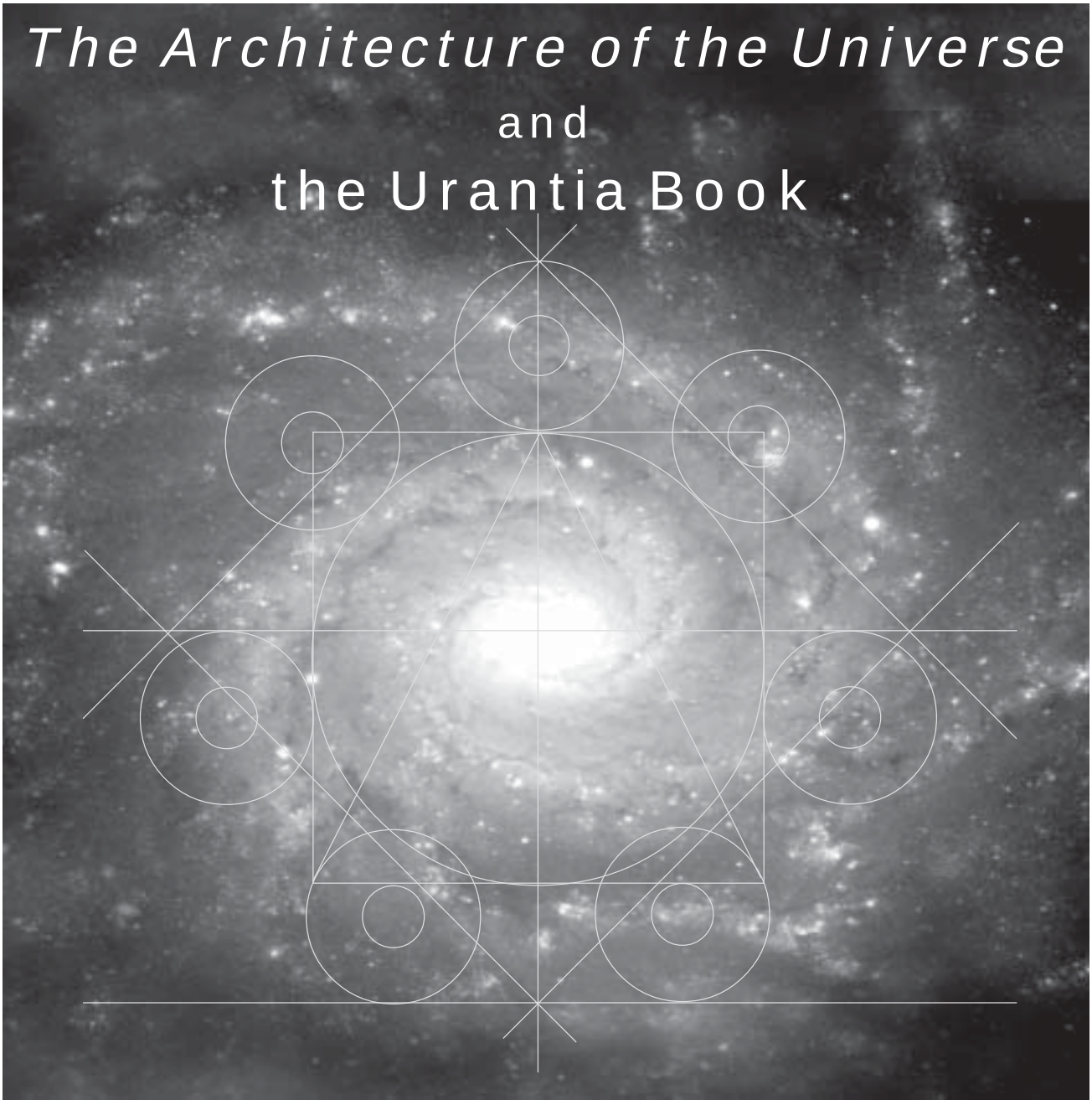
The Architecture of the Universe and the Urantia Book



by Frederick L. Beckner

THE *ARCHITECTURE OF THE UNIVERSE* (*AU*) is a book about the "broad features of the design of the physical world," written by W. F. G. Swann in 1934. Professor Swann was Director of the Bartol Research Foundation* of the Franklin Institute in Philadelphia, from 1927 until 1959. Born in England in 1884, he came to the United States in 1913, taught physics at the University of Minnesota, the University of Chicago, and Yale. An accomplished cellist, Swann founded the Swarthmore Symphony Orchestra. He was posthumously honored in ➤

1967 by having a crater on the Moon (52°N, 112.7°E, 42 km in diameter) named after him.

