ago did the oxygen level rise to just 1 percent of its current level. Even getting to that level was deemed so spectacular as to be called the "Great Oxygenation Event". It occurred suddenly and dramatically, but researchers had no explanation for that rapid change, until completion of a recent study by British environmental scientists. The research team determined that a certain minimum level of oxygen in the Earth's atmosphere precipitated the formation of ozone in the troposphere (the lowest layer of the atmosphere).[1] The ozone provided an ultraviolet radiation shield, which allowed for more efficient photosynthesis and enabled oxygen molecules in the troposphere to last longer. These effects combined to raise the oxygen level up to and eventually beyond the 1 percent level.

Higher oxygen levels made possible a transition from strictly unicellular life to more complex forms of life. It also helped fill the Earth's oxygen "sinks" (pockets of oxygen-absorbing minerals in the crust). These changes paved the way for a "Second Great Oxygenation Event", roughly 600 million years ago, and thus producing conditions favorable for large active animals.[2]

The research team described their discovery without commenting on the spectacular fine-tuning these two oxygenation events required, but that is where the astronomical data help out. Only with the particular energy output, luminosity history and spectral signature of our star, the Sun, would photosynthesis be efficient enough to yield any significant increase in atmospheric oxygen (i.e., the energy source had to be virtually identical to the Sun[3]). At the same time, the characteristics of both the planet's atmosphere and oceans had to be finely-tuned to maximize photosynthetic output.[4]

For human life to ever become a possibility, photosynthetic life had to be introduced to the planet at the earliest possible moment – in Earth's case, 3.8 bya, after the the Late Heavy Bombardment (which ended about 3.9 bya), when thousands of asteroids, comets and other objects repeatedly pelted the Earth. Immediately after the Earth cooled, it was blanketed with abundant, diverse and globally-distributed photosynthetic life. And unless conditions stayed that way for many hundreds of millions of years, the Great Oxygenation Event could not have occurred.

Ozone represents another indication of remarkable fine-tuning. If any of the three major atmospheric layers had contained either too little or too much ozone during any given era, the results would have been catastrophic.

- **Troposphere** (lowest layer) too little ozone: insufficient cleansing of biochemical "smog"; too much: reduced crop yields and respiratory disease and/or failure for advanced animals
- **Stratosphere** (middle layer) too little ozone: insufficient shielding from ultraviolet radiation; too much: reduced plant growth and insufficient vitamin production in animals
- **Mesosphere** (highest layer) too little or too much ozone: disruption of the circulation and chemistry of various gases that regulate the delicate balance of life-essential gases in the lower atmosphere layers

Such extraordinarily fine-tuned details strain naturalism's credibility, but affirm the greatness of supernatural creation. Unless the Creator introduced the just-right life-forms in the just-right quantities at the just-right times, and removed life forms no longer appropriate for maintaining the required balances (see Psalm 104:27-30), we humans would not be on the Earth to research and discuss the wonders of our existence – or of His.[5]

