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THE SCIENTIFIC VALUE OF *DAKIK AL-KALAM*

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This paper discusses the concepts and principles suggested by Mutakallimin of Islam, confining the study to the subjects of Dakik Al-Kalam. We find that the Mutakallimin had adopted five basic principles. These are: Creation, Discreteness, Persistent re-creation, Undeterminism and Relativity. Each of these five principles is discussed separately and evaluated in the light of facts and theories of contemporary physics. The results show a remarkable parallelism in most cases.

However, although the Mutakallimin were comprehensive thinkers of their times, the scientific assessment of the concepts and facts which they proposed was never taken into quantitative judgment. The aim of the present study is directed at:

1. *Exploring an important part of Islamic thought that formed the basis of Islamic belief (Creed), and*
2. *The possible utilization of some of the Mutakallimin's thoughts in contemporary Islamic philosophy of science.*

It is hoped that this pioneerning study would help to open the way for greater clarification of issues concerning the place of science in the Muslim worldview.

Introduction to the role of Dakik-al-Kalam

The Mutakallimin were a group of Muslim thinkers and theologians who appeared during the second century A.H and continued their original work up to the end of the fifth century A.H. Their main aims were to repudiate the non-Islamic philosophic claims against the basic beliefs of Islam and therefore they tried to discover the natural and theoretical foundations of the basic beliefs of Islam. For this reason the contribution of the Mutakallimin, which is called *"Ilm al-Kalam"* (meaning: the science of *kalam*), is sometimes considered to stand for "Islamic theology" or "Islamic Creeds".

Since the opponents of the Mutakallimin were the non-believers in Islam, their approach followed the logical reasoning but without any direct reference to the

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Qur'an or *Hadith*, though the Qur'an was the main source of their beliefs and ideology. This fact can be traced through their writings and internal discussions, where it is noticed that when they intend the writings for an opponent who is a non-believer in Islam, they never mention the Qur'anic verses, whereas when they discuss the different opinions of other divisions of Mutakallimin they refer to the Qur'anic verses in support of the said beliefs.

Arabic, which is the language of the Qur'an, played a major role in forming and structuring *'Ilm al-Kalam*, being the medium of communication and thinking of that time. This role of Arabic has led at least one contemporary author to suggest correlation between the doctorines of Mutakallimin and Arabic Reason, in general; accordingly this author considers the Mutakallimin as "the true and faithful representatives of Arabic Reason."[1]

Historically, the *Mutakallimin* were divided into two divisions: Ash'aria and Mu'tazila. The Ash'aria were named after their Imam, Abul-Hasan Al-ash'ary (d.935). The Mu'tazila, however, were the pioneers of Kalam and some authors date them back to Al-Hasan Al Basri (d. 728). The basic difference between the Asha'ria and the Mu'tazila lies in the details regarding understanding the status of Human acts. The Ash'aria believe that all Human acts are created and supervised by Allah (SWT), whereas the Mu'tazila think that Man is the creator of his own acts. On this difference of opinions many authors have explored the "thoery of Human freedom" in Islamic thought.[2]

When we try to re-evaluate the contributions of the Mutakallimin to Human knowledge, we should point out first that the basic difference between Mutakallimin and philosophers lies in the starting and end points of their dialects, as well as in the approach of the two groups. Briefly we can say that philsophers start from nature and hence try to understand Allah (SWT), whereas Mutakallimin start from Allah (SWT) and thence to understand nature. This fact may not be clear enough unless we look closely throught the writings of both groups. The *Wahi* constitutes an important source of the beliefs of the Mutakallimin and they perceive nature accordingly. Therefore, it is not surprising to find that the Qura'nic theme embodies their concepts and theories. On the opposite side, philosophers perceive the necessity of the existence of "God" through studying nature. This fact can be best observed in the writings of Gazali (d.1111), particularly in his book *Tahafut al-Phalasipha*[3] while the opposite opinions of Ibn - Rushd (Averroes, d. 1198) can be found in his treatise *Tahafut Al-Tahafut*.[4]

