Science in the holy quran philosophy essay

The use of math to validate theories has always been used in Physics, as a computation in most cases will somewhat fit what is occurring by shuffling numbers, but if the theory is wrong, the set of equations are useless and stagnation within the field will occur as progress to expand knowledge slows to a crawl. Quantum mechanics is a very powerful theory which has led to an accurate description of the micro-physical mechanisms. It is founded on a set of postulates from which the main processes pertaining to its application domain are derived. A challenging issue in physics is therefore to exhibit the underlying principles from which these postulates might emerge.

The theory of scale relativity consists of generalizing to scale transformations the principle of relativity, which has been applied by Einstein to motion laws. It is based on the giving up of the assumption of spacetime coordinate differentiability, which is usually retained as an implicit hypothesis in current physics. Even though this hypothesis can be considered as mostly valid in the classical domain (except possibly at some singularities), it is clearly broken by the quantum-mechanical behavior. It has indeed been pointed out by Feynman that the typical paths of quantum mechanics are continuous but nondifferentiable. Even more, Abott and Wise have observed that these typical paths are of fractal dimension DF = 2.

This is the reason why we propose that the scale relativity first principles, based on continuity and giving up of the differentiability hypothesis of the coordinate map, be retained as good candidates for the founding of the quantum-mechanical postulates. We want to stress here that, even if coordinate differentiabilty is recovered in the classical domain;

nondifferentiability is a fundamental property of the geometry that underlies the quantum realm.

To deal with the scale relativistic construction, one generally begins with a study of pure scale laws, i. e., with the description of the scale dependence of fractal paths at a given point of space (spacetime). Structures are therefore identified, which evolve in a so-called ‘ scale space’ that can be described at the different levels of relativistic theories (Galilean, special relativistic, general relativistic).

The next step, which we consider here, consists of studying the effects on motion in standard space that are induced by these internal fractal structures.

Scale relativity, when it is applied to microphysics, allows us to recover quantum mechanics as a non-classical mechanics on a nondifferentiable, therefore fractal spacetime. Since we want to limit our study to the basic postulates of nonrelativistic quantum mechanics (first quantization), we focus our attention on fractal power law dilations with a constant fractal dimension DF = 2, which means to work in the framework of ‘ Galilean’ scale relativity.

Now, we come to a rather subtle issue. What is the set of postulates needed to completely describe the quantum-mechanical theory? It is all the more tricky to answer this question that some of the postulates usually presented as such in the literature can be derived from others.

THE POSTULATES OF QUANTUM MECHANICS

The postulates listed below are formulated within a coordinate realization of the state function, since it is in this representation that their scale relativistic derivation is the most straightforward. Their momentum realization can be obtained by the same Fourier transforms which are used in standard quantum mechanics, as well as the Dirac representation, which is another mathematical formulation of the same theory, can follow from the definition of the wavefunctions as vectors of a Hilbert space upon which act Hermitian operators representing the observables corresponding to classical dynamical quantities.

The set of statements we find in the literature as ‘ postulates’ or ‘ principles’ can be split into three subsets: the main postulates which cannot be derived from more fundamental ones, the secondary postulates which are often presented as ‘ postulates’ but can actually be derived from the main ones, and then statements often called ‘ principles’ which are well known to be as mere consequences of the postulates.

1. MAIN POSTULATES

1. Complex state function. Each physical system is described by a state function which determines all can be known about the system. The coordinate realization of this state function, the wavefunction is an equivalence class of complex functions of all the classical degrees of freedom generically noted r, of the time t and of any additional degrees of freedom such as spin s which are considered to be intrinsically quantum mechanical.

Two wavefunctions represent the same state if they differ only by a phase factor (this part of the ' postulate' can be derived from the Born postulate, since, in this interpretation, probabilities are defined by the squared norm of the complex wavefunction and therefore the two wavefunctions differing only by a phase factor represent the same state). The wavefunction has to be finite and single valued throughout position space, and furthermore, it must also be a continuous and continuously differentiable function.

2. Schrodinger equation. The time evolution of the wavefunction of a non-relativistic physical system is given by the time-dependent Schrodinger equation

,

where the Hamiltonian Ä¤ is a linear Hermitian operator, whose expression is constructed from the correspondence principle.

