



Journal of The Brotherhood of Man Library, an Information, Telecommunication and Lending Service
Resource for Students of *The URANTIA Book*.

Prophecy and Error in

The Urantia Book

Introduction

Have you ever realised that your God is too small? Think on this. Dotted over the night sky at a distance of about 8 billion light-years or more, are curious objects called quasars. They appear to be associated with colliding galaxies or colliding black holes. A single quasar may shine with the blinding light of 10 thousand billion ordinary suns. What on earth can they really be? What unimaginable event does such a release of energy herald?

This work discusses error and prophecy in the Urantia Papers. Its purpose is to put them in their right place. If the revelators used them, they must have had good reason. What could it be? Well certainly to prevent us from messing up their true purposes. Perhaps there could be no other.

If you find yourself unable to cope with a few harmless errors—included with a revelation for the purpose of diverting you from sabotaging its real purpose—then your God is certainly by far too small. Ask yourself did the material that bothers you have any conceivable spiritual value? If not then it was doomed to die with your brain—which may be indicative of its real importance.

"Only those human experiences of spiritual value survive—your past life and its memories, having neither spiritual meaning nor eternity value, will perish with the human brain."

Your spirituality is the measure of your nearness to God. And so surely the true purpose of the revelators in giving us the Urantia Papers would have been to increase our spirituality. That means increasing our love for God and for one another.

For nigh on thirty years or more after publication of the Papers almost all their readers believed firmly in their infallibility. Many still cling to this belief, regardless of how convincing the contrary evidence may be. One conspicuous thing among those early readers that persists to this day, is that, as a group and in terms of their spirituality, they do not stand out from the average church-going Christian.

So why did we need a 2000 page revelation? To make us better scientists, accurate historians, accomplished theologians? Is that what Jesus did? If we go to the conversations between Jesus and Immanuel just prior to Jesus' incarnation, we find Immanuel saying: (P.1328)

In this issue...

This and the following issue of Innerface consists of a discussion of both the prophetic material in the Urantia revelation and its many apparent errors in the scientific and historic components of its text.

The words, 'apparent errors' are used in recognition that we mortals know nothing with absolute certainty. However errors in simple arithmetic are difficult to argue with and for those who hold to the concept that a revelation must be infallible, attention is drawn to the revelators' assertion that during their initial growth period, our moon and the earth remained at much the same size until the earth was one fifth its present mass—and that made the moon 16 times more massive than it now is. Moreover, the Appollo missions brought back much evidence that is quite incompatible with the revelators' account.

But the purpose for this presentation is not to convince committed fundamentalists of their wrongness. Rather it is to help new readers of the revelation to understand that the authors themselves asserted that not only this but any revelation provided to mortals anywhere, is partial and incomplete, and even that "this cosmology is not inspired." Quotations from the book confirming these assertions are provided.

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Please address donations and submissions to:
USA: David Biggs, 4040 Beecher Rd., Flint MI
48532, USA

Internet: elsnerr@comcast.net

All other countries:

Ken Glasziou, 2/9 Fig St., Maleny 4552 Australia

Internet: kglaszio@ozemail.com.au

Web: www.ozemail.com.au/~kglaszio

But no revelation short of the attainment of the Universal Father can ever be complete. All other celestial ministrations are no more than partial, transient, and practically adapted to local conditions in time and space. While such admissions as this may possibly detract from the immediate force and authority of all revelations, the time has arrived on Urantia when it is advisable to make such frank statements, even at the risk of weakening the future influence and authority of this, the most recent of the revelations of truth to the mortal races of Urantia. (1008)

"Your great mission...to live a life wholeheartedly motivated to do the will of your Paradise Father, thus to reveal God, your Father, in the flesh and especially to the creatures of the flesh...the achievement of God seeking man and finding him and the phenomenon of man seeking God and finding him... Exhibit in your one short life in the flesh, as it has never before been seen..., the transcendent possibilities attainable by a God-knowing human during the short career of mortal existence."

Jesus' revelatory life in the flesh was to demonstrate the 'transcendent possibilities attainable by us mortals'—which must surely mean those realities having spiritual value for life 'in the spirit'—life as it is lived in God's eternal kingdom.

For the first thirty years of its shelf life neither prophecy nor error in The Urantia Book was an issue. But then a handful of readers began to ask questions. Prior to this time both types of material were in the exclusive possession of 'the experts.' But then the effects of the knowledge explosion began to leak to the general public arena. Parallel with this, and due to extraordinary technological advances, there was an explosion in the accuracy with which measurements could be made. The results are twofold—sheer wonderment for some of the prophetic knowledge contained in the Papers and sheer puzzlement about the error content that suddenly became exposed.

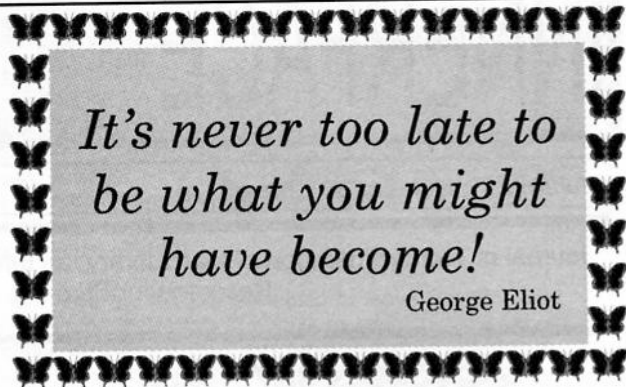
Items that produce true wonderment if read and digested thoroughly are those covering the discovery of the radii of the electron and proton, another being confirmation that the neutrino exists and truly is released in vast quantities during the explosion phase of neutron star formation. For anybody with a trenchancy for appraising probabilities, the careful study of these cases to assess the chances of correctly guessing the answers is likely to induce the feeling that, at the time of writing, no human author had the capacity to do so.

Perhaps to comply with the universe dictum that providing us with unearned knowledge is forbidden, in both these cases the revelators quoted almost word for word from published papers. In the electron and proton radii case they made subtle alterations to the text of the quotes that vastly altered the answers obtained—but were not confirmable as correct until the 1990's period. In the neutrino case, the authors of the original paper betrayed the fact they did not believe their own speculation, and, in fact, favored a quite different outcome. But, after a lapse of many years, it was their highly speculative suggestion, the one chosen by the revelators, which turned out to be correct.

Wonderment also comes if we read the Book's account of the early parallel growth of the Earth and its Moon through an accretion process and, on checking the sums, we discover that the revelators' account has the Moon attain a mass 16 times its present size. Curiously it took almost fifty years before anyone even noticed this obvious error. Such was the faith of readers in the infallibility of heavenly sources—and this despite the authors' own denials:

"Let it be made clear that revelations are not necessarily inspired. The cosmology of these revelations is not inspired." (P.1109)

[Note: In the 1930's, the word "cosmology" still retained its traditional connotation as a branch of metaphysics dealing with features of the world as a whole—including, for example, St Thomas Aquinas' famous cosmological argument—see Oxford University Press, *Oxford Companion to Philosophy*.]



The Urantia Papers—What should our expectations be?

Summary

The Papers' authors describe the boundaries of the universe mandate for revelation—which include giving **preference to the highest human concepts relating to any topic**. They declare they have resorted to pure revelation only when there is no adequate previous presentation upon a particular topic by a human mind. They state that vast amounts of information were available to them both for the preparation of Parts 1-3 and for Part 4 of the Papers. Also we are informed that divine revelation, meaning infallible truth, is the exclusive possession of creator identities. Reference to The Urantia Book's contents index shows that none of these authors were of that exalted status—thereby warning us that the Papers are the work of fallible beings. Hence they cannot legitimately be used as the foundation for a fundamentalist religion. (P.1109, etc)

In formulating the succeeding presentations having to do with the portrayal of the character of the Universal Father and the nature of his Paradise associates, together with an attempted description of the perfect central universe and the encircling seven superuniverses, we are to be guided by the mandate of the superuniverse rulers which directs that we shall, in all our efforts to reveal truth and co-ordinate essential knowledge, give preference to the highest existing human concepts pertaining to the subjects to be presented. We may resort to pure revelation only when the concept of presentation has had no adequate previous expression by the human mind. (P. 16)

And from the author of Part 4, "The Life and Teachings of Jesus," we have:

Acknowledgment: In carrying out my commission to restate the teachings and retell the doings of Jesus of Nazareth, I have drawn freely upon all sources of record and planetary information. My ruling motive has been to prepare a record which will not only be enlightening to the generation of men now living, but which may also be helpful to all future generations. From the vast store of information made available to me, I have chosen that which is best suited to the accomplishment of this purpose. As far as possible I have derived my information from purely human sources. Only when such sources failed, have I resorted to those records which are superhuman. When ideas and concepts of Jesus' life and teachings have been acceptably expressed by a human mind, I invariably gave preference to such apparently human thought patterns.... (P.1343)

The authors have left no room for us to elevate their records to a divine infallibility status. Outside of Paradise, they inform

us, "Truth is partial, relative, and progressive." And so as to leave no stone unturned in our efforts to acquaint the new reader with what the authors themselves claim about their efforts to bring us enlightenment, we have been informed:

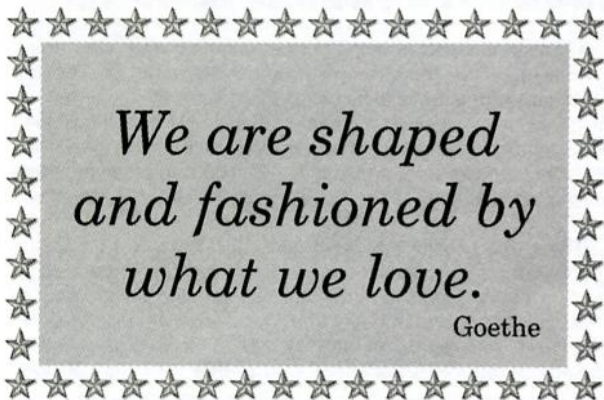
Partial, incomplete, and evolving intellects would be helpless in the master universe, would be unable to form the first rational thought pattern, were it not for the innate ability of all mind, high or low, to form a universe frame in which to think. If mind cannot fathom conclusions, if it cannot penetrate to true origins, then will such mind unfailingly postulate conclusions and invent origins that it may have a means of logical thought within the frame of these mind-created postulates. And while such universe frames for creature thought are indispensable to rational intellectual operations, they are, without exception, erroneous to a greater or lesser degree.