In dealing with the science of *Kalam*, we must differentiate between two major parts: *Jaleel Al-Kalam*, which deals mainly with the proofs of the existence of Allah (SWT) and His attributes. This part of *Kalam* is pure theology and has been mostly covered by the classical and contemporary authors of Islamic thought. The second part, which is seldom studied or discussed, is called *Dakik Al-Kalam;* this part is more profound than *Jaleel al-Kalam*, since it deals with the understanding of nature, its composition, behaviour and the relations between its basic constituents. We believe that the unbalanced care given to *Jaleel al-Kalam* in published literature has undoutedly veiled the real value and the profound theoretical origins of *Kalam* as a whole. However, modern authors may well be excused for this unintended

carelessness in studying *Dakik Al-Kalam* because such a subject is not clear even in the books of Mutakallimin. Whereas *Jaleel Al-Kalam* is over exposed, no separate book of original writings is devoted to the subject of *Dakik-Al-Kalam*. Besides, there arises the difficulty of understanding the complicated terms of *Dakik Al-Kalam,* which deal with the physics of nature in a precise and concise Arabic terminology. This may explain why we do not see any mention of the subjects of *Dakik Al-Kalam* in an extensive study like *The Legacy of Islam* edited by Schacht and Boseworth.[5]

In this paper we have attempted a critical study of some basic principles and concepts of *Dakik Al-Kalam*, which can be found in the original writings of Mutakllimin dispersed among their thoughts and beliefs of *Jaleel Al-Kalam.* We have tried to extract these principles and concepts and to formulate them into separate and possibly independent principles, in order to be able to see the possible contemporary scientific value of this part of *Kalam*. We do not and cannot claim that the Mutakallimin were professional physicists or scientists in the modern sense of the word, but we can confidently talk about them as professional thinkers of their times in the same sense as we speak of the contemporary "philosophers of science." On the other hand we do not intend to transpose the advanced theories of today's physics into an age which is one thousand years older, but would in fairness present a consistent theory that has been suggested at that time with a wider scope, that goes well beyond the time of its formulation.

1. The Principle of Creation

Most Mutakallimin start their writings by presenting the necessary proofs that the Universe at large was created from nothing, from vacuum, contrary to the belief of the philosophers who say that the Universe is eternal and never had a start in time. To this end the Mutakallimin and the philosophers present extensive proofs and counter-proofs. The principle of creation is vital for the consistency of the beliefs of Mutakallimin (and all theologians) because assemption of the eternity of Universe would mean that there exist two entities with one common feature of permanence, Allah (SWT) and the Universe; this contradicts the basic belief of Uniqueness of Allah (SWT). Some Muslim philosophers, however, tried to compromise on the issue by assuming an intermediary between Allah (SWT) and the Universe. This is seen in the works of Ibn Rushd (Averroes).[6]

Therefore we find that Mutakallimin believe that the Universe was created a long time ago out of absolute nothing, through the Will of Allah (SWT) and, since then, it is controlled by Him. The Universe has a start in time and should have an end at Doomesday.

The Scientific Aspect: For a long time man had thought that the Universe is static, with the distant stars fixed at their positions and the daily periodic changes of the relative position of the Earth with respect to the Sun is calculable accurately all over the period of the year. It was thought that the Universe is a gigantic self-contained machine and seems to have no start in time and no end in space. This picture of the Universe was considered scientifically correct and acceptable until the beginning of the second decade of this century when Edwin Hubble (d.1953) discovered in 1921 that the galaxies are spreading outwards through the space,

away from each other at very high speeds. Physicists and cosmologists then gave the subject a prolonged second thought; after several checks they discovered that the Universe is not static but is expanding, the distances between galaxies increasing at a rate proportional to the separating distance itself. It ultimately follows from this that at some time in the remote past the galaxies were lumped together in a small volume of space and for some reason this small lump exploded, making later the galaxies which separated from each other at high speeds. This theory is known as the "Big Bang Model". Subsequent research in astronomy and cosmology showed more supporting evidence, both experimental and theoretical, and by the end of the sixtees of this century it was established that the Big Bang Model presents the most acceptable and scientifically sound picture of the creation and existence of the Universe[7]. This meant that the Universe had a start in time. People then asked whether it had a start in space? To answer this question vast research was done during the last twenty years, all in support of the creation theory. It was found that the Universe must have started from a minute point (mathematical point) in spacetime. The creation is assumed to emanate from vacuum.

