# MIRACULOUS UNIVERSE

Farin Zokaee

IKIU, Qazvin, Iran

Miroslaw Kozlowski

Warsaw University, Poland

Abstract

There have been eras in which an educated man could only live up to his standard if he were at the same time a poet and a philosopher and an experimental or mathematical researcher. I argue that it is a time to come back and look for the physics, mathematics and botany - why not, from the different perspective-Fibonacci series

*Number rules the Universe*

Pythagoreans ( ca. 530-510 B.C)

## Introduction

*In the preface to the first ( German) Edition of the book "Collected Papers on the Quantum Mechanics" , Zurich 1926 [1] E Schrodinger wrote: a young lady friend recently remarked to the Author ( Schrodinger) "When you began this work you have no idea that anything so clever would come out of it , had you "*

This unorthodox comparison between scientific and purely aesthetic communication is able to provide a first clue towards criteria distinguishing good fantasy in science from bad. Science as a crowning intellectual achievement is essentially disciplined; but it is not always easy to realize the need for an equally severe discipline in the domain of the imaginative arts. Imagination and intellect, however, are not always in antithesis to one another. Reason implies not only a capacity for logical sequence of argument, but also a sensitivity to balance and contrast a trained intuition without untrained intuition s arrogant claims to short-circuit the discipline of the intellect When the imagination thus becomes disciplined, and undertakes the severest obligations inherent in perfecting the pattern of an art-form, it has taken the essential step towards security against the weaknesses of fantasy. Structure as disciplined as that of a mathematical argument is capable of transfiguring the merest nonsense into divine nonsense.

Modern physics might well be regarded as study of the structure of matter and of the behavior of radiation. A criterion for success pursuit of the former study demands that analysis of material structures into atoms and molecules, and of these into nuclei with groups of associated electrons, must be capable of giving rise to verifiable prediction of the bulk properties of matter, mechanical, thermal, chemical, and electrical. Criteria for theories as to the behaviour of radiation are that the phenomena of light, colour, radio, X-rays, heat radiation, must become explainable by some single mechanism; the only mechanism so far successful has been the propagation of electric and magnetic quantities with a unique and universal speed which is accurately measurable. This speed exceeds that of the fastest material particles, as a limit towards which the latter can only approach. Within the scope of these two most general schemes, the structure of matter has been a prime example of pattern since D Mendeleyev in XIX century arranged all the then known chemical species or elements into a two- dimensional framework. Written down in a table of horizontal rows and vertical columns, the chemical elements were found to repeat certain properties periodically, much as the harmonic properties of the notes on a piano keyboard repeat themselves at intervals of octaves. To form the gross substances which we distinguish by touch, smell, taste, etc., the affinities for chemical combining of atomic species are found to wax and wane with precise regularity throughout the periods of this table. The whole assemblage of empirically periodic patterns is now understood as manifesting the way in which successive electrons can become associated with atomic nuclei of definite mass: these additions proceed until one after another their possible federations into electrically and mechanically stable groups or sub-patterns are.

There have been eras in which an educated man could only live up to his standard if he were at the same time a poet and a philosopher and an experimental or mathematical researcher. E. Schrodinger is a good example. He attended a gymnasium , which emphasized the study of *Greek* and *Latin* classics**.** His book Nature and the Greeks published in 1948 is an elegant exposition of ancient physical theories and their relevance. Schrodinger wrote in 1925 an intensely account of his beliefs, *Seek for the Road*. The book was influenced by *Hinduism* and is an argument for the essential oneness of human consciousness.

**1. The beautiful mathematics / physics**

During my work as a lecturer in Physics Department [2] , Warsaw University I like very much the Kepler – Copernicus ( Kopernik in Polish)- Newton panorama of the planet moving. I started as usual with historical facts and write the basic equations. Considering the FQXI community I left of all steps and start from the equation :

$$\frac{d^2u}{d\Theta^2}+u=-\frac{m}{L^2}\frac{1}{u^2}F\left(\frac{1}{u}\right),$$
$$u=\frac{1}{r}. \qquad (1)$$

Equation 1 is the master equation which describes the movement of the body with mass m in the field of central forces F(1/u). We can imagine the following functions F(1/u)

$$F\left(\frac{1}{u}\right)=K_1u^{\pi},\quad K_2u^3,\quad K_3u^2,\quad K_4u^{0.64},\quad K_5u^{-4.62}. \qquad (2)$$

We can imagine the “other” universes for which the central forces have the different F(1/u). But can life be originated and developed in all these universes? This question is answered by the anthropic principle and will be discussed later on. For the moment we can say the following:macroscopic structure of the Universe we live in can be understood with just two forces: Newton and Coulomb. For both forces

$$F\left(\frac{1}{u}\right)=Ku^2. \qquad (3)$$

Why?