AU was identified by Matthew Block in 1992 as a source for some of the science-related material in Papers 15, 41, and 42 of the Urantia Book (UB). However, there is little or no evidence of verbatim copying of Swann, and in three instances, errors in Swann's material were corrected or avoided by the authors of the UB.

CORRESPONDENCES

In this study, ten apparent correspondences between these two books are examined. Two of these were discussed by Martin Gardner in his 1995 book *Urantia: The Great Cult Mystery* (347).

1. The Seven Openings of the Human Head

Both the UB and *AU* make statements concerning the seven openings of the human head.

> UB: When a renowned religious teacher reasoned that the number seven was fundamental to nature because there are seven openings in the human head, if he had known more of chemistry, he might have advocated such a belief founded on a true phenomenon of the physical world. (479:6)

> *AU*: [Quoting 16th century astronomer Francesco Sizzi:] "There are seven windows in the head, two nostrils, two eyes, two ears, and a mouth; . . ." [nearly four paragraphs deleted] . . . [I]f he had known that there were chemical elements, and had predicted something about the recurrence of their properties after periods of seven, when arranged in order of their atomic weights, he might have hit upon a truth there also. (3:1-4:1)

While the concept of the UB passage may well have been derived from Swann's work, there is a significant difference between the two statements. In particular, the passages are not speaking of the same person. The UB statement is about a "renowned religious teacher," while Swann's discussion concerns Francesco Sizzi, an astronomer who attacked Galileo because he taught the unorthodox view that the earth revolved around the sun, and not vice versa. In no way was Sizzi a "renowned religious teacher." Gardner tries to make him appear so by calling him an "eminent Roman Catholic contemporary of Galileo," but even Gardner can't bring himself to call him a "renowned religious teacher." This is just one example of Gardner's tendency to twist facts to support his preconceived opinions. Actually, the religious significance of the seven openings of the human head derives not from Sizzi, but from an ancient Indian Vedic teaching called Prana Vayu. The seven openings are known as the seven Rishis, or seven Pranas. So, in fact, the UB's "renowned religious teacher" is most probably not a reference to Sizzi at all. (As an aside, Sizzi was broken on the wheel in 1617 for writing a pamphlet attacking the king of France.)

W.F.G. Swann

2. Mass of an electron vs. one-tenth of ounce.

The UB states:

> If the mass of matter should be magnified until that of an electron equaled one tenth of an ounce, then were size to be proportionately magnified, the volume of such an electron would become as large as that of the earth. (477:2)

The mass of the electron is 9.10938 x 10^-28 gram. An ounce is 28.35 grams. The magnification required to increase the electron mass to one-tenth ounce is then given by 2.835/9.10938 x 10^-28 = 3.112 x 10^27. The Institute of Physics web site (www.iop.org/Physics/Electron/Exhibition/section1/properties.html) states that the size of the electron has never been measured. It is only known that its radius is less than 10^-18 m. The radius of the earth, however, is quite well known to be 6.378 x 106 m. In order for the size of the electron to be proportionately magnified to equal the size of the earth, the electron radius must be 6.378 x 10^6/3.112 x 10^27 = 2.049 x 10^-21m, which is 2.049 zeptometers. The UB thus implies that the electron radius is about five hundred times smaller than the currently known upper limit of its radius. The corresponding diameter of the electron is thus 4.098 x 10^-19 cm.

The corresponding passage in *AU* is:

> The mass of the electron is so small that if you should magnify all masses so that the electron attains a mass of one tenth of an ounce, that one tenth of an ounce would, on the same scale of magnification, become as heavy as the earth. (44:2)

The mass of the Earth is 5.9736 x 10^27 gm. If one magnifies one-tenth ounce (2.835 gm) by 3.112 x 10^27, one has a mass of 8.83 x 10^27 gm. This estimate is about 47% greater than the actual mass of the Earth. In order to make this statement absolutely accurate, the reference mass must be 0.082 oz rather than 0.1 oz. One-tenth ounce is probably close enough for the purpose of this illustration.

What is most interesting about this correspondence is that the UB author, a Mighty Messenger, changed the second ratio from one concerning mass, which is easily verifiable, to one concerning the size of the electron. In doing this, the Mighty Messenger provides a way for Urantians to calculate the size of the electron, scientific information which is unknown to this day. This is an apparent violation of the mandate not to provide scientific information unknown on Urantia (see UB 1109).

