Exploration

Hidden Order

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Abstract

Universe is organized according to a few simple receipts. One of them is Euler-Ramanujan formula.The formula describes the energies of bounded systems. In the paper, we discuss the formula for bounded states of atoms (harmonic oscillator approximation).

Keyword: Hidden order, Universe, Euler-Ramanujan formula, energy, bounded system, harmonic oscillator.

> *Let me say at the outset, that in this discourse, I am opposing not a few special statements of quantum mechanics held today, I am opposing as it were the whole of it, I am opposing its basic views that have been shaped 25 years ago, when Max Born put forward his probability interpretation, which was accepted by almost everybody. It has been worked out in great detail to form a scheme of admirable logical consistency that has been inculcated ever since to every young student of theoretical physics.*
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> *The view I am opposing is so widely accepted, without ever being questioned, that I would have some difficulties in making you believe that I really, really consider it inadequate and wish to abandon it. It is, as I said, the probability view of quantum mechanics. You know how it pervades the whole system. It is always implied in everything a quantum theorist tells you. Nearly every result he pronounces is about the probability of this* or *that or that . . . happening—with usually a great many alternatives. The idea that they be not alternatives but* all *really happen simultaneously seems lunatic to him, just* impossible. *He thinks that if the laws of nature took* this *form for, let me say, a quarter of an hour, we should find our surroundings rapidly turning into a quagmire, or sort of a featureless jelly or plasma, all contours becoming blurred, we ourselves probably becoming jelly fish. It is strange that he should believe this. For I understand he grants that unobserved nature does behave this way—namely according to the wave equation*. E, Schrodinger, 1952, Colloqium July 195, in The Interpretation of Quantum Mechanics , Ox Bow Press.

1. Introduction

Consciousness phenomenon is the subquantum process (cosmic consciousness) generated out of spacetime and carried by consciousness quanta.The mass of the quanta of consciousness is of the order 10^{-15} eV, well beneath of mass of CBR quanta = 10^{-4} eV The emission and absorption of consciousness quanta is the consciousness phenomenon. The results published by B.Riemann and S. Ramanujan are the examples of out of spacetime source of our consciousness (mathematics).

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In 1859, B. Riemann published paper in which he defined Riemann function (Edwards,1974)

$$\prod(s) = \int_0^\infty e^{-s} x^s dx, (s > -1)$$

$$\zeta(x) = \frac{\prod(-s)}{2\pi i} \int_{-\infty}^{\infty} \frac{(x)^s}{e^x - 1} \frac{dx}{x}$$

The epoch-making 8-pages paper ”On the Number of Primes Less Than a Given Magnitude” inaugurated the revolution in number theory and recently in theoretical physics: quantum mechanics and cosmology. In the paper we for the time consider the application of Zeta function to the study of the human consciousness and especially , time recognition. We argue that time life of the Universe and the consciousness can be described as the product of Zeta function and Planck time. The possible scenario for the creation of consciousness is discussed.

The Zeta function - the dialogue between music and mathematics .During his years in Paris in the 1820s, Dirichlet had become fascinated by Gauss's great youthful treatise *Disquisitiones Aritlvneticae.* Although Gauss's book marked a beginning of number theory as an independent discipline, the book was difficult and many failed to penetrate the concise style Gauss preferred. Dirichlet, though, was more than happy to battle with one tough paragraph after another. At night he would place the book under his pillow in the hope that the next morning's reading would suddenly make sense. Gauss's treatise has been described as a 'book of seven seals', but thanks to the labours and dreams of Dirichlet, those seals were broken and the treasures within gained the wide distribution.

Dirichlet was especially interested in Gauss's clock calculator. In particular, he was intrigued by a conjecture that went back to a pattern spotted by Fermat. If you took a clock calculator with N hours on it and you fed in the primes, then, Fermat conjectured, infinitely often the clock would hit one o'clock. So, for example, if you take a clock with 4 hours there are infinitely many primes which Fermat predicted would leave remainder 1 on division by 4. The list begins 5, 13, 17, 29, . . .