3. Correspondence principle. To every dynamical variable of classical mechanics there corresponds in quantum mechanics a linear, Hermitian operator, which, when operating upon the wavefunction associated with a definite value of that observable (the eigenstate associated to a definite eigenvalue), yields this value times the wavefunction. The more common operators occurring in quantum mechanics for a single particle are listed below and are constructed using the position and momentum operators.

Position Multiply by

Momentum

Kinetic energy

Potential energy Multiply by

Total energy

Angular momentum

More generally, the operator associated with the observable A which describes a classically defined physical variable is obtained by replacing in the ‘ properly symmetrized’ expression of this variable the above operators for r and p. This symmetrization rule is added to ensure that the operators are Hermitian and therefore that the measurement results are real numbers.

However, the symmetrization (or Hermitization) recipe is not unique. As an example, the quantum-mechanical analogue of the classical product can be either or . The different choices yield corrections of the order of some ¯h power and, in the end, it is the experiments that decide which is the correct operator. This is clearly one of the main weaknesses of the axiomatic foundation of quantum mechanics, since the ambiguity begins with second orders, and therefore concerns the construction of the Hamiltonian itself.

4. Von Neumann’s postulate. If a measurement of the observable A yields some value ai , the wavefunction of the system just after the measurement is the corresponding eigenstate (in the case that ai is degenerate, the wavefunction is the projection of Ïˆ onto the degenerate subspace).

5. Born’s postulate: probabilistic interpretation of the wavefunction. The squared norm of the wavefunction | Ïˆ| 2 is interpreted as the probability of the system of having values (r, s) at time t. This interpretation requires that the sum of the contributions | Ïˆ| 2 for all values of (r, s) at time t be finite, i.

e., the physically acceptable wavefunctions are square integrable. More specifically, if Ïˆ(r, s, t) is the wavefunction of a single particle, is the probability that the particle lies in the volume element located at r at time t. Because of this interpretation and since the probability of finding a single particle somewhere is 1, the wavefunction of this particle must fulfil the normalization condition

2. SECONDARY POSTULATES

One can find in the literature other statements which are often presented as ‘ postulates’ but which are mere consequences of the above five ‘ main’ postulates. We examine below some of them and show how we can derive them from these ‘ main’ postulates.

1. Superposition principle. Quantum superposition is the application of the superposition principle to quantum mechanics. It states that a linear combination of state functions of a given physical system is a state function of this system. This principle follows from the linearity of the Ä¤ operator in the Schrodinger equation, which is therefore a linear second order differential equation to which this principle applies.

2. Eigenvalues and eigenfunctions. Any measurement of an observable A will give as a result one of the eigenvalues a of the associated operator , which satisfy the equation

3. Expectation value. For a system described by a normalized wavefunction Ïˆ, the expectation value of an observable A is given by

This statement follows from the probabilistic interpretation attached toÏˆ, i. e., from Born’s postulate.

4. Expansion in eigenfunctions. The set of eigenfunctions of an operator forms a complete set of linearly independent functions. Therefore, an arbitrary state Ïˆ can be expanded in the complete set of eigenfunctions of (Ïˆn = anÏˆn), i. e., as

where the sum may go to infinity. For the case where the eigenvalue spectrum is discrete and non-degenerate and where the system is in the normalized state Ïˆ, the probability of obtaining as a result of a measurement of A the eigenvalue an is | cn| 2. This statement can be straightforwardly generalized to the degenerate and continuous spectrum cases.

Another more general expression of this postulate is ‘ an arbitrary wavefunction can be expanded in a complete orthonormal set of eigenfunctions Ïˆn of a set of commuting operators An’. It writes

while the statement of orthonormality is

where is the Kronecker symbol.

5. Probability conservation. The probability conservation is a consequence of the Hermitian property of Ä¤. This property first implies that the norm of the state function is time independent and it also implies a local probability conservation which can be written (e. g., for a single particle without spin and with normalized wavefunction Ïˆ) as

where

6. Reduction of the wave packet or projection hypothesis. This statement does not need to be postulated since it can be deduced from other postulates. It is actually implicitly contained in von Neumann's postulate.