With the forces described by formula (3) we obtain for equation (1)

$$\frac{d^2u}{d\Theta^2}+u=-\frac{Km}{L^2}. \qquad (4)$$

with constant on the right hand side of the equation- only for quadratic in u forces Only for that force! Can you imagine ! This is miracle, is not ?

This beautiful equation describes the classical motion of the planets, and electrons round the source of the force F = $Ku^2$. Moreover, the equation (4) in fact is the harmonic oscillator equation, which can be solved at once The solution to the eq. (4) can be written as

$$u = A\cos(\Theta - \Theta_0) - \frac{mK}{L^2}, \qquad (5)$$

or

$$r = \frac{1}{A\cos(\Theta - \Theta_0) - \frac{mK}{L^2}}. \qquad (6)$$

Equation (6) describes the conic curves: ellipse, parabola and hyperbola depending on constants A, $\Theta_0$, m, K and L. We can choose our coordinate axes so that $\Theta_0 = 0$ to simplify things just a little:

$$r = \frac{1}{A\cos\Theta - \frac{mK}{L^2}}. \qquad (7)$$

This is a conic sections. From plane geometry, any conic section can be written as

$$r = r_0 \frac{1+e}{1+e\cos\Theta}, \qquad (8)$$

where *e* is called the eccentricity of the orbit.

**Other dimensions**

In any higher organism, a large number of cells must be inter-counted by nerve fibers. If space had only two dimensions, an organ-ism could be only a two-dimensional configuration and its nerve paths would cross. At the intersections, the nerves would have to penetrate each other, for absence of a third dimension would not permit a fiber to be led above or below another one. As a consequence nerve impulses would mutually interfere. The existence of a highly developed organism having many non-intersecting nerve paths in thus possible only in a space having at least three dimensions.

As we know both the Newtonian gravitational force and electrostatic force can be described in the three dimensional space (formula (9))

$$F = \frac{K}{r^2}, \qquad n = 3, \tag{9}$$

where n is the number of dimension of space. For $n \neq 3$ the natural generalization of formula (1.180) is

$$F = (n-2)\frac{K}{r^{n-1}}, \qquad n \neq 2. \tag{10}$$

The impossibility of stable planet orbit for n > 3 can be seen in an elementary way. Let m be the mass of planet and L angular momentum (which is constant for the central force (1.181))

$$L = mr^2\dot{\Theta} = \text{const.} \tag{11}$$

The gravitation potential for the conservative force  will be

$$V = -\frac{K}{r^{n-2}}. \tag{12}$$

At the extreme distances from the central body for a planet with mass m, we have

$$\frac{dr}{dt} = 0. \tag{13}$$

The kinetic energy T at such points is then $T = \frac{p^2}{2m} = \frac{1}{2}mr^2\dot{\Theta}^2,$ (14)

which by equation (15) becomes

$$T = \frac{L^2}{2mr^2}. \qquad (16)$$

By conservation of mechanical energy T + V = constant, or

$$\frac{L^2}{2mr_1^2} - \frac{K}{r_1^{n-2}} = \frac{L^2}{2mr_2^2} - \frac{K}{r_2^{n-2}}, \qquad (17)$$

where $r_1$ is the minimum distance from the central body and $r_2$ is the maximum distance, perihelion and aphelion respectively.

The equation (17) shows that for n = 4 there can be a finite, positive solution only if $r_2 > r1$ For n > 4 it can be shown that an orbit in which r oscillates between two extremes is likewise ruled out.

In general the centripetal force in a circular orbit is

$$F_c = mr^2\dot{\Theta}^2. \qquad (18)$$

Using Eq. (1.182) this becomes

$$F_c = \frac{L^2}{mr^3}. \qquad (19)$$

In the actual eccentric orbit, the attractive force must be less than this centripetal force at perihelion, for then the planet is about to move outward. At aphelion, it is just the other way around.