Therefore we conclude that the Universe was created from vacuum, it had a start in time and possibly a start in space too since the quantum effects must have played an important role at the very early stages of the creation.[9] This as it stands to physical knowledge now is the "Standard Model". It is successful enough to explain many observations that other models cannot explain. Further research is now being done to clarify the ambiguous (singular) start of the Universe at very early times approaching 10^{-43} seconds!

Therefore, physically and epistemologically the, Universe is not eternal; it was created from nothing long time age ($\sim 10^{10}$ years) and is now still expanding. As to the fate of the Universe no firm scientific result has been obtained yet. The expansion may continue forever or it may stop at a point, turning to collapse and reversing the cycle of creation.[9]

2. The Principle of Discreteness

According to Mutakallimin all created things can be divided into two parts, each of which can be further divided into two parts and so on. This divisibility must stop at an element they call "*Jawhar*".[10] The *Jawhar* is an abstract entity which represents a very basic element in the composition of things. It has been identified as one and unique (one and the same for all types), they call it *Jawhar al-fard.* It has no dimensions, no shape, but it has a value *(qadr). Jawhars* do not exist together but separated they have no intrinsic properties. In order to compose an existence of natural thing, the Mutakallmin proposed yet another notion to describe the physical properties of the body; this was called *arath.* This is a separate and independent term used to describe the external properties of things like colour, smell, temperature.... etc. Therefore, *arath* is any property that *Jawhar* may accept. Different types of *arath* correspond to different properties of the composing *jawhars.*

The choice of the word *arath* by Mutakallimin is no coincidence; here the accurate use of Arabic comes into action clearly. *Arath* in Arabic is something that "cannot stay long."[11] therefore Mutakallimin had to choose the word *arath* in order

to express their notion of the ever-changing properties of events and bodies. This will be discussed in the next section since it constitutes a separate principle.

To summarize the principle of discreteness we say that Mutakallimin viewed all and every thing in the Universe, be it a whole body or an event, as being divisible into basic elements or units that cannot be divided any further, i.e discrete, in contrast to philosophers who assumed that things in the Universe are divisible infinitely and did not admit the existence of elementary units. This means that philosophers believe that things in the Universe are continuous by its own nature.

The strong argument of Mutakallmin against philosophers was the logical impossibility of confining an infinite into a finite. Mutakallimin argued that if the philosphers' theory of continuity and unlimited divisibility is to be accepted then one has to admit that a finite contains an infinite, which is impossible.[12]

One counter argument of philosophers was brought by Ibn-Rushd (Averroes) who discussed the theory of Mutakallimin in his book *Kashf manahej al-Adella*, and concluded that[13]: "if Mutakallimin's theory is to be accepted then the geometrical status of things will be defined in term of the numbers". In fact Ibn-Rushd was correct in this conclusion; he was successful in deducing the immediate implications of discreteness but he was wrong in refusing it. This will be further elaborated below when we discuss the scientific value of principle of discreteness.

One last point worthy to be mentioned here is that according to Mutakallimin the principle of discreteness is assumed to be universal and applies to every thing that exists in nature including space, time and motion. Accordingly they believed that time is discrete and is composed of basic units called "*Aana*", which means a very short moment that exists between past and future.[14]

The Scientific Value: Until the end of the last century it was generally believed that continuity is the general property of physical quantities in nature. However, just before that a few experimental observations were noticed about unusual behaviour of heat radiations. Furthermore, the atomic spectra, which is connected with the problem of radiation, and closely connected with the understanding of the internal structure of the atom, was a stumbling block in the way of understanding the nature of the interactions between matter and radiation. The electromagnetic theory of Maxwell (d.1879) had achieved spectacular success in understanding the nature of radio waves, its generation, propagation and reception. However this sophisticated theory was unable to explain the emission and absorption of radiation by matter. The key solution was suggested in 1901 by the German physicist Max Planck (d. 1947) who assumed that radiations are emitted and absorbed by matter in the form of discrete lumps of energy called "quanta", each of which contains a fixed amount of energy proportional to the frequency of the radiation, thus explaining the experimentally observed behaviour of radiation at different frequencies. Albert Einstein (d.1955) soon utilized this theory of Planck to explain yet another experimentaly observed phenomenon by which electrons are emitted from the surface of certain metals when exposed to light. Then it did not take long to find that the assumption of discrteness is also needed to explain the related problem of atomic structure. It was the Danish physicist Niels Bohr (d.1962) who