In 1838, at the age of thirty-three, Dirichlet had made his mark in the theory of numbers by proving that Fermat's hunch was indeed correct. He did this by mixing ideas from several areas of mathematics that didn't look as if they had anything to do with one another. Instead of an elementary argument like Euclid's cunning proof that there are infinitely many primes, Dirichlet used a sophisticated function that had first appeared on the mathematical circuit in Euler's day. It was called the *zeta function,* and was denoted by the Greek letter ζ . The following equation provided Dirichlet with the rule for calculating the value of the zeta function when fed with a number x*:*

$$\zeta(x) = \frac{1}{1^x} + \frac{1}{2^x} + \frac{1}{3^x} + \ldots\ldots \frac{1}{n^x} + \ldots..$$

To calculate the output at x, Dirichlet needed to carry out three mathematical steps. First, calculate the exponential numbers 1^x, 2^x,3^x, n^x , . . . Then take the reciprocals of all the numbers produced in the first step. (The reciprocal of 2^x is $1/2^x$) Finally, add together all the answers from the second step.

It is a complicated recipe. The fact that each number 1, 2, 3,. . . makes a contribution to the definition of the zeta function hints at its usefulness to the number theorist. The downside comes in having to deal with an infinite sum of numbers. Few mathematicians could have predicted what a powerful tool this function would become as the best way to study the primes. It was almost stumbled upon by accident.

The origins of mathematicians' interest in this infinite sum came from music and went back to a discovery made by the Greeks. Pythagoras was the first to discover the fundamental connection between mathematics and music. He filled an urn with water and banged it with a hammer to produce a note. If he removed half the water and banged the urn again, the note had gone up an octave. Each time he removed more water to leave the urn one-third full, then one-quarter full, the notes produced would sound to his ear in harmony with the first note he'd played. Any other notes which were created by removing some other amount of water sounded in dissonance with that original note. There was some audible beauty associated with these fractions. The harmony that Pythagoras had discovered in the numbers 1, 1/21/3, 1/4, . . . made him believe that the whole universe was controlled by music, which is why he coined the expression "*the music of the spheres*".

Ever since Pythagoras' discovery of an arithmetic connection between mathematics and music, people have compared both the aesthetic and the physical traits shared by the two disciplines. The French Baroque composer Jean-Philippe Rameau wrote in 1722 that "*Not withstanding all the experience I may have acquired in music from being associated with it for so long, I must confess that only with the aid of mathematics did my ideas become clear."* Euler sought to make music theory *"part of mathematics and deduce in an orderly manner, from correct principles, everything which can make a fitting together and mingling of tones pleasing".* Euler believed that it was the primes that lay behind the beauty of certain combinations of notes.

Many mathematicians have a natural affinity with music. Euler would relax after a hard day's calculating by playing his clavier. Mathematics departments invariably have little trouble assembling an orchestra from the ranks of their members. There is an obvious numerical connection between the two given that counting underpins both. As Leibniz described it, "*Music is the pleasure the human mind experiences from counting without being aware that it is counting"'* But the resonance between the subjects goes much deeper than this.

Mathematics is an aesthetic discipline where talk of beautiful proofs and elegant solutions is commonplace. Only those with a special aesthetic sensibility are equipped to make mathematical discoveries. The flash of illumination that mathematicians crave often feels like bashing notes on a piano until suddenly a combination is found which contains an inner harmony marking it out as different.

G.H. Hardy wrote that he was 'interested in mathematics only as a creative art'. Even for the French mathematicians in Napoleon's academies, the buzz of doing mathematics came not from its practical application but from its inner beauty. The aesthetic experiences of doing mathematics or listening to music have much in common. Just as you might listen to a piece of music over and over and find new resonances previously missed, mathematicians often take pleasure in re-reading proofs in which the subtle nuances that make it hang together so effortlessly gradually reveal themselves. Hardy believed that the true test of a good mathematical proof was that 'the ideas must fit together in a harmonious way. Beauty is the first test: there is no permanent place in the world for ugly mathematics. For Hardy*, A mathematical proof should resemble a simple and clear-cut constellation, not a scattered Milky Way.*

Both mathematics and music have a technical language of symbols which allow us to articulate the patterns we are creating or discovering. Music is much more than just the minims and crochets which dance across the musical stave. Similarly, mathematical symbols come alive only when the mathematics is played with in the mind.

