ISLAM AND SCIENCE - CONCORDANCE OR CONFLICT?

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This speech was delivered by Professor Abdus Salam, Nobel Laureate in Physics (1979), in Paris at the UNESCO House on April 27, 1984 at the invitation of the Organization 'Islam and the West'. The Secretary General of the Organization of the Islamic Conference, Dr. Habib Chatti, inaugurated the meeting. The format of the meeting was to invite two representatives of Islam and two Western representatives to speak comparatively. Thus, on the Muslim side were Professor Salam and Dr. Hussein AlJazaeri, former Minister of Health of the Kingdom of Saudi Arabia and presently regional director of the World Health Organization. From the Western side there were Professor Louis Leprince-Ringuet, Emeritus Professor of Physics at the Ecole Polytechnique and Professor Jean Bernard, President of the French Academy of Sciences and Director of the Leukemia Research Institute.

THE HOLY QURAN AND SCIENCE

Let me say at the outset that I am both a believer as well as a practicing Muslim. I am a Muslim because I believe in the spiritual message of the Holy Quran. As a scientist, the Quran speaks to me in that it emphasizes reflection on the Laws of Nature, with examples drawn from cosmology, physics, biology and medicine, as signs for all men. Says the Quran:

“Can they not look up to the clouds, how they are created; and to the Heaven how it is upraised; and the mountains how they are rooted, and to the earth how it is outspread?” (88:17)

And again:

“Verily in the creation of the Heavens and of the earth, and in the alternation of the night and of the day, are there signs for men of understanding. They who, standing, sitting or reclining, bear Allah in mind and reflect on the creation of the Heavens and of the earth, saying: 'Oh our Lord! Thou has not created this in vain.’” (3:189-190).

The Quran emphasizes the superiority of the alim-the man possessed of knowledge and insight, asking: How can those, not possessing these attributes, ever be equals of those who do? **Seven hundred and fifty verses of the Quran (almost one-eighth of the Book) exhort believers to study Nature, to reflect, to make the best use of reason in their search for the ultimate and to make the acquiring of knowledge and scientific comprehension part of the community's life.**

The Holy Prophet of Islam emphasized that the quest for knowledge and sciences is obligatory upon every Muslim, man and woman. He enjoined his followers to seek

knowledge even if they had to travel to China in its search. Here clearly he had scientific rather than religious knowledge in mind, as well as an emphasis on the internationalism of the scientific quest.

This is the first premise on scientific knowledge with which any fundamentalist thinking in Islam must begin. Add to this the second premise, eloquently stated by Maurice Bucaille in his perceptive essay on The Bible, the Quran and Science.
There is not a single verse in the Quran where natural phenomena are described and which contradicts what we know for certain from our discoveries in Sciences.

Add to this the third premise: in the whole of Islamic history there has never been an incident like that of Galileo or Giordano Bruno. Persecution there has been; denunciation, even excommunication (takfeer) over doctrinal differences, but never for scientific beliefs. And paradoxically, the first Inquisition (Mihna) in Islam came to be instituted, not by the orthodox theologians, but by the so-called rationalists, the Mu'tazzala-theologians themselves who prided themselves on the use of reason. The saintly Ahmad ibn Hanbal was one of those subjected to the lash of their fury.[1]

EARLY ISLAM AND SCIENCE

How seriously did the early Muslims take these injunctions of the Holy Quran and of the Holy Prophet?

Barely a hundred years after the Holy Prophet's death the Muslims had made it their task to master the then-known sciences. Systematically, they translated the entire corpus of the then known knowledge in their religious language, Arabic. Founding institutes of advanced study (Bait-ul-Hikmas), they acquired an ascendancy in the sciences that lasted for the next 350 years.