Conceptual frames of the universe are only relatively true; they are serviceable scaffolding which must eventually give way before the expansions of enlarging cosmic comprehension. The understandings of truth, beauty, and goodness, morality, ethics, duty, love, divinity, origin, existence, purpose, destiny, time, space, even Deity, are only relatively true. God is much, much more than a Father, but the Father is man's highest concept of God.... Man must think in a mortal universe frame, but that does not mean that he cannot envision other and higher frames within which thought can take place. (P.1260)

What then was their purpose in giving us a 2000 page book if not to provide a true and reliable description of the universe in which we live? One answer is that any true and reliable account would have quickly be turned into an object of irrational reverence, obsessive devotion, even worship. This problem certainly arose with Adam and Eve, and with Melchizedek, who were all elevated to the status of Gods or demi-Gods by mortals of their time. The same problem occurred with Jesus who came to lead us into a knowledge of the Father, but we mortals quickly submerged his teachings by substituting the worship of Jesus himself. The Bible too has suffered the fate of becoming an object of worship.

In seeking to avoid this same fate, we believe the authors have gone to great lengths to mix remarkable prophecy with obvious error, or sometimes subtle error. But they knew that, at least initially, they would have only limited success. Eventually the included error would dominate the responses of the new readers—and the real message, the facts about our personal relationship with the Father, and the spiritual nature of our real goals, would have to be selected out from the window dressing and presented in its pure form.

The religious challenge of this age is to those farseeing and forward-looking men and women of spiritual insight who will dare to construct a new and appealing philosophy of living out of the enlarged and exquisitely integrated modern concepts of



cosmic truth, universe beauty, and divine goodness. Such a new and righteous vision of morality will attract all that is good in the mind of man and challenge that which is best in the human soul. (P. 43)

Why is there both Error and Prophecy in the Urantia Revelation?

Summary

For certain, the Urantia Revelation was not given to us to make us into good scientists, nor to teach us the history of our evolution. Neither was its purpose to enlighten us on the duties of Celestial Artisans, Heavenly Reproducers, Energy Manipulators, nor to tell us about the Circles of Angels, Universe Aids, Courtesy Colonies, and so on. Its major purpose, perhaps its sole purpose, is to spiritualize our minds and souls. For that purpose we are presented with Jesus' living revelation of the nature of God.

"Only those human experiences of spiritual value survive—your past life and its memories, having neither spiritual meaning nor eternity value, will perish with the human brain."

Although the Urantia Papers contain a considerable amount of science-related material, the advanced reader may have recognized that most such content is simply a background setting for the more important aspects of the Papers—those concerned with the spiritual values of mankind. And from mankind's viewpoint, that whether this background setting ranks as infallible truth is not as important as that it provides a framework in which we can think. Think about what? About that which is ultimately important—why we are here and what is our destiny?

Furthermore, all sincere, truth-seeking readers must sooner or later discover that the Papers do present some truly prophetic scientific material having content that was unknown to human scientists at the time of their receipt in 1935. But contrasting with that, the Papers also contain much material that was either outdated at the time of printing, soon to be outdated, or simply erroneous.

A thorough reading of the Papers also discloses that their authors were amazingly knowledgeable, highly intelligent, and displayed extraordinary wisdom. Therefore their strange way of presentation must have been considered and deliberate. But why, why, why?

Historically, few early readers of the Papers were qualified to judge the quality of science in the book. Hence most, swayed by the exalted status accredited to their authors, and despite the denials of the authors themselves, assumed that revelation must automatically imply infallibility.

Since those early days, many readers have discovered that the science content of the Papers includes serious error. And skeptics have leveled the criticism that if enough random guesses are made, some will be correct through lucky guesswork. However there are instances in these Papers where the probability of being right or wrong through random guesswork can be rationally assessed—and in enough instances to cause us to conclude that the "through guesswork" alternative is not really a valid option. For example if there is one chance in 100 of being right then there are 99 ways of being wrong. There are too many instances that the Papers were right for lucky chance to always be the explanation.

But that still leaves the unanswered question—what is the explanation for this strange mix of prophetic and flawed science material?

The history of the Urantia Papers as provided by the convener of the so-called Contact Commission, Dr W. S. Sadler¹, and by others^{2,3}, tells of distinct phases during the receipt of the Papers. The first, a preparatory stage, commenced perhaps as early as 1905 and continued through until 1924; a second, in which questions were asked and new Papers received, was from 1925 until 1935 when the final version of the Papers was pronounced to be complete; a third period lasted until 1943 during which some minor, but important, modifications were made, the contract to print was signed and the galley proofs checked. There then followed a lengthy and unexplained period terminating in 1955 when The Urantia book was finally published. During the whole of this final period the completed printing plates remained in the strong room of the publishers, R. R. Donnelly and Sons, awaiting instructions to print.

If we accept Dr Sadler as our authority, all of the Papers of Parts 1, 2, and 3 were received through a single unidentified person, a patient of Dr's William and Lena Sadler, who either spoke or wrote during a disturbed period of sleep of which he was quite unconscious. Part 4 of the book, *The Life and Teachings of Jesus*, may have had a different origin though the evidence for this is conflicting.² Parts 1, 2, and 3 were virtually complete in 1934, though there were additions and modifications up until about 1943. Part 4 was delivered complete in 1935.

For our present purpose, the period during which the Papers were received is our main interest. Lasting about ten years, according to Dr Sadler it commenced in a contact experience when a "visitor," speaking through the sleeping subject, answered a question with these words, "If only you knew what you are in contact with you would not ask such trivial questions. You would rather ask such questions as might elicit answers of supreme value to the human race."

Later that night one of Dr. Sadler's group exclaimed: "**Now they have asked for it—let us give them questions that no human being can answer¹.**"

A group called the Forum was then organized, the arrangement being that Papers would be received only as answers to specific questions from the Forum. Questions were posed, collected by Dr Sadler, placed in an arranged location, and an answer later received through the medium of the "sleeping subject."

One of these Papers contained material important to our quest for understanding the error content of the Papers. It needs to be read in the light of the aim of the Forum members that they should ask questions that no human being could answer.

*"Because your world is generally ignorant of origins, even of physical origins, it has appeared to be wise from time to time to provide instruction in cosmology. And always has this made trouble for the future. The laws of revelation hamper us greatly by their **proscription of the impartation of unearned or premature knowledge.** Any cosmology presented as a part of revealed religion **is destined to be outgrown in a very short time.** Accordingly, future students of such a revelation are tempted to discard any element of genuine religious truth it may contain because they discover errors on the face of the associated cosmologies therein presented.*

"Mankind should understand that we who participate in the revelation of truth are very rigorously limited by the instructions of our superiors...within a few short years many of

*our statements regarding the physical sciences **will stand in need of revision** in consequence of additional scientific developments and new discoveries. These new developments we even now foresee, but we are forbidden to include such humanly undiscovered facts in the revelatory records. Let it be made clear that **revelations are not necessarily inspired.**" (from P. 1109)*

From the first paragraph we note that the laws of revelation "proscribe the impartation of unearned or premature knowledge." In this Paper it is also stated that in some cases information could be supplied to fill vital missing gaps in otherwise earned knowledge. Perhaps this was what sanctioned the inclusion of prophetic material—despite the proscription against the provision of unearned knowledge.

The goal of Forum members to pose questions that human beings could not answer is in conflict with what are described as the laws of revelation—those proscribing provision of unearned knowledge. We might ponder what would have occurred if the answer to each such question had been, "Sorry, we are not permitted to answer." The revelators, whoever they might be, were in the hot seat. Failure to answer probably would have resulted in collapse of the project and loss of twenty years of preparatory work.

If we believe what we find in the Papers themselves, a betrayal of trust on the part of the revelators is unthinkable. Celestial beings of their apparent status simply do not break the rules. In most cases what they appear to have done is to provide the most up-to-date knowledge available in the early 1930's that came reasonably close to being an answer to the question—even though it might later prove to be erroneous. In some cases, there was no suitable response available and rather than responding, "Sorry we cannot answer," fill material was used that would pass muster for many years into the future but eventually would be discovered as being seriously wrong.

In the long run this served to solve two problems. Granting the high status of the authors, they would probably anticipate the inevitability of many Forum members, and later readers of the Papers, acquiring a fundamentalist attitude to the revelation comparable with that of biblical fundamentalists. But the inclusion of what would later show up as blatantly erroneous answers, could act to prevent those at a higher level of rationality and scientific knowledge from accorded an infallibility status to the Papers. It is also possible that the inclusion of prophetic material had the deliberate purpose of seeking to attract the attention of those receptive individuals whose major interests would find common ground with the Papers because of their intrinsic spiritual and religious value—despite the erroneous cosmology.

The revelators covered themselves by stating what they were doing in a number of places with comments such as "the cosmology of these Papers is not inspired." Up to and even beyond the 1930's, for most people that word "cosmology" had a far broader meaning than astronomy alone. Cosmology was a traditional branch of metaphysics and was even inclusive of the famous cosmological argument of Thomas Aquinas about the existence of God. And their words "not inspired" later received a meaning that is less than infallible in the authors' statement, "*The creature may crave infallibility, but only the Creators possess it.*" (P. 1768) In actuality, none of the listed authors of the Papers were of "Creator" status.

