ENTROPY and GOD

by Caner TASLAMAN, Ph.D.

The second law of thermodynamics, also known as the law of entropy, is considered one of the most fundamental laws of the universe. This law states that the disorder in the universe is constantly increasing in a single direction. This law has great importance, especially in terms of the debate of whether the universe has a beginning and an end, a debate that has been raging between theists and atheists throughout history. In addition to this, entropy also has to be considered in discussions of the "argument from design" and the "miracles," both of which are important subjects in philosophy of religion. In this paper, after defining entropy and presenting some of its important physical and philosophical points, the results of this law will be analyzed under four headings from the point of philosophy of religion. The first of these headings concerns the end of the universe, the second its beginning, the third the argument from design, and the fourth the miracles.

ENTROPY: UNIDIRECTIONAL, PROBABILISTIC LAW OF DISORDER

The first law of thermodynamics states that the total energy in the universe (or in an isolated system) is always the same. In the 19th century, this law was expressed as two separate laws, one for energy and one for matter; "the law of conservation of energy" and "the law of conservation of matter". However, thanks to Einstein's famous $E = m \cdot c^2$ *(Energy= Mass* $\times$ *The speed of light squared)* formula, these two laws that initially appeared separate, were united. It had previously been discovered that different kinds of energy, like acoustic energy, solar energy, electrical energy, all had the same essence. Once it was understood that matter was one of the shapes energy took, it became "the law of conservation of energy and matter". According to this, since the total energy (E) of the universe does not change, its change (Δ) is equal to zero. The mathematical formula for this is:

$$\Delta E_{Universe} = 0$$

The second law of thermodynamics was formulated in the second half of the 19th century, thanks especially to the work of Clausius. He was also the first to use the term entropy. According to this law, energy is continuously transformed from a usable to a less

usable form. In other words, the disorder in the universe is continuously increasing unidirectionally and irreversibly. While the first law, which states that the energy of the universe remains fixed even though it is subject to many changes, is expressed with an equality, the second law, which states that the energy of the universe is continuously getting more disordered (the increase in disorder can be expressed as an increase in entropy or as a positive entropy change), is expressed with an inequality. Actually, Clausius was initially hoping to find the law of conservation of entropy, similar to the law of conservation of energy; however, he realised that the universe is governed by the law of lack of conservation of entropy.[1] In the formula expressing this, it is stated that the change (Δ) of the universe's entropy (S), is greater than zero, so as to be able to indicate the fact that the change is unidirectional and positive. The formula is as follows:

$$\Delta S_{Universe} > 0$$

One-way processes are harbingers of the end. Mankind's process of growing old and the increase of entropy in the universe are both examples of such processes. Actually, what we are observing continuously is a multitude of one-way processes that cause an increase in the universe's entropy. Heat always flows from a hot to a cold environment, never the opposite. Hot tea will get cold, but the heat in a room will never flow back to the tea (reversal of the process) and heat it. The process caused by pressing on the brakes of a bicycle, which ends with the bicycle stopping, will free heat, but it will never happen that a bicycle heated by the sun should start moving. If the cap of a perfume bottle is open, the perfume will dissipate into the room, but once the molecules are spread into the room will never get back into the bottle.

Arthur Eddington says that the entropy law is the most important among all natural laws. According to Eddington, a theory concerning the universe may be correct even if it is in discordance with Maxwell's formulae, or even with experiments previously carried out; however, if it is in discordance with the entropy law, it is absolutely impossible for it to be correct.[2] According to Einstein, the most successful part of Newtonian mechanics is that they

[1] Michael Guillen, *Dünyayı Değiştiren Beş Denklem*, translated by: Gürsel Tanrıöver, Tübitak Popüler Bilim Kitapları, Ankara, 2001, p. 213-215.
[2] Arthur Eddington, *The Nature Of The Physical World*, Macmillan, New York, 1929, p. 74.

can be applied to thermal motion; this success can be observed in kinetic theory and in statistical mechanics.[3] The entropy law, which is one of the most basic laws of physics according to the most famous physicists, satisfies all criteria established by various philosophers of science, for it to be considered a successful scientific law, such as being based on observation and experimentation, having the possibility of falsification, serving as an instrument of prediction, and having the possibility of being explained mathematically.

Nevertheless, what is remarkable is that such a definite law like the entropy law, is a probabilistic law. In changes which involve the diffusion of molecules, as in the case of the unidirectional flow of heat, it is impossible to calculate the movement of each molecule. What we are talking about is a quantity of molecules much greater than what can be expressed in quadrillions, and consequently it is impossible to calculate factors like molecules crashing into each other, for each single molecule. However, since the number of molecules that we are talking about is so unimaginably high, probabilistic entropy laws concerning diffusion always provide us with accurate results. Let us take the example of the molecules of air over the world; there is a very low probability that all the molecules of air over the world should assemble over the Atlantic Ocean and that the rest of the world should remain without air, but this probability is so low as to be considered impossible, and thus there is nothing for us to worry about. George Gamow calculated the fact that even in a single room the probability of all the molecules of air assembling in one half of the room is so low as to be practically impossible, in the following way: In one room there are about 10^{27} (billion× billion × billion) molecules. Since the probability of a single molecule to be in one half of the room is ½, the probability for all molecules is $(½)^{10^{27}}$; and that is the equivalent of a probability of 1 in $10^{3\times10^{26}}$. Let us keep in mind that molecules of air move at a speed of 0.5 km. per second and that during 0.01 of a second their distribution in a room changes 100 times. The time required for all these molecules to assemble in one half of the room is $10^{299.999.999.999.999.999.999.999.998}$ seconds, and when we compare this time period with the total age of the universe, which is 10^{17} seconds, we see why such a probability is considered impossible.[4] On the basis of the example provided by Gamow to prove the probabilistic impossibility of the molecules assembling in one half of a single room (in mathematics, probabilities lower than 1 in 10^{50} are generally considered impossible), we can understand very clearly why our example

[3] Albert Einstein, *The Theory Of Relativity And Other Essays,* MJF Books, New York, 1997, p. 30.
[4] George Gamow, *1-2-3 Sonsuz*, translated by: C. Kapkın, Evrim Yayınevi, Istanbul, 1995, p. 212-213.

concerning all the air in the world concentrating over the Atlantic Ocean is absolutely impossible. This kind of calculations arising from the diffusion of molecules demonstrate why the entropy law is considered an absolutely certain law of physics, even though it is a probabilistic law.