found himself unable to explain the structure of the atom without assuming that the angular momentum of the electron in an atoms being allocated in fixed units or quanta and accordingly it was found that the orbits of an electron circulating around the atomic nucleus are fixed by certain discrete number called the "principal quantum number" which takes successive values 1,2,3... This same number defines the possible energy levels that an electron can have within the atom. Further studies of the atomic structure yielded more "quantum numbers" which defined the status of the energy, position, spin, angular momentum... etc. in an atom, thus changing the geometrical status into numerical status, exactly as Ibn-Rushd conjectured nearly a thousand years ago.

These complementary and remarkable achievements of the new physics became the quantum theory of matter and radiation during the first half of this century, in which discreteness plays a desicive role.

However, as far as time is concerned, modern physics assumes that time is a continuous variable and is not quantised. In respect of kinematics, the theory of Special Relativity connects time with space in one intergrated continuum called the space-time continuum. This point will be discussed further at a later section of this study.

In respect of whether nature is finitely for infinitely divisible, we can only say that contemporary physics lays a boundary to divisibility at a further most limit defined by the Uncertainty Principle of Werner Heisenberg (d.1976). According to this principle, divisibility should stop at a certain point where physical knowledge becomes completely uncertain beyond it. On the other hand particle physics showed that elementary particles at the sub-nuclear level are more or less abstract entities and no longer carry the properties of known matter.

3. *The Principle of Persistent Re-Creation*

Mutakallimin believed that while *jawhars* are unrenewable entities, *arath* is a physical entity that can be measured. By definition *arath* is thought to be an ever changing character of the *Jawhar*: it is oscillating between existence and non-existence, and since existing things are composed of *Jawhars* and *araths* only, then this means that material compositions are fluctuating between existence and the nothing (vacuum), which implies that matter is persistently re-created every moment that passes.

This principle stems from the fact that according to the Qur'an Allah (SWT), the immortal creator of the Universe, is active and a live *(Hayyul Qayyum)*. Accordingly the will of Allah(SWT) should be present at each moment in the minute details of the Universe. However, if the counter belief that the laws of nature act on their own is to be adopted, then Mutakallimin say, Allah (SWT) will not be the divine controller of the universe because in such a case nature will be independent of Allah (SWT) and such a "God" is not needed any more once He has created the Universe and secured the actions of the natural laws in it. In such a model the role of Allah (SWT) is cearly limited to the moment of creation; thereafter nature would be submitted to the action of the laws that governs it. In fact this kind of "God" is what

Greek philosophers, and presently most western philosophers, think of. This presentation exposes the difference between Allah (SWT) of Muslims and "God" of others; wheras Allah (SWT) is live and active, "God" is a retired one!

Therefore, Allah (SWT) has to intervene every moment of time *(Aana)* and re-create things persistently, otherwise things will vanish. This intervention is done through the re-creation of *arath*. Therefore, according to Mutakallimin, *jawhars* are not re-created but 'arath are.[15] This principle of persistent re-creation has been studied by contemporary authors[16] who call it the "principle of continuous creation". The different name given by us here is meant to cast a more precise meaning to the idea of the Mutakallimin contained therein and to be consistent with the principle of discreteness discussed earlier.

The presentation of the principle of re-creation poses two important questions: the first is related with the existence of deterministic causality and deterministic casual event. This will be discussed in the next section since it is also closely related to the principle of uncertainty. The second question is related with the meaning of existence and nothing (vacuum) and whether this assumed persistent fluctuation of things between the state of being existent and the state of vacuum does give a new meaning to the state of nothing *('adm)*.

