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Ed Gerck *

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Quantum Computing Arrives

Ed Gerck *

Planalto Research ORCID: 0000-0002-0128-5875
* https://www.researchgate.net/profile/Ed_Gerck

Abstract: Quantum computing arrives. Preceded by Mādhava of Sangamagrāma and other Hindu mathematicians, around 1,500 CE, and our previous work, we show at least 4 quantum properties that are indeed universal in some number systems; here we use them to enable quantum computing. Using the sets B={0,1}, B^n, N, Z, Q, and Q*, one has +4 quantum properties that one can trust, as archetypes of easy communication to friends and foes, to ignoranti or cognoscenti, and for quantum consciousness. Therefore, this work applies to computer calculations, apps in cell phones, algebra, atoms, mathematics, physics, and the human mind.

1. INTRODUCTION

"Die ganzen Zahlen hat der liebe Gott gemacht, alles andere ist Menschenwerk" Leopold Kronecker.

Quantum computing arrives. This is not based on what has become common, phantasy, but it is based on actual experiments. No references today are cited, as they correspond to "fake news", an impotent reach that infests science, and deserve no further mention -- they are easily found through common search engines, for what is worth -- hype. They include absurdities such as ''qubits'' , ''complex qubits'', and ''imaginary numbers'' in quantum mechanics.

This is announced based on the properties of natural numbers, integers in the set N, that everyone can use, anywhere, for free.

Therefore, this work applies to computer calculations that use Boolean sets natively, apps in cell phones, algebra, mathematics, physics, and in the human mind -- any human mind.

Quantum computing opens to quantum consciousness, and an even higher performing mind, and mental communication. This may impact mental health, in eliminating what has been considered a mental pathology, such as "idiot savants"doing fast calculations.

Calculus was invented by Hindu mathematicians (led by Mādhava of Sangamagrāma) 250 years before Newton and Leibniz [1-6], and they did not use the fiction that infinitesimals or imaginary numbers exist. This is being misinterpreted even by current Hindus. They used discrete mathematics. The same that we are doing as the properties of integer numbers, and obtained the same formulas and new results that we reproduce. We are just revisiting their results in modern language, and adding quantum mechanics as opening new avenues and results, such as in calculating prime numbers with a closed formula [7], using periodicity.

We understand that new mathematical methods build upon the old, even when not using them, and will be successful without any criticism.

But, as we have seen what "old" mathematics based on Newton and Leibniz prevents one from knowing, it is worth all the trouble to try to speed up new uses by revisiting Hindu mathematics dating back to 1,500 CE. Thus, one needs to both block and affirm for better results.

For example, electronic engineering can cease to be complicated, stopping to use mathematical complex numbers, and start using the new set Q* (discussed by the author, elsewhere). Calculus can also cease to be complicated, ceasing to use infinitesimals and mathematical real-numbers, and use the set Q, and even the set N -- allowing middle-school students to calculate using calculus -- revisiting now what Hindu mathematicians already discovered in the middle ages -- including the basis of quantum computing as based on the properties of integers, in the set N [7,8].

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2. Periodicity

Numbers qua values obey a physical law, using periodicity in numbers. As well-known, Peter Shor at the Massachusetts Institute of Technology was the first to say it, in 1994 [cf. 7], in modern times. It is a wormhole, connecting physics with mathematics, has existed even before the Earth existed, and was used, as well-known, by Ramanujan in studying partitions, and others, and Mādhava of Sangamagrāma [1-6].

So-called "pure" mathematics is, after all, governed by objective laws. The Max Planck Institute of Quantum Optics (MPQ) showed the mathematical basis by recognizing the differentiation of discontinuous functions [cf. 7, 8], in 1982, which led us to use the set Q to define calculus with rigor.

3. Complex Numbers are Deprecated and This Simplifies Quantum Computation

The above [1-6] denies any type of square-root of a negative number -- a.k.a. an imaginary number -- rational or continuous. Qubits are also denied in [7].

These factors, along with the non-existence of "complex qubits", does not allow us to scientifically cite any such effort, although respectful; in the same way that we do not cite quantum poetry, also existing and influential.