As Pythagoras discovered, it is not just in the aesthetic realm that mathematics and music overlap. The very physics of music has at its root the basics of mathematics. If you blow across the top of a bottle you hear a note. By blowing harder, and with a little skill, you can start to hear higher notes - the extra harmonics, the overtones. When a musician plays a note on an instrument they are producing an infinity of additional harmonics, just as you do when you blow across the top of the bottle. These additional harmonics help to give each instrument its own distinctive sound. The physical characteristics of each instrument mean that we hear different combinations of harmonics. In addition to the fundamental note, the clarinet plays only those harmonics produced by odd fractions: 1/3,1/5, 1/7, . . . The string of a violin, on the other hand, vibrates to create all the harmonics that Pythagoras produced with his urn - those corresponding to the fractions1/2,1/3,1/4….

Since the sound of a vibrating violin string is the infinite sum of the fundamental note and all the possible harmonics, mathematicians became intrigued by the mathematical analogue. The infinite sum 1 + 1/2 +1/3+1/4+. . . became known as the *harmonic series*. This infinite sum is also the answer Euler got when he fed the zeta function with the number $x = 1$. Although this sum grew only very slowly as he added more terms, mathematicians had known since the fourteenth century that eventually it must spiral off to infinity.

So the Zeta function must output the answer infinity when fed the number $x = 1$. If, however, instead of taking x = 1, Euler fed the zeta function with a number bigger than 1, the answer no longer spiralled off to infinity. For example, taking $x = 2$ means adding together all the squares in the harmonic series:

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + ...$$

This is a smaller number as it does not include all possible fractions found when $x = 1$. We are now adding only some of the fractions, and Euler knew that this time the smaller sum wouldn't spiral off to infinity but would home in on some particular number. It had become quite a challenge by Euler's day to identify a precise value for this infinite sum when .x = 2. The best estimate was somewhere around 8/5. In 1735, Euler wrote that 'So much work has been done on the series that it seems hardly likely that anything new about them may still turn up . . . *I, too, in spite of repeated effort, could achieve nothing more than approximate values for their sums*.'

Nevertheless, Euler, emboldened by his previous discoveries, began to play around with this infinite sum. Twisting it this way and that like the sides of a Rubik's cube, he suddenly found the series transformed. Like the colors on the cube, these numbers slowly came together to form a completely different pattern from the one he had started with. As he went on to describe, *'Now, however, quite unexpectedly, I have found an elegant formula depending upon the quadrature of the circle' - in modern parlance, a formula depending on the number* π *= 3.1415. . .*

By some pretty reckless analysis, Euler had discovered that this infinite sum was homing in on the square of π divided by 6:

$$1 + \frac{1}{4} + \frac{1}{9} + \frac{1}{16} + ... = \frac{\pi^2}{6}$$

The decimal expansion of $\frac{\pi^2}{6}$ like that of π , is completely chaotic and unpredictable. To this day, Euler's discovery of this order lurking in the number $\frac{\pi^2}{6}$ ranks as one of the most intriguing calculations in all of mathematics, and it took the scientific community of Euler's time by storm. No one had predicted a link between the innocent sum 1+1/4+1/9+1/16 +…. and the chaotic number π. This success inspired Euler to investigate the power of the zeta function further. He knew that if he fed the zeta function with any number bigger than 1, the result would be some finite number. After a few years of solitary study he managed to identify the output of the zeta function for every even number. But there was something rather unsatisfactory about the zeta function. Whenever Euler fed the formula for the zeta function with any number less than 1, it would always output infinity. For example, for $x = -1$ it yields the infinite sum 1 + 2 + 3 + 4 + . . . The function behaved well only for numbers bigger than 1.

