The wave function ψ of the Riemann Zeta function $\zeta(0.5+it)$: *The New "Hermitain L-function Operator" mathematical tool*

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Abstract

In order to prove RH using an Operator the Hermitian Operator must be mathematically structured like an L-function to prove RH. For Physicists and Mathematicians, the take away from this approach is that Hermitian Operator if it is to prove RH can't be a single Operator or single differential equation. It must be a new type of Hermitian Operator structured like an L-function where the roots of this L-function mirror the Zeta zeros. Imagine taking an infinite series of wave functions such as **$\Sigma = \psi+2\psi+3\psi+4\psi+5\psi$........** analogous to the Zeta series and transforming that infinite sum of wave functions into an functional equation in the complex plane that mirrors the Zeta functional equation. The conjecture is that the roots of this Complex Hermitian L-function Operator will match the roots of the Riemann Zeta function to prove RH.

The Riemann Zeta function is based on the following functional equation

$$\zeta(s) = 2^s \pi^{s-1} \sin\left(\frac{\pi s}{2}\right) \Gamma(1-s)\, \zeta(1-s). \quad \textbf{(1)}$$

Using the input of 0.5+it the Riemann Zeta function generates a wave graph that intersects the critical line at nontrivial zero(root) locations.

The following is the wave graph of Zeta function as $\zeta(0.5+it)$ showing it's real and imaginary part waves both intersecting at the nontrivial zero locations. The Riemann Hypothesis states that all the nontrivial zeros lie on the critical line.

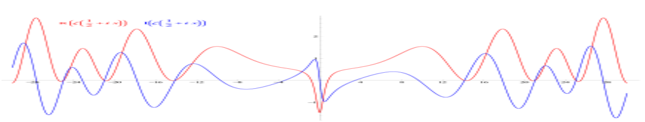


Fig. 1

One approach to proving Riemann Hypothesis is to map the nontrivial zeros of Zeta to a Quantum mechanical operator. However, attempting to map the nontrivial zeros to eigenvalues have fail short. This research takes a radically different approach in linking that Zeta function to Quantum mechanics were its operator is Hermitian and it's eigenvalue matches the nontrivial zeros of the Zeta function as a breakthrough towards proving R.H. For instance, the Zeta function wave graph above is conjectured to be based upon wave functions ψ graph below. In which the wave graph of Zeta ζ(0.5+it) is simply adjacent wave functions linked in a chain on the critical line.

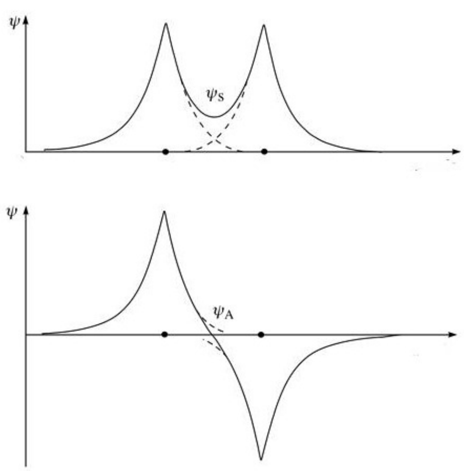


Fig. 2

Below is the wave function interpretation of the Zeta function were the dots highlight the locations of the atoms on the critical line with respect to their wave functions.

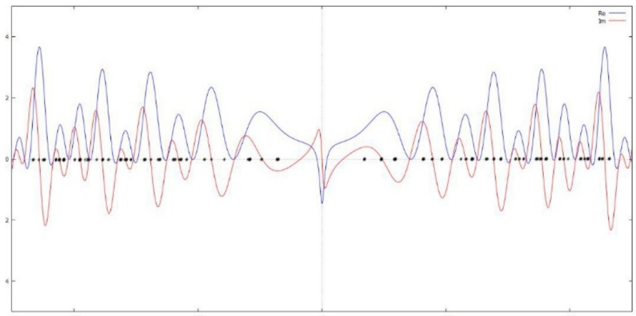


Fig 3

The following graph correlate Even and Odd Parity Operator wave function to the real and imaginary part of the previous wave Zeta graph.

