IS THE UNIVERSE A THERMODYNAMIC SYSTEM?

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To ask the question, Is the universe a thermodynamic system?, is meaningless scientifically. Scientific opinions regarding the extent of the universe vary widely. Examples of both conservative statements and unqualified speculation are found in current reports. There is no way to determine the extent of the universe or its thermodynamic character at the present time using the scientific method alone. However, a Christian may use the Scriptures and reach the conclusion that the universe is a thermodynamic system, since it is subject to the first and second laws of thermodynamics. It is speculated herein that the universe is also an isolated thermodynamic system.

I. General Types of Thermodynamic Systems

If the universe can be considered as a thermodynamic system, it must be classified as open, closed, or iso1ated.[1] These terms may be defined:

(a) Open system: Exchanges both energy and matter with surroundings.

(b) Closed system: Exchanges energy but no matter with surroundings.

(c) Isolated system: Exchanges neither energy nor matter with surroundings.

Can the universe be placed in one of the above categories? To do so scientifically requires knowledge regarding the extent of the universe, and it would be helpful to have some knowledge of the material or energy content of the universe.

In normal thermodynamic operations, calculations are made on energy and mass transfers between the system and its near-surroundings.[2] There is an obvious problem; with what would the universe exchange matter or energy? However, let us explore what is known about the universe before discussing the exchange problem.

II. Extent of the Universe

Tolman states that

> . . . we do not know whether the actual universe is spatially closed or open, and can choose between universes which are finite and infinite in spatial extent only on the basis of dubious metaphysical predilections.[3]

Inglis[4] claims, "If our universe is Euclidean it could be infinite in extent . . . ."

Many scientists conclude that the universe is infinite.[5-7] Other scientists consider the universe to be a closed system.[8,9] Eddington[10] prefers a closed system universe with an infinite radius. According to Newtonian theory the universe ought to be a finite island in an infinite sea of space.[6] Einstein realistically states that

> . . . a most interesting question arises for astronomers and physicists, and that is whether the universe in which we live is infinite, or whether it is finite in the manner of the spherical universe. Our experience is far from being sufficient to enable us to answer this question.[11]

To confirm the above opinion, Ford[12] claims that the question as to whether the universe is finite or infinite, closed or open remains unanswered. Weizsäcker[13] admits that we cannot observe the limits of the universe.

When writing about space, it is well to mention that, according to the general theory of relativity, the geometric properties of space are not independent but are determined by matter that occupies the space.[14] It should be remembered, however, that the theory of general relativity is probably the least tested theory of nature, yet, the theory is widely accepted.[15]

Obviously the extent of the universe is unknown, and DeSitter[16] bluntly states that the universe as far as science is concerned is just a hypothesis. Mulfinger[17] aptly sums up what is known at the present concerning the universe, "Scientists are thoroughly stymied by the nature of the *present* world . . . we don't even know what it is." It is an understatement, then, to claim that scientists can offer no definite answer as to the extent of the universe. So far man cannot fathom the depth of the universe.

Possibly this is why God created the universe, to reveal His power to man (Psalm 19:1, Isaiah 40:26). Nowhere may man turn and not be confronted with God's power and Deity (Romans 1: 19,20). When men look into the heavens, they should be awed by the power of the Creator and realize their insufficiency to understand what is seen.[18] When God confronted Job in order to humble him, He asked, "Do you know the ordinances of heaven?" (Job 38:33).

III. What is Known About the Universe?

In 1934 Tolman[19] commented that it was possible to see out into the universe only some 100 million light years by using the Mount Wilson 100 inch telescope. In 1952 Krogdahl[20] stated that the observable region of the universe extended with the power of available instruments to a billion light years in any direction. In 1964 Abell speculated that the most remote observed galaxies were between five and ten billion light

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years away.[21] Using information obtained from Orbiting Astronomical Observatory, astronomers claim that the universe may be several times larger than previously believed.[22]

It is obvious that we have some knowledge only of the part of the universe which we can observe.[23] Abell[24] states it must be assumed that the part of the universe which we actually see is representative of the entire cosmos. Of course this is a bold step of faith.