Some may object by saying that the machinery and buildings made by people are a change from disorder to order, and that the activity of plants, from which we receive negative entropy, is in contrast with the entropy law. What we should be careful about at this point is that the second law of thermodynamics states that the total entropy of an isolated system increases. The cost of an order established in one part of the universe, will certainly be paid in the form of disorder in another part. Let us take the example of a building. The materials used for the building (iron, wood, etc.) will be obtained by consuming the resources of the world, and in addition to this, a certain quantity of energy will be consumed during the building activity. A complete calculation will show that the disorder created is always more than the order.[5] All living creatures survive by means of negative entropy with their environment. We take negative entropy from plants or from animals that eat plants, while plants survive by taking negative entropy from the sun by means of the photosynthesis process. It is for this reason that Bertrand Russell said that all living creatures are imperialists that receive as much energy as possible from the environment for themselves and their descendants.[6] However the feeding of each living creature creates a greater disorder in its environment. For example, during each phase of the feeding process, as a grasshopper eats a leaf, a frog eats the grasshopper, and the trout eats the frog, there is a continuous loss of energy. According to Miller, during a feeding process, 80-90 % of the energy is dissipated into the environment as heat. It is only 10-20 % of the energy that is conserved in the tissues of the living creature, for further use. Let us assume that the nourishment need of a person during a year consists of 300 trout; these fish will survive by eating (receiving negative entropy) 90.000 frogs, which consume 27 million grasshoppers, which survive by consuming a 1000 tons of grass.[7] By taking carbon dioxide molecules from the air, water from the earth and by using sun rays, a plant will transform simple molecules into complex ones; transforming simple molecules into complex ones means reducing entropy; however, the

[5] Paul Davies, *God And The New Physics*, Simon and Schuster, New York, 1983, p. 10.
[6] Jeremy Rifkin, Ted Howard, *Entropi*, translated by: Hakan Okay, İz Yayıncılık, Istanbul, 1997, p. 60-61.
[7] G. Tyler Miller, *Energetics, Kinetics and Life*, California, Wadsworth, 1971, p. 46; quoted in: Jeremy Rifkin, Ted Howard, *ibid*, p. 62.

entropy law will still not have been violated.[8] Just like other living creatures, plants are also "open systems" and the cost of their order is the disorder that they create in their environment. In contrast to the ever increasing entropy of the sun, and to the decreasing order of the earth, the increase in the negative entropy of the plants is very low. According to calculations, the cost of the decreasing entropies of living creatures, machinery and all other ordered structures, is paid as a greater entropy increase in the whole of the system, and in this way the second law of thermodynamics is never violated.

As the 19th century was dawning, Newtonian physics was dominant. The laws of Newtonian physics were characterised by absolute determinism, absolute space and time, and reversibility over time. Thanks to absolute deterministic mathematical laws, it had become possible to establish exactly the time of solar eclipses that were going to happen forty years later or that had happened fifty years earlier. Space and time were perceived as absolute concepts that were not affected by each other and by celestial bodies in movement. Something going up an incline could fall back, an object going forward could come back, and a pendulum oscillating towards the right could also oscillate towards the left; all these reversible processes were possible without violation the laws of motion in physics.

The view according to which time and space are absolute, changed in the 20th century when Einstein formulated his theories of special and general relativity. By showing that celestial bodies, space, and objective and subjective time are all related to each other, Einstein changed the concepts of absolute space and time, as independent of each of other, as was typical in classical mechanics.[9] In the Einsteinian physics it is the speed of light that is absolute, and this is as deterministic as the laws of Newton. Even though the deterministic approach of macrophysics continued into the 20th century with Einstein, it also began to be debated in the same century, because of the "uncertainty principle" of the quantum theory of microphysics. Even though there were those like Heisenberg, who considered the "uncertainty principle" to be the proof of nature's indeterminist structure,[10] there were also those like Planck and Einstein, who claimed that uncertainty derived from our ignorance, and from the fact that at a micro level our observation capacities were limited.[11] As in the case of the

[8] George Gamow, *ibid*, p. 217-218.
[9] Albert Einstein, *ibid*, p. 52.
[10] Ian Barbour, *Religion In An Age Of Science*, The Gifford Lectures, New York, 1990, p. 101-104.
[11] Albert Einstein, *ibid,* p. 41-49.

entropy law, the quantum theory has also developed a probabilistic approach.[12] However, we should bear in mind that there is not the same unanimity about quantum mechanics as there is about thermodynamics. In addition to this, even though the second law of thermodynamics is probabilistic, it does not claim that the universe has an indeterministic structure, like the much debated interpretation of the quantum theory suggests. Even though the entropy law is as deterministic as Newtonian and Einsteinian physics, and even though it has a probabilistic approach like the quantum theory, its difference from all these theories is that it has showed that an unidirectional and irreversible law is one of the most basic laws of the universe.

We think that the most important characteristic of this law is its irreversible structure. The entropy increases in the same direction as the arrow of time, and this is why the entropy law is important from the point of view of an ontological debate concerning time. By underlining the process, this law will show time's contribution in physical phenomena. Nevertheless I am of the opinion that the views considering time as a function of entropy are wrong. This is due to the fact that time flows unidirectionally all over the universe; since time is basically a sequence of "before" and "after", there cannot be exceptions to it anywhere in the universe and it does not have anything to do with a probabilistic structure. The fact that somewhere in the universe there is an increase in order is not an exception to the entropy law; the total sum of the entropy in the universe will still have increased. Time on the other hand advances in a more definite way than entropy, since in no part of the universe can time be reversed by means of an advance of time in another part. This is why it would be wrong to identify the 'arrow of entropy' with the arrow of time, even if they both have the same direction.

Another mistake made concerning entropy, is to connect its increase to the expansion of the universe. Lemaitre and Friedmann were the first, on the basis of Einstein's formulae, to show at a theoretical level that the universe was expanding. In the 1920's and 1930's, observations from the Mount Wilson Observatory, by astronomers like Edwin Hubble, Vesto Slipher and Milton Humason, proved that it was actually expanding. Some physicists, who also influenced by laws concerning the diffusion of molecules, came to the conclusion that the increase in entropy was due to the expansion of the universe and, on the basis of this, stated that if the force of gravity became dominant and the universe began to shrink, entropy also

[12] Werner Heisenberg, *Fizik ve Felsefe*, translated by: M. Yılmaz Öner, Belge Yayınları, İstanbul, 2000, p. 21-22.

would decrease. Considering entropy as being only a diffusion of gases gave birth to the mistaken belief that the gravitational pull could decrease entropy. In the same way that the diffusion over time of gases to a vast area creates an increase in entropy, also black holes forming at the end of a process in time will correspond to a high level of entropy.[13] It was his discovery that this second law of thermodynamics was also valid in these celestial bodies that led Stephen Hawking to make his famous discovery concerning black holes.[14] This shows that the entropy law is not valid only in fixed or expanding dimensions, since black holes can also represent an increase in entropy. Even if one day the force of gravity wins and the universe starts to collapse towards a Big Crunch, the increase in entropy will continue. In the universe there is a continuous transfer of energy from matter to radiation. This is why, as also Richard Tolman's studies have proved, if the universe starts to collapse, this collapse will not be symmetrical with its expansion and will collapse faster than it expanded. Accumulated radiation represents an increase in entropy, and this shows that the rise of entropy in the universe is inevitable.[15]

As a result of all this, I am of the opinion that in the universe there are four unidirectional processes that cannot be reduced to each other. The first of these is the expansion of the universe, the second the increase in entropy, the third space-time, and the fourth time connected to the mind. We can state that the expansion of the universe in the first process is completely independent from the other three, that this expansion has been confirmed by observations, and that the opposite of this process – the collapse of the universe – is perfectly possible; this is why we can say that a reduction of the expansion of the universe to the other three processes is completely wrong. The entropy law expressed in the second process is supported by experiences based on observations and all physical data shows that this law is irreversible. In other words the increase in entropy moves in the same direction as the arrow of space and mental time. However, for reasons that we have already expressed, the increase in entropy cannot be reduced to space-time or to time connected to the mind. By means of air-conditioning we can reduce the entropy of the room in which we are, but our mind will not be able to observe the increase in entropy outside, since it will only witness the reduction in entropy; however, no contradiction will arise in our minds. If, as some maintain, it had been possible to reduce our psychological arrow to entropy, such a situation should