A semi-quantitative measure of this is given by George Sarton in his monumental History of Science. Sarton divides his story of the highest achievement in science into Ages, each Age lasting 50 years. With each, he associates one central figure: thus, 500-450 BC is the Age of Plato, followed by the Ages of Aristotle, Euclid, Archimedes and so on. From 750 to 1100 CE, however, it is an unbroken succession of the Ages of Jabir, Khwarizmi, Razi, Masudi, Abu'I-Wafa, Biruni and Omar Khayam. In those 350 years, Arabs, Turks, Afghans and Persians chemists, algebraists, clinicians, geographers, mathematicians, physicists and astronomers of the commonwealth of Islam-held the world stage of sciences. Only after 1100 CE, in Sarton's scheme, do the first Western names begin to appear; however, for another 250 years, they share the honors with men of Islam like Ibn Rushd, Nasir-ud-din Tusi and Ibn Nafis.

An important reason for the success of the scientific enterprise in Islam was its international character. The Islamic commonwealth itself cut across nations and color; and early Muslim society was tolerant of men from outside it, and of their ideas.

An aspect of reverence for the sciences in Islam was the patronage they enjoyed in the Islamic Commonwealth. To paraphrase what H.A.R. Gibb has written about Arabic

literature to the parallel situation for the sciences; 'To a greater extent than elsewhere, the flowering of the sciences in Islam was conditional... on the liberality and patronage of those in high positions. Where Muslim society was in decay, science lost vitality and force. But so long as, in one capital or another, princes and ministers found pleasure, profit or reputation in patronizing the sciences, the torch was kept burning.'

THE GOLDEN AGE OF SCIENCES IN ISLAM

The Golden Age of Sciences in Islam was doubtless the Age around the year 1000 CE, the Age of Ibn-i-Sina (Avecenna) , the last of the mediaevalists, and of his contemporaries, the first of the moderns, Ibn-al-Haitham and AI Biruni. Ibn-alHaitham (Alhazen, 965-1039 CE) was one of the greatest physicists of all time. He 'enunciated that a ray of light, in passing through a medium, takes the path which is the easier and "quicker".' In this he was anticipating Fermat's Principle of Least Time by many centuries[2]. He enunciated the law of inertia, later to become Newton's first law of motion. He described the process of refraction in mechanical terms, by considering the movement of 'particles of light' as they passed through the surface of separation of two media, in accordance with the rectangle law of forces-an approach later rediscovered and elaborated by Newton. Part V of Roger Bacon's 'Opus Majus' is practically a copy of Ibn-al-Haitharn's optics[3]. No wonder Bacon never wearied of declaring that a knowledge of Arabic and of Arabic Science was the only way to true knowledge.'

Al Biruni (973-1048 CE), Ibn-i-Sina's second illustrious contemporary worked in Afghanistan. He was an empirical scientist like Ibn-al-Haitham. He was as modern and as unmedieval in outlook as Galileo, six centuries later, with whom he shares the independent (prior) discovery of the so-called Galilean invariance of the laws of Nature-the liberating statement that the same Laws of Physics apply here on earth and on the starry-orbs in the heavens.

There is no question that Western Science is a Greco-Islamic legacy. However, it is commonly alleged that Islamic science was a derived science, that Muslim scientists followed the Greek theoretical tradition blindly and added nothing to the scientific method.

This statement is false. Like all periods of intense scientific work, one first builds on what one has inherited; this is followed by an Age of maturity when doubts are raised on the teachings of the old masters followed by a break. Such a break came with the rise of observation and experiment, early in the Sciences of Islam; its clearest exponents were Ibn-al-Haitham and AI Biruni. Listen to this assessment of Aristotle by AI Biruni:

The trouble with most people is their extravagance in respect of Aristotle's opinions, they believe that there is no possibility of mistakes in his views, though they know that he was only theorizing to the best of his capacity, and never claimed to be God's protected and immune from mistakes.

Or this on geology, with its insistence on observation:

...But if you see the soil of India with your own eyes and meditate on its nature, if you consider the rounded stones found in earth however deeply you dig, stones that are huge near the mountains and where the rivers have a violent current, stones that are of smaller size at a greater distance from the mountains and where the streams flow more slowly, stones that appear pulverized in the shape of sand where the streams begin to stagnate near their mouths and near the sea-if you consider all this, you can scarcely help thinking that India was once a sea, which by degrees has been filled up by the alluvium of the streams.