Also the universe is normally assumed to be homogeneous.[6,25] Since there is very little matter in the universe compared to the space of the system, Motz and Duveen[26] claim that when developing any models for the universe it can be treated essentially as empty. Morris[27] probably makes the most conservative statement of all when he maintains that the physical universe is simply a space-time-matter continuum. Again it should be obvious to the reader that scientists know very little about the universe.

However, some scientists are willing to speculate on the material content of the universe regardless of the dearth of knowledge about which they are speculating! As an example, Ford states[28] that there are approximately 10^{23} stars, approximately 10^{82} protons and the same number of electrons, yet fewer neutrinos, and an infinite number of photons and gravitons[29] in the universe. In the same place he maintains that there are fewer unstable particles than protons. To balance this assertative statement, he contends that one of the unanswered questions in science is whether the amount of matter (and energy) in the universe is truly constant. (p. 722) In other words, does the first law of thermodynamics hold for the universe?

IV. Conservative Statements by Scientists vs. Unqualified Speculation

The preceding paragraph is an example of reasonable statements in scientific circles (admitting that it is not known scientifically if the first law is true for the universe) as opposed to reckless speculation (estimating the number of stars and particles in the universe). If a scientist is able to predict the number of particles, should he not also to be able to predict with a degree of certainty whether the first law applies to the universe?

I have found that some scientists become very conservative when expressing the limits of the first and second laws of thermodynamics yet will go to radical degrees of speculation when defending any form of the evolutionary hypothesis. This is interesting since the first and second laws are "the best science" we have today, being experimentally verified, whereas accepting and promulgating evolution requires sheer faith in an unproven absolutely unverifiable hypothesis.[30] It is my opinion that scientific statements concerning the first and second laws of thermodynamics and their application to the universe should be conservative since so little is known about the universe. Also, any statement about the evolutionary hypothesis should be very cautious.

It is interesting to examine some statements concerning the first and second laws and their relation to the universe since they apply to this treatise. In discussing thermodynamic systems, Kestin gives the following commentary:

> The material objects not included in the system inside its boundary constitute its surroundings. We may be inclined to say at this point that the surroundings of a system therefore include "the rest of the universe." In order to avoid speculation about the nature of the universe on whether it is contracting, expanding, or oscillating it is not necessary to succumb to such an impulse.[31]

This is a reasonable statement based on present scientific knowledge. When discussing the first law, he states,

> In connection with the enunciation for the principle of energy conservation . . . the reader must contain his impulse to consider the "whole universe" as an isolated system and to state the first law of thermodynamics in the sweeping form that the energy of the universe is constant. In order to give a precise meaning to such a statement it would be necessary to analyze in detail the nature of our universe, a task which transcends the resources of present-day science. Otherwise, the assertion becomes a mere, emotional, oratorical exclamation.[32]

In discussing the second law, he notes

> since the principle of entropy increase has been enunciated in terms of an isolated system the already familiar impulse to equate the universe with an isolated system presents itself in this context too and the statement is made that the entropy of the universe increases. This together with the parallel statement that the energy of the universe remains constant leads to the speculation about the gloomy consequence which would follow when the entropy of the universe will have reached a maximum so that it could increase no more. All processes would be arrested and the universe would die an entropy death. For reasons outlined . . . we do not believe that any physical meaning can be ascribed to statements of this kind.[33]

These are examples of quite conservative scientific statements. We honestly do not know enough (scientifically) about the universe to

know if the first and second law apply, or even to judge if the universe is a thermodynamic system.

