

# Science and the Bible

## *A Search for Meaning & Significance*

### The Anthropic Principle – Part 2

#### *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:** “Equipped with his five senses, man explores the universe around him and calls the adventure Science.”

**Reminder:** 20<sup>th</sup> Century agnostic/atheistic scientists: Copernican Principle ≈ Principle of Mediocrity

**Christianity:** The Creator’s Fingerprint is on the Universe as described in General and Special Revelation

**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.*

#### *The Fine-Tuning of the Laws, Properties & Constants in the Physics of the Universe*

“I have deep faith that the principles of the universe will be both beautiful and simple.” Albert Einstein

**The Laws of Physics:** The fact that man is able to use math to describe the physics of the universe is truly incredible. Many equations appear complex to the untrained; however, most basic equations are surprisingly simple. The following are a few examples...

- † Newton’s Law of Universal Gravitation
- † Coulomb’s Inverse Square Law
- † Newton’s Second Law of Motion
- † Einstein’s Law of Mass-Energy Equivalence

**Newton’s Law of Universal Gravitation:** The gravitational attraction between two bodies with mass can be calculated with the following simple equation:

$$F_1 = F_2 = G \frac{m_1 \times m_2}{r^2}$$

where: **F** is the gravitational attraction force, **G** is the gravitational constant, **m<sub>1</sub>** & **m<sub>2</sub>** are the masses of the two bodies and **r** is the separation distance.

**Coulomb’s Inverse Square Law:** The equation that determines the electrostatic force between two point charges is known as Coulomb’s Law, and is given by:

$$F = k_e \frac{q_1 \times q_2}{r^2}$$

where: **F** is the electrostatic force, **k<sub>e</sub>** is the proportionality constant, **q<sub>1</sub>** & **q<sub>2</sub>** are the point charges and **r** is the separation distance.

**Newton's Second Law of Motion:** When a force is imparted to a body, an acceleration of that body results, and is described by the following simple equation:

$$\mathbf{F} = m\mathbf{a}$$

where: **F** is the force applied to the body, **m** is the mass of the body and **a** is the resultant acceleration.

**Einstein's Law of Mass-Energy Equivalence:** Of all of the equations in the laws of physics, the most famous defines the relationship between mass and energy, and is one of the many equations resulting from the Theory of Relativity developed by Albert Einstein.

$$\mathbf{E} = mc^2$$

where: **E** is energy, **m** is mass and **c** is the speed of light.

**The Properties of Nature:** Nature's properties have extraordinarily fine-tuned characteristics.

The Electromagnetic Spectrum is presented as an example of these unusual traits. The spectrum of radiation spans a total range of frequencies from  $10^3$  to  $10^{25}$  Hz. While almost all of the frequencies are either lethal or useless for life, there is one tiny band of electromagnetism that is essential to plant, animal and human life: visible light. And yet the vital sliver of radiation called visible light is only 4 millionths of a percent of the entire spectrum, but visible light is produced in abundance by the Sun.

**The Fundamental Constants of Physics:** Each of the constants in the physical laws has a very limited range of values that would allow for the existence of advanced life anywhere in the universe.

A few of these constants will be presented, along with the devastating effects of minor changes in the actual value, demonstrating the fine-tuning of the constants from the beginning of time.

1. **gravitational force constant** – *larger*: stars would be too hot, burn too quickly; *smaller*: stars cold, no nuclear fusion/heavy elements
2. **electromagnetic force constant** – *larger or smaller*: insufficient chemical bonding
3. **strong nuclear force** – *larger*: no hydrogen, life essential nuclei unstable; *smaller*: no elements other than hydrogen
4. **weak nuclear force** – *larger*: heavy elements too abundant from star burning; *smaller*: not enough heavy elements from star burning
5. **expansion rate of the universe** – *larger*: no galaxy formation; *smaller*: universe would collapse prior to star formation
6. **velocity of light** – *faster*: stars would be too luminous; *slower*: stars would not be luminous enough
7. **ratio of electron to proton mass** – *larger or smaller*: insufficient chemical bonding
8. **ratio of numbers of protons to electrons** – *larger or smaller*: electromagnetism would dominate over gravity, preventing galaxy, star and planets to form
9. **number of effective dimensions in present universe** – *larger or smaller*: unstable electron, planet and star orbits
10. **polarity of the water molecule** – *greater*: heat of fusion & vaporization too high – no life; *smaller*: heat of fusion/vaporization low, ice not float
11. **ratio of exotic to ordinary matter** – *larger*: universe would collapse before solar stars form; *smaller*: galaxies would not form
12. **mass excess of the neutron over the proton** – *greater*: too few neutrons to form heavy elements; *smaller*: too many neutrons, only neutron or black holes

Biblical passages are taken from the NIV1984.