There is a second and important reason why this revelation could not be both consistent and infallible. The Papers state, "*As to eternal survival, God has decreed the sovereignty of the material and mortal will and that decree is absolute.*" (P. 71) And, "*the portal of eternity opens only to the freewill choice of the free sons of the God of free will.*" Furthermore,

the Papers also state that faith alone will pass you through that portal. (P. 71)

An authoritative and infallible revelation provides a certainty and an authority that is incompatible with human beings having free will choice. For, as it has been stated, "If we had reason for faith, then it would not be faith at all, it would be logic. Faith can only be unreasonable." (Appleyard⁴)

Elsewhere we find: "*Uncertainty with security is the essence of the Paradise adventure—uncertainty in time and in mind, uncertainty as to the events of the unfolding Paradise ascent; security in spirit and in eternity, security in the unqualified trust of the creature son in the divine compassion and infinite love of the Universal Father...*" (P. 1223)

For example, the Urantia Papers state that our eternal universe career is dependent upon the goal of our freewill decisions eventually becoming coincidental with God's will. To reject that as our goal is to sentence ourselves to "become as if we had never been." (Paper 2, Section 3) So do we really have free will? Only if we are uncertain about the veracity of these conditional statements.

In reality it appears that God had no option but to ensure that "*uncertainty with security is the essence of the Paradise adventure.*" God's alternative? To have created us as robots lacking in free will. Realization of this truth eliminates those puerile arguments about good and evil. We humans are totally responsible for all deliberate evil. And both intended and accidental evil is the unavoidable and inevitable result of giving free will to imperfect beings.

Thus the authors of these Urantia Papers also had **no option but to seek ways and means of preventing their revelation from becoming an infallible security blanket** for those whose faith was not yet sufficiently advanced to accept the free will offered to them by the God of free will.

"They would not lie to us" is the cry we hear from those who, in their insecurity, cling to fundamentalism. But the revelators have explained very carefully and very explicitly what they were doing:

"No revelation short of the attainment of the Universal Father can ever be complete. All other celestial ministrations are no more than partial, transient, and practically adapted to local conditions in time and space. While such admissions as this may possibly detract from the immediate force and authority of all revelations, the time has arrived on Urantia when it is advisable to make such frank statements, even at the risk of weakening the future influence and authority of this, the most recent of the revelations of truth to the mortal races of Urantia." (P. 1008)

A further consideration is the stated hope of the authors that

Give the milk of truth to those who are babes in spiritual perception. Serve spiritual food in a form attractive to the capacity of receptivity of your inquirers. (1474)

their offering will help to catalyze the metamorphosis of Christianity from a religion of authority, one that is largely dependent on the infallibility or near infallibility ascribed to the Gospels and apostolic letters of the New Testament, to a religion of the spirit that discovers its authority and meaning in the personal relationships of individual Christians with their indwelling spirit of Deity. Religion of the spirit, as described in the Urantia Papers (Paper 155, Sections 5 & 6), could never be either authoritarian or infallible.

"Ecclesiasticism is at once and forever incompatible with that living faith, growing spirit, and firsthand experience of the faith-comrades of Jesus in the brotherhood of man in the spiritual association of the kingdom of heaven. The praiseworthy desire to preserve traditions of past achievement often leads to the defense of outgrown systems of worship. The well-meant desire to foster ancient thought systems effectually prevents the sponsoring of new and adequate means and methods designed to satisfy the spiritual longings of the expanding and advancing minds of modern men. Likewise, the Christian churches of the twentieth century stand as great, but wholly unconscious obstacles to the immediate advance of the real gospel—the teachings of Jesus of Nazareth." (P. 2084)

"The kingdom of God is within you' was probably the greatest pronouncement Jesus ever made, next to the declaration that his Father is a living and loving spirit." (P. 2084)

References

1. Dr W.S. Sadler (editor) *History of the Urantia Movement.*
2. Larry Mullins with Dr. M.J. Sprunger. (2000) *A History of the Urantia Papers.* (Penumbra Press, Boulder.)
3. Ernest P. Moyer. (2000) *The Birth of a Divine Revelation.* (Moyer Publishing, Hanover Pa)
4. Bryan Appleyard, *Understanding the Present.*

Prophetic materials from the Urantia Papers

Two truly remarkable prophecies: The radii of the electron and proton.

Summary

This short excerpt from the Urantia Papers should be enough to send anyone with an elementary knowledge of high school mathematics scurrying to discover what it is these Papers have for them. For in this short article there is to be found what many would consider to be absolute proof that the authors were what they claimed to be—out of this world, off the planet. However, a word of caution. These authors brought us a unique work that could open our doorway to spiritual living, but they also denied that their revelation was 'inspired'—meaning 'has divine authority.'

In the 1930's, the electron and the proton were the best known sub-atomic particles. The proton was large enough for many of its properties to be measured even at the beginning of the 1900's. But the electron was so tiny that for most of the 20th century, it was considered by many to be a dimensionless point. The Urantia Papers include short 'fables' taken from a popular 1930's physics text book that involved the radii of the electron and the proton. But prior to the 1990's, there was no way for the reader to check these fables—which, in any case, appeared to be ridiculous.

All changed when, in the 1990's, Nobel prize winner, Hans Dehmelt, found a way to hold a single electron in a trap. This enabled him to then measure the electron's diameter. In its

turn, the way opened for Urantia Book reader, physicist Stefan Tallqvist, to check out the book's two fables—with the truly amazing results that, within the limits of Heisenberg uncertainty, both the radii of the electron and proton were correctly estimated.

In a textbook published at an American university in 1934 entitled, "The Architecture of the Universe," physicist W.F.G. Swann wrote:

"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."

The words of Swann were reproduced in Paper 42, Section 6 but with the comparison obviously deliberately changed from mass to volume. It reads:

"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." (P.477)

Taking the rest mass of the electron at 9.1×10^{-28} g, 0.1 ounce as 2.8 g, the radius of the earth as 6.4×10^6 m and putting k as the magnification constant, then:
 $k \times 9.1 \times 10^{-28} = 2.8 \dots\dots\dots 1$, and so

$$k = 3.1 \times 10^{27} \dots\dots\dots 2$$

As the radius of the expanded electron (Re) x k is said to be equal to the radius of the earth, we have:
 $Re \times k = 6.4 \times 10^6 \dots\dots\dots 3$
 And substituting for k in (3), we get the electron radius:

$$Re = 2 \times 10^{-21} \text{ m} \dots\dots\dots 4$$

At the time of receipt of the Urantia Papers and up until the 1990's this made no sense. Many physicists treated the electron as a dimensionless point so at best its radius would be half the Planck length of 10^{-35} m. Others, by a process of circuitous reasoning, assigned it a radius of 5×10^{-15} m.

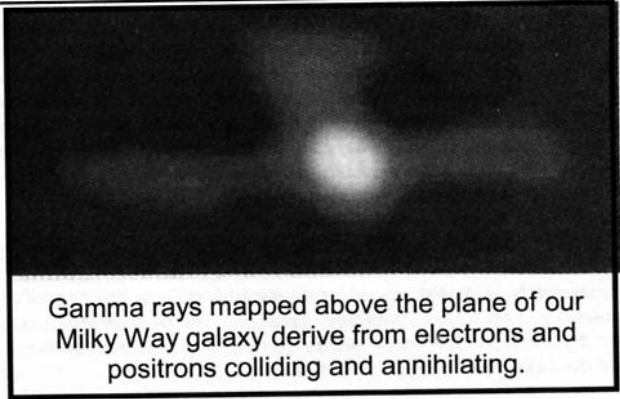
The Urantia Book statement remained nonsensical until the 1990's when Nobel prize winner, Hans Dehmelt, found a way to confine a single electron to a trap semi-permanently. This achievement allowed actual measurements to be made that assigned the radius of the electron to fall into the range of 10^{19} m to 10^{22} m.

This estimate was noticed by physicist Stefan Talqvist, a Urantia Book student who had previously checked the calculation using the Urantia Paper's version of Swann's earlier work. A few years later at Dehmelt's laboratory¹, refining of their techniques allowed them to settle for the electron radius being in the order of 10^{-22} m, so even closer to the 2×10^{-21} that is calculated for the Urantia Papers' modified version of Swann's comparison.

There was a second part to Swann's comparison that went:

"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 that of the earth's orbit around the sun."

[Note: Swann's estimate of the size of the proton as 1800 times smaller than the electron came from using $r = e^2/mc^2$, where e is the charge of the electron. The charge to mass ratio for the electron was known accurately by the early 1900



Gamma rays mapped above the plane of our Milky Way galaxy derive from electrons and positrons colliding and annihilating.

period. The charge was determined by Millikan in 1909. Its mass was then determined as 9.11×10^{-28} g.]

The Urantia Paper's author did not use this equation, changing the comparison to:

"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." (P.477)

Stefan Talqvist was again responsible for doing the calculations and drawing attention to this remarkable piece of prophetic material in the Papers.

Taking the radius of the Earth's orbital around the sun as 1.5×10^{14} mm and the radius of the pinhead as 1 mm, the magnification factor (k) is obtained by dividing the Earth's orbital radius by the pinhead radius, so $1.5 \times 10^{14} / 1.0$, which is 1.5×10^{14} (k)

The radius of the proton times the magnification factor (k) is equal to the radius of the pinhead, hence:

$$\begin{aligned} \text{Proton radius} \times 1.5 \times 10^{14} &= \text{pinhead radius (1.0 mm)}, \text{ so} \\ \text{Proton radius} &= 1.0 / 1.5 \times 10^{14}, \text{ which is } 6.7 \times 10^{-15} \text{ mm, or} \\ &6.7 \times 10^{-18} \text{ m.} \end{aligned}$$

The classical radius for the proton was given as 0.85×10^{-15} m so again the Urantia Paper's comparison looked to be nonsensical.

In later years it was realized that the proton consisted of three subunits called quarks and this component accounts for only about 50% of the proton's measured momentum, the remainder being accounted for by virtual particles that flip in and out from the vacuum. The current estimate of what is now termed the Bohr radius, a measurement of the 'real' part of the proton was given in *Physics Today* of November 1993, as 7.7×10^{-18} m.—the same order of magnitude as that for the Urantia Paper's estimate.

When we take into consideration that Swann's details were deliberately modified in both estimates in order that they produce these results, it becomes impossible to support the notion that this was simply a lucky guess. Any rational interpretation must surely allow that it is a most remarkable prophecy, impossible to explain as by pure chance. So what is left?

[Please note that Swann's work, where correct, was used verbatim by the authors of the Urantia Papers. But where erroneous, it was either ignored or modified.]