Gardner writes the following about this correspondence:

> Note that the Mighty Messenger made a mighty mistake in copying from Swann. He says the magnified electron would have a volume equal to that of the earth when he should have said mass. (348:3)

Gardner himself makes the mistake of assuming that the Mighty Messenger intended to copy Swann exactly. If he had read the UB passage carefully he would have found that the Mighty Messenger knew exactly what he was saying. He did not make the mistake of confusing mass and volume. We know this because he explicitly refers to size as the quantity he is proportionately magnifying. He is saying that the magnification factor derived from mass, if applied to size, would make the electron have the same size as the Earth. As we have shown above, the value of electron size this implies is not inconsistent with current scientific estimates of the upper limit on the size of the electron.

3. Volume of a proton.

The UB states the following concerning the relationship of the size of the proton, a pinhead, and the earth's orbit:

> If the volume of a proton—eighteen hundred times as heavy as an electron—should be magnified to the size of the head of a pin, then, in comparison, a pin's head would attain a diameter equal to that of the earth's orbit around the sun. (477:2)

The diameter of the Earth's orbit is 2.992 x 10^13 cm (see www.seds.org/nineplanets/nineplanets/earth.html). I measured the diameter of the head of a common sewing pin as 0.068 in, or 0.173 cm. The head of this pin is probably the smallest typical value; I have seen other pins with larger heads. This pinhead would have to be magnified by a factor of 1.73 x 10^14 to equal the diameter of the Earth's orbit. Decreasing the pinhead by this factor yields the diameter of the proton as indicated by the UB, 1.0 x 10^-15 cm.

The radius of the proton was measured by spectrographic techniques in 1996 to be 0.861 x 10^-15 m, or 8.61 x 10^-14 cm (see http://www.cnrs.fr/Cnrspresse/n22a3.html and www.physlink.com/reference_constants.cfm). This is not the first measurement of this diameter; a less accurate measurement was made in 1963, which gave nearly the same value. The measured diameter of the proton is thus 1.722 x 10^-13 cm. This diameter is 172 times larger than the value inferred from the UB statements.

Swann's corresponding statement is essentially the same as the UB's:

> Then, we have the proton—the fundamental unit of positive charge—a thing 1800 times as heavy as the electron, but 1800 times smaller in size, so that if you should magnify it to the size of a pin's head, that pin's head would, on the same scale of magnification, attain a diameter equal to the diameter of the earth's orbit around the sun. (44:3)

It accordingly is equally in disagreement with the currently accepted measurements. Today's scientists believe that the electron is smaller than the proton; thus Swann's statement that the proton is smaller than the electron is not consistent with current science. Interestingly enough, the UB does not make this mistake.

The Mighty Messenger provides a way for Urantians to calculate the size of the electron, scientific information which is unknown to this day. This is an apparent violation of the mandate not to provide scientific information unknown on Urantia.

4. Size of an atom.

The UB gives a specific value for an unspecified type of atom, while *AU* gives a value for the size of the hydrogen atom.

> UB: Each atom is a trifle over 1/100,000,000th of an inch in diameter, while an electron weighs a little more than 1/2,000th of the smallest atom, hydrogen. (477:1)

> *AU*: It would take about 2000 protons laid side by side to make up the diameter of an electron, about thirty thousand electrons side by side to stretch the diameter of a hydrogen atom, and about a hundred million hydrogen atoms side by side to stretch one third of an inch. (46:2)

The diameter of the hydrogen atom is about 8 x 10^-9 cm, or 3.15 x 10^-9 inches. One hundred million hydrogen atoms would then occupy a distance of 0.315 inches or approximately one-third inch, as stated by Swann. This is about 1/317,500,000 of an inch. Given that the size of atoms varies according to the particular element, the UB's value of 10^-8 inch is a reasonable round number to use in a generic sense.

An even closer correspondence to this passage is to be found in Eddington's book, *Stars and Atoms*, written in 1926. Thus it is quite possible that both Swann's corresponding passage and the UB passage are derived from Eddington's work. See my previous paper, "Stars and Atoms and the Urantia Book,"for further discussion of this correspondence.

5. Emissions of radium.

One of the most interesting correspondences between *AU* and the UB is that concerning the emissions of radium. Both books identify the two types of emissions, called alpha and beta particles. Alpha particles are the positively charged helium nucleii, and beta particles are negatively charged electrons. The two books use the same sentence structure in expressing these results, first giving the velocity of the positive particles, and then that of the negative particles.