[13] Roger Penrose, *The Road To Reality*, Jonathan Cope, London, 2004, p. 706-707.
[14] Stephen Hawking, *Stephen Hawking's A Brief History of Time*, Bantam Books, New York, 1992, p. 92-95; Stephen Hawking, *A Brief History of Time*, Bantam Books, New York, 1988, p. 102-108.
[15] Paul Davies, *The Last Three Minutes*, Basic Books, New York, 1994, p. 142-147.

have given rise to a contradiction. It may be that the most controversial debate is whether space-time can be reduced to mental time. Einsteinian physics has demoted time from the level of an absolute concept. Even though there is no space for absoluteness anymore in time's ontological status, we think that there is still space for the reality of time. Even if Einstein suspected that time was an illusion – it is thought that towards the end of his life he changed his mind [16] might it not be that the speed of light that in his formulae appears as a given, is actually the physical expression of time in the outer world? Studying irreversible processes like entropy, and in particular the order created by such processes as they tend towards disorder, has in recent times become dominant in physics, and these processes have also become elements that have to be taken into consideration with emphasis on time and process.[17] I agree with Prigogine, who said, *"we are not progenitors of time but children of time."*[18] No matter how much the reality of time is weakened, there should be something corresponding to the fact that phenomena outside the mind are ordered as "before" and "after", and that not all phenomena are presented at the same time. With the expression "*cogito ergo sum*", Descartes had expressed the fact that no matter how much the reality of his own existence weakened, and even if the material body was not taken into consideration, the creature defined by him as "I" had an ontological correspondent.[19] In the same way, notwithstanding Einstein's formulae that took time's absoluteness away, there should be something corresponding to its ontological reality. As for time's existence in the mind, Kant showed that if the mind did not *a priori* have such a intuition, it would not be able to understand the outer world.[20] However, the fact that time is an *a priori* intuition does not prove that time is just an invention of the mind. Noam Chomsky claimed that our minds have the ability *a priori* to learn languages;[21] however this does not mean that the languages don't exist in the outer world. That is why the fact that Kant has proved the existence of time in the mind *a priori*, does not show that space-time can be reduced to mind-time. As I see it, since time is a reality of the outer world, and since the mind has also the intuition of time *a priori,* these cannot be reduced to each other. By using the expression "cannot be reduced", I mean that these two are not completely equivalent, otherwise the time intuition existing a priori in the mind and the space-time are clearly related to each other, and cannot be taken up

[16] Ilya Prigogine, *Kesinliklerin Sonu*, translated by: İbrahim Şener, İzdüşüm Yayınları, İstanbul, 2004, s. 186.
[17] Ilya Prigogine, Isabelle Stengers*, Kaostan Düzene*, translated by: Sezai Demirci, İz Yayıncılık, Istanbul, 1998.
[18] Ilya Prigogine, *ibid*, p. 10.
[19] Descartes, *Metot Üzerine Konuşma*, translated by: K. Sahir Sel, Sosyal Yayınlar, Istanbul, 1994, p. 32-34.
[20] Immanuel Kant, *The Critique of Pure Reason*, translated by: J.M.D. Meiklejohn, William Benton, Chicago, 1971, p. 27-28.
[21] Noam Chomsky, *Knowledge of Language: It's Nature, Origin And Use*, Praeger, New York, 1986.

independently. Yet, if time had been only an invention of the mind, it would have been unimportant and even useless in the description of natural processes. However, the entropy law showed the importance of irreversibility/time/process in universal phenomena; and it also acquired importance from the point of view of philosophical debates concerning the ontological status of time.

Understanding that time is not an absolute concept helps to provide answers to important questions regarding philosophy of religion. For example, Kant's antinomies were shaped within the "absolute time" concept of Newtonian physics, which had influenced him.[22] On the other hand, since in Einstein's formulae space and time are connected, it will become meaningless to ask what God was doing before the beginning of the Big Bang process, when spare-time did not exist. Also questions like, "why did God wait 15 billion years to create humankind?" are meaningless. Such questions are the result of a point of view that considers time absolute; from the point of view of an approach that considers time as something relative, a time period of 15 billion years in one point of view, could be as unimportant in another point of view as a few seconds are for us. Those – like me – who do not perceive time as absolute, but nevertheless consider it as a concept that corresponds to a reality from an ontological point of view, might try to reach different results from the point of view of philosophy of religion. It might be important to try and find a relation between "theodicy" and entropy, which increases as time flows by,[23] or to take into consideration the reality of time from the point of view of debates about "free will." Since these matters require talking into consideration other than the subject of this article, I shall not go into their details.

I shall try to explain those among the entropy law's results, which I consider important from the point of view of philosophy of religion, under four headings. The first of these is about the fact that this law tells us that the universe will have an end.

1- THE END OF THE UNIVERSE AND ENTROPY

As we have already said, one-way processes are harbingers of death, and the universe is characterised by an increase in disorder. This process, which in physics is called increase

[22] Stephen Hawking, *ibid*, p. 7-8.
[23] For a similar example see: Robert John Russell, *Entropy And Evil*, Zygon magazine, vol. 19, no. 4, December 1984, p. 449-467.

of entropy, cannot go on forever. Heat will continuously flow from hotter to colder environments, until the temperature of all environments is the same. This kind of end for the universe is called "heat death" or "thermodynamic equilibrium." Certain claims concerning the fact that the universe could not exist for all eternity had also been put forward previously. For example the Islamic philosopher and theolog Kindi, who lived in the 9th century, developed lines of thought concerning the passage from the finite quality of the objects in the universe to the vastness of the universe that had nevertheless an end, and from this to the universe's end over time.[24] However, within the scope of natural sciences, it was discovered for the first time that the end of the universe was inevitable when the entropy law was formulated in the 19th century. According to the Aristotle-Ptolemy system, widely accepted until the 16th century, stars would exist for all eternity thanks to an inexhaustible fuel. Galileo's and Newtonian physics, which were dominant in the 19th century, had nothing to say about the end of the universe. The evolution of groups of stars, was explained first of all in Kant's, *"A General Natural History and Theory of the Heavens"*[25] which was an application of Newtonian physics. Later, when this theory was developed by Laplace, it showed the importance of the transformation in the universe, but this transformation could be seen as something having a circular nature; in other words, the Kant-Laplace approach also did not reach a conclusion on whether the universe would end. What is more, since the first law of thermodynamics, which was formulated in the first half of the 19th century, stated that the total amount of energy remained the same, even if the form of energy is changed, it could be taken as proof that the universe would exist for ever. When, amidst the dominance of such a view, the entropy law stated that the energy within this constant total was evolving into less usable forms, and that thus the universe had to have an end, it created a shock effect in the world of sciences and among philosophers. For example, Bertrand Russell stated his depression following the fact that scientific laws had anticipated the end of the universe, in the following way: *"Even more purposeless, more void of meaning, is the world which science presents for our belief. Amid such a world, if anywhere, our ideals henceforward must find a home… that all the labours of the ages, all the devotion, all the inspiration, all the noonday brightness of human genius, are destined to extinction in the vast death of the solar system, and the whole temper of Man's achievement must inevitably be buried beneath the debris of a universe in ruins – all these things, if not quite beyond dispute, are yet so nearly certain that no philosophy which rejects them can hope to stand. Only within the scaffolding*