With respect to this last question the Ash'ariya considered that the state of vacuum *('adm)* is the same as the state of nothing. It is the absolute non-existence of *jawhars* and *'arath*. The Mu'tazila, however, augured that "the fact that a thing exists is that of being known, and since *'adm* is known therefore it must exist."[17] Accordingly, Mu'tazila believed that vacuum is composed of "virtual" *Jawhars* that exist epistomologically (hypothetically) in accordance with the principle of re-creation.

The Scientific Value: Primarily we should note the fact that mutakalimin were not physicsist or mathematician in the modern sense. They were comprehensive thinkers who proposed a comprehensive philosophy of nature. On the other hand, objectivity presumes that one should not be selective in dealing with historical thoughts and facts. Accordingly we will not try here to be selective when deciding on the scientific values of the contributions of Mtakallimin. Therefore we will rather try here to present the accepted theory of modern physics in view of its profound concepts.

It is known that the state of a physical system can be described by a wave picture represented by the so-called "wave function", which is an abstract entity being proposed in quantum mechanics as a complex function of space and time. The wave function of a particle moving with a velocity much less than of light is a solution of the Schrodinger equation of motion. Generally this solution is an oscillating amplitude between a minimum and a maximum, passing through zero. This wave picture of particles (and all physical systems) is the quantum, mechanical model of nature which is fully accepted now after being verified both theoretically and experimentally. Further development of quantum physics by P.M.A Dirac (d.1984) into the relativistic case (velocity of particles comparable to that of light) has shown that the state of vacuum can be visualized as being composed of opposite

(virtual) particles. These particles are unlocalized and are in negative energy states. This picture of the vacuum in modern physics is very necessary to explain the creation of pairs of particles whenever enough energy is available within the vicinity of heavy nuceii. Moreover, quantum field theory proposed that "vacuum fluctuation" could generate positive energy, which appeares as flux of particles. Recent scientific research in theoretical physics has shown that the creation of the Universe at early times could be attributed to such fluctuations in presence of curved spacetime.[18] In short we can say that principle of re-creation adopted by Mutakallimin is not very exotic to present physical theory.

4. The Principle of Undeterminism

Since Allah (SWT) is the divine controller of the Universe both macroscopically and microscopically and since the action of Allah (SWT) cannot be fully predicted with absolute certainty, therefore, Mutakallimin say that nature does not act by itself and therefore the laws of nature cannot be deterministic but are probabilistic. Mutakallimin rejected the philosophers, idea of "Natural Reason" that was thought to exist within natural bodies like planets and stars. Such a subjective theory would mean that Allah (SWT) is not the only controller of the Universe and subsequently one will fall into *shirk* (believing in more than one God).

This principle of undeterminism is complementary to the previous two— the principle of discreteness and the principle of persistent re-creation. Mulakallimin presented many arguments in support of this; we will not present their full arguments here, however the main content of it is the question of causality. Much has been written in modern literature about this question and it is often believed that Mutakallimin rejected causality and causal relations. This is not true as such in fact Mutakalliminn ever rejected causal events; however, they consistently refused to accept the idea that nature acts by itself through deterministic law. Again we repeat here the fact that Mutakallemin were no physicists but comprehensive thinkers, and their outlook at any behaviour of nature takes the view from the absolute reference that has to be consistent with their basic beliefs. Accordingly they adopted new concepts in order to explain the canonical behaviour of nature, this behaviour which seems deterministic taking place according to fixed laws which are independent to any external controller. It is known that the Ash'ariya adopted the concept of "*ada*" (in English this means custom) to explain causal relations. Mu'tazila adopted more sophisticated set of concepts to cover the different types of causal relations between events in nature. These are[19] conjugation *(Iktiran)*, generation *(Tawleed)*, dependence *(I'timad)* and custom *('ada)*. Conjugation is used to explain the occurrence of an event in conjuction with another. Generation is meant to describe those relations through which new event (or effect) is produced as a result of another. Dependence is the concept used to explain the causal relations between two events connected with a third liable party (such as the motion of a particle under the effect of gravitational field of earth and pushing force). '*ada* is just the type of casual relations that represent a repetition of conjugation, in a similar sense to what Ash'ariya believe. The occurrence of an event follows the concept of possibility rather than

determinism, so that all events of nature are possible within the concepts of causality mentioned above this clearly means that the laws of nature exist as an exposition of the possibility preserving the role of Allah (SWT) to change such according to his will.