For a statement similar to those previously quoted from Ford, consider the following remark by Blinder, which is a cautious statement coupled with imaginative speculation:

> The entropy-death hypothesis for the universe is almost certainly fallacious in view of the fact that the second law of thermodynamics is not an absolute principle. It is rather a statistical generalization based on the most probable behaviour of a large assemblage of molecules. Even in a thermodynamic system at equilibrium there spontaneously occur large and random fluctuations within microscopic subunits of the system. Now the universe is so enormous in size and so prolonged in duration that events on the scale of births and deaths of stars—and perhaps even galaxies—might rank among statistically admissible fluctuations.[34]

The **cautious part** of the statement is that we just cannot know scientifically if the universe will die an entropy death because our knowledge of the universe is too limited. The statement then gets progressively worse from a scientific standpoint. According to the statistical interpretation of thermodynamics, fluctuations can occur within thermodynamic systems.[35]

However, as pointed out by Wilder Smith,[36] the next fluctuation would cause the system to return to an equilibrium situation. An ordering fluctuation following an ordering fluctuation, etc. would be an upward evolutionary process, and it would be an *observable* contradiction to the second law of thermodynamics. Such a case has never been substantiated to my knowledge and is only a fancy dream in many evolutionists' minds because it is necessary for their supposed process.

The last part of Blinder's statement is **pure speculation.** To say the universe is prolonged in duration is a statement of faith, not scientific knowledge. Scientific dating methods have been examined in previous Creation Research Society publications, particularly the September, 1968 *Quarterly* and articles in this *Annual* issue. The age of the earth or the universe **cannot** be determined utilizing the scientific method. The birth of stars has never been seen, much less verified.[37] Discussion of the birth of stars or galaxies is not part of scientific activity but an application of evolutionary faith, a necessary step in the supposed evolutionary sequence of the universe.

It is interesting to note that the most frequent statements made as to limitations of the first and second laws of thermodynamics are voiced when these laws clash with evolutionary theory. Yet evolutionary guesswork may be expressed in one imaginative form after another and be acceptable in so-called scientific circles. Many scientists attempt to show a naturalistic beginning and development of the universe when they don't even know what the universe is! It would be well to heed Abell's remark,[38] "Cosmology is one of the most difficult and most speculative fields of science."

Other astronomers have made opposite claims to that provided from Blinder. Krogdah1[39] believes that the universe will approach a heat death. Weizsäcker[40] says that the second law of thermodynamics has been applied to astrophysics with good success. Mulfinger[41] claims all observable processes in the universe are seen to be degenerative when properly interpreted.

V. Scientists and the Universe

Considering all of the previous statements it is simply impossible to tell if the universe is a thermodynamic system using the scientific method. We do not know enough to make a positive statement. Scientists must be mute on the subject. God may have intended it this way, and Surburg makes an interesting comment on this:

> After setting forth in verse I [Genesis 1] the creation of the entire universe, "the heavens and the earth," the author leaves "the heavens" as lying outside the sphere of investigation.[42]

VI. The Universe in Scripture

Since the scientific method cannot be used for the question under discussion, we now go to the final authority on the universe to seek any revelation from the Creator. Some references from Scripture were given in an earlier section. In addition, Isaiah 55:9 and Job 22:12 indicate that the heavens are vast, a fact admitted by modern-day scientists. Today's astronomers would have to answer, no, to the question presented in Job 38:33. Ecclesiastes 8:17 mentions that there are many things mankind will not learn, and this possibly could be applied to a knowledge of the universe. What about new scientific evidence that might be found as men investigate the universe? Reymond states,

> Man does not live then in an impersonal or uninterpreted universe, for every fact of the universe is what it is because of the direct exertion of the divine will of the Creator.[43]

No matter how much more man may learn about the universe, he will be unable to successfully "explain" its origin by natural means.

Is the universe a thermodynamic system? Consider these verses:

> For the whole creation was made subject to vanity . . . (Romans 8:20).
>
> For we know that the whole creation groaneth and travaileth in pain together until now (Romans 8:22).

These are essentially scriptural statements of the second law of thermodynamics. Thus it is obvious that the universe is subject to the second law. From II Peter 3:7 it can be seen that the universe is subject to the first law of thermodynamics. Since the universe is subject to these laws of thermodynamics, a Christian can reach the conclusion that the universe is indeed a thermodynamic system.