Complex numbers, of any type, are not objective and are not part of a quantum description, as well-known to have been said first by Erwin Schrödinger in 1926 -- yet, cryogenic behemoth quantum machines, see Fig.(1), consider a "complex qubit" -- two objective impossibilities [7]. Any one part of it is wrong. They are just poor physics and expensive analog experiments in these pioneering times, hopelessly using the money of naive investors in hype.

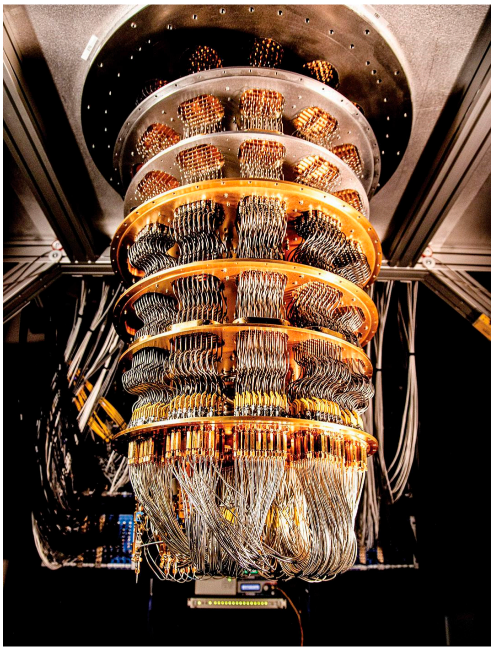

Figure 1. Cryogenic proposal for quantum computing.

Quantum computing is, albeit, natural. Atoms do it all the time, in nature, and the human brain also -- ask yourself, how was quantum mechanics made possible? It is all based on +4 quantum properties of numbers, present in the atoms and in the brain.

Three of these properties are defined in [7]. The fourth quantum property of numbers can be seen in prime numbers, and defined here as *indistinguishability*.

Indistinguishability sets in because one cannot distinguish any specific number among many, e.g., in the prime number **163283381**. A prime number is a “blob” and cannot be split in any way, or understood in terms of any of its digits.

This is valid, using the set N, here on Earth and in the star Betelgeuse. It is a universal quantum property, and the fourth.

Each point, in a quantum reality, is a point ... not continuous. It includes its own neighborhood, where "empty" is provided naturally. No one needs limits, convergence, or Cauchy epsilon-deltas. Thus, reality is grainy, everywhere. Ontically.

Continuity is denied in the physical universe [7]. But can continue to exist mathematically, though that mathematics cannot describe physical reality [7]. Otherwise, paradoxes result [7].

4. Quantum Mathematics

To deal with numbers and objective properties seems contradictory.

Albeit, we take the well-known mathematical position of Gottlob Frege. Using Frege himself, in his historical words often cited and well-known, but now interpreted under the discoveries of numbers by quantum computing.

By that we mean the +4 quantum properties of numbers, presented in Section 3.

The reference of a sentence is its truth value, whereas its sense is the thought that it expresses. Frege justified the distinction in a number of ways.

Sense is something possessed by a name, whether or not it has a reference. For example, the name "Odysseus" is intelligible, and therefore has a sense, even though there is no individual object (its reference) to which the name corresponds. "Centaur" and "elf", likewise.

The sense of different names can be different, even when their reference is the same.

Frege argued that if an identity statement such as "Hesperus is the same planet as Phosphorus" is to be informative, the proper names flanking the identity sign must have a different meaning or sense. But clearly, if the statement is true, they must have the same reference.

The sense is a 'mode of presentation', which serves to illuminate only a single aspect of the referent.

Much of current analytic philosophy is traceable to Frege's philosophy of language.

Frege's views on logic (i.e., based on his idea that some parts of speech are complete by themselves, and are analogous to the arguments of a mathematical function) led to his views on numbers, which we now use for treating numbers as semiotic quantities -- using the +4 quantum properties of numbers and Frege.

This denies dialectics, as there is no opposing idea, and it did not use any opposing idea to generate. Daletics is denied by nature. Nature is complete by itself, we just have to observe (cf. Kronecker; cited in the Introduction).