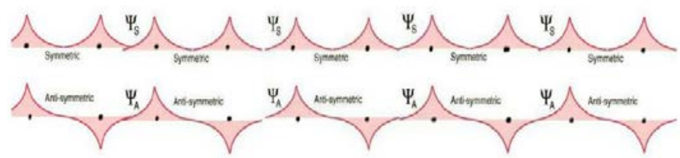


Fig. 4

The Even and Odd Parity Operator is a real value function but the new approach is to correlate the Real Part (Even curves) of the Zeta graph to the Even Parity and the imaginary part (Odd curves) of the Zeta graph to the Odd Parity Operator. That will be the basis for extending the Parity Operator into the Complex plane. Because, the Complex Parity Operator wave functions have complex conjugates they can be multiplied together to obtain real values. The Parity Operator wave function is Hermitian and can have eigenvalue the match the nontrivial zeros of the Zeta function with respect to correlating the wave graph of Zeta ζ(0.5+it) to the Parity Operator Wave function.

The following express is a mathematical correlation between the Parity Operator wave function to the Zeta function.

Even Zeta R(ζ(0.5+it) =R(ζ((0.5-it))

is equivalent to

Even Parity Pψ(x)=+1ψ(-x)

(2)

And

Odd Zeta I(ζ(0.5+it) = I(-ζ((0.5-it)))

is equivalent to

Odd Parity Pψ (x) = -1ψ (-x)

(3)

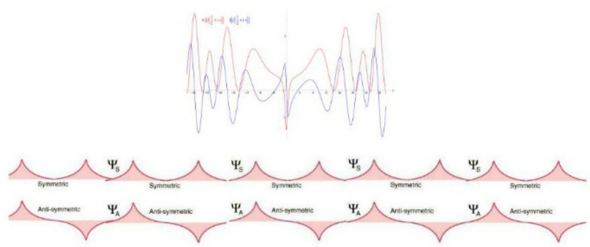
The Zeta function encodes Quantum information in it's wave function ψ graph of ζ(0.5+it)

Most research attempting to connect the nontrivial zeros of Zeta to Quantum Mechanics is to only focus on the nontrivial zeros as discrete energy values of an Operator. That approach hasn't yield any fruitful results. This paper proposes that Mathematicians and Physicist don't focus solely on the discrete nontrivial zeros but the wave graph of Zeta ζ(0.5+it) related to the nontrivial zeros. The new approach is interpreting the wave graph of Zeta ζ(0.5+it) as a wave function ψ. This wave function interpretation of the wave graph of Zeta identifies the Parity Operator wave function as the Operator behind the nontrivial zeros. From this wave function interpretation, we see an interesting arrangement of atomic nuclei locations and eigenvalues (nontrivial zeros) on the critical line of the Zeta function. This Complex version of the Parity Operator is Hermitian and it's eigenvalues matches the nontrivial zeros of the Zeta function. Because it is a Complex Parity wave function the complex conjugate wave functions can be multiplied together to yield real values. A Complex Parity Operator functional equation can be formulated to mirror the Riemann Zeta Functional Equation to have its eigenvalue correlate to the nontrivial zeros. This new breakthrough is a huge breakthrough toward linking the nontrivial zeros of the Zeta function to Quantum Mechanics based on wave functions.

This paper gives a new line of attack on linking nontrivial zeros to quantum Physics using wave functions rather than directly mapping the nontrivial zeros to a discrete operator as with traditional methods.

The Euler Product formula for the Hermitian L-function Operator

Just as the Zeta functional equation and the new Hermitian L-function operator can equal based on the graphs below that equality can apply to all values of Zeta. Meaning you can plug in real values only for the new Hermitian L-function Operator and that will equal Zeta for values greater than 1 over the reals (Euler Product formula).



This paper doesn't provide the new Complex Parity wave function equation that mirrors the Zeta function equation but suggests it exist. That equation can mirror all values of Zeta including Zeta equality to the Euler Product formula for values greater than 1 over the reals.

$$\sum_{n} \frac{1}{n^s} = \prod_{p} \frac{1}{1 - \frac{1}{p^s}}$$

References

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