Our sun. Modern science gives the core temperature as 15 million K (27 million F), the photosphere as 6000K (10,800 F), and the chromosphere (surface) as 10,000 K (18,000 F). Out into the corona the temperature soars to millions of degrees K.

What Fuels our Sun and other Stars?

Summary

At the time the Urantia Papers were received, by a process of elimination, it had been concluded that some kind of nuclear process must be the source of the sun's energy. If included in the 1935 Papers, the account given below would have been remarkably prophetic as it describes the proton-proton process discovered by Bethe and Critchfield in 1938 and the carbon cycle discovered by Bethe in 1939.

"In those suns which are encircled in the space-energy channels, solar energy is liberated by various complex nuclear-reaction chains, the most common of which is the hydrogen-carbon-helium reaction. In this metamorphosis, carbon acts as an energy catalyst since it is in no way actually changed by this process of converting hydrogen into helium. Under certain conditions of high temperature the hydrogen penetrates the carbon nuclei. Since the carbon cannot hold more than four such protons, when this saturation state is attained, it begins to emit protons as fast as new ones arrive. In this reaction the ingoing hydrogen particles come forth as a helium atom." (P. 464)

During the early years of the 20th century, attempts to account for the energy liberated by stars such as our sun had all failed. In 1929, Atkinson and Houtermans were able to show that some kind of nuclear process is the only way that would account for the exceedingly high temperatures thought to exist at the center of the sun. In 1938, Bethe and Critchfield formulated the proton-proton chain reaction by which smaller stars such as our sun produced their energy and in 1939, Bethe described another reaction in which carbon catalyses helium production in larger stars.

The above quotation from the Urantia Book is interesting in that it stems directly from the work of Hans Bethe and coworker but later illustrates a technique supportive of the credentials of the book's authors in that it repeats a procedure that became evident in the earlier paper, "Two remarkable prophecies: the radii of the electron and the proton." In that, the authors utilised subject matter taken from a then current science text book by physicist, W.F.G. Swann, quoting directly when the text was correct but avoiding material that would turn out to be incorrect.

In the articles that follow that highlight the saga of the neutrinos, a major contributor to the contentious material is the colourful and speculative Russian physicist, George Gamow who claimed original authorship for the Big Bang theory—even though his proposed pathways of element synthesis turned out to be quite wrong—and the work was discredited and abandoned. In this instance Gamow also quotes from Bethe's article but mistakenly states that "the carbon cycle (that catalyses conversion of hydrogen to helium) is the particular nuclear reaction responsible for energy production in the sun and all other stars of the main sequence."

In fact the carbon cycle operates only in large high temperature stars (as pointed out in the quote in the Urantia Paper) but in relatively small stars like our sun, it is the proton-proton chain reaction that is the major energy source. Again the Urantia Book authors have avoided repeating the errors of authors from whom they are quoting. This we will see recurring in the articles that follow.

Neutrinos, Neutrons, and Neutron Stars.

Summary

Prior to the 1960's, the response from any astrophysicist reading the Urantia Papers' page 464 quotation (see below), would likely have been, "Who wrote that rubbish."

These 'tiny particles devoid of electric potential' were first postulated in the early 1930's by Wolfgang Pauli as a possible answer for a missing energy source during the radioactive beta decay of atoms. Pauli immediately apologized for speculating about a particle that could never be detected because it had no properties. However that page 464 quotation turned out to be an accurate description of a process involving Pauli's little particles that took almost 30 years to confirm. And it also reveals the remarkable depth of technical knowledge possessed by the Papers' authors.

A star like our sun fails to collapse under gravity because of an equal and opposite back pressure generated by nuclear reactions at its core. The major factor preventing collapse is the slowness by which light energy is conducted to the exterior—about a million years. The importance of Pauli's 'tiny particles devoid of properties' is that even in the sun's interior they travel close to the speed of light in a vacuum. And if generated "in vast quantities" they must have the potential to eliminate that back pressure and ensure collapse of the star.

For many years, much uncertainty remained about neutron star formation. Fortunately, in 1987, our companion galaxy, the Clouds of Magellan, cleared matters up by hosting a supernova explosion—which was followed up by a shower of neutrinos being recorded at the huge neutrino detectors built at Kamiokande in Japan.

"In large suns when hydrogen is exhausted and gravity contraction ensues, and such a body is not sufficiently opaque to retain the internal pressure of support for the outer gas regions, then a sudden collapse occurs. The gravity-electric changes give origin to vast quantities of tiny particles devoid of electric potential, and such particles readily escape from the solar interior thus bringing about the collapse of a gigantic sun within a few days."(P. 464)

No tiny particles devoid of electric potential that could escape readily from the interior of a collapsing star were

known to exist in 1934. In fact, the reality of such particles was not confirmed until 1956, one year after the publication of *The Urantia Book*. The existence of particles that might have such properties had been put forward as a suggestion by Wolfgang Pauli in 1932, because studies on radioactive beta decay of atoms had indicated that a neutron could decay to a proton and an electron, but measurements had shown that the combined mass energy of the electron and proton did not add up with that of the neutron. To account for the missing energy, Pauli suggested a little neutral particle was emitted, and then, on the same day, while lunching with the eminent astrophysicist Walter Baade, Pauli commented that he had done the worst thing a theoretical physicist could possibly do, he had proposed a particle that could never be discovered because it had no properties. Not long after, the great Enrico Fermi took up Pauli's idea and attempted to publish a paper on the subject in the prestigious science journal *Nature*. The editors rejected Fermi's paper on the grounds that it was too speculative.

An interesting thing to note is *The Urantia Book* statement that tiny particles devoid of electric potential would be released in vast quantities during the collapse of the star. If, prior to about 1960, any author other than a knowledgeable particle physicist was prophesying about the formation of a neutron star (a wildly speculative proposal from Zwicky and Baade in the early 1930's), then surely that author would have been thinking about the reversal of beta decay in which a proton, an electron and Pauli's little neutral particle would be squeezed together to form a neutron.

Radioactive beta decay can be written:

1. neutron \longrightarrow proton + electron + LNP (where LNP stands for little neutral particle.)

Hence the reverse should be:

2. LNP + electron + proton \longrightarrow neutron

For this to occur an electron and a proton have to be compressed to form a neutron but somehow they would have to add a little neutral particle in order to make up for the missing mass-energy. Thus, in terms of available speculative scientific concepts in 1934, *The Urantia Book* appears to have put things back to front, it has predicted a vast release of LNP's, when the reversal of radioactive beta decay would appear to demand that LNPs should disappear.

The idea of a neutron star was considered to be highly speculative right up until 1967. Most astronomers believed that stars of average size, like our sun, up to stars that are very massive, finished their lives as white dwarfs. The theoretical properties of neutron stars were just too

preposterous; for example, a thimble full would weigh about 100 million tonnes. A favored alternative proposal was that large stars would blow off their surplus mass a piece at a time until they got below the Chandrasekhar limit of 1.4 solar masses, when they could retire as respectable white dwarfs. This process did not entail the release of vast quantities of tiny particles devoid of electric potential that accompany star collapse as described in the cited *Urantia Book* quotation.

Acceptance of the existence of neutron stars gained ground slowly with discoveries accompanying the development of radio and x-ray astronomy. The Crab nebula played a central role as ideas about it emerged in the decade, 1950-1960. Originally observed as an explosion in the sky by Chinese astronomers in 1054, interest in the Crab nebula increased when, in 1958, Walter Baade reported visual observations suggesting moving ripples in its nebulosity. When sensitive electronic devices replaced the photographic plate as a means of detection, the oscillation frequency of what was thought to be a white dwarf star at the center of the Crab nebula turned out to be about 30 times per second.

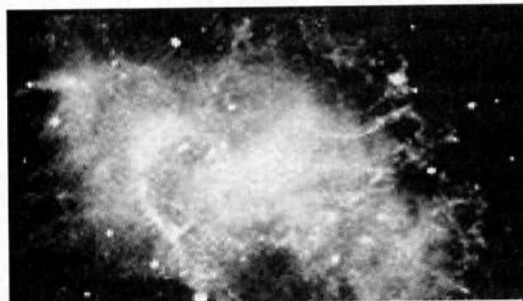
For a white dwarf star with a diameter in the order of 1000 km, a rotation rate of even once per second would cause it to disintegrate due to centrifugal forces. Hence, this remarkably short pulsation period implied that the object responsible for the light variations must be very much smaller than a white dwarf, and the only possible contender for such properties appeared to be a neutron star. Final acceptance came with pictures of the center of the Crab nebula beamed back to earth by the orbiting Einstein X-ray observatory in 1967. These confirmed and amplified the evidence obtained by prior observations made with both light and radio telescopes.

The reversal of beta-decay, as depicted in (2) above, involves a triple collision, an extremely improbable event, unless two of the components combine in a meta-stable state—a fact not likely to be obvious to a non-expert observer which also indicates that the author(s) of the *Urantia Paper* was highly knowledgeable in this field.

The probable evolutionary course of collapse of massive stars has only been elucidated since the advent of fast computers. Such stars begin life composed mainly of hydrogen gas that burns to form helium. The nuclear energy released in this way holds off the gravitational urge to collapse. With the hydrogen in the central core exhausted, the core begins to shrink and heat up, making the outer layers expand. With the rise in temperature in the core, helium fuses to give carbon and oxygen, while the hydrogen around the core continues to make helium. At this stage the star expands to become a red giant.

After exhaustion of helium at the core, gravitational contraction again occurs and the rise in temperature permits carbon to burn to yield neon, sodium, and magnesium, after which the star begins to shrink to become a blue giant. Neon and oxygen burning follow. Finally silicon and sulphur, the products from burning of oxygen, ignite to produce iron. Iron nuclei cannot release energy on fusing together, hence with the exhaustion of its fuel source, the furnace at the center of the star goes out. Nothing can now slow the onslaught of gravitational collapse, and when the iron core reaches a critical mass of 1.4 times the mass of our sun, and the diameter of the star is now about half that of the earth, the star's fate is sealed.

Within a few tenths of a second, the iron ball collapses to about 50 kilometers across and then the collapse is halted as its density approaches that of the atomic nucleus and the protons and neutrons cannot be further squeezed together. The halting of the collapse sends a tremendous shock wave back through the outer region of the core.