And finally, AI Biruni on medieval superstitions:

People say that on the 6th (of January) there is an hour during which all salt water of the earth gets sweet. Since all the qualities occurring in the water depend exclusively upon the nature of the soil... these qualities are of a stable nature.... Therefore this statement ... is entirely unfounded. Continual and leisurely experimentation will show to anyone the futility of this assertion.

According to Briffault[3]

the Greeks systematized, generalized, and theorized, but the patient ways of investigation, the accumulation of positive knowledge, the minute methods of science, detailed and prolonged observation and experimental inquiry were altogether alien to the Greek temperament. What we call science arose in Europe as a result of a new spirit of inquiry, of new methods of investigation, of the method of experiment, observation, measurement, and of the development of Mathematics in a form unknown to the Greeks. That spirit and those methods were introduced into the European world by the Arabs. 'Modern' science is the most momentous contribution of the Islamic civilization.

These remarks of Briffault are reinforced by Sarton

The main, as well as the least obvious, achievement of the middle Ages was the creation of the experimental spirit and this was primarily due to the Muslims down to the 12th century.

One of the tragedies of history is that this dawning of the modern spirit in Sciences with AI Biruni and Ibn-al-Haitham, was interrupted; it did not lead to a permanent change of course in scientific methodology. Barely a hundred years after they worked, creation of high Science in Islam came to a halt. Mankind had to wait a full 500 years before the same level of maturity and the same insistence on observation and experimentation was reached again, with Tycho Brahe, Galileo and their contemporaries.

THE DECLINE OF SCIENCE IN ISLAM

'In my view, the demise of living science within the Islamic commonwealth was due more to internal causes-firstly of isolation of

our scientific enterprise and secondly of discouragement to innovation (taqlid)'

Why did creative Science die out in Islam? Starting around 1100 CE, this decline was nearly complete by 1350 CE. Why did we in the Islamic lands lose out?

No-one knows for certain. There were indeed external causes, like the devastation caused by Mongol invasion, but, grievous though it was, it was perhaps more in the nature of an interruption. Sixty years after Ghengiz, his grandson Halagu was founding an observatory at Maragha, where Nasir-ud-din Tusi worked.

In my view, the demise of living science within the Islamic commonwealth was due more to internal causes-firstly of isolation of our scientific enterprise and secondly of discouragement to innovation (taqlid). The later parts of the 11th and early 12th centuries in Islam were periods of intense politically motivated, sectarian and religious strife. Even though a man like Imam Ghazali, in the first chapter of his great Ihaya ulum-ud-din, The Revival of Religious Learning, writing around 1100 CE, could say:

A grievous crime indeed against religion has been committed by a man who imagines that Islam is defended by the denial of the mathematical sciences, seeing that there is nothing in the revealed truth opposed to these sciences by way either of negation or affirmation, and nothing in these sciences opposed to the truth of religion.

Even though Imam Ghazali could write this, the temper of the age had turned away from creative science, either to Sufism with its otherworldliness or, to a lack of tolerance for taqlid and innovation in all fields of learning including the Sciences.

To illustrate the apathy towards the creation of Sciences which came over Islam, let me quote from Ibn Khaldun (1332-1406 CE), one of the greatest social historians and one of the brightest intellects of all times in his field. Ibn Khaldun writes, in his Muquddima:[4]

We have heard, of late, that in the land of the Franks, and on the northern shores of the Mediterranean, there is a great cultivation of philosophical sciences. They are said to be studied there again, and to be taught in numerous classes. Existing systematic expositions of them are said to be comprehensive, the people who know them numerous, and the students of them very many... Allah knows better, what exists there ... But it is clear that the problems of physics are of no importance for us in our religious affairs. Therefore, we must leave them alone.