3. DERIVED PRINCIPLES.

1. Heisenberg's uncertainty principle. If P and Q are two conjugate observables such that their commutator equals iâ„, it is easy to show that their standard deviations P and Q satisfy the relation

whatever the state function of the system. This applies to any couple of linear (but not necessarily Hermitian) operators and, in particular, to the couples of conjugate variables: position and momentum, time and energy. Moreover, generalized Heisenberg relations can be established for any couple of variables.

2. The spin-statistic theorem. When a system is composed of many identical particles, its physical states can only be described by state functions which are either completely antisymmetric (fermions) or completely symmetric (bosons) with respect to permutations of these particles, or, identically, by wavefunctions that change sign in a spatial reflection (fermions) or that remain unchanged in such a transformation (bosons). All half-spin particles are fermions and all integer-spin particles are bosons.

Demonstrations of this theorem have been proposed in the framework of field quantum theory as originating from very general assumptions. The usual proof can be summarized as follows: one first shows that if one quantizes fermionic fields (which are related to half-integer spin particles) with anticommutators one gets a consistent theory, while if one uses commutators, it is not the case; the exact opposite happens with bosonic fields (which correspond to integer spin particles), one has to quantize them with commutators instead of anticommutators, otherwise one gets an inconsistent theory. Then, one shows that the (anti)commutators are related to the (anti)symmetry of the wavefunctions in the exchange of two particles. However, this proof has been claimed to be incomplete but more complete ones have been subsequently proposed.

3. The Pauli exclusion principle. Two identical fermions cannot be in the same quantum

state. This is a mere consequence of the spin-statistic theorem.

SCIENCE IN THE HOLY QUR'AN

Al-Mighty Allah has given a lot of sign; about 1400 years ago regarding the movement of planets and stars in the Holy Qur'an. It is depends on us whether to sit down and relax or to seek the wonder of Allah's creation.

Surah Al ' Imran verse 27:

" You make the night to enter into the day, You make the day to enter into the night (i. e. increase and decrease in the hours of the night and the day during winter and summer), and You bring the living out of the dead, and You bring the dead out of the living. And you give wealth and sustenance to whom You will, without limit (measure or account)"

also in Surah Al-Anbiya' verse 33:

“ And He it is Who has created the night and the day, and the sun and the moon,

each in an orbit floating”

Another one is in Surah Yasin verse 40:

“ It is not for the sun to overtake the moon nor does the night outstrip the day.

They all float, each in an orbit”

Titius-Bode Law

http://milesmathis. com/bode. jpg

Bode’s Law, also known as the Titius-Bode Law is one of the most famous unexplained laws in the Solar System. The Titius-Bode Law or Rule is the observation that orbits of planets in the solar system, the distances of the planets from the Sun follow a simple arithmetic rule quite closely. The relationship was first pointed out by Johann D. Titius in 1766 and was formulated as a mathematical expression by J. E. Bode in 1778.

The first mention of a series approximating Bode’s Law is found in David Gregory’s “ The Elements of Astronomy”, published in 1715. In it, he says, “…supposing the distance of the Earth from the Sun to be divided into ten equal parts, of these the distance of Mercury will be about four, of Venus seven, of Mars fifteen, of Jupiter fifty two, and that of Saturn ninety five” A similar sentence, likely paraphrased from Gregory, appears in a work published by Christian Wolff in 1724.

Titius and Bode experimented with my formulas until they found one that closely fit the orbital profile of our solar system. It was a great achievement for their time, but does not accurately predict all planetary orbits in this, or any solar system in the universe. It was a mathematical representation of what he observed in their point in time.

The law relates the mean distances of the planets from the sun to a simple mathematic progression of numbers. Translated into astronomical units (AU), where one AU is the mean distance of the Earth from the Sun, the law amounts to this. Make a sequence of numbers:

0, 3, 6, 12, 24…

With the exception of the first number, the other are simple twice the value of the preceding number.

Add 4 to each number:

4, 7, 10, 16, 28…

Then divide by 10.

The law can be written as

a = (n + 4) / 10

where n= 0, 3, 6, 12, 24…

The modern formulation is that the mean distance a of the planet from the Sun is, in astronomical units (AUearth = 147. 597 * 106 km):

a = 0. 4 + 0. 3 * k

where k = 0, 1, 2, 4, 8, 16… (sequence of powers of 2 and 0).

There is no solid theoretical explanation of the Titius-Bode Law.