1. Colin Goldblatt, Timothy M. Lenton and Andrew J. Watson, "Bistability of Atmospheric Oxidation: Implications for Life/Detection", *Astrobiology* 7 (June 2007): 483.
2. D.A. Fike et al., "Oxidation of the Ediacaran Ocean", *Nature* 444 (December 7, 2006): 744-47.
   Richard A. Kerr, "A Shot of Oxygen to Unleash the Evolution of Animals", *Science* 314 (December 8, 2006): 1529.
   Don E. Canfield, Simon W. Poulton and Guy M. Narbonne, "Late-Neoproterozoic Deep-Ocean Oxygenation and the Rise of Animal Life", *Science* 315 (January 5, 2007):92-95.
   David C. Catling and Mark W. Claire, "How Earth's Atmosphere Evolved to an Oxic State: A Status Report", *Earth and Planetary Science Letters* 237 (2005): 1-20.
   David C. Catling et al., "Why O2 is Required by Complex Life on Habitable Planets and the Concept of Planetary 'Oxygenation Time' ', *Astrobiology* 5 (2005): 415-38.
   James F. Kasting, "Ups and Downs of Ancient Oxygen", *Nature* 443 (October 12, 2006): 643-45.
   Colin Goldblatt, Timothy M. Lenton and Andrew J. Watson, "Bistability of Atmospheric Oxygen and the Great Oxidation", *Nature* 443 (October 12, 2006): 683-86.
   Paul G. Falkowski et al., "The Rise of Oxygen Over the Past 205 Million Years and the Evolution of Large Placental Mammals", *Science* 309 (September 30, 2005): 2202-04.
3. Nancy Y. Kiang et al., "Spectral Signatures of Photosynthesis II: Coevolution with Other Stars and the Atmosphere on Extrasolar Worlds", *Astrobiology* 7 (2007): 252-274.
4. John Raven, "Photosynthesis in Watercolours", *Nature* 448 (July 26, 2007): 418.
5. Hugh Ross, "Creation as Science", (Colorado Springs, CO: NavPress, 2006): 125-147 (Chapter 7).

Breakthroughs of 2008: Scientific Discoveries that Affirm Creation

"Two things are infinite: the universe and human stupidity; and I'm not sure about the universe." Einstein

A Dime's Worth of Difference Dr.Hugh Ross

The universe is incredibly massive. Nevertheless, its mass must be spectacularly fine-tuned for life to be possible. Exactly how massive the universe is remained unknown until astronomers focused the Hubble Space Telescope on a patch of sky no bigger than a tenth the Moon's angular diameter and held it there for 278 hours. The effort, called the Ultra Deep Field, successfully imaged all the galaxies bigger than dwarfs that exist in that region. The image field contained roughly 10,000 galaxies. By extrapolation, astronomers determined that the entire observable universe

contains at least 200 billion galaxies, with an estimated average of 200 billion stars in each galaxy. Therefore, the total number of stars in these galaxies is about 40 billion trillion (i.e., 4×10^{22}). In addition, the unobserved dwarf galaxies would contribute an estimated additional 10 billion trillion stars. Thus, the total number of stars in the observable universe adds up to about 50 billion trillion (5×10^{22}). Fifty billion trillion stars is an unimaginably vast universe. And yet the universe is more massive by far. The stars, both those that are still shining and those that have burned out, account for just one percent of the universe's total mass!

One reason the universe must be so massive is that life requires it. The density of protons and neutrons determines how much of the universe's hydrogen fuses into heavier elements. With a slightly lower density (producing fewer than about 50 billion trillion stars), nuclear fusion would be less productive and at no time in cosmic history would elements heavier than helium be produced. Or, if the density were slightly higher (producing more than about 50 billion trillion stars), nuclear fusion would be so productive that only heavier-than-iron elements would exist. Either way, life-essential elements such as carbon, nitrogen, oxygen and phosphorous would be too scarce or nonexistent.

Another life-related reason the universe must be so massive is that the cosmic mass critically influences the universe's expansion rate. If the mass density was smaller, the influence of gravity would be too weak for stars like the Sun and planets like Earth to form. On the other hand, if the mass density was greater, only stars much larger than the Sun would form. Either way, the universe would contain no stars like the Sun or planets like Earth, and life would have no possible home. The required fine-tuning is so extreme (one part in a quadrillion quadrillion quadrillion quadrillion = 10^{60}) that if one were to *remove or add a single dime's worth of mass to this vast cosmos*, the balance of the observable universe would be thrown off and physical life would not be possible. Such amazing fine-tuning suggests the involvement of a supernatural, super-intelligent Creator.

Jonathan Coles, "A New Estimate of the Hubble Time with Improved Modeling of Gravitational Lenses," *Astrophysical Journal* 679 (May 20, 2008): 17-24.