> UB: The positive particles of radium fly off into space at the rate of ten thousand miles a second, while the negative particles attain a velocity approximating that of light. (477:5)

> *AU*: [Speaking of emanations from the radium atom:] First, we have the alpha particle, a positively charged atom of helium moving with a velocity of about 12,000 miles per second. Then we have the beta particle, which is an ordinary electron traveling with a speed comparable with that of light. (67:1)

What is most interesting is that the UB cites a different value of the velocity of the positive particles than Swann. Swann ➤

gives the velocity of the alpha radiation from radium as 12,000 miles per second, while the Urantia Book gives a value of 10,000 miles per second. The actual velocity can be easily calculated in the following manner.

The energy of the alpha radiation from Ra226, the most common isotope of radium, is found to be 4.871 MeV (million electron Volts), as given at www.dne.bnl.gov/CoN/nuc/R/Ra226.shtml.

The mass of the alpha particle is given as 7294.299 times that of an electron (see www.//physics.nist.gov/cgi-bin/cuu/Value?malsme|search_for=electron-mass). Finally, one electron Volt is equivalent to an energy of 1.602 x 10-12 erg. From the definition of kinetic energy, one has E = (m v^2)/2, where E is the energy of the alpha particle in ergs, and m is the mass of the alpha particle in grams, and v is its velocity in cm/s. From the information given above, the energy of the alpha particle is 4.871 x 10^6 eV x 1.602 x 10^-12 ergs/eV = 7.8033 x 10^-6 ergs. The mass of the alpha particle is 9.10938 x 10^-28 gm x 7294.299 = 6.6447 x 10^-24 gm. Solving the energy equation above for the velocity and substituting the values we have obtained for mass and energy yields a velocity of 1.5326 x 109 cm/s. Now one mile equals 1.6093 x 10^5 cm. Dividing our velocity in cm/sec by this number gives the velocity of the alpha emission from radium as 9,523 miles per second.

It is thus clear that the UB value is correct when rounded to the nearest thousand. The value given by Swann is approximately 20% too large. If *AU* was indeed a source for the statement concerning the emissions of radium given in the UB, one must conclude that the UB author knew the correct value for the velocity of the alpha emissions and substituted the correct value for the erroneous value given by Swann. Technically this might also be a violation of the mandate not to provide unearned scientific knowledge. Of course, it is possible that the UB value was obtained from another human source.

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6. Use of the term "grand universe."

Both books use the word "grand" in reference to the universe. The UB uses the term "grand universe," while Swann uses the term "grander universe."

> UB: The seven evolving superuniverses in association with the central and divine universe, we commonly refer to as the grand universe (1:6)

> *AU*: The number of stars in the in the grander universe is, possibly, about 10,000 million-million-million [10^22] (232:1)

Swann uses the term "grander universe" to mean all material creation. This would correspond to the Urantian term "master universe." The UB uses the term "grand universe" to refer to the seven inhabited superuniverses plus the central universe of Havona.

7. Number of stars in universe.

Both books compare the number of stars in the master universe with the number of glasses of water in the Earth's oceans.

> UB: But in the master universe there are as many suns as there are glasses of water in the oceans of your world. (173:0)

> *AU*: In other words, there are about as many stars in the grander universe as there are glasses of water in all the oceans of the world. (232:1)

This correspondence is strikingly exact. Starting with the word "as," the phraseology is exactly the same except that the UB drops the modifier "all." The editing results in a more elegant phrasing without sacrificing clarity.

A calculation of the number of glasses of water in the oceans of the world gives a value of about 5 x 10^21. This is reasonably close to values derived from current estimates of the number of galaxies obtained from Hubble telescope deep field measurements, and to current estimates of the average number of stars in a galaxy.

Swann's estimate of the number of stars in the universe was made in 1934, when the number of galaxies known to exist in the universe was thought to be orders of magnitude less than current estimates, and when the average number of stars per galaxy was also thought to be much less. Swann surely had no observational basis for his estimate. This estimate, however, can be shown to be in agreement with current scientific knowledge that there are about 100 billion galaxies in the universe, that our Milky Way galaxy has about 200 to 400 billion stars, and that it can be considered an unusually large galaxy.

8. Star with a density one-thousandth of Earth's atmosphere.

Both books refer to a star whose density is one thousandth that of the Earth's atmosphere.