[24] Kindi, *Felsefi Risaleler*, translated by: Mahmut Kaya, İz Yayıncılık, Istanbul, 1994, p. 87-92.
[25] Immanuel Kant, *Evrensel Doğa Tarihi Ve Gökler Kuramı*, translated by: Seçkin Selvi, Sarmal, Istanbul, 1997.

of these truths, only on the firm foundation of unyielding despair, can the soul's habitation henceforth be safely built."[26]

The scientific demonstration of an end for the universe created an existential crisis for some people. Many people had found solace for their own deaths in the idea that their work, their reputation and their descendants would survive. Can the wish of politicians to build giant structures not also be seen as a manifestation of a wish for immortality? We see the manifestation of this same wish for immortality by means of work done and reputation, in Pericles's oration: *"For this offering of their lives, made in common by them all, they each of them individually received that renown which never grows old, and for a tomb, not so much that in which their bones have been deposited, but that noblest of shrines wherein their glory is laid up to be eternally remembered upon every occasion on which deed or story shall be commemorated."*[27] The way man attempts to satisfy the wish for immortality by leaving behind creations and a reputation, and even by sacrificing his own life, was expressed in this way by Hannah Arendt: *"Therefore whoever consciously aims at being 'essential', at leaving behind a story and an identity which will win 'immortal fame', must not only risk his life but expressly choose, as Achilles did, a short life and premature death."*[28]

For those who desire to attain immortality by leaving behind the results of their work or their reputation, the entropy law turned out to be an unpleasant physical law. And specially for the defenders of materialist ontology, who throughout history have opposed God's eternal existence by asserting universe's eternal existence, the result indicated by entropy is a tough bullet to swallow. The unshakeable faith in the immortality of the universe is present in the writings of many a materialist philosopher, beginning from the atomism of Democritos and Epicuros.[29] Nobody before Lucretius had been as firm as he was in the belief that to claim the non-existence of God one had to claim that the universe/matter had always existed and would exist for ever. This poem of his reflects his belief that the universe was immortal:

Of two kinds are all objects:
Atoms and their composites
No force can break up atoms

[26] Bertrand Russell, *Why I Am Not A Christian,* Simon And Schuster, New York, 1957, p. 106.
[27] Thucydides, *Funeral Oration Of Pericles*, from *The Landmark Thucydides*, edited by Robert B. Strassler, The Free Press, New York , 1996, p. 115.
[28] Hannah Arendt, *The Human Condition*, Doubleday Anchor Books, New York, 1999, p. 172-173.
[29] Freidrich Albert Lange*, Materyalizmin Tarihi Ve Günümüzdeki Anlamının Eleştirisi 1*, translated by: Ahmet Arslan, Sosyal Yayınları, İstanbul, 1998, p. 40-44.

Being the absolute end will keep them forever[30]

In addition to the fact that the followers of materialist philosophy claimed the existence of an eternal universe, which encompassed an explanation for everything, agnostic philosophers stated that as it was possible to find the explanation for everything in God, it was also possible to find it in the universe, and by putting forward the impossibility of choosing between these two alternatives, they formulated the base of their agnosticism. Given that we have to stop at a certain point and not go further, Hume wondered whether it would not be possible to stop in the material world, rather than going up there to God.

As you can see, the result deriving from the entropy law is important both from the point of view of existential worries, and from an ontological point of view. Theists (and by theists I mean especially the believers in the three main theist religions) find the meaning of their lives, and the aim of their hopes, in their God centred ontologies and eschatologies, based on the word of God, as transmitted in His sacred texts. This is why a theist need not fall into a mood of despair as Russell did, just because the entropy law indicates the end of the universe. In the 1930's, William Inge explained why the "heat death" of the universe was a problem only from the point of view of modern philosophy, in the following way: *"The idea of the end of the world is intolerable only to modernist philosophy, which finds in the idea of unending temporal progress a pitiful substitute for the blessed hope of everlasting life, and in an evolving God a shadowy ghost of the unchanging Creator and Sustainer of the Universe… Modernist philosophy is, as I maintain, wrecked on the second law of thermodynamics; it is no wonder that it finds the situation intolerable, and wriggles piteously to escape from its toils."*[31]

According to the eschatologies of the three great theist religions, first of all life in the universe will stop completely, and later God will begin to recreate. This is why the idea of a universe that ends is in accordance with the cosmologies and eschatologies of the theist religions. The fact that a scientific law confirms the idea claimed by theists throughout history, on the basis of their sacred texts, and against the judgement of almost everybody else, that the universe will cease to be, will increase the faith that the theists have in their sacred texts and eschatologies. Consequently, a scientific law that is a source of despair for others will be a source of hope for the theists whose source of solace is in their eschatologies. From

[30] A. Osman Gürel, *Doğa Bilimleri Tarihi*, İmge Kitabevi, Ankara, 2000, p. 102.
[31] John D. Barrow, Frank J. Tipler, *The Anthropic Cosmological Principle*, Oxford University Press, Oxford, 1996, p. 168.

the point of view of theist ontology, the universe depends upon God, and since universe was created by God, He can destroy it whenever he wishes. This is why the result arising from the entropy law is in accordance with the ontology and cosmology of theism. The fact that one of the more basic theses of materialism -the eternity of the universe- which has been theism's most ardent foe throughout history, has been disproved, is a source of additional satisfaction.

The scientific developments of the 20th century have also confirmed the entropy law. Thanks to Hubble's observations, it has been understood that the universe is in constant expansion; this phenomenon, one that has been tested many times after Hubble, has been confirmed both in theory and as a result of observation.[32] The fact that the universe is in continuous expansion tells us that it will end in one of two ways; according to the first scenario, the universe will expand continuously and will end with a "cold death" called the Big Chill, while according to the second, the force of gravity will gain dominance and the universe will collapse into itself in the Big Crunch, becoming a singularity. Whether the universe will end according to the first or second scenario depends on whether the matter in the universe is more or less than the critical density (this critical density is called Omega), and this is still subject of debate.[33] The fact that it has been understood that the stocks of gases with which the stars in the space are being formed will someday finish, and that the formation of stars will become impossible, is only one of many signs that the end is inevitable.[34] In other words, the scientific discoveries of the 20th century have provided additional proof to the entropy law's conclusion that the universe will cease to exist.

2-THE BEGINNING OF THE UNIVERSE AND ENTROPY

Thanks to the entropy law, it was understood for the first time that the disorder in the universe was constantly increasing and that this process, which could not go on forever, would cause the end of the universe. Actually, this result tells us also that the universe has to have a beginning. We can state this in the following way:

1- The entropy in the universe is continuously increasing in an irreversible way.

[32] Caner Taslaman, *Big Bang Ve Tanrı*, İstanbul Yayınevi, 2003, p. 30-46.
[33] Ralph A. Alpher, Robert Herman, *ibid*, p. 160-163.
[34] Paul Davies, *ibid*, p. 49-65.

2- As a result of this, a thermodynamic equilibrium will be established some day and a "heat death" will happen. In other words the universe is not eternal; its existence will end.
3- In infinite time, it is inevitable that the universe will reach a thermodynamic equilibrium and that all movement will stop.
4- At the moment we see that movement is going on.
5- All this means that the universe has not existed since infinity and that consequently it has a beginning.