Properties of numbers must be obeyed by the sets B={0,1}, B^n,N, Z, Q, Q*, and any other set based on them, e.g., the new set Q* we proposed elsewhere. P-adic numbers are not used.

All begins with two elements: 0 and 1, and we add angle in the set Q*. There is no final uncertainty, even though uncertainty is considered [7].

Any physical system can be represented only with the set B, and that is how computers calculate anything, natively, with no uncertainty. Humans can work more efficiently and intuitively using the set Q*, as we propose elsewhere. There is no imaginary number, or infinitesimal numbers.

One can see a number as pointing to its truth value (called a value) and expressing a thought (called its digit in the base used). The digit is the sense, the meaning of the number.

The digit can change at will, subjectively, but the value stays objectively fixed. And, they can exchange positions.

For example, the name V can have the value of 5 (Arabic), and as used by the Romans, but the native Alaskans will understand the same name as having the value of 2 (Arabic). There is no "reference theory" of numbers, though used by native Alaskans. A point can also mean 5, in mathematics.

Thus one can write F in hexadecimal, while the value is 15 in base 10. The number is this 1:1 mapping between a name ("F") and a value (15).

Or, in reverse, exchanging positions, one can use 15 for the name, pointing to the value F.

Or, one can use 1111 in 64-bit signed binary for the name, pointing to the same value (15).

A number is seen as this flexible semiotic concept, very used in computers, and now for quantum computing [7].

Note also the absence of the sets R, C, the irrational numbers, and the p-adic numbers, e.g. There is no classical epsilon-delta in the description, as the +4 quantum properties of each number provide a natural empty neighborhood around each 0-dimensional pont.

To imagine a continuous point is to imagine a "mathematical paint" without atoms, as described by Nahin [cf. 7]. Take an AFM microscope ... atoms appear in the modern age.

The atoms, an objective reality, imply a graininess. This quantum description includes at least, necessarily (Einstein, 1917), three logical states -- with stimulated emission (coherent), absorption, and emission. Further states are possible, as in measured superradiance [7]. This deprecates the well-known Gödel's uncertainties, and qubits.

Mathematical complex numbers or mathematical real-numbers do not describe objective reality [7]. They are continuous, without atoms. They are not computable according to Gisin [cf. 7].

Poor math and poor physics, without any philosophical considerations, shows that numbers must have physical significance in order to model physical processes, which theory invalidates "practical" investments, see Fig. 1, as a correct theory that must be obeyed objectively.

Numbers qua values can work without physical considerations as well, but the results are not trustworthy, as physically valid. Such as defining distance using the well-known p-adic numbers, where one gets the incorrect physical measurement.

It is easy to see that multiplication or division "infests" the real part with the imaginary part, and in calculating modulus -- e.g., in the polar representation as well as in the (x,y) rectangular representation. The Euler identity is a fiction, as it mixes types … one can avoid it. The FT will no longer have to use it, and FT=FFT (to be published).

The complex number system "infests" the real-number part with the imaginary part, even for Gaussian numbers, and this is well-known in third-degree polynomials.

Complex numbers, of any type, must be deprecated, they do not represent an objective sense. They should not "infest" quantum computing.

5. DISCUSSION

Quantum computing is better without complex numbers. Software makes R,C=Q --> B={0,1}, the Boolean set, which digital hardware calculates using at least 4 quantum properties.

Some other results are immediate, like $0^n = 0$ and $1^n = 1$, for any n in the set N.

That is more than an exponential increase, as some results become also immediate with quantum computing. Such as, no irrationals, no mathematical real-numbers, no mathematical imaginary numbers.

Going forward (to be published), the number π becomes an unbounded series of rational numbers, where each last term is the inverse of an objectively specific natural number (i.e., an odd number) [1-4], which can be calculated numerically as a rational number using continued fractions [1-6,7], as well as any conventional irrational number, such as e or the $\sqrt{2}$. For π the unbounded series of rational numbers will be published elsewhere, which can be always written as a rational number, a member of the set Q. Not an irrational number.

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