The Scientific Value: Classical physics formulated the laws of nature in such a way that the results are always deterministic, this is the essence of any law of classical physics. Causal events are those governed by a given law, accordingly peoples thought that nature is self-contained and need not to be governed by an external controller.

Modern physics of the twentieth century has revealed that such a picture of nature is not accurate enough, the laws that govern the motion of atomic and nuclear particles are not deterministic. In fact the result of measurements at microscopic level cannot be predicted with full accuracy, no matter how accurate the measuring device is. This was established by Werner Heisenbering and is called "The Uncertainty Principle". This new principle of underminism embodies all laws of modern (quantum) physics one way or another, thus limiting our physical knowledge up to certain range. On the other hand the introduction of quantum mechanics, of which uncertainty principle is a vital part, has changed our view of nature in a way that physical quantities and events can no longer be defined to an absolute value, instead the "average" value of a physical quantity appears. This average value is the value which is mostly expected in a sequence of repeated measurements, so the name "expectation value" is given. This means the events are possible rather than determined to happen. The reason why it looks deterministic on the large scale is because of the low rate of occurrence of events on the macroscopic level whereas events occur at much higher rate, but in small quantities, at the microscopic level, leading to the situation where probabilistic behaviour of nature is more transparent on atomic scale.

Causality on the other hand has suffered controvertial argumentation during the last fifty years. Though the notion of casualty is widely vague, in some cases [20] people think that causality cannot be preserved on the microscopic level. This constitutes a necessary incompleteness in our knowledge according to the Copenhagen school of thought.

5. The Principle of Relativity

The fifth principle which we deduce from the contributions of Mutakallimin is the principle of relativity. This concerns the concepts of space, time and motion.

Mutakallmin considered the existence of space being meaningful only when it is occupied, otherwise there cannot be a meaning to the space.[21] On the other hand, time was also considered to be meaningful only when connected with the happening of an event. This understanding of space and time can be seen clearly through the definitions set by Mutakallimin to both concepts. Space was defined as "The imagined volume occupied by the body through which it manifests its dimension"[22]. Time was defined to be a "known renewable that is used to define another imaginable, so when one says we meet at sunset then sunset represents the known

renewable (the event), however the meeting is imaginable."[23] This means that space and time are combined at the occurrence of the events, without which neither space nor time can have an independent identity.

With respect to the nature of space and time the Mutakallimin followed the principle of discreteness consistently and considered that events are discrete, and since the time is a kind of measure of the events, therefore they explicitly broke time into discrete units called *"Aana"*; however, they did not specify a quantitative magnitude to such a unit.

This understanding of space-time manifests itself in the concept of motion. This concept has been discussed within Mutakallimin under different circumstances. Juayni[23] (d. 1085) presents discussion of Al-Nadham's (d.845) ideas who introduced the concept of "jump" in order to explain the nature of motion. This problem needs a closer look in order to understand the reason why Nadham had to introduce the concept of jumps; this may be reported in another more specialised article. Generally we can say that motion has been viewed by Mutakallimin to be divided into discrete instants such that the trajectory of a moving particle be composed of "stationary" points. This means that when we say that a particle (A) is faster than particle (B) then it means that the trajectory of particle (A) contains less stationary points than that of (B) and vice-versa. Therefore motion is considered to be discrete, being composed of finite instances of "stills" that endogen the path.