Euler's discovery of his expression for $\frac{\pi^2}{6}$ in terms of simple fractions was the first sign that the zeta function might reveal unexpected links between seemingly disparate parts of the mathematical canon. The second strange connection that Euler discovered was with an even more unpredictable sequence of numbers.

S. Ramanujan notebooks (1910) and the power of the Brahmin network had secured Ramanujan a job as an accountant with the Port Authority in Madras. He had begun to publish some of his ideas in the *Journal of the Indian Mathematical Society*, and by now his name had come to the attention of the British authorities. C.L.T. Griffith, who worked at the College of Engineering in Madras, recognised that Ramanujan's work was that of a 'remarkable mathematician' but he felt unable to follow or criticise it. So he decided to get the opinion of one of the professors who had taught him as a student in London.

Without formal training, Ramanujan had evolved a very personal mathematical style. It is perhaps not surprising, then, that when Professor Hill of University College, London received Ramanujan's papers claiming to have proved that (Berndt,1985)

$$1 + 2 + 3 + 4 + \ldots = -1/12$$

he dismissed most of them as meaningless. Even to the untrained eye, this formula looks ridiculous. To add up all the whole numbers and get a negative fraction is clearly the work of a madman! 'Mr Ramanujan has fallen into the pitfalls of the very difficult subject of Divergent Series,' he wrote back to Griffith.

Ramanujan had recently been given a copy of Hardy's *Orders of Infinity* by Ganapathy Iyer, a Professor of Mathematics in Madras with whom he regularly discussed mathematics on the beach in the evenings. As he read Hardy, Ramanujan must have recognised that here at last was someone who might appreciate his ideas, but later he admitted that he had feared his infinite sums would prompt Hardy 'to point out to me the lunatic asylum as my goal'. Ramanujan was particularly excited by Hardy's statement that 'no definite expression has been found as yet for the number of prime numbers less than any given number'. Ramanujan had discovered an expression which he believed very nearly captured this number. He was very keen to find out what Hardy thought of his formula.

Hardy's first impression on finding in the morning post Ramanujan's envelope covered in Indian stamps was not immediately favorable. It contained a manuscript filled with wild, fantastic theorems about counting primes, alongside well-known results presented as if they were original discoveries. In the covering letter Ramanujan declared that he had 'found a function which exactly represents the number of prime numbers'. Hard) knew that this was a stunning claim, but no formula had been supplied. Worst of all - no proofs of anything! For Hardy, proof was everything. He once told Bertrand Russell across the high table at Trinity, 'If I could prove by logic that you would die in five minutes, I should be sorry you were going to die, but my sorrow would be very much mitigated by pleasure in the proof.'

According to C.P. Snow, Hardy, having quickly looked over Ramanujan's work, 'was not only bored, but irritated. It seemed like a curious kind of fraud.' But by the evening the wild theorems were beginning to work their magic, and Hardy summoned Littlewood for after-dinner discussions. By midnight they had cracked it. Hardy and Littlewood, equipped with the knowledge to decode Ramanujan's unorthodox language, could now see that these were not the outpourings of a crank but the works of a genius - untrained, but brilliant.

They both realized that Ramanujan's infinite sum was none other than the rediscovery of how to define the missing part of Riemann's zeta landscape. The clue to decoding Ramanujan's formula is to rewrite the number 2 as 1/(2''') (2^{-1} is another way of writing Applying the same trick to each number in the infinite sum. Hardy and Littlewood rewrote Ramanujan's formula as

$$1+2+3+4+\ldots=1+1/2^{-1}+3^{-1}+4^{-1}+\ldots=-1/12$$

Staring them in the face was Riemann's answer to how to calculate the zeta function when fed with the number — 1. With no formal training, Ramanujan had run the whole race on his own and reconstructed Riemann's discovery of the zeta landscape.