A tiny star at the center of the Crab nebula was found to spin 30 times per second. At that speed, a White Dwarf would come apart. Thus the central star had to be a neutron star.

The light we see from our sun comes only from its outer surface layer. However, the energy that fuels the sunlight (and life on earth) originates from the hot, dense thermonuclear furnace at the Sun's core. Though sunlight takes only about eight minutes to travel from the sun to earth, the energy from the sun's core that gives rise to this sunlight takes in the order of a million years to diffuse from the core to the surface. In other words, a sun (or star) is relatively "opaque" to the energy diffusing from its thermonuclear core to its surface, hence it supplies the pressure necessary to prevent gravitational collapse. But this is not true of Pauli's hypothetical "little neutral particles," postulated to exist since the early 1930's and now known by the name *neutrinos*. These particles are so tiny and unreactive that their passage from our sun's core to its exterior would take only about 3 seconds. But did they exist?

It is because neutrinos could escape so readily that a critical role was attributed to them for bringing about the star's sudden death and the ensuing explosion. Neutrinos are formed in a variety of ways, many as neutrino-antineutrino pairs from highly energetic gamma rays and others arise as the compressed protons capture an electron (or expel a positron) to become neutrons, a reaction that is accompanied by the release of a neutrino. Something in the order of 10^{57} electron neutrinos are thought to be released in a supernova-type collapse. Neutral current reactions from Z^0 particles of the weak force also contribute electron neutrinos along with the 'heavy' muon and tau neutrinos.

Together, these neutrinos would constitute a "vast quantity of tiny particles devoid of electric potential" that readily escape from the star's interior. Calculations indicated that they would carry ninety-nine percent of the energy released in the final supernova explosion. The gigantic flash of light accompanying the explosion accounts for only part of the remaining one percent!

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Renewal of the Search for the Neutron Star

Hypotheses on the possible origins of the Urantia Paper's statement on star collapse:

In the early 1930's, the idea that supernova explosions could occur and result in the formation of neutron stars was extensively publicized by Fritz Zwicky of the California Institute of Technology (Caltec) who worked in Professor Millikan's Dept. For a period during the mid-thirties, Zwicky was also at the University of Chicago. Dr. Sadler is said to have known Millikan. So alternative possibilities for the origin of The Urantia Book quote above could be:

1. The revelators followed their mandate and used a human source of information about supernovae, possibly Zwicky.
2. Dr Sadler had learned about the tiny particles devoid of electric potential from either Zwicky, Millikan, or some other knowledgeable person and incorporated it into The Urantia Book.
3. It is information supplied to fill missing gaps in otherwise earned knowledge as permitted in the mandate. (1110)

Zwicky had the reputation of being a brilliant scientist but given to much wild speculation, some of which turned out to be correct. A paper published by Zwicky and Baade in 1934 proposed that neutron stars would be formed in stellar collapse and that 10% of the mass would be lost in the process (Phys. Reviews. Vol. 45)

In "*Black Holes and Time Warps. Einstein's Outrageous Legacy*" (Picador, London, 1994), a book that covers the work and thought of this period in detail, K. S. Thorne, Feynman Professor of Theoretical Physics at Caltec, writes: In the early 1930's, Fritz Zwicky and Walter Baade joined forces to study novae, stars that suddenly flare up and shine 10,000 times more brightly than before. Baade was aware of tentative evidence that, besides ordinary novae, there existed superluminous novae. These were roughly of the same brightness but since they were thought to occur in nebulae far out beyond our Milky Way, they must signal events of extraordinary magnitude. Baade collected data on six such novae that had occurred during the current century.

As Baade and Zwicky struggled to understand supernovae, James Chadwick, in 1932, reported the discovery of the neutron. This was just what Zwicky required to calculate that if a star could be made to implode until it reached the density of the atomic nucleus, it might transform into a gas of neutrons, reduce its radius to a shrunken core, and, in the process, lose about 10 % of its mass. The energy equivalent of the mass loss would then supply the explosive force to power a supernova.

Zwicky believed cosmic rays accounted for the supernova mass-energy loss

Information, extracted from Thorne's book⁶, indicates that Zwicky knew nothing about the possible role of "little neutral particles" in the implosion of a neutron star, but rather that he attributed the entire mass-energy loss to cosmic rays. So, if not from Zwicky, what then is the human origin of The Urantia Book's statement that the neutrinos escaping from its interior bring about the collapse of the imploding star? (Current estimates attribute about 99% of the energy of a supernova explosion to being carried off by the neutrinos).

In his book⁶, Thorne further states: "astronomers in the 1930's responded enthusiastically to the Baade-Zwicky concept of a supernova, but treated Zwicky's neutron star and cosmic ray ideas with disdain...In fact it is clear to me from a detailed study of Zwicky's writings of the era that he did not understand the laws of physics well enough to be able to substantiate his ideas."

This opinion was also held by Robert Oppenheimer who published a set of papers with collaborators Volkoff, Snyder, and Tolman, on Russian physicist Lev Landau's ideas about stellar energy originating from a neutron core at the heart of a star.

Einstein and Eddington opposed neutron star concept

These Oppenheimer papers concluding that either neutron stars or black holes could be the outcome of massive star implosion were about as far as physicists could go at that time. However, the most prominent physicist of the time, Albert Einstein, and the doyen of astronomers, Sir Arthur Eddington, both vigorously opposed the concepts involved in stellar collapse beyond the white dwarf stage. Thus the subject appears to have been put on hold coincident with the outbreak of war in 1939.

During the 1940's, virtually all capable physicists were occupied with tasks relating to the war effort. Apparently this

was not so for Russian-born astronomer-physicist, George Gamow, a professor at Leningrad who had taken up a position at George Washington University in 1934. Gamow conceived the beginning of the Hubble expanding universe as a thermonuclear fireball in which the original stuff of creation was a dense gas of protons, neutrons, electrons, and gamma radiation which transmuted by a chain of nuclear reactions into the variety of elements that make up the world of today. Referring to this work, Overbye⁴ writes: "In the forties, Gamow and a group of collaborators wrote a series of papers spelling out the details of thermonucleogenesis. Unfortunately their scheme didn't work. Some atomic nuclei were so unstable that they fell apart before they could fuse again into something heavier, thus breaking the element building chain. Gamow's team disbanded in the late 40's, its work ignored and disdained."

Among this work was a paper by Gamow and Schoenfeld that included a suggestion that energy loss from aging stars could be mediated by an efflux of neutrinos. This proposal appears to have been overlooked or ignored until the 1960's. However it appears to be the direct source for the P. 464 quotation from the *Urantia Papers* and bears similarities to the use of the direct quotations from the *Swann book* by the *Papers'* authors in that the authors selectively use that which is right and ignore that which is wrong. In their conclusions, Gamow and Schoenfeld drew attention to the fact that, "the neutrinos are still considered as highly hypothetical particles because of the failure of all efforts to detect them," also noting that "the dynamics of the collapse represents very serious mathematical difficulties." And in other papers from this Gamow group, the neutron star idea is ignored in favor of large stars gradually shedding their excess mass and retiring gracefully as white dwarfs.

Conservation of energy law under fire

As time went by, the need for the neutrino grew, firstly to save the law of conservation of energy, but also laws of conservation of momentum, angular momentum (spin), and lepton number. As knowledge of what it ought to be like grew, plus the knowledge accruing from the intense efforts to produce the atom bomb, possible means of detecting this particle began to emerge. In 1953, experiments were begun by a team led by C.L. Cowan and F. Reines. Fission reactors were now in existence in which the breakdown of uranium yielded free neutrons that, outside of the atomic nucleus, were unstable and broke down via beta decay to yield a proton, an electron, and, if it existed, the missing particle.

Detection of the elusive neutrino

The Cowan and Reines team devised an elaborate scheme to detect the antineutrinos from a reactor. By 1956 their system was detecting 70 such events per day, unequivocally ascribable to antineutrinos. It now remained to prove that this particle was not its own antiparticle, as is the case with the photon. This was done by R.R. Davis in 1956 using a detection system designed specifically for what the properties of the neutrino should be and testing it with an antineutrino source from a fission reactor.

Search resumed

According to eminent Russian astrophysicist, Igor Novikov, no searches in earnest for neutron stars or black holes were attempted by astronomers before the 1960's. He says, "It was tacitly assumed that these objects were far too eccentric and most probably were the fruits of theorists' wishful thinking...at any rate, if they existed, then they could not be detected."⁴

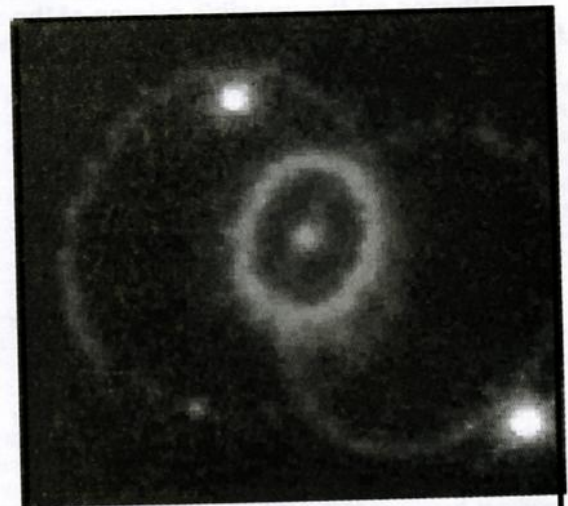
The subject of the fate of imploding stars re-opened with vigor when both Robert Oppenheimer and John Wheeler, two

of the really great names of physics, attended a conference in Brussels in 1958. Oppenheimer believed that his 1939 papers said all that needed to be said about such implosions. Wheeler disagreed, wanting to know what went on beyond the well-established laws of physics.

When Oppenheimer and Snyder did their work in 1939, it had been hopeless to compute the details of the implosion. In the meantime, nuclear weapons design had provided the necessary tools because, to design a bomb, nuclear reactions, pressure effects, shock waves, heat, radiation, and mass ejection had to be taken into account. Wheeler realized that his team had only to rewrite their computer programs so as to simulate implosion rather than explosion. However his hydrogen bomb team had been disbanded and it fell to Stirling Colgate at Livermore, in collaboration with Richard White and Michael May, to do these simulations. Wheeler learned of the results and was largely responsible for generating the enthusiasm to follow this line of research. The term 'black hole' was coined by Wheeler.