The Scientific Value: Till the end of the last century physicists considered space and time as two separate entities that can exist absolutely and independently. By the beginning of this century Albert Einstein proposed the "Special Theory of Relativity" according to which space and time were considered inter-dependent and are always manifested through the occurrence of an event. Accordingly Einstein had to add yet a fourth dimension to the three known space dimensions. This new dimension is the time. Moreover, Einstein found that space and time measurements depend on the kinetic status of the observer, so that space and time can interchange role within the invariance of the event itself. However, relativity theory of Einstein could not consider the possibility of spacetime discereteness, instead a spacetime continuum is assumed. This is because of the mathematical structure of the theory of relativity which heavily depend on differential calculus. Thus, the concept of motion in respect of being a change in space taking place within a definite period of time, remains valid.

The confrontation between the principle of discretences adopted by quantum theory and the principle of continuity adopted by the theory of relativity manifests itself in a much larger dilemma faced by contemporary theoretical physics. In spite of the elegant works of P.M.A Dirac who succeeded in combing special relativity with quantum theory, the more general attempt at combining the theory of General Relativity with quantum mechanics has not been successful yet. It seems that a more profound alternative to both quantum theory and relativity theory is needed to resolve the problems of contemporary physics.

Therefore, we can confidently say that though the contributions of Mutakallimin in the subject of space, time and motion were not fully developed into

quantitative analysis, their concepts of the relation between space and time has a sound scientific value that cannot be denied. On the other hand their belief that time is discrete suggests a new perspective that may be utilised quantitatively in a new theory of space, time and matter that resolves the fundamental questions that cause stumbling within contemporary theoretical physics.

Summary and Conclusions

Throughout this study we tried to expose the main principles and concepts of *"Dakik al Kalam"* which stands, in our opinion, for the true "Islamic philosophy of Nature". The objectives of this study are directed at:

(1) Preliminary exposition of an important part of Islamic thought, which is rarely studied to date and which could be further studied and criticized.

(2)The possible utilization of the original ideas and concepts of Mutakallimin in contemporary philosophy of science or possibly contemporary theoretical physics.

As in respect to the first objective, this study has covered most of the main issues of *Dakik al-Kalam*; however the work is by no means complete since we have paid no attention to the details of the concepts of different schools of Mutakallimin, nor have we dwelled on the details of arguments given in support of their beliefs. Further studies surely will expose such subjects and enlighten the approach of Mutakallimin in respect to historical and scientific values. Therefore more interest is to be directed into such subjects and perhaps a closer look at certain specialised topics will uncover useful information which could be utilized historically, philosophically and scientifically. One such case is the understanding of the motion of a body and Nedham's idea of "jumps" through motion. Another case is the novel conjecture of Ibn-Rushd that the principle of discreteness leads to converting geometry into arithmetics. A third case is the understanding of Mu'tazila of a vacuum *('adm)* being composed of unlocalized *Jawhars*.

In respect of the second objective, it is well known that contemporary theoretical physics is facing a real dilemma in an endeavor to understand nature and give the correct scientific explanation of microscopic as well as macroscopic physical world. The inhomogeneous body of theoretical physics, being composed of quantum theory (or the more sophisticated quantum field theory and the theory of general relativity), presents an unsurmountable difficulty. On the one hand quantum field theory based on the philosophy of continuity (the notion of field) is suffering from a chronic disorder manifesting itself through the divergent terms appearing whenever one wants to calculate physical parameters of interacting fields (or particles). On the other hand general relativity, which describes the Universe at large, cannot be integrated with quantum theory because of the nonlinear nature of the gravitational field as described by the theory of general relativity.

By induction, Mutakallimin's thoughts tell us that infinities (divergences) ought to appear in a theory like quantum field theory since the notion of a field itself assumes that a finite contains an infinite. Therefore if ever a success is to be achieved at the microscopic level, the concept of field should be abolished. This

notion applies equally to the theory of general relativity (which is also a theory of continuous media); spacetime has to be quantised. Accordingly the concept of spacetime continuum is to a be abolished too, then spacetime may be quantised through more fundamental and unified rules that will be common for both quantum theory and relativity theory.

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20. These ideas are spread through the book of Al-Jwayni, *Al-Shamel Fi usual Al-din,* specially p. 60 & 61. Here we will not quote expect the basic definition as given by Jurjani in his book, *Al-Tareefat.*
21. Al-Jurjani, Op.cit. Cit p. 59.
22. Al-Jurnani, Op.cit. City p. 67.