R.D. Blandford and R. Narayan, "Cosmological Applications of Gravitational Lensing," *Annual Reviews of Astronomy and Astrophysics* 30 (1992): 311-58, powerpoint available at www.asu.edu/clas/hst/classes/ast494+591/2007-04-06/grav_lens.pdf and at http://www.answers.com/topic/gravitational-lens.

E. Komatsu et al., "Five-Year Wilkinson Microwave Anisotropy Probe (WMAP) Observations: Cosmological Interpretations," *Astrophysical Journal Supplement Series* (2008), in press.

Video Interlude – Journey to the Edge of the Universe

Breakthroughs of 2009: Scientific Discoveries that Affirm Creation

"What happens if a big asteroid hits Earth? Judging from realistic simulations involving a sledge hammer and a common laboratory frog, we can assume it will be pretty bad." Dave Barry

Harsh Environment Prepared Earth for Life Dr.Jeff Zweerink

Meteors (about a million trillion tons worth, ranging from dust-sized particles to miles-wide objects) rained down on Earth between 4.4 and 3.9 billion years ago, with the worst of the impacts occurring in the last 2 hundred million years. This time is referred to as the Late Heavy Bombardment (LHB) and was a time when no life was possible on the Earth. Although hostile to life, the LHB played an important role in Earth's capacity to eventually support advanced life. This event reduced the number of asteroids and comets in the solar system by roughly a factor of a thousand, and it caused significant changes in Earth's chemistry.

Recent research by a pair of British scientists, Richard Court and Mark Sephton, revealed that the water and carbon dioxide added during the LHB may have helped establish and maintain Earth's water cycle. One particular class of meteorites that struck Earth – carbonaceous chondrites – contained an abundance of biologically important elements

such as carbon, oxygen and hydrogen. As these meteorites crashed through Earth's atmosphere, the high temperatures caused them to undergo chemical reactions, producing molecules like carbon dioxide and water.[1]

Using recovered meteorites, Court and Sephton subjected samples to conditions similar to those encountered passing through the atmosphere. They then determined how much carbon dioxide, water and methane were produced. Their research indicates that each year during the LHB roughly one million tons of both carbon dioxide and water were added to our planet.

These results have provided important clues as to how (even through a chaotic time in history) the Earth's stable, critical-for–life water cycle was established and where many of the materials necessary for the later establishment of advanced life came from.

1. Richard W. Court and Mark A. Sephton, "Meteorite Ablation Products and Their Contribution to the Atmospheres of Terrestrial Planets: An Experimental Study Using Pyrolysis – FTIR", *Geochemica et Cosmochimica Acta* 73 (2009): 3512-21.

"This means we have here an entirely separate kind of chemistry for which the current tool we use is the electrometer, not the balance, and which we might well call the chemistry of the imponderable." Marie Curie

Thank God for Aluminum Dr.Hugh Ross

Aluminum makes up less than 0.01 percent of the universe's ordinary matter, but measures an astounding 8.1 percent of the Earth's crust. Aluminum has no known biological function; furthermore, its high abundance in terrestrial soils makes aluminum accumulate in the bodies of large animals, and after a few decades can reach toxic levels. As a result, some atheists claim Earth's surplus of biologically useless and potentially harmful aluminum is evidence of God's mismanagement or nonexistence. However, new research has revealed that advanced life could not have survived without the quantity of aluminum in the primordial Earth being finely-tuned to an extreme degree.

Two mantras of astrobiology have been *follow the water* and *follow the carbon*. The rationale is that because physical life must be carbon-based and all life requires liquid water, life beyond Earth most likely will be found on bodies rich in both. However, for Earth's size and distance from its star, our planet contains about 500 times less carbon and 250 times less water that what the best planetary formation models predict.[1] In fact, the Earth may be the most carbon- and water-poor body of its type in the Milky Way Galaxy.

Being extremely water- and carbon-poor means that Earth's oceans are fairly shallow and its atmosphere is thin. With deeper oceans, no amount of plate tectonics could have produced continents. And without continents, no land life could exist and several crucial nutrient-recycling mechanisms would be absent. Furthermore, a thicker atmosphere loaded with carbon compounds would have trapped a huge quantity of heat, resulted in atmospheric pressures making lungs inoperable and blocked out so much sunlight as to impede photosynthesis.