Scientists have concentrated on the fact that entropy means that the universe has to have an end, but they have not quite thought about it meaning also that the universe has to have had a beginning. This is a pity, because the debate in the fields of philosophy, theology and cosmology has more than anything else concentrated on whether or not the universe had a beginning. This is what Paul Davies says about the interesting fact that this other result that can be reached on the basis of the entropy law did not at first attract much attention: *"Something that runs down at a finite rate obviously cannot have existed for eternity. In other words, the universe must have come into existence a finite time ago. It is remarkable that this profound conclusion was not properly grasped by the scientists of the 19th century."*[35]

The fact that the universe must have had a beginning was put forward before by Jewish, Christian and Muslim philosophers, with various argumentations.[36] Reasonings concerning the facts that "actual infinity" could not exist, that eternity could not be surpassed and that thus the universe could not have existed for all past eternity made up the basis of these argumentations. In addition to this, expressions in the sacred texts of all three great theist religions describe a universe with a beginning:

In the beginning God created the heaven and the earth.[37]

Torah-The Book of Genesis Chapter 1-1

All things were made by him; and without him was not any thing made that was made.[38]

[35] Paul Davies, *ibid,* p. 13.
[36] William Lane Craig, *The Kalam Cosmological Argument*, Wipf And Stock Publishers, Eugene, 1979, p. 19-60.
[37] *Kitabı Mukaddes*, Eski Ahit, Kitabı Mukaddes Şirketi, İstanbul, 1993, p. 1.
[38] *Kitabı Mukaddes,* Yeni Ahit, *ibid*, p. 92.

Bible-John 1-3

Creator of the heavens and the earth from nothingness. He has only to say when He wills a thing: "Be," and it is.[39]

Quran, Surah-2 The Cow-117

The followers of materialist philosophy on the other hand based their views on the idea of the eternity of the universe.[40] If we want to reduce the debate between theism and atheism (materialist philosophy) to a single matter, we can state, in a Hamletian way, "is the universe eternal or not; that is the question!" Since the fact that the universe is not eternal will also mean that it had a beginning, we can restate our Hamletian sentence in the following way: "Had the universe a beginning or not; that is the question!" The claim that the universe had a beginning is the most important point that distinguishes theism, not just from materialist philosophy, but also from other religions like Hinduism, Buddhism, Taoism, and from ancient Greek Philosophy. The idea of an autonomous universe limiting the power of God, or independent from God's will to create, is an idea that could never be accepted by theism;[41] as for those that want to deny the existence of God, accepting the eternity of the universe and ascribing to it divine attributes, is the only alternative. In opposition to these views, Kant stated that of the thesis and antithesis concerning the beginning of the universe in a certain point of time, or the lack of it, none of the two could be confirmed or denied; and that because of this it was impossible to establish a rational cosmology. This thesis and antithesis, known as Kant's first antinomy (contradiction) is as follows:

Thesis: The world has a beginning in time, and is also limited in regard to space.

Antithesis: The world has no beginning and no limits in space, but is, in relation both to time and space, infinite.[42]

As you can see, the idea that the universe was created and that it thus has a beginning, is the greatest conflict between theism and all other systems of thought, and it was debated

[39] *The Quran,* Translated by: Ahmed Ali, Princeton University Press, New Jersey, 1994, p. 25.
[40] Georges Politzer, *Felsefenin Başlangıç İlkeleri,* translated by: Enver Aytekin, Sosyal Yayınları, Istanbul, 1997, p. 24.
[41] Even though there have been philosophers like Farabi and Avicenna, who have tried to reconcile the idea of an eternal universe in Aristotle's philosophy with creation, these have always been a minority within the general theistic approach.
[42] Immanuel Kant, *ibid,* p. 135.

before the 19th century by means of various philosophical argumentations. However, it was only with the discovery of the entropy law that it became possible for the natural sciences to be involved in this debate. What is more, this law's nature is such that almost all scientists, be they theist or atheist, are in agreement over it, and the law is considered as a basic law of the universe. This law requires the universe to have a beginning, and a universe with a beginning cannot be considered the explanation of everything; it is the universe itself that requires an explanation. This argument, which in the history of Islamic theology and philosophy is known as the *hudus* argument, can be summarised in the following way.[43]

1- Everything that has a beginning requires a cause.
2- The universe has a beginning.
3- Consequently the universe has a cause other than itself.

The cosmological argument has been expressed by Islamic theologians and philosophers as the "argument from necessary versus contingent being." This argument can be described in the following way: "*Even though thinking about the absence of a necessary Being creates a contradiction in the mind, the existence or non-existence of a contingent being, whose existence depends on someone else, are within the limits of possibility. We cannot explain this second category of beings, and their existence, by means of an infinite number of causes tied to each other and going back in time; in other words their existence has to originate in a self-existing and necessary Being (God).*"[44] According to this, every being that was not, but became, is a contingent being. Actually, the followers of materialist philosophy also accept that there has to be a necessary being, but they think that this necessary being is the universe, and they consider God's existence to be only a projection of the mind. We can formulate our argument in the following way:

1- A being is either necessary, or contingent.
2- Every contingent being requires a necessary being. A being that became later (in the shape of matter or as a projection of the mind), cannot be a necessary being.
3- It is either God or the universe that is a necessary being.
4- The universe has a beginning.
5- Consequently (according to 2 and 4) the universe is a contingent being.
6- And (according to 1,3 and 5) God is a necessary being.

[43]Necip Taylan, *Tanrı Sorunu*, Şehir Yayınları, İstanbul, 2000, p. 52-63.
[44] Necip Taylan, *ibid,* p. 64.

The critical point is point (4) which is the same as point (2) of the *hudus* argument, which states "the universe has a beginning." Even though these arguments was first stated around a thousand years ago, by confirming the critical fourth point, the entropy law has provided scientific support to philosophical reasoning.

The findings following the discovery of the entropy law have provided additional scientific support for these philosophical argumentations. Thanks to the Big Bang theory, which was formulated in the 1920's, the idea that the universe has a beginning gained new scientific support. Basing himself on Einstein's formulae, Alexander Friedmann proved in 1922 that the universe had to be expanding. In the same period and based on the same formulae, the cosmologist and priest Georges Lemaitre discovered, independently from Friedmann, that the universe had an expanding and dynamic structure. Tracing the history of the expanding universe backwards it shrinks towards a point. In this way, Lemaitre became the first person to put forward the model according to which God created the universe as a primeval atom and that this atom splitted and expanded.[45] When Hubble discovered that the universe was expanding, this theory was confirmed also by observation. Even though theories claiming that the universe was stable, like the Steady State theory, were put forward in opposition to the Big Bang, the discovery in 1965 of "cosmic background radiation," which had survived from the early periods of the universe, and which supported the Big Bang model of the universe, destroyed the credibility of all other opposing theories.[46] All data from observations done later, the proportions of hydrogen and helium in the universe, the data provided by the COBE satellite, data obtained for far away galaxies, confirmation of the fact that the heat of the universe was much higher in the past have all confirmed the Big Bang model of the universe. In this way, the entropy law has been confirmed by the Big Bang theory's theoretical and observational data that proved the fact that the universe has to have had a beginning.