Is the universe an open, closed, or isolated system? Admittedly this question leads to pure conjecture. With what could the universe exchange matter or energy? God *could* intervene in His cursed creation. Would He add or take away energy from the universe (an energy exchange)? It is impossible to answer such a question.

However, setting aside for the moment any direct intervention by God, the universe can be considered as an isolated system, since it does not appear to exchange energy or matter with any surroundings. Frankly this is a guess, but is appears plausable.

One can observe that degeneration of parts of the universe is called for by Scripture. As stated in Scripture, the first law of thermodynamics is operating in the present heavens. Since the universe is subject to these laws of thermodynamics and no matter or energy exchange can be observed, it is *assumed* here that the universe is an isolated thermodynamic system,

Whether the universe is open, closed, or isolated, it is definitely degenerating. No matter what type of a thermodynamic system is chosen, the entropy of the system always increases with the occurrence of an irreversible process.

VII. Conclusion

It is not possible using the scientific method (observation) to determine if the universe is a thermodynamic system. Scientists should remain mute on the subject, as scientists. However, from Scriptural evidence it is concluded that the universe is a thermodynamic system. It is further speculated that the universe is an isolated system. From these inferences one may suggest that the evolution theory, which demands decreasing entropy, is still indefensible in the face of the second law of thermodynamics.

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LETTER TO THE EDITOR

In reply to the Letter to the Editor by Emmett L. Williams, *Creation Research Society Quarterly,* 6 (3): 155 (December, 1969), whether a general scientific conservation principle encompassing both energy conservation and biological conservation is possible, the following observations are pertinent.

The first law of thermodynamics as you stated in your March, 1969 article (A Simplified Explanation of Laws of Thermodynamics, *Creation Research Society Quarterly,* 5:138ff.), involves essentially the concept that matter and energy can be transformed, one to another, but the total energy content of the universe remains the same.

This means that, except experimentally, no new mass is now originating in the universe. And of course the second law, among other things, involves the concept that the conversion of energy into mass (or vice versa) is never 100% efficient, and so there is an ever increasing unavailability of energy, or tendency toward disorder.

Now regarding inheritance in plants and animals, we do of course have much evidence of degeneration. Also of course the DNA system, originally created in order to have the great variety, both of and in plants and animals, must be substantially the same now as at creation, however due to mutation, the *quality* of the DNA units or system has changed.

As far as we can tell the changes in the DNA units are toward *inferior* offspring. This conclusion is challenged by our evolution-minded colleagues, who insist that some mutations are beneficial, though they are hard put to give examples. In fact, they claim that since the original primitive DNA system came into being spontaneously, mutations have *added* new DNA units or codons, thus leading to the complexity we now see. Modification of existing beneficial conditions is assumed.

Hence the only "law" I can think of as expressing our viewpoint might be stated: "Except for degenerative changes and losses (as extinct species) the total number of species determining DNA units now existing is the same as the number originally created."

Though I am not good at neatly expressing laws, one might perhaps combine both these laws by the following:

The law of conservation of energy essentially states that the total energy content of the universe remains constant, both inorganically as regards atomic reactions and biologically as regards the inheritance of an original total number of species determining DNA units.

The second law states that the conversion of mass into energy, or energy into mass, is never 100% efficient and leads to an ever increasing unavailability of energy or a tendency toward disorder in the inorganic realm. Likewise biologically, the DNA system becomes increasingly degenerate or disorderly due to the accumulation of random mutational changes.

No doubt the above can be simplified but at least it may prove helpful in promoting further discussion.

Signed,
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Added Note

Dr. Emmett L. Williams sends the following letter excerpt as a follow-up to his December, 1969 letter that he received from David A. Shetland who stated,

> I am convinced that such a conservation principle [any universal conservation principle] would find its firmest base in parallels drawn at the microcosmic level.