Ibn Khaldun displays little curiosity, no wistfulness. The apathy his words appear to convey led to a drawing inwards, to an isolation of our scientific enterprise. As everyone knows, isolation in .the sciences and the veneration for authority it engenders, spells intellectual death. In our great days in the 9th and 10th centuries, we had founded, in Baghdad and Cairo, international institutes of advanced studies (Baitul-Hikmas), and assembled international concourses of scholars there. But from 1300 CE, no more. Any science that was cultivated was concentrated in religious seminaries, where tradition was

valued more than innovation. 'The learned men of Transociana, who upon hearing of the establishment of the first Madrasah, appointed a solemn menesonial science, as tradition tells us, in commemoration of departed science, were shown to be correct in their estimate.[5] The very encyclopedic nature of knowledge and science in Islam was now a hindrance in an age of specialization. The wholesome faculty of criticism, by which a young researcher questions what he is taught, re-examines it, and brings forth newer concepts, was no longer tolerated or encouraged.

To complete the story, from Ibn Khaldun's days, this intellectual isolation continued-even during the great empires of Islam, the empires of Osmani Turks, of the Iranian Safvis, and of the Indian Mughals. It is not that the sultans and the shah-in-shahs were not cognisant of the technological advances being made by the Europeans; they could hardly have been unaware of the intrusive superiority of the Venetians or the Genoese in the arts of gun-founding, or of the navigational and ship-building skills of the Portuguese who controlled the oceans of the world, including all oceans bordering on Islamic lands, and even the Hajj sea routes. But they seem never to have realized that navigational skills of the Portuguese were not accidental; these had been scientifically developed and sedulously cultivated, starting with the research establishment of Sagres set up in 1419 by Prince Henry the Navigator.

Was this decline due to misplaced arrogance? William Eton[6], the British Consul to the Ottoman Empire would write in the year 1800:

No one has the least idea of navigation and the use of the magnet ... Traveling, that great source of expansion and improvement to the mind is entirely checked by arrogant spirit of their religion and ... by the jealousy with which intercourse with foreigners ... is viewed in a person not invested with an official character ... Thus the man of general science ... is unknown: anyone, but a mere artificer who should concern himself with the founding of cannons, the building of ships or the like, would be esteemed little better than a madman.

He concluded with the remark, with an ominous modern ring:

They like to trade with those who bring to them useful and valuable articles, without the labor of manufacturing.

MODERN SCIENCE AND FAITH

What is the situation today? Of all the major civilizations on this globe, science is the weakest in the Islamic Commonwealth. I sometimes suspect that some of us Muslims believe that while technology is basically neutral, and that its excess can be tempered through an adherence to the ethics of Islam, science, on the contrary, is valueloaded; that modern science must lead to 'rationalism', and eventually apostasy; that scientifically trained men among us will 'deny the metaphysical presuppositions of our culture.' There is in this sentiment an implied insult to our cultural values for their fragility; but leaving this aside, to such thinking, all I can say is: Do not fight the battles of yesterday when the so-called 'rational philosophers', with their irrational and dogmatic faith in the

cosmological doctrines they had inherited from Aristotle, found difficulties in reconciling these concepts with their faith.

One must remind oneself that such battles were even more fiercely waged among the Christian school men of the Middle Ages. The problems which concerned the schoolmen were mainly problems of cosmology and metaphysics: 'Is the world located in an immobile place, does anything lie beyond it; Does God move the primum mobile directly and actively as an efficient cause, or only as a final or ultimate cause? Are all the heavens moved by one mover or several? Do celestial movers experience exhaustion or fatigue? What was the nature of celestial matter? Was it like terrestrial matter in possessing inherent qualities such as being hot, cold moist and dry?' No wonder when Galileo tried, first, to classify those among the problems which legitimately belonged to the domain of Physics, and then to find answers to them through physical experimentation, he was persecuted. Restitution for this is being made now 350 years later.

At a special ceremony in the Vatican on May 9, 1983, His Holiness the Pope, in the presence of 33 Nobel Laureates and 300 other scientists, declared:

The Church's experience, during the Galileo affair and after it, has led to a more mature attitude ... The Church herself learns by experience and reflection and she now understands better the meaning that must be given to freedom of research ... one of the most noble attributes of man. It is through research that man attains to Truth ... This is why the Church is convinced that there can be no real contradiction between science and faith.... (However), it is only through humble and assiduous study that (the Church) learns to dissociate the essential of the faith from the scientific systems of a given age, specially when a culturally influenced reading of the Bible seemed to be linked to an obligatory cosmogony.