In addition to this, the entropy law is also useful in disproving the theories presented as alternatives to the Big Bang. The measure used to express the quantity of entropy in the universe is given by dividing the number of photons (the smallest units of light), by the number of baryons (a class of particles of the atom; the proton and the neutron). If we apply

[45] Stephen Hawking, *Ceviz Kabuğundaki Evren*, translated by: Kemal Çömlekçi, Alfa Yayınları, Bursa, 2002, p. 22.
[46] Ralph A. Alpher, Robert Herman, *ibid*, p. 107-115.

this operation to the cosmic background radiation, we obtain entropy of 10^8-10^9 per baryon.[47] Such a high level of entropy cannot be explained with the Steady-State theory, but on the other hand, such a high level of entropy is perfectly in accordance with the Big Bang theory, according to which the heat of the universe was very high at the beginning.[48] What is more, even the Oscillating model of the universe cannot escape from the rule of increasing entropy. Since the Big Bang theory was effectively proved, the only way of preserving the idea of eternal universe was the infinite repetition of the model. If, as we have already stated, the universe should begin to collapse, this collapse will never be a symmetrical version of the expansion of the universe, and it will not escape from the increase of entropy. The reexpansion of a universe that has collapsed into a singularity, is inconsistent with all known physical laws; however, even if this were possible, the increase in entropy at each stage would not permit the universe to be eternal. Actually, the speed with which the universe is expanding is at a very critical level. If the Big Bang explosion had happened with a greater speed, the matter would have spread over such a vast area that the galaxies could not have been formed, and the transition to a process of collapse would not have been possible. If the explosion had happened with a lower speed, the matter spread around would have immediately, under the effect of gravity, collapsed into itself, becoming a singularity. The probability of the explosion happening at just the right speed for galaxies to form and life to appear, is even lower than that of a pencil standing on its point after it has been thrown. (This critical probability has been calculated as 1 in 10^{17}.)[49] Since the universe will start to collapse with more radiation, a collapsed universe will have much more radiation than the first and with this increased entropy, even if it could manage to expand again according to the Oscillating model, the critical expansion speed would be surpassed and a future collapse would become impossible. In summary, the entropy law is a basic law of the natural sciences, and it shows that there is no escape from the beginning of the universe and it disproves all other models put forward as alternatives.

The entropy law did not just describe a universe contrary to all atheist expectations, but painted also a picture where a pantheist universe could not be. Whittaker explains it in the following way: *"The knowledge that the world has been created in time, and will ultimately die, is of primary importance for metaphysics and theology: for it implies that God is not*

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[47] Roger Penrose, *ibid*, p. 717.
[48] Hugh Ross, *The Fingerprint Of God*, Whitaker House, New Kensington, 1989, p. 85-87.
[49] Stephen Hawking, *A Brief History Of Time,* p. 121-122.

Nature, and Nature is not God; and thus we reject every form of pantheism, the philosophy which identifies the Creator with creation, and pictures him as coming into being in the self-unfolding or evolution of the material universe. For if God were bound up with the world, it would be necessary for God to be born and to perish… The certainty that the human race, and all life on this planet, must ultimately be extinguished is fatal to many widely held conceptions of the meaning and purpose of the universe, particularly whose central idea is progress, and which place their hope in an ascent of man."[50]

The entropy law supports the claim made by the three great theist religions that the universe has a beginning. What is ironical is that notwithstanding the support provided by this law towards the end of the 19th century, and by other scientific findings of the 20th century, to theist ontology and cosmology, these centuries should have been a time when a materialistic world view gained the most ascendance versus theism, and positivist philosophy, which tries to put "science" in place of religion, became one of the most widely held views in scientific spheres. There most certainly is a lot to be said about this ironical situation, but I shall not dwell on this subject that goes beyond the limits of this article.

3- THE ARGUMENT FROM DESIGN AND ENTROPY

The argument most widely used throughout history to prove the existence of God by rational ways is the argument from design (teleological argument).[51] Those who use this argument, base their claims on the order of nature or on the fact that nature has a purpose. There have been different formulations of this argument; at times benevolence has been underlined, while at other times purpose or order. The most famous critiques of this argument are those of Hume and Kant. Hume's critique was based on the idea that no analogy between natural phenomena and creations of human ability could be established.[52] Kant's approach to this argument was one of great respect and he placed it in a special position, apart from the other arguments, since it had brought about an increase of our knowledge and had encouraged

[50] John D. Barrow, Frank J. Tipler, *ibid,* p. 168-169.

[51] Although some distinguish "teleological argument" from "argument from design," I use them in the same sense.

[52] David Hume, *ibid*, p. 174-175.

scientific research. However its rationality had to be rejected from the point of view of Kant's system, since the aim of his system was to prove that "pure reason" could not do metaphysics. Kant criticised this argument by repeating and expanding Hume's critique.[53]

In the 19th century, argument from design formulations based on William Paley's analogy between a watch and its maker and the universe and God[54] were criticised by means of the objections of Hume and Kant (together with Darwin's theory). In the 20th century, we saw the rather frequent use of argument from design formulations based on probability calculations that could also be expressed mathematically. We can use such a mathematical description to explain the accuracy balance of entropy at the beginning of the universe. We know that the entropy law states that the universe's disorder is continuously increasing. The logical conclusion from this is that as we go back in time, entropy will diminish and that the lowest level of entropy (order) will be the one at the beginning of the universe. Yet, this is not the result of the small volume of the beginning of the universe, because in the end of the universe even if the universe's volume decreases, its entropy will not diminish. We can compare this fact to the way the height of people decreases with old age; such a situation does not mean that one is growing younger. Entropy is like time; unidirectional, rigid and definite. This beginning situation with low entropy, is the absolutely necessary condition for the formation of galaxies and the birth of life, and since it is the sign of an extraordinary order, it requires an explanation. According to Roger Penrose, no data known by him in the domain of physics can even get close to the mathematical description of the precise balance of entropy at the beginning of the universe. The quantity of entropy in the universe, which at the moment is around 10^{88}, will go up to 10^{123} if the universe collapses with the Big Crash. (Penrose calculates this by using the Bekenstein-Hawking entropy formula.)[55] During the Big Crash of the universe, there will be about 10^{43} entropy per baryon, and considering that in the universe there are a total of 10^{80} baryons, the entropy of the universe will be 10^{123}.[56] The precise balance of entropy at the beginning of the universe can be calculated on the basis of the entropy of the probable end of the universe. Actually, during the beginning of the universe there might very well have been the same entropy of the end, with the same volume; in such a

[53] Immanuel Kant, *The Critique Of Pure Reason*, p. 187-190.
[54] William Paley, *Natural Theology*, from *Philosophy of Biology*, edited by Michael Ruse, Prentice Hall, New Jersey, 1989, p. 36.
[55] Roger Penrose, *ibid*, p. 728.
[56] Roger Penrose, *The Emperor's New Mind*, translated by: Tekin Dereli, Tübitak Popüler Bilim Kitapları, Ankara, 2003, p. 50.

case our galaxy, our world, the writer of this article and its readers would not have existed. The precision of entropy at the beginning of the universe can be calculated as $10^{10^{123}}$. Penrose, who made this calculation, makes the following comment. "*This now tells us how precise the Creator's aim must have been, namely to an accuracy of one part in* $10^{10^{123}}$*.*" The reason why this number is written with two exponents is that if we had attempted to write this number without exponents (in other words by putting zeroes after the 1), all the raw materials in the universe would not have been enough. If we had written a quadrillion zeroes (10^{15}) over each of all the particles in the universe (about 10^{80}) and over each of all the particles of light in the universe (about 10^{88}), we would have been able to write only 10^{104} zeroes. While to be able to write 10^{123} we would have had to use ten million (10^{7}) by trillion (10^{12}) more universes like ours, and we would have had to use the protons, neutrons and photons of all these universes like notebooks over which it was possible to write quadrillions of zeroes, and only then would we have been able to write the number expressing the precise balance of entropy at the beginning of the universe. So, not only is it impossible for the critical point of entropy at the very beginning of everything to have been attained by coincidence, it is not even possible to write the number expressing the level of precision of this balance by putting zeroes behind 1. It is not possible to explain the level of precision needed at the beginning of the universe, without admitting the presence of an Establisher of order. The *a priori* expectation of those that view the universe as a being that has not been designed, should be a chaotic universe with no order. However the data available does not even indicate a normal order, but an extraordinary one. Since the most objective language of expression of science is mathematics, from a scientific point of view the support given to the argument from design, by the precision of the balance of entropy at the beginning, is more powerful than the total of all the descriptions provided with such success and mastery, by William Paley.