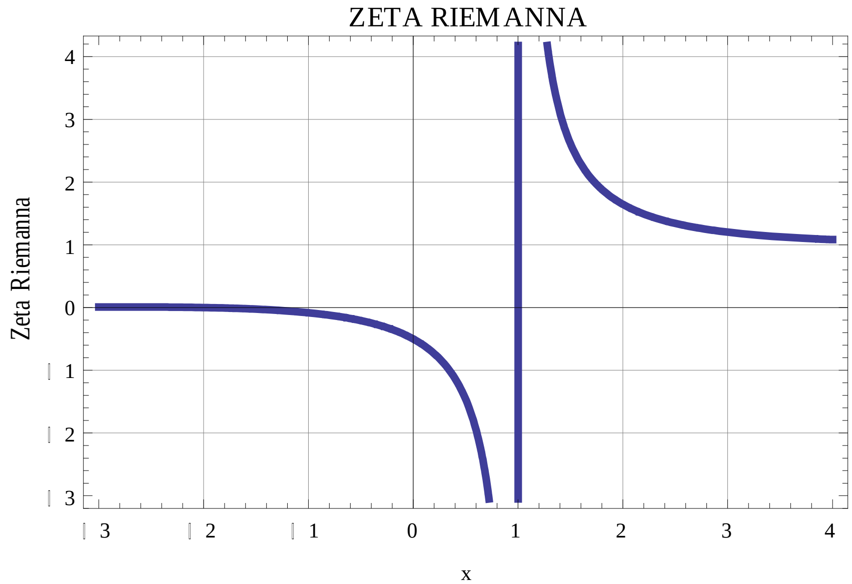
2. Riemann`s Zeta (x) function and human consciousness

Riemann`s Zeta function is described by formula

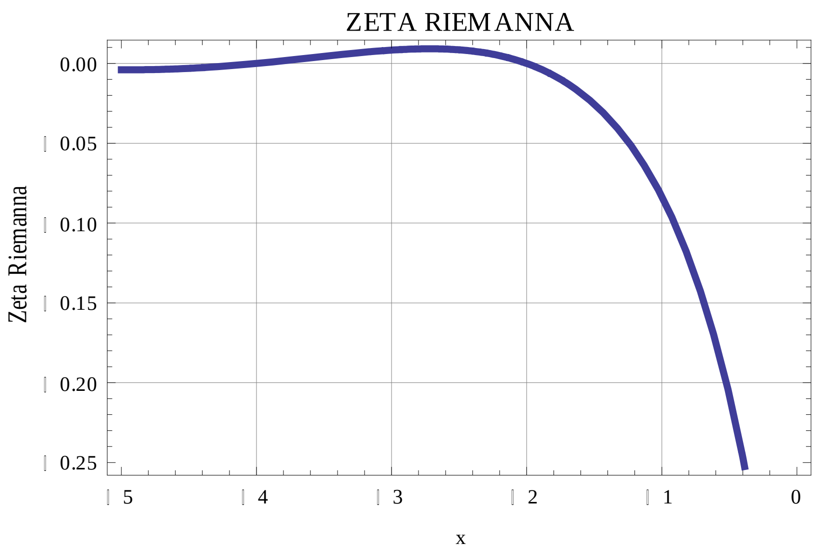
$$\prod(s)=\int_0^\infty e^{-s}x^s dx,(s>-1)$$

$$\zeta(x)=\frac{\prod(-s)}{2\pi i}\int_{-\infty}^{\infty}\frac{(x)^s}{e^x-1}\frac{dx}{x}$$

In Figs.1 and 2 we present the shape of the Zeta (x) for different ranges of x



Rys.1 Riemann`s Zeta(x), for $-3 \le x \le 4$



Rys.1 Riemann`s Zeta(x), for $-5 \le x \le 0$

For x=-1 we have the formula

$$\zeta(-1) = 1 + 2 + 3 + 4 + 5 + ... = -\frac{1}{12} \tag{1}$$

According to formula (1) the binding energy of hydrogen atom (harmonic oscillator) can be write as

$$E = \zeta(-1)\omega_0 h = -\frac{1}{12}\omega_9 h \tag{2}$$

where $\omega_9 h$ is the fundamental hydrogen atom energy

Conclusion

The contemporary interpretation of quantum mechanics is the coincidence only. For all fundamental properties of hydrogen atom the binding energy is hidden in the Euler- Ramanujan formula

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