THE LIMITATIONS OF SCIENCE

In his remarks, the Pope stressed the maturity which the Church had reached in dealing with science; he could equally have emphasized the converse-the recognition by the scientists from Galileo's times onwards, of the limitations of their disciplines-the recognition that there are questions which are beyond the ken of present or even future Sciences. We may speculate about some of them, but there may be no way to verify empirically our speculations. And it is this empirical verification that is the essence of modern science. We are humbler today than, for example, Ibn Rushd (Averroes) was. Ibn Rushd was a physician of great originality with major contributions in the study of fevers and of the retina; this is one of his claims to scientific immortality. However, in a different discipline-cosmology-he accepted the speculations of Aristotle, without recognizing that these were speculations, and that future experiments may prove them false. The scientist of today knows when and where he is speculating; he would claim no finality for the associated modes of thought. And even about accepted facts, we recognize that newer facts may be discovered which, without falsifying the earlier discoveries, may lead to generalizations; in turn, necessitating revolutionary changes in our concepts and our 'world-view'. In Physics, this happened in the beginning of this century with the

discovery of relativity and quantum theory. It could happen again; with our present constructs appearing as limiting cases of the newer concepts, still more comprehensive, still more embracing.

I have been asked to elaborate on this.

I have mentioned the revolution in the physicists' concepts of the relativity of time. It appears incredible that the length of a time interval depends on one's speed that the faster we move the longer we appear to live to someone who is not moving with us. And this is not a figment of one's fancy. Come to the particle physics laboratories of CERN at Geneva which produce short-lived particles like muons, or the laboratories here at Orsay, and make a record of the intervals of time which elapse before muons of different speeds decay into electrons and neutrinos. The faster muons take longer to die, the slower ones die early, precisely in accord with the quantitative law of relativity of time first enunciated by Einstein in 1905. It took time for Physics to verify and comprehend Einstein. Fortunately, it seems no philosopher has understood Einstein. To my knowledge, no system of philosophy appears to have been erected on his ideas of space and time.

The second and potentially the more explosive revolution in thought came in 1926 with Heisenberg's Uncertainty Principle. This Principle concerns the existence of a conceptual limitation on our knowledge. It affirms, for example, that no physical measurements can tell you that there is an electron on this table and also that it is lying still. Experiments can be made to discover where the electron is; these experiments will then destroy any possibility of finding simultaneously whether the electron is moving and if so at what speed. There is an inherent limitation on our knowledge, which appears to have been decreed. I shudder to think what might have happened to Heisenberg if he was born in the Middle Ages-just what theological battles might have raged on whether there was a like limitation on the knowledge possessed by God.

As it was, battles were fought, but within the 20th century physics community. Heisenberg's revolutionary thinking, supported by all known experiment, has never been accepted by all physicists. The most illustrious physicist of all times, Einstein, spent the best part of his life trying to find flaws in Heisenberg's arguments. He could not gainsay the experimental evidence, but he hoped that such evidence may perhaps be explained within a different theoretical framework. Such framework has not been found so far, notwithstanding Einstein's repeated attempts. It appears unlikely, but who among us can assert that it may never be discovered.

Is the Science of today on a collision course with metaphysical thinking? Let us consider some examples of modern scientific thinking in this context.

My first example concerns the metaphysical doctrine of the creation from nothing. Today we believe in cosmology, that the most likely value for the density of matter and energy in the Universe is such that the mass of the Universe adds up to zero, precisely. The mass of the Universe is defined as the sum of the masses and energies of the

electrons, the protons, photons and neutrinos, which constitute the Universe minus an expression for their mutual gravitational energies. If the mass of the Universe is indeed zero, and this is an empirically determinable quantity-the Universe shares with the vacuum state the property of masslessness. A bold extrapolation made as recently as a decade back then treats the Universe as a quantum fluctuation of the vacuum--of the state of nothingness. I must emphasize here that what distinguishes physics from metaphysics is that this bold extrapolation can and will be tested by measuring the density of matter in the Universe more and more precisely. We shall know empirically whether the idea can be sustained in the physicists sense. If it cannot be, we shall discard it.