Distance from Sun (AU)

Double

x

(x +4) / 10

Mercury

0. 387

0. 25

0

0. 4

Venus

0. 723

0. 5

3

0. 7

Earth

1

1

6

1

Mars

1. 524

2

12

1. 6

(Ceres)

2. 767

4

24

2. 8

Jupiter

5. 203

8

48

5. 2

Saturn

9. 539

16

96

10

(Uranus)

19. 19

32

192

19. 6

(Neptune)

30. 06

64

384

38. 8

(Pluto)

39. 53

128

768

76. 4

Noted that Ceres is the asteroid belt.

http://www. astro. cornell. edu/academics/courses/astro2201/images/bodes_moons. gif

All well and good, except that there was a big gap between Mars and Jupiter. Titius and Bode decided to skip a number, making Jupiter a particularly good fit. This law was sometimes taken to predict that a planet would be found between Mars and Jupiter. Within a few years (1781), Uranus was discovered by Sir William Herschel, and it fit right into the law. This discovery made the law respectable, and the hunt for the missing planet began.

In 1801, Giuseppe Piazzi discovered the minor planet Ceres, at just the right distance. Ceres was incredibly tiny for a planet. To date, more than 9000 minor planets (asteroids) have been discovered. At first it was thought that a planet was destroyed by a collision, at the distance from the Sun. Now it is thought that the gravity of Jupiter prevented planet from forming the fragments there.

The hypothesis correctly predicted the orbits of Ceres and Uranus, but failed as a predictor of Neptune and Pluto's orbit. The first explanation is just a guess, but it is a bad guess since orbital resonances have been given to gravity, but no one has ever shown a mechanical cause of any " gravitational resonance". Resonances cannot be caused by gravity, and no one in history has shown that they can.

http://upload. wikimedia. org/wikipedia/commons/thumb/8/8e/Titius-Bode_law. svg/350px-Titius-Bode_law. svg. png

Comparison of Bode's Law with Actual Distances

Bode's Law does become more inaccurate as we move out to the margins of the Solar system. Perhaps one reason for this is that it does not take into account a planet's mass. More recent versions of the law have been elaborated during the XX sec., as for example the Blagg Law (1913) and the Richardson Law (around 1943).

In these last versions the law is able to describe not only the planetary distances within the solar system, including planets like Neptune and Pluto, but also can be successfully applied to the systems of satellites orbiting Jupiter, Saturn and Uranus. The agreement between the predicted and the observed distances of the various satellites from the central body is really astonishing, of the order of a few percents.

The main feature shared by these modern versions of the Titius-Bode Law is that the rule can be expressed, if we neglect second order corrections, by an exponential relation as r = ae2Î» n,

where the factor 2 is introduced for convenience reasons and n = 1, 2, 3, …

For the Solar system we have

2Î» = 0. 53707, e2Î» â‰ƒ 1. 7110,

a = 0. 21363 A. U.

The amazing thing found by Blagg was that the geometric progression ratio e2Î» is roughly the same both for the Solar system, and also for the satellite systems of Jupiter (e2Î» â‰ƒ 1. 7277), Saturn (e2Î» â‰ƒ 1. 5967), Uranus (e2Î» â‰ƒ 1. 4662). Of course the parameter a, which is linked to the radius of the first orbit, will take case by case the opportune values.

A plenty of theories have been developed during the last 240 years in order to explain the Titius-Bode Law. There have been dynamical models connected with the theory of the origin of the Solar system, electromagnetic theories, gravitational theories, nebular theories.

QUANTUM APPROACH OF PLANETARY ORBIT DISTANCE

It is known that quantum mechanics exhibits fractality at dF = 2, and an extensive report has been written on this subject. Moreover, a fractal solution of time-dependent Schrodinger equation has been suggested some time ago by Datta (1997). On the other side, if one takes a look at planetesimals in the case of planetary system formation, interstellar gas and dust in the case of star formation, the description of the trajectories of these bodies is in the shape of non-differentiable curves, and we obtain fractal curves with fractal dimension 2.

This coincidence between fractality of quantum mechanics and fractal dimension of astrophysical phenomena seems to suggest that we can expect to use quantum mechanical methods such as wave mechanics and periodic orbit quantization to analyze astrophysical phenomena.