Two British astronomers offer a partial explanation for how Earth became so incredibly water- and carbon-poor.[2] J. D. Gilmour and C. A. Middleton point out that the oldest known rocks in the solar system (chondritic meteorites) show strong evidence that aluminum-26 was abundant in the early solar system. The wealth of this strongly radioactive isotope was responsible for the widely demonstrated thermal processing of the solar system's planetesimals. These small celestial bodies led to the formation of rocky planets, including Earth. Planetesimal heating would have eliminated most of the water, carbon monoxide and carbon dioxide in these bodies.

Thirty-to-forty million years later, an exquisitely designed collision event removed even more water, carbon monoxide and carbon dioxide from Earth. A Mars-sized planet struck the Earth, leading to the formation of the Moon, which has features crucial for the support of advanced life.[3]

Gilmour and Middleton attribute the early solar system's extremely high amount of aluminum-26 to "anthropic selection". They said that such an abundance is "difficult to produce in models of star formation". The solar system must have formed in an exceptionally large and dense star cluster with the Sun exposed to the just-right combination of supernovae all exploding at the just-right times and the just-right distances. After forming, the cluster strongly ejected the solar system to the just-right location in the Milky Way Galaxy.

Too little aluminum-26 in the early solar system would have supplied Earth with too much water and carbon, and too much aluminum-26 would have resulted in too little water and carbon. Such precise fine-tuning testifies to a super-natural, super-intelligent Creator. Thanks be to God for the just-right amount of aluminum – part of His perfect plan.

1. Linda T. Elkins-Tanton and Sara Seager, "Ranges of Atmospheric Mass and Composition of Super-Earth Exoplanets", *Astrophysical Journal* 685 (October 1, 2008): 1237-46.
   High Ross, "Planet Formation: Problems with Water, Carbon and Air", Today's New Reason to Believe, January 12, 2008: http://www.reasons.org/rtbs-creation-model/cosmic-design/planet-formation-problems-too-much-water-too-much-carbon-and-too-much-air.
2. J.D. Gilmour and C.A. Middleton, "Anthropic Selection of a Solar System with a High $^{26}Al/^{27}Al$ Ratio: Implications and a Possible Mechanism", *Icarus* 201 (June 2009): 821-23.
3. Hugh Ross, *Creation as Science* (Colorado Springs: NavPress, 2006): 111-15.

Breakthroughs of 2010: Scientific Discoveries that Affirm Creation

"Aim at heaven and you will get earth thrown in. Aim at earth and you get neither." C.S. Lewis

The Largest Possible Habitat for Humanity Dr.Hugh Ross

One of the latest justifications by atheists for their beliefs is that an all-loving, all-powerful God would never confine his creatures to such a tiny pale blue dot of a planet.[1] However, thanks to the research and discovery of extrasolar "super-earths", a twofold response to this challenge is beginning to develop.

First, super-earths are planets that weigh one to ten times the mass of the Earth. To date, astronomers have discovered 23 such planets outside the solar system.[2] Until recently, most astronomers presumed super-earths were composed – similarly to Earth – almost entirely of rocks and metals with only miniscule oceans and atmospheres. However, as described in two articles[3], emerging research – both observational and theoretical – reveals that super-earths possess densities considerably lower than Earth's (which is 5.52 times that of liquid water). In fact, the densities of these extrasolar planets imply that they must be loaded with at least a hundred times as much water per unit of mass as Earth. That much water rules out the possibility of continents and oceans coexisting on these planets' surfaces and, thus, the possibility of advanced life.