These conditions can be expressed respectively by the following inequalities

(20)

$$F < F_c$$

$$\frac{(n-2)K}{r_1^{n-1}} < \frac{L^2}{mr_1^3} \quad \text{or} \quad \frac{K}{r_1^{n-2}} < \frac{L^2}{(n-2)mr_1^2},$$

(21)

$$F > F_c$$

$$\frac{(n-2)K}{r_2^{n-1}} > \frac{L^2}{mr_2^3} \quad \text{or} \quad \frac{K}{r_2^{n-2}} > \frac{L^2}{(n-2)mr_2^2}. \qquad (22)$$

$$\frac{L^2}{2mr_1^2} - \frac{L^2}{(n-2)mr_1^2} < \frac{L^2}{2mr_2^2} - \frac{L^2}{(n-2)mr_2^2}. \qquad (23)$$

and

$$\frac{L^2}{mr_1^2}\left(\frac{1}{2} - (n-2)^{-1}\right) < \frac{L^2}{2mr_2^2}\left(\frac{1}{2} - (n-2)^{-1}\right). \qquad (24)$$

This relation obviously cannot be true for n = 4, for then each of the brackets becomes zero. Remembering that $r_2 > r_1$ it also cannot be true for any n > 4, which makes the values of the brackets less than ½ .

Thus, the existence of an elliptic orbit for $n \geq 4$ is ruled out. The results for planetary orbits are collected in Table 1.

1. Planetary orbits

| Phenomena | Cases thus excluded | |
|---|---|---|
| Bio-topology (existence of a | n <3 | |
| Stability of planetary orbits | n >3<br>n = 4<br>n >4 | Possible only for circular orbit<br>Excluded if the potential is too vanish at $\infty$ |

In conclusion, it may be said that stable elliptical planetary orbits can exist and support the existence of the highly developed organisms only in three dimensional space. The second miracle !

**The Fibonacci series**

We have the series of numbers:

- **2** - Gravity and electromagnetic fields,
- **3** – Structure of the Universe, the next must be 5- I suspect!
- **5**-. This is the dimension of space time in which gravity and electromagnetic can be unified ( Kaluza-Klein scenario). Enough is enough! But wait !What means 8?
- **8** -N = 8 Supergravity in 4 Dimensions**. and
- In botany the phenomenon of *phylotaxis* is well known: The leafs are placed according to rules of Fibonacci series!*** Does the flowers knows the mathematics? Certainly no !They do not attend *maths or physics* classroom. Now we have real problem, who teaches plants and what about *the unreasonable effectiveness of mathematics in physics , botany, medicine* ... Take a radical step. There are not medicine, botany, mathematics, physics.. as the separated part of SCIENCE. . The Universe has only four pillars with N= 2,3,5,8 respectively , which can be seen may be at the Level IV [3]. It is worth to add that the ancient Egyptians depicted a cosmos with a heavenly roof " supported by 4 women at the cardinal points"[4]

---

** More generally the term may refer to an eight-dimensional vector space over any field, such as an eight-dimensional complex vector space, which has 16 real dimensions. It may also* *refer to an eight-dimensional manifold such as an 8-sphere, or a variety of other geometric constructions*

***N=8 Supergravity is the most symmetric quantum field theory which involves gravity and a finite number of fields. It can be found from a dimensional reduction of 11D supergravity by making the size of 7 of the dimensions go to zero. It has 8 supersymmetries which is the most any gravitational theory can have since there are 8 half-steps between spin 2 and spin -2. (A graviton has the highest spin in this theory which is a spin 2 particle). More supersymmetries would mean the particles would have superpartners with spins higher than 2. The only theories with spins higher than 2 which are consistent involve an infinite number of particles (such as String Theory).*

****The beautiful arrangement of leaves in some plants, called phyllotaxis, obeys a number of subtle mathematical relationships. For instance, the florets in the head of a sunflower form two oppositely directed spirals: 55 of them clockwise and 34 counterclockwise. Surprisingly, these numbers are consecutive Fibonacci numbers. The ratios of alternate Fibonacci numbers are given by the convergents to* $\phi^{-2}$, *where* $\phi$ *is the golden ratio, and are said to measure the fraction of a turn between successive leaves on the stalk of a plant: 1/2 for elm and linden, 1/3 for beech and hazel, 2/5 for oak and apple, 3/8 for poplar and rose, 5/13 for willow and almond, etc. A similar phenomenon occurs for daisies, pineapples, pinecones, cauliflowers, and so on. Lilies, irises, and the trillium have three petals; columbines, buttercups, larkspur, and wild rose have five petals; delphiniums, bloodroot, and cosmos have eight petals; corn marigolds have 13 petals; asters have 21 petals; and daisies have 34, 55, or 89 petals--all Fibonacci numbers.*

References

[1] Erwin Schrodinger Collected papers on Wave Mechanics, AMS Chelsea Publishing , USA, 1982

[2] M.Kozlowski, PHYSICS . Lecture Notes Science Teacher College, I-Proclaim Press USA, 2012

[3]  Max Tegmark, Our Mathematical Universe: My Quest for the Ultimate Nature of Reality

A Knopf, 2014 USA

[4] E.T. Bell, Numerology,  vol.3 Hyperion Press, USA , 1933