BOHR MODEL OF THE HYDROGEN ATOM

The electron orbits in the Bohr model for the hydrogen atom are supposed circular (this will be held for planetary orbits also). The two main equations are the equation for the force (i. e. the equation of motion)

where m and e are the mass and charge of the electron; and the quantization condition on the (z-component) of the angular momentum

In the Bohr model, all the orbits belong to the same plane, and this is also taken for true in the planetary models. From the two equations above, one easily derives

The first equation is the law of electron distance from the nucleus in the Bohr model. With this law, from the classical expression for the total energy we get the energy spectrum of the bound orbits.

MODEL a la BOHR FOR A PLANETARY SYSTEM

It is a model for the “ quantization” of a planetary system. The model acquires its discrete, or “ quantum”, properties from a modification of the Bohr quantization rule for the angular momentum. The equations here proposed, for a generic planet of mass m, orbiting a central body of mass M, are

where n = 1; 2; 3; : : : and s is a constant. Some comments are immediately required:

Because of the principle of equivalence the masses m on the LHS and on the RHS of eq. (3) cancel out each other.

The constant s in the RHS of the second of the equation has the dimensions of an action per unit mass. It plays the role of Ñ› and it must be understood as an action typical of the planetary system under consideration. It is not possible to use Ñ› itself, because this would fix the wrong initial radius in the Titius-Bode law, that is the constant in .

The constant Î» is the one obtained from the observation (2Î» = 0. 53707 for the Sun, 2Î» = 0. 54677 for Jupiter, 2Î» = 0. 46794 for Saturn, 2Î» = 0. 38271 for Uranus).

In the second of the equation we quantize the angular momentum per unit mass. This is somewhat a consequence of the principle of equivalence. If we did not do so, we would obtain a law for where the scale of distance changes from a planet to another, as the planetary masses change. We should in fact remind that not all the planets have the same mass, as instead the electrons have.

From the equation one immediately gets

which is the Titius-Bode law if we identify

We can also compute the energy spectrum for the i-th planet from the equation above

where n = 1, 2, 3,…

As we see, the energy of the i-th planet is not properly quantized by itself. This is because the mass changes in general with the planet, and this would imply different sets of energy levels for different planets. Instead, the energy per unit mass

is exactly quantized, i. e. it is a quantity which depends on only (apart from the general constants). Therefore, the energy levels per unit mass are valid for the whole set of planetary orbits.

Also here some comments are needed, in order to complete the explanation given before.

The constant can be computed in terms of the mass of the central body and of the parameter (remind that the radius of the first orbit is)

This constant is not the same for all the planetary systems (Sun, Jupiter, Saturn, Uranus). In fact, if it were so, this would imply that the parameter should be in inverse proportion to the mass of the central body, which is not true. Therefore the constant is not universal, like â„, but it depends on the planetary system under consideration.

If the quantization rule had been written with the mass of the planet, namely

this would have implied for

that is, the parameter would change from planet to planet, contrary to the generality of the Titius-Bode law, which maintains the same parameters within the same planetary system.

The quantization rule does not allow us to compute some known experimental constant, as instead it happens in the case of the Bohr model of the hydrogen atom, where the Rydberg constant was computed from the model. Nevertheless, a semiclassical quantum language is introduced.

It should be noted also that a condition like presents some difficulties for a wave interpretation. In fact, the Bohr quantization condition for the H-atom can be easily interpreted in terms of de Broglie's stationary matter waves

while and is an integer. The quantity can be interpreted as a wavelength of a stationary wave just because n is an integer. The analog condition in our model yields (for a given planet of mass)

The number is not an integer, in general. Hence is difficult to interpret as a wavelength of a stationary wave.

Moreover, even using a de Broglie-like relation the wavelength of the matter wave associated to the planet has to be of the same order of the parameter a. In fact

In principle, this could create interference phenomena in the probability amplitudes, but these phenomena are not observed at classical level in planetary systems. We must therefore postulate a unknown mechanism which suppresses these interferences of probability waves.

From this last observation, it appears clearly that the model we are building is not actually a quantum model, in the sense of ordinary quantum theory. Rather, it resembles some quantum-like properties, mainly the quantization of the orbital radii.

In spite of all these difficulties, we shall see that a wave equation can still be written in coherence with the condition, and this wave equation will be able to describe the main features of planetary systems.