### *The Solar Eclipse as an Example of Fine-Tuning, Discoverability and Comprehensibility*

**The Eclipse of the Sun:** A Solar Eclipse is a glorious event in Earth's history. The people who are able to be within the relatively small area of land where a total eclipse is observed are blessed with a superb illustration of the Biblical verse: *The heavens declare the glory of God!* <sup>Psalm 19:1</sup>

Even more, the Solar Eclipse is a just-right example of the design in Nature that demonstrates all three: Habitability, Discoverability and Comprehensibility.

**Goldilocks Principle:** When applied to the fine-tuning of the universe, it means that certain factors must be within limited ranges for advanced life to be possible. In other words, an essential characteristic cannot vary significantly toward either extreme, but must be "Just Right".

**Habitable (Habitability) Zone:** A volume of space where the conditions are favorable for the existence of advanced life.

**Discoverability Zone:** A volume of space where and a period of time when the conditions are favorable for the observation of the universe.

**Comprehensibility:** The ability of mankind to observe, understand and characterize the origin and history of the universe.

**The Geometry of a Solar Eclipse:** The Sun is about 400 times larger than the Moon, but it is also about 400 times farther away. As a result, when the Earth, the Moon and the Sun are aligned, the Moon blocks all of the sunlight from reaching the Earth, except for the outer two layers of the Sun's atmosphere: the pinkish Chromosphere and the white Corona. These parts of the Sun would otherwise never be seen.

**Flash Spectrum:** The flash spectrum is the emission spectrum of the Sun's chromosphere which can be observed the few seconds before and after a total eclipse of the Sun. It is formed by a prism and provides a large amount of information about star formation and function.

**Sir Arthur Eddington (1882-1944, British Astronomer):** In the Spring of 1919, Sir Arthur Eddington noted the positions of some stars close to a total solar eclipse and then at a later time (when the stars were in the same relative location) again noted their positions. These observations confirmed that the light from stars is curved by the Sun's gravitation, as predicted by Einstein's Theory of Relativity.

**God's Gift of the Solar Eclipse:** As has been shown, the total eclipse of the Sun is a comprehensive example of all three aspects of the Fine-Tuning of the Universe.

1. **Habitability:** The data that has been (could only be) obtained during a solar eclipse has provided vital facts about the stars and physics. This information has enabled scientists to define the parameters of advanced life habitability in the universe.
2. **Discoverability:** The Earth is by far the best place in the solar system to observe solar eclipses.
3. **Comprehensibility:** Mankind has been able to not only observe & predict these spectacular phenomena, but to also take the data provided and better understand the physics of the cosmos.

### **Quantitative Probabilities of the Fine-Tuning for Advanced Life**

“Astronomers now find they have painted themselves into a corner because they have proven, by their own methods, that the world began abruptly in an act of creation to which you can trace the seeds of every star, every planet, every living thing in this cosmos and on the earth. And they have found that all this happened as a product of forces they cannot hope to discover. That there are what I or anyone would call supernatural forces at work is now, I think, a scientifically proven fact.” Robert Jastrow (*Christianity Today*)

**Reasons to Believe Tables of Fine-Tuning:** As a supplement to material presented in his university lectures and in his book *Why the Universe Is the Way It Is*, Hugh Ross makes available a catalog of cosmic design evidences, along with a bibliography of the journal articles and books from which they are drawn. The catalog can be found at the website: <http://www.reasons.org/links/hugh/research-notes>.

Part 1: Fine-Tuning for Life in the Universe

Part 2: Fine-Tuning for Intelligent Physical Life

Part 3: Probability Estimates for Features Required by Various Life Forms

Part 4: Probability Estimates on Different Size Scales for the Features Required by Advanced Life

The results will be presented from the eight categories (A. to H.) in:

Part 4: Probability Estimates on Different Size Scales for the Features Required by Advanced Life

A. Galaxy Cluster

B. Galaxy

C. Star

D. Planetary System

E. Planet

F. Moon

G. Planet Surface

H. Planet Ecosystem

**The Fine-Tuning of Galaxy Clusters:** Probability for occurrence of all 99 parameters  $\approx 10^{-62}$ .

Maximum possible number of galaxy clusters in the observable universe  $\approx 10^9$ .