My second example is the Principle of the anthropic Universe -the assertion by a number of cosmologists that one way to understand the processes of cosmology, geology, biochemistry and biology is to assume that our Universe was conceived in a potential condition and with physical laws, which possess all the necessary ingredients for the emergence of life and intelligent beings. 'Basically this potentiality relies on a complex relationship between the expansion and the cooling of the Universe, after the Big Bang, on the behavior of the free energy of matter, on the intervention of chance at various levels', as well as on a number of coincidences which we shall have to explain and which have permitted the Universe to survive a few billion years.

Consider some of the elements of this story as told by Carr, Rees and Hubert Reeves[7].The Universe started with a Big Bang; as it expanded and thereby cooled, quarks bound themselves through the well-known physical forces into nucleons, these with electrons into atoms, and the atoms into galaxies and stars.

It is of interest to note that stars can form only if they can emit light and heat and emission of light and heat can take place only in a cold universe. This is guaranteed by the expansion itself. If the Universe was to stop expanding, all structure -including living structures-would be dismantled. If the night were not dark, there would be no one to notice it.

Now, normally, nuclear binding should proceed by reaching for the lowest possible stable state. 'Nuclear binding, on a cosmic scale, however, stops short of reaching this lowest state. In principle, Big Bang nucleosynthesis could have yielded a world of iron. In fact we hardly go past helium in the table of nuclei. Why? Because the number of relativistic particles per unit volume created was not high enough.' Equilibrium ceased before nuclear evolution reached its lowest state. Did this happen because iron is hardly an appropriate element to promote life?

Next we come to a second chapter of organization of matter. The first chapter, from the Big Bang to the birth of the first stars is a chapter of global organization following the decline of cosmic temperature. The second chapter witnesses the rise of complexity in a local scale around the multitude of stars, with their hot interiors and warm surroundings.

The stars formed according to standard cosmological laws: they exploded whenever they were larger than a certain size. This time however heavy nuclei were formed-generating

ices NH3, CH4, H2O, complex molecules, and grains of dust of iron-magnesium silicate. And around a later generation of stars these grains and ices gave birth to planets with atmospheres and oceans into which chemical evolution pursued its course.

'Is the future of the Universe and in particular the course of events leading to this organization, implicitly written down in the laws of physics from the very beginning?' It appears NOT. The chemist and the biologist tell us that the 'physical processes have not always been in equilibrium. We have a large number of energetically equivalent states, and it is between these states that the game of organization takes place, largely through the effect of chance'-chance, presumably guided and driven by the biologists' principle of 'need for survival'.

I am longing at this point for my biological colleagues to take up the story and tell us of the operation of their non-equilibrium and the principle of survival mechanism. The equilibrium physicist has, however, a principle analogous to this. We call it the principle of self-consistency. Since I am more familiar with it, I shall illustrate its operation, so far as the coincidences I referred to earlier are concerned, by taking an example of something I am currently working on myself.

As an extension of the recent excitement in physics-that is of our success in unifying and establishing the identity of two of the fundamental forces of Nature, the electric and the weak nuclear-we are now considering the possibility that spacetime may have 11 dimensions. Within this context we hope to unify the electroweak force with the remaining two basic forces, gravity and the strong nuclear. Of the 11 dimensions which we have postulated, four are the familiar dimensions of space and time. The other seven dimensions are supposed to correspond to a hidden internal manifold-hidden because these seven dimensions are assumed to have curled in upon themselves to fantastically tiny dimensions of the order of 10-33cms. We live on the surface of a cylinder in the 11 dimensional space: our major source of sensory apprehension of these extra dimensions being the existence of familiar charges-electric, and nuclear-which in their turn produce the familiar electric and the nuclear forces.