The theoretical basis for supernova explosions is said to have been laid by E. M. Burbidge, G.R. Burbidge, W. A. Fowler, and Fred Hoyle in a 1957 paper². However, even in Hoyle and Narlikar's text book, "The Physics-Astronomy Frontier" (1980), no consideration is given to a role for neutrinos in the explosive conduction of energy away from the core of a supernova. In their 1957 paper, Hoyle and his co-workers proposed that when the temperature of an aging massive star rises to about 7 billion degrees K, iron is rapidly converted into helium by a nuclear process that absorbs energy. In meeting the sudden demand for this energy, the core cools rapidly and shrinks catastrophically, implodes in seconds, and the outer envelope crashes into it. As the lighter elements are heated by the implosion they burn so rapidly that the envelope is blasted into space. So, two years after the first publication of *The Urantia Book*, the most eminent authorities in the field of star evolution make no reference to the "vast quantities of tiny particles devoid of electric potential" that the book says escape from the star interior to bring about its collapse. Instead they invoke the conversion of iron to helium, an energy consuming process now thought not to be of significance.

Following on from the forgotten 1940's paper of Gamow and Schoenfeld paper, the next suggestion that neutrinos may have a role in supernovae came from Ph.D. student, Hong-Yee Chiu, working under Philip Morrison. Chiu



Supernovae 1987A, that gave rise to a neutron star in our neighboring galaxy, the Clouds of Magellan, photographed 7 years later

proposed that towards the end of the life of a massive star, the core would reach temperatures of about 3 billion degrees at which electron-positron pairs would be formed and a tiny fraction of these would give rise to neutrino-antineutrino pairs. Chiu speculated that X-rays would be given off by the star for about 1000 years and that the temperature would ultimately reach about 6 billion degrees when an iron core would form at the central region of the star. The flux of neutron-antineutrino pairs would then be sufficiently great to carry off the explosive energy of the star in a single day. The 1000-year period predicted by Chiu for X-ray emission was reduced to about one year by later workers. Chiu's proposals appear to have been first published in a Ph. D. thesis submitted at Cornell University in 1959. Scattered references to it are made by Philip Morrison³ and by Isaac Asimov¹.

No neutral current, no supernova

Dennis Overbye, in his book "Lonely Hearts of the Cosmos"⁵ records that, for supernovae, almost all the energy of the inward free fall comes out in the form of neutrinos. The success of this scenario (as proposed by Chiu) depends on a feature of the weak interaction called the neutral currents. Without this, the neutrinos do not supply enough 'oomph' and theorists had no good explanation for how stars explode. In actuality the existence of the neutral current for the weak interaction was not demonstrated until the mid 1970's.

A 1985 paper (Scientific American) by Bethe and Brown entitled "How a Supernova Explodes" showed that understanding of the important role of the neutrinos was well advanced by that time. These authors attribute this understanding to the computer simulations of W. David Arnett of the University of Chicago and Thomas Weaver and Stanford Woosley of the University of California at Santa Cruz.

The opportunity to confirm the release of the neutrinos postulated to accompany the spectacular death of a giant star came in 1987 when a supernova explosion, visible to the naked eye, occurred in the Clouds of Magellan that neighbors our Milky Way galaxy. Calculations indicated that this supernova, dubbed SN1987A, should give rise to a neutrino burst at a density of 50 billion per square centimeter when it finally reached the earth, even though expanding as a spherical 'surface' originating at a distance 170,000 light years away.

This neutrino burst was observed in the huge neutrino detectors at Kamiokande in Japan and at Fairport, Ohio, in the USA. lasting for a period of just 12 seconds, and confirming the computer simulations that indicated they should diffuse through the dense core relatively slowly. From the average energy and the number of 'hits' by the neutrinos in the detectors, it was possible to estimate that the energy released by SN1987 amounted to 2-3 x 10⁵³ ergs.

This is equal to the calculated gravitational binding energy that would be released by the collapse of a core of about 1.5 solar masses to a neutron star. Thus SN1987A provided a remarkable confirmation of the general picture of neutron star formation developed over the previous fifty years.

Presently (2003) it is believed that when the core of a collapsing star implodes with sufficient violence to form a mass of 'hot' neutrons at a temperature and pressure exceeding 10 billion degrees and 100 trillion (10¹⁴) g/cm³, huge numbers of neutrinos are formed that deposit a shock wave of energy into the envelope—which is blasted away in a supernova explosion. And thus is the Urantia Papers' assertion fulfilled:

"In large suns when hydrogen is exhausted and gravity

contraction ensures, and such a body is not sufficiently opaque to retain the internal pressure of support for the outer gas regions, then a sudden collapse occurs. The gravity-electric changes give origin to vast quantities of tiny particles devoid of electric potential, and such particles readily escape from the solar interior thus bringing about the collapse of a gigantic sun within a few days." (P. 464)

Who dunit? Paring away the alternatives

Referring to our three alternatives to explain how the reference to the role of the tiny uncharged particles in supernova explosions got to be in the Urantia Papers, our investigation showed that Zwicky is unlikely to have been the source as he firmly believed X-rays, not neutrinos, accounted for the postulated 10% mass loss during the death of the star.

Remembering that neutron stars were not demonstrated to exist until 1967, that some of the biggest names in physics and astronomy were totally opposed to the concept of collapsing stars (Einstein, Eddington), and that, well into the 1960's, the majority of astronomers, including Gamow, assumed that massive stars shed their bulk piecemeal prior to retiring respectably as white dwarfs, a process for which neutrino loss is unnecessary, it appears that it would have been a preposterous notion to attempt to support the reality of a revelation by means of speculation about neutron stars at any time prior to the 1960's.

If, however, it is assumed that, on what would have needed to be the expert advice of a knowledgeable but reckless astrophysicist, Dr Sadler wrote the page 464 material into the Urantia papers subsequent to the concepts on neutrinos appearing in the Gamow et al. publications of the 1940's, then it becomes necessary to ask why was it not removed when that work lost any credibility?

That appears to leave the revelators themselves as the major (only?) suspect.

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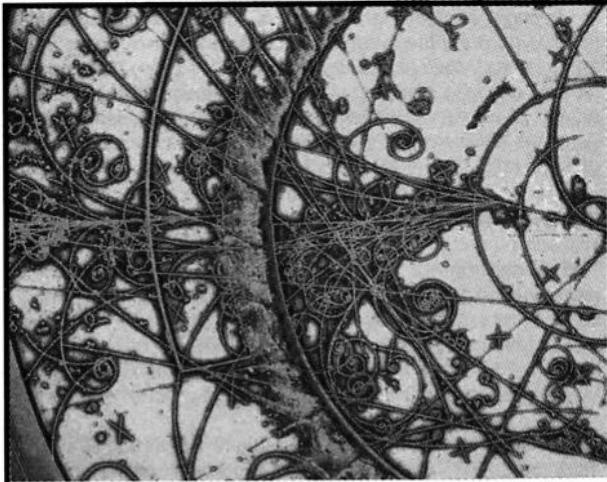
Quantum Stuff, Basic Physics

Yukawa and his Mesotrons

Summary

If the information provided in the paragraphs below had been available to receptive physicists, it possibly could have advanced sub-atomic physics considerably. Particularly paragraph 4, if taken as truth, could have saved many years of fruitless work. As it now is, it merely provides a historical picture of the kind of research proceeding in this field in the 1930 to 1950 period.

1. "The charged protons and the uncharged neutrons of the nucleus of the atom are held together by the reciprocating function of the mesotron, a particle of matter 180 times as heavy as the electron. Without this arrangement the electric charge carried by the protons



Particle accelerators focus beams of particles at high speed before smashing them together in order to study the effects. The particle tracks may be detected in a cloud or bubble chamber.

would be disruptive of the atomic nucleus.

2. "As atoms are constituted, neither electric nor gravitational forces could hold the nucleus together. The integrity of the nucleus is maintained by the reciprocal cohering function of the mesotron, which is able to hold charged and uncharged particles together because of superior force-mass power and by the further function of causing protons and neutrons constantly to change places. The mesotron causes the electric charge of the nuclear particles to be incessantly tossed back and forth between protons and neutrons. At one infinitesimal part of a second a given nuclear particle is a charged proton and the next an uncharged neutron. And these alternations of energy status are so unbelievably rapid that the electric charge is deprived of all opportunity to function as a disruptive influence. Thus does the mesotron function as a "energy-carrier" particle which mightily contributes to the nuclear stability of the atom.

3. "The presence and function of the mesotron also explains another atomic riddle. When atoms perform radioactively, they emit far more energy than would be expected. This excess of radiation is derived from the breaking up of the mesotron "energy carrier," which thereby becomes a mere electron. The mesotronic disintegration is also accompanied by the emission of certain small uncharged particles.

4. "The mesotron explains certain cohesive properties of the atomic nucleus, but it does not account for the cohesion of proton to proton nor for the adhesion of neutron to neutron. The paradoxical and powerful force of atomic cohesive integrity is a form of energy as yet undiscovered on Urantia." (P.479)

In recent years, a considerable amount of information has been forthcoming on the history of development of the present "standard model" for atomic structure. Though recognized as being incomplete, the standard model has enormously increased our understanding of the basic nature of matter. The electromagnetic force and the weak force of radioactive decay have been successfully unified to yield the "electroweak" theory. As yet this has not been unified with the theory of the "strong" force that holds the atomic nucleus together. The force of gravity remains intractable to unification with the others.

Para's 1-3 above from *The Urantia Book*, ostensibly presented in 1934, could have come directly from the mind of Hideki Yukawa. In the quantum theory of electromagnetism, two charged particles interact when one emits a photon and the other absorbs it. In 1932 Yukawa had decided to attempt a similar approach to describe the nuclear force field. He wrote, "...it seemed likely that the nuclear force was a third fundamental force, unrelated to gravitation or electromagnetism...which could also find expression as a field...Then if one visualizes the force field as a game of 'catch' between protons and neutrons, the crux of the problem would be to find the nature of the 'ball' or particle." This work was published in Japanese in 1935, but was not well known in the U.S.A.