Thus, there is less than **1 chance in  $10^{53}$**  that even one finely-tuned galaxy cluster would occur anywhere in the universe without invoking a Divine miracle.

**The Fine-Tuning of Galaxies:** Probability for occurrence of all 200 parameters  $\approx 3 \times 10^{-146}$ .

Maximum possible number of galaxies in the observable universe  $\approx 3 \times 10^{11}$ .

Thus, there is less than **1 chance in  $10^{135}$**  that even one finely-tuned galaxy would occur anywhere in the universe without invoking a Divine miracle.

**The Fine-Tuning of Stars:** Probability for occurrence of all 140 parameters  $\approx 6 \times 10^{-130}$ .

Maximum possible number of stars in the observable universe  $\approx 5 \times 10^{22}$ .

Thus, there is less than **1 chance in  $10^{108}$**  that even one finely-tuned star would occur anywhere in the universe without invoking a Divine miracle.

**The Fine-Tuning of Planetary Systems:** Probability for occurrence of all 137 parameters  $\approx 9 \times 10^{-132}$ .

Maximum possible number of planetary systems in the observable universe  $\approx 4 \times 10^{20}$ .

Thus, there is less than **1 chance in  $10^{112}$**  that even one finely-tuned planetary system would occur anywhere in the universe without invoking a Divine miracle.

Biblical passages are taken from the NIV1984.

**The Fine-Tuning of Planets:** Probability for occurrence of all 268 parameters  $\approx 4 \times 10^{-302}$ .

Maximum possible number of planets in the observable universe  $\approx 4 \times 10^{21}$ .

Thus, there is less than **1 chance in  $10^{281}$**  that even one finely-tuned planet would occur anywhere in the universe without invoking a Divine miracle.

**The Fine-Tuning of Moons:** Probability for occurrence of all 27 parameters  $\approx 10^{-39}$ .

Maximum possible number of moons in the observable universe  $\approx 10^{23}$ .

Thus, there is less than **1 chance in  $10^{16}$**  that even one finely-tuned moon would occur anywhere in the universe without invoking a Divine miracle.

**The Fine-Tuning of Planet Surfaces:** Probability for occurrence of all 137 parameters  $\approx 4 \times 10^{-127}$ .

Maximum possible number of planet surfaces in the observable universe  $\approx 4 \times 10^{21}$ .

Thus, there is less than **1 chance in  $10^{106}$**  that even one finely-tuned planet surface would occur anywhere in the universe without invoking a Divine miracle.

**The Fine-Tuning of Planet Ecosystems:** Probability for occurrence of all 159 parameters  $\approx 10^{-412}$ .

Maximum possible number of planet ecosystems in the observable universe  $\approx 4 \times 10^{21}$ .

Thus, there is less than **1 chance in  $10^{390}$**  that even one finely-tuned planet ecosystem would occur anywhere in the universe without invoking a Divine miracle.

### Understanding the Vastness of the Fine-Tuning Probabilities

In the eight categories, the largest probability is the one predicting how likely it is to find a finely-tuned Moon that is just-right for advanced life on its home planet. That probability is about **1 chance in  $10^{16}$** . Compare: the present probability for winning the NM lottery jackpot is about **1 chance in  $1.75 \times 10^8$** . Therefore, a person buying one lottery ticket has a 57 million times better chance of winning the jackpot than mankind has of finding a suitable Moon anywhere in the Universe.

Other values illustrating the vast sizes of the probabilities:

- † Number of Stars in observable Universe:  $10^{21}$
- † Number of Atoms in the Milky Way:  $10^{65}$
- † Number of Protons and Neutrons in the observable Universe:  $10^{79}$

### Summary and Conclusions

**Conclusion:** In these last two weeks, it has been shown on every size scale – from characteristics of the Earth to the entire universe, that the cosmos is exceedingly finely-tuned for advanced life. Furthermore, it has become more and more evident that without the supernatural, advanced life would not be possible anywhere in the Universe (including on Earth). As a result, since humans do exist on Earth, both Divine Intervention and the Anthropic Principle are being shown as true.

“Out of clutter, find simplicity. From discord, find harmony. In the middle of difficulty, lies opportunity.”

Albert Einstein

### Questions?

### Glimpse Ahead and Conclusion

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