> UB: The massive sun of Veluntia, one of the largest in Orvonton, has a density only one one-thousandth that of Urantia's atmosphere. (460:3)

> *AU*: There is Betelgeuse, the great red star of Orion. It is a gas, and a very rarefied gas at that, for its density is only about one-thousandth part of that of our atmosphere. (232:1)

Although we cannot be sure that the sun in Veluntia is the same as Betelgeuse, both are certainly "massive suns," and both

are said to have the same density. The name "Veluntia" is not given elsewhere in the UB, so we have no way to bolster this identification. Betelgeuse is in Orion, a part of the Milky Way galaxy, which is identified in the UB as being in Orvonton. This correspondence between *AU* and the UB is probably the weakest in the set.

9. Distance to the Andromeda nebula.

Both books give the distance to the Andromeda galaxy, one of the few objects outside of the Milky Way which are visible to the naked eye.

> UB: There are not many sun-forming nebulae active in Orvonton at the present time, though Andromeda, which is outside the inhabited superuniverse, is very active. This far-distant nebula is visible to the naked eye, and when you view it, pause to consider that the light you behold left those distant suns almost one million years ago. (170:1)

> *AU*: It is the great nebula of Andromeda - one of the giants of the universe, a thing so large that light, traveling at the rate of 186,000 miles per second, takes 50,000 years to cross it, but so far away that this light takes nearly a million years to reach us, so that we see that nebula not as it is today, but as it was a million years ago. (232:1)

Ten correspondences provide strong evidence that the UB authors referred to Swann's book and incorporated some of his discussions into their work.

These two passages contain the same idea, that the light we see when we view Andromeda originated one million years ago. This value of the distance to Andromeda is currently viewed as being incorrect. The current estimate of the distance to the Andromeda galaxy is nearly three million light years (see www.seds.lpl.arizona.edu/messier/m/m031.html). The value of one million light years was believed correct by astronomers until 1953. Thus the value given in the UB was the value known by astronomers at the time the Urantia Papers were written. The diameter of this galaxy is also given incorrectly in *AU*. Current science estimates its diameter at about 200,000 light years, or about twice the size of the Milky Way. The UB gives no value for the size of Andromeda, and thus avoids Swann's mistake.

10. Boiling of the Earth's oceans.

Both books state that the quantity of energy radiated by the sun per second is sufficient to boil the earth's oceans.

> UB: The total heat now given out by the solar system sun each second is sufficient to boil all the water in all the oceans on Urantia in just one second of time. (463:6)

The corresponding statement in the *AU* is:

> The heat sent out from the sun, if poured into the oceans of the earth, would cause them to boil in one second. (237:2)

The volume of the Earth's oceans is about 1.358 x 10^24 cm^3. Thus the mass of this water is 1.358 x 10^24 grams. The sun is emitting energy at a rate of 3.8 x 10^26 Joules per second. The energy required to raise one gram of water 100° C is 418.4 Joules, and the energy required to boil water at 100° C is 2,259 Joules per gram. Thus the time required to raise the Earth's oceans to the boiling point of water is less than 1.358 x 10^24 x 418.4 / 3.8 x 10^26 = 1.5 sec. The time required to boil the water once its temperature was at the boiling point, that is, to convert the liquid water to steam, would be an additional 8 seconds. This doesn't allow for the time required to melt the water in the ice caps.

If the UB statement is taken to mean that this energy is "sufficient to boil [away] all the water," then this statement is incorrect. It would take about 9.5 seconds to do this. If the UB statement is taken to mean "sufficient to [bring to] boil all the water," as is the common dictionary definition of the word "boil," then the UB statement is essentially correct.

CONCLUSIONS

These ten correspondences provide strong evidence that the UB authors referred to Swann's book and incorporated some of his discussions into their work. I see no evidence that the UB authors introduced deviations from Swann's work which might be considered errors in view of present scientific knowledge. On the contrary, in some cases the UB authors avoided including information from Swann's work which today would be considered erroneous: that the electron is bigger than the proton, that the alpha particles emitted from radium travel at 12,000 miles per second, and that the radius of Andromeda is 50,000 light years. The UB and Swann's statements concerning the size of the proton are in substantial disagreement with current knowledge. However, this knowledge was not available at the time the UB was written and thus the UB author was merely repeating Swann's mistake in accordance with the mandate not to reveal information not already known. The information concerning the distance-location of the Andromeda galaxy is also incorrect, and also falls into this category. ■

•The Bartol Research Foundation is now called the Bartol Research Institute. See www.bartol.udel.edu/basics/history.html for more information.

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