Second, a new set of planetary atmosphere models shows that super-earths also have atmospheres far thicker than Earth's.[4] Two astronomers, Eliza Müller-Ricci and Jonathan Fortney, took advantage of transit measurements[5] of the super-earth GJ 1214b to determine the planet's mass (6.5 Earth masses), radius (2.7 Earth radii), density (1.87 times the density of liquid water) and structure. They then explored the possible range of GJ 1214b's atmosphere. Müller-Ricci and Fortney concluded that GJ 1214b possesses an atmosphere dominated either by hydrogen and helium, carbon dioxide, water vapor or by all of these gases *plus* methane and ammonia. In every possibility, however, GJ 1214b's atmosphere must be at least 4,000 times more massive than Earth's. All of these atmospheric scenarios rule out the possibility of advanced life and question whether such planets should be identified as super-earths. It may be more accurate to refer to these planets as "mini-Neptunes" or as small gas giants, rather than as large terrestrial planets.

Extrasolar planetary research provides more evidence that a planet capable of sustaining advanced life must be fine-tuned (designed) to an extreme degree. It also shows that this "tiny pale blue dot", with the physical laws that God has chosen for his stated reasons[6], comprises the largest possible planet and ideal home for humanity.

1. Victor Stenger, *God: The Failed Hypothesis* (Amherst, NY: Prometheus Press, 2007), 160-161.
2. A complete catalogue of all known extrasolar planets is maintained online at: exoplanet.eu/catalog-all.php.
3. Hugh Ross, "Planet Formation: Problems with Water, Carbon and Air", *Today's New Reason to Believe*, January 12, 2008, http://www.reasons.org/rtbs-creation-model/cosmic-design/planet-formation-problems-too-much-water-too-much-carbon-and-too-much-air.
   High Ross, "Small Extrasolar Water World Discovered", *Today's New Reason to Believe*, January 18, 2010, http://www.reasons.org/small-extrasolar-water-world-discovered.
4. Eliza Müller-Ricci and Jonathan Fortney, "The Nature of the Atmosphere of the Transiting Super-Earth GJ 1214b", Astrophysical Journal Letters 716 (June 10, 2010): L74-L79.
5. Transit measurements are attainable because of a fortuitous alignment of the planet's orbital plane with the line between its host star and Earth. This alignment allows astronomers to measure the dimming of the host star's light as the planet passes in front of the star..
6. Hugh Ross, *Why the Universe Is the Way It Is* (Grand Rapids: Baker, 2008).

Breakthroughs of 2011: Scientific Discoveries that Affirm Creation

"We all know that light travels faster than sound. That's why certain people appear bright until you hear them speak." Albert Einstein

Faster than the Speed of Light? Dr.Jeff Zweerink

An experiment harnessed the rare capacity of the particle accelerator at the CERN laboratory (Switzerland) to aim a beam of neutrinos (difficult-to-detect subatomic particles) at a neutrino detector 450 miles away in a mine near Gran Sasso, Italy. Scientists used precise GPS measurements to record when the neutrinos were sent from the Swiss lab and when they arrived at the detection site in Italy. Knowing the distance to within a few centimeters between the accelerator and detector and the difference in generation/detection times, scientists calculated the speed of the neutrinos. After careful analysis, the results showed that the neutrinos arrived at the detector a few billionths of a second (60 nanoseconds to be precise) faster than light could travel between the two locations.[1]

While miniscule, the amount of time conveyed huge ramifications. If true, it would undermine one of the foundations of General Relativity. Appropriately, the team who announced the surprising results put out a call for a thorough inspection and verification, in case there had been a systematic error.

Three weeks later, an error was found. A Dutch scientist discovered a subtle effect in the calculations because the time measurements relied on a satellite in Earth's orbit. When he transformed the time measurements from each of the two locations on the ground into the satellite reference frame (using the principles of Special Relativity), each of the transformations added 32 nanoseconds. Combining the corrections accounted for slightly more than the 60-nanosecond discrepancy and brought the original results in line with the expectations of relativity theory.[2]

This situation affirms several points of good science: (1) rather than assuming that the speed of neutrinos obeyed the constraints of Relativity, the team of scientists devised an experiment to test it [1 Thessalonians 5:21], (2) instead of simply accepting their conclusions, the researchers sought testing and confirmation of the unexpected findings and (3) the results provided another confirmation that General Relativity accurately describes the dynamics of the universe.