I am of the opinion that it will be useful to analyse the data related to argument from design in three groups. Those who argue in favour of this argument have generally not followed this three point distinction, preferring to lump together what we have separated into three points, or to attribute more importance to one point neglecting the others. This three point classification is as follows:

1- ***Argument from Design Proof by Means of the Design of Natural Laws:*** The natural laws immanent in the matter should be analysed according to this point. The design of physical laws, like the gravity force, or laws of dynamics, and the design of forces that make up the structure of the matter like electromagnetic, strong nuclear and weak nuclear forces are subjects of this point. The necessity of the existence of entropy as a law is also a subject of this point. The use of characteristics immanent in the matter is the distinguishing property of this first point.

2- ***Argument from Design by Means of the Design of the Physical World:*** Even if all physical laws of the universe had been like this, this would not have been enough to explain the presence of design in the universe. For example, we could say that under these laws, the universe would not have necessarily expanded with the speed that permitted the formation of galaxies, or that the precise equilibrium in the solar system and the world, which made life possible, would not have necessarily existed. In similar way, the existing entropy law could have been as it is, but the explanation of the design of the entropy at the beginning is not given by the existence of this law. The distinguishing property of this point is that in the case of many situations that could have existed within the framework of existing physical laws, it stresses low probabilities that made designs and life possible.

3- ***Argument from Design by Means of the Design in the World of Living Creatures:*** (Those who so wish might form a fourth point, by separating the "mind".) With its hundreds of thousands of species, the world of living creatures is the richest source of material for the argument from design. The sonar system of dolphins, the distribution of labour among ants, the wings of birds, and the anatomical characteristics of people are all subjects of this point. Designs within the bodies of living creatures, which operate in accordance to entropy and which serve the purpose of keeping life in function, notwithstanding the disruptive tendency of entropy, should be taken into consideration within this point. The distinguishing property of this point is that while in the second example the realisation of events with very low probabilities in the physical world had been stressed, in this point the same stress is put on the world of living creatures.

As we have already said, the regulation of the entropy at the beginning of the universe is within the scope of the second point. However, the data for the argument from design,

related to entropy, are related also to the other two points. Let us take point one as an example. If such a law of entropy had not existed in the universe, also life could not have existed. For example let us remember how at the beginning of the article we saw the way the probabilistic law of entropy ensured life as far as the distribution of air in a room was concerned. If the air molecules had not been diffused in accordance with this law, life would have been an impossibility. The existence of this law within the framework of hundreds of phenomena that make life possible, like the way the sun heats us in the cold space, or the way that vital substances are distributed within the bodies of living creatures, is the sine qua non condition necessary for our existence and for that of all other living creatures. Thanks to the existence of a law like that of entropy, the universe carries within itself the potential for a great variety of life. Even if, as Monod[57] and Dawkins[58] claimed, it had been possible to explain the existence of living creatures by natural laws and by the coincidences created by this laws (the probability calculation concerning entropy, and the probability calculations concerning proteins, which we shall not mention in detail in this article, tell us that such coincidences are not possible), it would still have been necessary to explain how it was that natural laws carried within themselves the potential to make complex designs like living creatures possible. Since the entropy law makes it possible for the universe to carry the potential to give birth to these designs, it is one of the fundamental natural laws immanent in the matter, which supports the idea that the laws of nature are designed.

In addition to all this, the concept of entropy is important also for those who want to use the argument from design by means of the design in the world of living creatures, as we have mentioned in point three. The organs of living creatures are designed in a way as to acquire low entropy by means of nourishment and to conserve the body heat so as to be able to resist the increase in entropy. Many structures of the body, like the functioning of the brain, which preserves many balances related to entropy, like the body temperature, the digestive and blood circulation systems, and the cell organelles, have been designed according to the entropy law. What is more, problems related to entropy have been solved in different ways in various different living creatures, with different bodies and behaviour. Entropy is important also for the understanding of the regulation of differences in the organs and cell structures of for example a plant, a bird or a polar bear. The problems related to the entropy

[57] Jacques Monod*, Rastlantı Ve Zorunluluk*, translated by: Vehbi Hacıkadiroğlu, Dost Kitabevi, Ankara, 1997.
[58] Richard Dawkins, *Kör Saatçi*, translated by: Feryal Halatçı, Tübitak, Ankara, 2002.

of living creatures with different behaviours, have been solved with a range of solutions that take into consideration their differences.

Some were of the opinion that products of design like living creatures were violations of this law. Even Hermann von Helmhotz, who contributed to the formulation of this law, is among them.[59] Our universe is not a place where order originated from chaos like Plato thinks it was, nor is it a place where designs like living creatures are formed by violating the entropy law, which states that disorder is continuously increasing. The existence of living creatures has been possible, even though their design meant an increase in order, thanks to the price paid in an increase in more disorder somewhere else in the universe. An increase in disorder is the condition for the existence of life, and at the same time the creation of life is a creation of order that creates disorder. Living creatures are "open systems" that take and give back matter and energy from the world in which they exist. We take low entropy from plants directly, or indirectly through animals. Plants, on the other hand, take low entropy (order) from the sun. Since in all these processes the total entropy increases, there is no violation of the entropy law, but by taking in low entropy, living creatures manage to survive, notwithstanding the total increase in entropy.

The important point is that the fact that the existence of living creatures is not in contradiction with the entropy law does not mean that this law explains the existence of life. Some scientists have fallen into this mistake. To explain the error in logic done by people who fell into this mistake, Paul Davies provides the example of a person who says that by finding an electric socket he has explained the function of refrigerators.[60] By taking the refrigerator as an example, I want to give the following example: Just like in the case of living creatures, it may look like the refrigerator was behaving contrary to the general tendency of entropy, but since there is an increase in total entropy as the refrigerator carries out its transformation, there is no violation of the entropy law. That is why the fact that someone who has found that the refrigerator does not violate the entropy law (as in the case of living creatures) also thinks that the entropy law explains how the refrigerator that he found in the cellar of the house was formed and why it was that it came to be there; is making as big a mistake in this logical inference, the same as someone who states that this law is the explanation of the existence of living creatures. Even though the existence of designs like

[59] Paul Davies, *The Origin Of Life*, Penguin Boks, London, 2003, p. 28.
[60] Paul Davies, *ibid*, p. 30.

living creatures in a universe where the disorder increases is not in contradiction to the second law of thermodynamics, which is the law of disorder, it is a phenomenon that will add further strength to the argument from design.