At first, Yukawa followed the work of Heisenberg and used a field of electrons to supply the nuclear force between protons and neutrons. This led to problems. In 1934 he decided "to look no longer among the known particles for the particle of the nuclear force field. He wrote: "The crucial point came one night in October. The nuclear force is effective at extremely small distances, on the order of 0.02 trillionth of a centimeter. My new insight was the realization that this distance and the mass of the new particle I was seeking are inversely related to each other." He realized he could make the range of the nuclear force correct if he allowed the ball in the game of 'catch' to be heavy— approximately 200 times heavier than the electron."

Para. 3 above extends Fermi's 1934 theory of radio-active decay of the neutron. In his early work, Yukawa had considered that his mesotron might act as the 'ball' in the 'catch' game during radioactive decay. After re-running his calculations, in 1938 he published a paper predicting the properties of such a mesotron which he now called a 'weak' photon, from which it became known as the 'W' particle.

Para's 1-3 come close to being the contemporary, but incredibly speculative, science of 1934. They include three unknown particles—the pion mesotron (found 1947), the W particle mesotron (found 1983), and the small uncharged particles (neutrinos found 1956). Few would have bet on these predictions being right.

Para 2. comments, "**the alternations of energy status are unbelievably rapid...**" According to Nobel prize winner, Steven Weinberg, they occur in the order of a million, million, million, millionth of a second. In contrast, the process described in para. 3 takes about a hundredth of a second.

Para. 4 states that the mesotron (pi meson) **does not** account for certain cohesive properties of the atomic nucleus. It then tells us that there is **an aspect of this force that is as yet undiscovered on Urantia.**

Leon Lederman was a young research worker in 1950 who later became director of the Fermi Laboratory. He was awarded the Nobel prize in 1988. In his book, *The God Particle*, he comments: "The hot particle of 1950 was the pion or pi meson, as it is also called. The pion had been predicted in 1936 by a Japanese theoretical physicist, Hideki Yukawa. It was thought to be the key to the strong force, which in those days was the big mystery. Today we think of the strong force in terms of gluons. But back then (i.e. 1950's), pions which fly back and forth between the protons to hold them together tightly in the nucleus were the key, and we needed to make and study them."

This force, unknown in 1934, (and for that matter in 1955 when *The Urantia Book* was published) is now known as the color force. Writing about it in their book, *The Particle Explosion*, Close, Marten, and Sutton state, "Back in the 1940's and 1950's, theorists thought that pions were the transmitters of the strong force. But experiments later showed

that pions and other hadrons are composite particles, built from quarks, and the theory of the strong force had to be revised completely. We now believe that it is the color within the proton and the neutron that attracts them to each other to build nuclei. This process may have similarities to the way that electrical charge within atoms manages to build up complex molecules. Just as electrons are exchanged between atoms bound within a molecule, so are quarks and anti-quarks—in clusters we call 'pions'—exchanged between the protons and neutrons in a nucleus."

The strong force is also responsible for proton-proton and neutron-neutron interaction—such that, for example, if just a few percent stronger (says Freeman Dyson) two protons could combine in a relatively stable form (though with distrous effects on the rate of star burn-out).

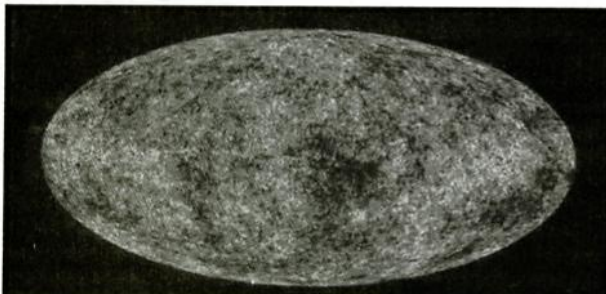
The mandate to the revelators permitted *"the supplying of information which will fill in vital missing gaps in otherwise earned knowledge."* (1110) The Urantia Papers were not in circulation before 1955, by which time the information provided in these paragraphs would have been redundant. However it does illustrate the degree of knowledge held by the authors of the Papers.

Cooking up a Universe.

Summary

What are the chances of a universe like ours with planets like ours creating itself by itself? The answer comes out so inconceivably low that it is virtually no different from no chance at all.

Is designing a universe easy or hard? It transpires that to put together a universe like ours, there are about twenty parameters (numbers) that are critical for specifying the kind of universe we cook up. The value we choose for the effect of gravity is one parameter. If we make it too strong, our stars will collapse to become black holes. If we make it too weak, they won't condense but will remain as a cloud of gas and dust. Another parameter is concerned with electric charge, how strong should we make the force of attraction between protons and electrons in atoms. Yet another determines how strong we make the force that holds the atomic nucleus together, and still another, how strong the cosmological constant should be, etc., etc. Designing an inhabitable universe introduces many more difficulties, so let's simply try for a universe having stars like ours.



The Background radiation supposedly left over from the Big Bang. The changing shades indicate zones of minute temperature changes. Except for this assymetry galaxies like ours would never have formed.

Let's imagine God is seated before a bank of celestial computers having the twenty dials that tune the parameters for providing the required outcome. He starts with the most important—tuning the force of gravity. The control dial is set in terms of proton masses and must be tuned so that stars are formed of the right size and lifetime to eventually provide a stable universe. If the stars are too small, they will not ignite to burn their hydrogen fuel to helium, if they are too big they won't last long enough to be useful. Or they might collapse to a black hole.

After some tinkering, the computers throw up the number, 1×10^{-38} proton masses. That means one divided by 10 followed by 38 zeros. Now that's tiny. God punches a few keys and gets some answers—the expected life of an average star comes out as ten billion years, which is about what is needed. Dropping a zero reduces lifetime by 1000-fold, drop another zero and the star lasts only 10,000 years. God accepts the computer value.

The next important job is selecting a cosmological constant that will fix the mass-energy density of space. The computers say it must be set to no more than 10^{-40} proton masses. More tinkering and it is found that for any bigger value, the universe won't last long enough to produce stars. God again accepts the computer value.

God still has 18 parameters (values) to assign. While he does the work, let's find out what the chances are of getting our kind of stars in our kind of universe if we just spin those twenty tuning dials at random.

That's not a major problem for the celestial computers, and the answer comes in a fraction of a second as just one chance in 10^{229} . That means one chance in 10 followed by 229 zeros!!! One chance in 10^{229} is so incredibly slight as to be beyond our wildest imagining—for all intents and purposes, impossible.

But a starry universe is only a beginning. For life to exist, the stars need to have planets and, among other things, inhabitable planets need to have an orbit giving a temperature range that permits permanent surface water to exist. Then an atmosphere, the right balance of chemicals, and thousands of other critical little things are essentials. Like the crucial need for an ultra-violet light filter at the top of the atmosphere. Or the right amount of oxygen in the atmosphere. A few percent increase and our forests and grasslands go up in an unstoppable blaze. Or too much carbon dioxide, temperatures soar, and the ice cap melts.

And so, from what commenced as just a modest design project, we have begun to realize the enormous complexity of our self-appointed task—to the point of appreciating that even the most highly skilled team of scientists ever assembled could not design our universe, let alone create it. In fact,

starting from nothing, our team could not even serve up its own breakfast. Which leads us to a question: if an all-knowing, all-powerful God did not create our universe, then who or what did???

P.S. **Did you know??** If a soup composed of the nucleotide ingredients (building blocks) for DNA is made to polymerize at random, the chances of forming a single functional gene averages about 1 in 10^{150} . That number is far, far higher than the total number of stars in the whole of the visible universe. And all higher animals require thousands of functional genes!!! Boggles the mind does it not? I wonder what mind really is?

Antigravity is Back.

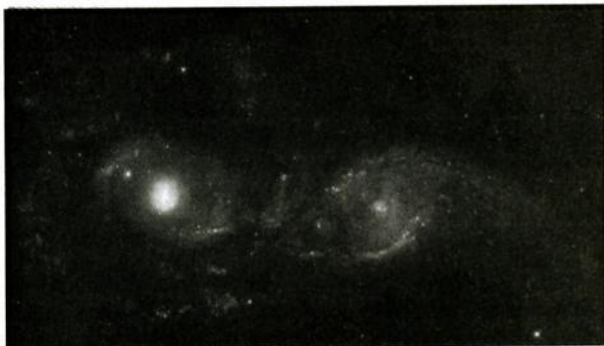
Summary

Nigel Nunn, an Australian physics boffin, believes the Urantia Book's description of the Master Universe must be some kind of geometrical projection from a higher dimension. Which seems highly likely. The revelators description of gravity and anti-gravity might also be an adaptation from a higher dimensional viewpoint, in which case there is little point in attempting to comprehend it in the way most of us do—from three spatial dimensions and one of absolute time. General relativity does away with absolute time, substituting a fourth dimension of space-time—which also does away with the force of gravity, substituting a difficult to conceive spatial curvature. And general relativity has stood up to hundreds of tests and never failed.

The Book's physical description of the mansion and higher worlds must also be an adaptation from the reality, but undoubtedly the reality will be an advance over the description given us.

Do you have trouble imagining the four dimensional universe of relativity? Then imagine the difficulty faced by the Urantia Book revelators in conveying to us a mental concept of a seven dimensional universe. (1439) This problem was highlighted by Australian reader, Nigel Nunn, who comments that the torus-like description given us for the Master Universe must be some kind of geometrical projection or representation as seen from a higher dimension rather than being reality.

The revelators also speak of antigravity as a means by which the Power Directors control energy and mass distribution. But for a considerable period, the concept of antigravity had no place among our physicists and cosmologists.



Colliding galaxies may give rise to a black hole or quasars or even gamma ray bursts, GRB's.

Observed from within, our universe is both expanding and its expansion accelerating, and is either flat, open, or closed. If open, it expands forever, if closed, it ultimately collapses—and flat is in between. Flat is the favorite, but cosmologists have exhausted all the possibilities they can think up to balance the mass-energy density budget required for flatness.