BOHR-SOMMERFELD QUANTIZATION RULES

Periodic orbit quantization as suggested by Bohr-Sommerfeld is used in order to analyze quantization in astrophysical phenomena, which is a planetary orbit distance. It is known that Bohr-Sommerfeld quantization rules can be deduce from Burger's turbulence, and such an approach leads to a subfield in physics known as quantum turbulence. Therefore turbulence phenomena can also yield quantization, which also seems to suggest that turbulence and quantized vortice is a fractal phenomenon.

Bohr-Sommerfeld quantization rules for planetary orbit distances have the same result with a formula based on macroscopic Schrodinger equation.

Begin with Bohr-Sommerfeld's conjecture of quantization of angular momentum. For the wavefunction to be well defined and unique, the momenta must satisfy Bohr-Sommerfeld's quantization condition:

,

for any closed classical orbit Đ". For the free particle of unit mass on the unit sphere the left-hand side is:

,

Where T = is the period of the orbit. Hence the quantization rule amounts to quantization of the rotation frequency (the angular momentum): Ï‰ = .

Then we can write the force balance relation of Newton’s equation of motion:

Using Bohr-Sommerfeld’s hyphothesis of quantization of angular momentum, a new constant g was introduced:

.

Just like in the elementary Bohr theory (just before Schrodinger), this pair of equations yields a known simple solution for the orbit radius for any quantum number of the form:

,

or

, *

Where 0 represents orbit radii (semimajor axes), quantum number (= 1, 2, 3, …), Newton gravitation constant, and mass of the nucleus of orbit, and specific velocity, respectively. In equation above we denote:

The value of m and g in equation above are adjustable parameters.

Interestingly, we can remark here that equation * is exactly the same with what is obtained by Nottale using his Schrodinger-Newton formula. Therefore here we can verify that the result is the same, either one uses Bohr-Sommerfeld quantization rules or Schrodinger-Newton equation. The applicability of equation * includes that one can predict new exoplanets (extrasolar planets) with remarkable result.

Furthermore, one can find a neat correspondence between Bohr-Sommerfeld quantization rules and motion of quantized vortice in condensed-matter systems, especially in superfluid helium. In this regards, a fractional Schrodinger equation has been used to derive two-fluid hydrodynamical equations for describing the motion of superfluid helium in the fractal dimension space. Therefore, it appears that fractional Schrodinger equation corresponds to superfluid helium in fractal dimension space.

Therefore, we can conclude that while our method as described herein may be interpreted as an oversimplification of the real planetary migration process which took place sometime in the past, at least it could provide us with useful tool for prediction. Now we also provide new prediction of other planetoids which are likely to be observed in the near future (around 113. 8AU and 137. 7 AU). It is recommended to use this prediction as guide to finding new objects (in the inner Oort Cloud).

What we would like to emphasize here is that the quantization method does not have to be the true description of reality with regards to celestial phenomena. As always this method could explain some phenomena, while perhaps lacks explanation for other phenomena. But at least it can be used to predict something quantitatively, i. e. measurable (exoplanets, and new planetoids in the outer solar system etc.). In the mean time, a correspondence between Bohr-Sommerfeld quantization rules and Gutzwiller trace formula has been shown in, indicating that the Bohr-Sommerfeld quantization rules may be used also for complex systems. Moreover, a recent theory extends Bohr-Sommerfeld rules to a full quantum theory.

MAN BEHIND THE SCENE

JOHANN ELERT BODE

bode2. GIF 200px-Johann_Daniel_Titius. jpg

Johann Elert Bode Johann Daniel Titius

Johann Elert Bode was born on January 19, 1747 in Hamburg, Germany. He became a member of the Berlin Academy of Sciences and director of the Berlin Observatory. Together with Johann Heinrich Lambert, he founded the German language ephemeris, the Astronomisches Jahrbuch oder Ephemeriden [Astronomical Yearbook and Ephemeris] in 1774, later called simply Astronomisches Jahrbuch and then Berliner Astronomisches Jahrbuch, which he continued to publish until his death in 1826. In 1774, Bode started to look for nebulae and star clusters in the sky, and observed 20 of them in 1774-5. Among them are three original discoveries, M81 and M82 which he both discovered on December 31, 1774, and M53, discovered on February 3, 1775, as well as a newly cataloged asterism.

Bode merged his discoveries and other observed objects with those from other catalogs he had access, namely the exis