The continual validation of General Relativity strongly supports the Big Bang Creation event and the implication that a Being beyond space-time-matter-energy created and maintains the universe.

1. The OPERA Collaboration, "Measurements of the Neutrino Velocity with the OPERA Detector in the CNGS Beam", arXiv.org, September 22, 2011 (http://arxiv.org/abs/1109.4897).
2. Ronald A.J. van Elburg, "Time-of-flight Between a Source and a Detector Observed from a Satellite", arXiv.org, October 17, 2011 (http://arxiv.org/abs/1110.2685).

"Pluto is just the brightest of the many objects in the Kuiper Belt. It's a fossil relic of the formation of our solar system." Alan Stern

The Utility of Just-Right Belts Dr.Hugh Ross

The belts of asteroids and comets (regions of space containing many of these bodies) in our Solar System deliver important ingredients to Earth. Asteroids, for example, supplied the Sudbury (Ontario, Canada) nickel and South African gold deposits. In addition, comets replenish the small amounts of water that Earth loses to outer space. Thankfully, though, our solar system's belts of asteroids and comets are tiny enough that Earth gets pummeled only once every hundred million years or so by collisions wiping out half or more of our planet's species.

Two astronomers at the University of Toronto have discerned that other planetary systems are not so fortunate.[1] They began their analysis by noting that a large fraction of stars of similar mass and age as the Sun harbor detectable infrared excesses. The excesses arise primarily from small dust grains. Due to their short survival times, the dust grains must be produced continuously by collisions among asteroids, comets and even larger bodies called planetesimals – all of which are leftover remains from the era of planet formation.

Accordingly, the team estimated that the concentration of asteroids, comets and planetesimals around the Sun-like stars manifesting infrared excesses must be a hundred to a thousand times greater than what astronomers observe in the solar system's "Kuiper Belt". The Kuiper Belt exists beyond the orbit of Neptune and contains at least a hundred times as many asteroids and comets as does the "Main Belt" (the belt between the orbits of Mars & Jupiter).

This research explains why other astronomers discover so many planets between two and thirty times the mass of the Earth orbiting their host stars at less than half the distance Earth orbits the Sun.[2] The many asteroids, comets, planetesimals and dust interact dynamically with the planets in the same system, causing those planets to drift inward from their birthing location. The inward drifting and the gravitational pull of these planets would significantly disturb the orbit of any other potentially life-hospitable planet in the same system. As a result, such planetary systems cannot produce habitats for advanced life.

Though the researchers do not mention it, their work yields accumulating evidence for the rare-Earth principle: in spite of the enormous number of planets in the universe, Earth remains very rare, if not unique, in its capacity to support advanced life. In other words, Earth appears special in that it resides in a planetary system with the just-right number density and geographical distribution of partner planets. These just-right conditions provide ample evidence for the guiding hand of the supernatural, super-intelligent God of the Bible.

1. Andrew Shannon and Yanqin Wu, "Planetesimals in Debris Disks of Sun-Like Stars", *Astrophysical Journal* 739 (September 20, 2011): 36.
2. Leslie A. Rogers et al., "Formation and Structure of Low-Density Exo-Neptunes", *Astrophysical Journal* 738 (September 1, 2011): 59.
   Joseph Catanzarite and Michael Shao, "The Occurrence Rate of Earth Analog Planets Orbiting Sun-Like Stars", *Astrophysical Journal* 738 (September 10, 2011): 151

Conclusion

Conclusion: **Scientific progress has taken both very small and very large steps, but it is finally going in the general direction where it started out and should always have been ⇒ toward God.**

"Nothing in life is to be feared, it is only to be understood.

Now is the time to understand more, so that we may fear less." Marie Curie

Questions?

Glimpse Ahead and Conclusion

Biblical passages are taken from the NIV1984.