4- MIRACLES AND ENTROPY

Etymologically speaking "miracle" means an action carried out by someone who claims to be a prophet, to prove his status; or an extraordinary event manifesting divine intervention (from the Latin *miraculum*, something to be wondered at). The concept of "miracle" is important from the point of view of all three theist religions. Belief in miracles is a must for faith in the sacred texts of the three religions; miracles are narrated in many parts of these texts. In addition to this, the way miracles are understood is also important from the point of view of the way believers in these religions should establish the God-universe relationship. One of the most important questions that have to be answered at this point is whether a miracle is a violation of natural laws. In sacred texts there are no statements according to which a miracle should be a violation of natural laws; however, the fact that in these texts it is said that Moses made the sea part and that Jesus Christ healed those that were blind from birth led to a belief that a miracle was a violation of natural laws.

One of the observations made by most atheists, who claim that religion is in contradiction with science, is that religion claims the existence of miracles. According to this observation, religion is in contradiction with natural laws as they are observed, since it claims that events not in accordance with natural laws have happened. Opposition to the idea of miracles is not limited to atheists; some philosophers who believed in God were also opposed to the conception of miracle because they considered it as a violation of natural laws and contrary to their idea of God. For example, according to Spinoza natural laws were a result of God's nature, and since God would not do something against His nature, Spinoza opposed the idea of miracles. Spinoza was monist and in his pantheism Divine essence coincided with nature; this is why in his case the passage between Divine nature and natural laws was direct.[61] Schleiermacher, who was influenced by Spinoza, also maintained that Christianity's

[61] Spinoza, Benedictus, *Tractatus Theologico-Politicus*, çev: Samuel Shirley, Brill Academic Publishers, 1997.

conception of miracles had to be changed. He considered the causality operating within natural laws was not just physical, but also logical.[62]

Various answers have been provided in response to these objections to miracles. We can summarise in the following way the response that was most probably the one most often repeated: God's laws have to be seen as something with a very wide range that encompasses also natural laws. According to this view, the fact that natural laws are violated when a prophet performs a miracle is part of God's laws. Consequently, exceptions similar to the need to stop a machine working according to mechanical principles, for maintenance work, can also exist for the performance of miracles.

With a conception similar to Leibniz's "preestablished harmony", an attempt may be made to shape a view of miracles that does not violate natural laws. According to this view, in the same way that a billiards player will plan what he is going to do after five-ten plays, God may have calculated at the beginning of the universe the place and time of miracles, and, from the very beginning, set future miracles within the framework of natural laws.

If you look at them with attention, you will notice that all the above-mentioned objections against--and arguments in favour of--miracles were done assuming *a priori* that the laws of classical physics had an absolute nature. However, it has been understood that the entropy law and the most basic natural laws, function in a probabilistic way, in addition to a deterministic causality. According to this, probable events, like the one we mentioned at the beginning of this article of all the air collecting over the Atlantic Ocean, are not to be taken into consideration, not because they are against scientific laws or absolutely impossible, but because their probability of happening is very low. However the probability will be low only if the various probabilities are realised randomly. The probability of all of a thousand dice thrown randomly to turn out as six is very low, but for someone who in theory can manage dice, the low probabilities are not binding. Theism considers God to be the Creator of the universe and the Establisher and Preserver of scientific laws. A person who holds this kind of a view will consider God to be the Establisher of the low probabilities and may explain miracles on this basis. This kind of an explanation for miracles will not imply a violation of

[62] Schleiermacher, Friedrich, *The Christian Faith*, T. and T. Clark Publishers, 1999.

scientific laws, and thus it will not be possible to make the above mentioned objections of Spinoza or Schleiermacher.

I should point out the following: I am not claiming that God had miracles performed in this way or that He did not. Showing that miracles are possible within the context of natural laws, does not mean that God had His miracles performed in that way. What I want to show is that the modern scientific picture of the universe, which has resulted from developments in natural sciences, potentially includes many events, the probabilities of happening of which were so low as to have them classified as miracles, and that this kind of conception of miracles disproves the objection against miracles that states that they are "in contradiction with natural laws". Even those who, like Spinoza and Schleiermacher, cannot accept the thought of the violation of natural laws, could accept the conception of miracles as it is in the sacred texts, on the basis of this result. For example let us consider together the way a high number of molecules moves, which is a very important part of the entropy law, and the way Moses had the sea part. Actually the sea is made of a very high number of molecules that move in haphazard ways. We can imagine that all the molecules on the right side of an imaginary line that we will draw over the sea might move rightwards, with no exception, and all those on the left of that line leftwards, again with no exception. As a result of such a movement of molecules, the sea would part and no physical laws would be violated. The reason why we never see such a phenomena is not that it is impossible, but that its probability is so low as to be practically impossible. However, for those, who see in God an Intelligent Establisher of probabilities, the low probabilities will not be a problem. When miracles happen in this way, the involvement of God is not directly visible; what is observed is an unexpected and extraordinary natural phenomenon, which is nevertheless not against natural laws. Since the performance of miracles is the result of the realisation of very very low probabilities, this conception will not even cast a shadow over the extraordinary nature of miracles.

As you can see, there is a place for miracles even in a deterministic universe, or in a universe in harmony with the formulae of Newton and Einstein. There have been those who stated that because of the quantum formulae established in the 20th century, it has been understood that the universe has an indeterministic and probabilistic structure. Let us repeat that there is no unanimity concerning this interpretation of the quantum theory. There is an ongoing debate on whether quantum uncertainties derive from our ignorance, and thus

correspond to a subjective indeterministic situation, or whether they correspond to an objective indeterministic situation in nature. The approach that thinks that nature has an objective indeterministic structure, makes it possible to think that God's intervention in the universe is made possible by making these uncertainties certain. Consequently, while in a universe that works with deterministic and probabilistic laws it is possible to base Divine intervention, which is in harmony with natural laws, to a "choice of a certain probability among many", in an indeterminist universe Divine intervention might be explained as the "determination of indeterminacies." In the 1960's it was discovered how very small differences in the input related to one corner of the universe could produce big differences in output. This situation is generally known as the "butterfly effect", and according to this when a butterfly moves its wings in Istanbul it might cause a tornado in Cambridge.[63] This shows how even very small interventions at a micro level can have a great importance, and that by choosing to carry out events with a very low probability or by determining indeterminacies, very big changes can be wrought on the universe.

The entropy law indicates a universe functioning deterministically and probabilistically, and it does not claim that the universe is indeterministic, as does the Heisenbergian interpretation of the quantum. However, this probabilistic law can also show us that there is a possibility for miracles to happen in the universe, without this violating the laws of nature. However, if we approach the question of "free will" from the point of view of this matter, the presence or absence of objective indeterminism in the universe become more important. What is more, one should even add scientific and philosophical debates concerning the structure of the human mind to this subject. That is why I shall not analyse the subject of "free will", as I have the problem of "miracles." The problem of "free will" should be analysed in a context where other matters like the quantum theory and the philosophy of mind are also analysed.

The entropy law is a law about which there is no argument, and also a law that will bring new perspectives to how we view the God-universe relation. We would like to underline the fact that we are trying to extract philosophical conclusions from a law that is in accordance with various schools of physics, like the Newtonian, Einsteinian, Heisenbergian

[63] James Gleick, *Kaos,* translated by: Fikret Üçcan, Tübitak Popüler Bilim Kitapları, Ankara, 2000, p. 1-29.

and Prigoginean schools. We would like to finish our article about entropy, which brings with it interesting philosophical conclusions, with a short poem on the same subject:

Entropy;
Rigid and ironic,
Unbending and probabilistic,
Sine qua non of disorder and order,
Harbinger of the end and of the beginning.
Entropy;
Despair for some, hope for others.