Exciting idea, which may or may not work quantitatively. But one question already arises; why the difference between the four familiar space-time dimensions and the seven internal ones? And why 11 dimensions in the first place, and not a wholesome number like 13 or 19? Were these 11 dimensions on par at the beginning of time? Why have the seven curled in upon themselves, while the other four have not? At present, we make this plausible by postulating a self-consistency principle; we invent a field of force designed to guarantee this configuration as the only stable self-consistent dynamical system which can exist. But there will be a price to pay.

There will be a subtle physical consequence of this hypothesis, for example, in the form of remnants, like the three degree radiation which we believe was a remnant of the recombination era following on the Big Bang. We shall search for these remnants. If we do not find them, we shall abandon the idea.

Creation from nothing, an anthropic Universe, extra dimensions - strange topics for late 20th century physics - which appear no different from metaphysical preoccupations of earlier times. But so far as Science is concerned, mark the provisional nature of the conceptual edifice, the insistence on empirical verification at each stage and the concept of driving self-consistency.

'I do not see why once having created certain attributes within matter, and the laws which govern the operation of the fundamental forces, the path we follow in physics is not creationism in the wider sense.'

For the agnostic, self-consistency (if successful) may connote irrelevance of a deity. For the believer, it provides no more than an unraveling of a small part of the Lord's design- its profundity, in the areas it illuminates, only enhances his reverence for the beauty of the design itself.

I can offer no new resolution, except to make two remarks. First, I find the creationist creed insulting that while we are willing to ascribe subtlety to ourselves in devising these self-consistency modalities, the only subtlety we are willing to ascribe to the Lord is that of the potter's art-kneading clay and fashioning it into man. I do not see why once having created certain attributes within matter, and the laws which govern the operation of the fundamental forces, the path we follow in physics is not creationism in the wider sense.

My second remark is personal. Personally for me, my faith was predicted by the timeless spiritual message of Islam, on matters on which physics is silent. It was given meaning to by the very first verse of the Holy Quran after the opening:

“This is the Book, wherein there is no doubt, a guidance to the God-fearing, who believe in the unseen.”

The unseen - beyond the reach of human ken - the unknowable.

CONCLUDING REMARKS

Since in my audience today, there are a number of Muslims, who can influence decisions in their own countries, let me say in all humility that to know the limitations of science, one must be part of living science; otherwise one will continue fighting yesterday's philosophical battles today. Believe me, there are high creators of Science among us - and potentially among our youth. Trust them; their Islam is as deeply founded, their appreciation of the spiritual values of the Holy Book as profound as anyone else's. Provide them with facilities to create Science in its standard norms of inquiry. We owe it to Islam. Let them know Science and its limitations from the inside. There truly is no disconsonance between Islam and modern Science.

Let me conclude with two thoughts. One is regarding the urge to know. As I mentioned before the Holy Quran and the teaching of the Holy Prophet emphasize the creating and

acquiring of knowledge as bounden duties of a Muslim throughout his or her life. I spoke of AI Biruni who flourished at Ghazna in Southern Afghanistan one thousand years ago. The story is told of his death by a contemporary who says: I heard, AI Biruni was dying. I hurried to his house for a last look; one could see that he would not survive long. When they told him of my coming, he opened his eyes and said: Are you so and so? I said: Yes. He said: I am told you know the solution to a knotty problem in the laws of inheritance of Islam. And he alluded to a well-known puzzle which had baffled the Faqihs in the past. I said: Abu Raihan, at this time? And AI Biruni replied: 'Don't you think it is better that I should die knowing, rather than ignorant?' With sorrow in my heart, I told him of my resolution, and then took my leave. I had not yet crossed the portals of his house when the cry arose from inside: AI Biruni is dead.

As my last thought, I would like to quote from the Holy Book which, more than anything else I know, speaks of the eternal wonder I have personally discovered in my own Science:

'Though all the trees on earth were Pens And the Sea was Ink
Seven seas after it to replenish,
Yet would the Words of Thy Lord never be spent,
Thy Lord is Mighty and All Wise.'

The Quran (31:27)

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