At one time it seemed that vacuum energy could do the trick. This comes from virtual particles popping in and out of reality—and can actually be measured and shown to agree with quantum theory to an accuracy of nine decimal places. But things went wrong when vacuum energy was used to make up for the missing mass of the cosmologists, being a mere 120 orders of magnitude too large!!

With all possibilities apparently exhausted, what was left was either an open universe or one filled with energy of an unknown kind in order to produce flatness.

To make the latter work, we have a re-introduction of Einstein's long abandoned cosmological constant, which acts to oppose the effect of gravity with a repulsive rather than an attractive force, antigravity. Sounds simple enough, but it now has to be tuned to an accuracy of 123 decimal places—124 will not do. So no wonder that Einstein was pleased to let it go.

Among other things The Urantia Book tells us that, "*antigravity is a power of the Infinite Spirit...It can annul gravity within a local frame. It does so by the exercise of equal force presence. It operates only with reference to material gravity, and it is not the action of mind.*" (P.101) I wonder who has the task of balancing it to the 123rd decimal place?

Colliding Black Holes and the Urantia Papers.

Summary

The Urantia Book's comment, "*peculiar conditions in space near highly energized cold bodies of condensed matter*" (P.175) is surely indicative of a 'black hole.' The terms 'highly energized' and 'cold' could refer to their enormous gravitational field and 'cold' to the fact that almost no heat could radiate from such a body. No other known heavenly body fits this description. The book also refers to collisions among dead giants of space which again points to some of the events that give rise to 'quasars,' events that give rise to enormous outpouring of energy and appear to be associated with galaxies having a black hole at their center colliding with another galaxy or with another galaxy also having a central black hole.

Although black holes were objects of derision amongst astronomers prior to the late 1960's, they were being picked up by radio telescopes before that time—among them Cyg A and Cas A, two of brightest radio sources in the sky and now thought to be powered by gigantic black holes. A happy comment accompanying this quite remarkable material is "*Universes do not run down.*"

"*Evolving energy has substance; it has weight, although weight is always relative, depending on revolutionary velocity, mass, and antigravity. Mass in matter tends to retard velocity in energy; and the anywhere-present velocity of energy represents: the initial endowment of velocity, minus retardation by mass encountered in transit, plus the regulatory function of the living energy controllers of the superuniverse and the physical influence of near-by highly heated or heavily charged bodies....*"

"Given a sufficient duration of retarding influence, gravity would eventually convert all energy into matter were it not for two factors: First, because of the antigravity influences of the energy controllers, and second, because organized matter tends to disintegrate under certain conditions found in very hot stars and under certain peculiar conditions in space near **highly energized cold bodies of condensed matter.**

"When mass becomes over-aggregated and threatens to unbalance energy, to deplete the physical power circuits, the physical controllers intervene unless gravity's own further tendency to over-materialize energy is defeated by the occurrence of a **collision among the dead giants of space, thus in an instant completely dissipating the cumulative collections of gravity. In these collisional episodes enormous masses of matter are suddenly converted into the rarest form of energy, and the struggle for universal equilibrium is begun anew. Eventually the larger physical systems become stabilized, become physically settled, and are swung into the balanced and established circuits of the superuniverses. Subsequent to this event no more collisions or other devastating catastrophes will occur in such established systems.**

"During the times of plus energy there are power disturbances and heat fluctuations accompanied by electrical manifestations. During times of minus energy there are increased tendencies for matter to aggregate, condense, and to get out of control in the more delicately balanced circuits, with resultant tidal or collisional adjustments which quickly restore the balance between circulating energy and more literally stabilized matter. To forecast and otherwise to understand such likely behavior of the blazing suns and the dark islands of space is one of the tasks of the celestial star observers....

"The superuniverse of Orvonton is apparently now **running down**; the outer universes seem to be winding up for unparalleled future activities; the central Havona universe is eternally stabilized. Gravity and absence of heat (cold) organize and hold matter together; heat and antigravity disrupt matter and dissipate energy. The living power directors and force organizers are the secret of the special control and intelligent direction of the endless metamorphoses of universe making, unmaking, and remaking. Nebulae may disperse, suns burn out, systems vanish, and planets perish, but **the universes do not run down.**" (P.176)

Commentary

To include this article which is primarily on astrophysics and physics, probably seems extraordinary to most readers. But its content is capable of exciting true wonderment if we are old enough or knowledgeable enough to be familiar with the historical background.

In 1955, this Urantia Book Section could appear to be a fanciful extract from a science fiction novel. For one thing, antigravity was considered to be nonsense by most of the physics fraternity. Only recently has it attained a degree of respectability. And despite Einstein's $E = mc^2$, very few people believed that energy could be converted to matter or that the weight (mass) of an object could be affected by its rate of rotation.

Nowadays we might not be surprised to read something like: "Bottomonium, for example, is what you get by putting together a bottom quark and its antiquark. They can come together to form a number of different mesons, depending on how they move relative to one another. The simplest is the "upsilon." It has the lowest energy—and the smallest mass—because the bottom quark and its antiquark rotate about one another as slowly as possible. **Set these quarks rotating more vigorously, and you get other mesons with larger**



This Hubble photo of a quasar reveals two colliding galaxies.

masses."

Science fiction? No, it comes from a serious 1998 discussion on lattice quantum chromodynamics computations. For more information ask a physicist.

"**Highly energized cold bodies of condensed matter**" from the Urantia Paper quotation could only mean black holes to the modern day physicist. Pre-1960's, condensed matter was known to exist in white dwarf stars but these could have a surface temperature in the order of 3000 degrees. The then hypothetical neutron star was even more condensed but both the neutron star and black holes remained undiscovered and their existence severely in doubt.

A respectability status for black holes is a very recent acquirement. In 1939, after Oppenheimer and co-workers demonstrated (via a highly simplified mathematical model) that black holes could be a possibility, Einstein and Eddington both vigorously rejected that concept. At the time, Einstein had a God-like status among physicists while Eddington had a similar status among astronomers, possibly attributable to his claim that only two people in the world understood relativity and Einstein was the other. To go against either of these demigods was akin to denying God himself.

Is a black hole devoid of heat? Nobody knows the answer. Matter entering black holes is accelerating under the influence of enormous gravitational forces and is assumed to carry on to a Schwarzschild singularity, a dimensionless point at the hole's center where the laws of physics are assumed to breakdown. However, all agree that heat cannot escape from a blackhole, so even a pinpoint-size black hole could not be used to heat the household hearth. Actually it would extract heat from the home so, for all practical purposes, we can consider black holes to be dead cold.

That brings us to "collisions among the dead giants of space"—colliding black holes? If it were not for quasars, we would not know that such was a realistic possibility. A quasar was a "quasistellar radio source." The original quasar was an extremely powerful radiosource discovered in Australia in 1962. After plotting its position, details were sent to the Mount Palomar Observatory where its optical spectrum revealed only a hydrogen spectrum and a location about 2 billion light-years from earth. "Quasar" was a misnomer as these bodies radiate over the full range of the spectrum and now are more often known as quasistellar objects—QSO's.

Since the repair job on the Hubble telescope, new work has revealed that a "typical" QSO is embedded in a host galaxy which, in turn, is surrounded by a fuzzy halo and about three quarters of them are either colliding with or swallowing other galaxies. The most likely explanation for the observations is that a very high proportion of galaxies have a black hole at their center. The QSO characteristics are due to the black hole swallowing stars that then provide for their enormous

energy output.

A recent survey of nearby galaxies indicates that 11 of 27 may harbor a black hole. It would seem, at least to me, that if both partners of colliding galaxies have black holes then, sooner or later, in some collisions the gravitational fields of the two black holes would overlap to the point that their collision became inevitable, perhaps with fusion, a doubling of mass and a rain of in-falling stars consequent upon the increased gravitational field—a hyperquasar maybe!!

Many quasars shoot out jets in opposite directions that may extend for more than a million light years. One explanation for the jets is that a giant spinning black hole accumulates a spinning accretion disk in its equatorial plane from materials being drawn towards it by gravity. Friction and gravity supply the energy necessary to heat the disk to the point where a gas plasma forms and slides inwards along magnetic fields lines later to be hurled out by centrifugal forces as two jets in opposite directions.

The accretion disk is the major source of radiation—X-rays at its hot, innermost regions, and ultra-violet, visible, and infrared radiation further out. Radio frequency emitting lobes may form where a quasar's jets terminate. Geoffrey Burbidge calculated that these lobes may have as much magnetic and kinetic energy as would be obtained by **converting all the mass of ten million suns into pure energy.**

Burbidge's calculation demonstrates that The Urantia Book's statement, "*in these collisional episodes enormous masses of matter are suddenly converted into the rarest form of energy*" is not just the wild imagination it would have appeared to be at the time of the printing of the book.

Some might argue that colliding black holes would simply result in bigger black holes. But perhaps a critical situation is reached when temperature and pressure conditions cause matter to disrupt yielding their most basic constituents which may not respond to gravity. Such an event would then convert gravitational implosion to rebound explosion. Once the fireworks are over, the revelators tell us that such devastating

collisions become a thing of the past. Incidentally, the measured frequency of quasars in our vicinity is one in a million galaxies. Perhaps quasar activity is mainly an 'outer space' phenomenon.

The Urantia Papers inform us that the power directors and force organizers have these catastrophic collision things under control? And that it's all just part of a routine universal recycling program!

We are also informed that the running down of our universes is apparent and not real. Science rightly uses what it conceives to be the simplest explanation for known data. It sees an expanding universe and so assumes a beginning calculated by extrapolating backwards from the expansion rate. Rightly, it also assumes the universality of its observed laws of conservation of energy, from which it sees an eventual running down. Continuous creation and controlled energy flow are not measurable—not yet anyhow—and it is good science to stick with the observable.

It was in about 1955 that the New York Times carried a headline report that the size and age of the universe had just doubled. The reason for the report was a new estimate of the rate of expansion of the universe which also increased the estimate of its age from 2 billion to 4 billion years, about 10 billion years short of current estimates. And, at about the same time, The Urantia Book appeared on the bookshelves speaking of colliding black holes and continuous creation!! In 2003, it all seems plausible.

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