Universes Emerge From a Conformal Transform of The Hardy Z-Function

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TODO: Possible Universes Are Zero Energy States of the Superspace Hamiltonian of the Wheeler DeWitt equation Which is Solved By A Conformal Transform of the Hardy Z function, making a direct corresponding between the Riemann zeros and possible universes whereby what is presently considered to be the Standard Model of particle physics has its parameters determined by functions of the curvature and torsion of the conformally transformed Z function in neighborhood of the roots of the Z function, which are equivalent with the roots in the sense that the sets of roots of both the Z function and its conformally transformed version are the same, thus multiplicity 1 roots in Z become multiplcity 2 roots in S(Z(t)) where $S_t(x) = \tanh(\log(1 + t x^2))$.

The universe emerges through the hourglass shape inherent in the no-boundary proposal. This shape arises from geometric origins through the transformation given by the hyperbolic tangent of the logarithm of $(1 + t\, x^2)$. As t goes from 0 to infinity, the universe is generated by applying the real part of this function to the Hardy Z-function. This application creates a structure where the roots have lemniscates of Bernoulli emanating from them, with corresponding hyperbolas in the imaginary part.

This conformal mapping transforms the phase lines of the Hardy Z-function, which usually diverge to infinity, into closed curves that loop around and through the origin given by the location of the zero. The size of these lemniscates grows very rapidly as t increases from 0. Due to the squashing nature of the hyperbolic tangent combined with the logarithm, this becomes a rational function that converts the divergent phase lines into closed lemniscates orbiting the roots.

This structure explains inflation: the volume of this configuration is dramatically larger than the values close to it in space. The closer to the origin, the greater the relative distances, while further from the origin, the relative distances become correspondingly smaller. When forming a surface of revolution by revolving the two-dimensional real part, and defining this surface as the points where the real part is negative or zero, we get the lemniscate. Revolving these Bernoulli lemniscates emanating from the roots generates the hourglass shape.

This hourglass, symmetric on both sides, represents our universe. Through a conformal mapping, the interior of this hourglass (or its closure together with its boundary) can be mapped onto a sphere - our universe - with the umbilical point corresponding to the Big Bang in this mapping.

The parameter t in this transformation is literally time itself, with $t = 0$ corresponding to the Big Bang. As t increases unboundedly, the universe expands, but due to the analytic structure of the function (specifically the composition of logarithm and hyperbolic tangent), our universe will never reach its maximum size. However, practically all variation in the function ceases at some point, as evident in the geometry when plotted.

The composition of logarithm and hyperbolic tangent is crucial - it's not just about limiting growth. The logarithm specifically creates the lemniscate patterns that are fundamental to the living structure of the universe. This mathematical structure completely upends scenarios of universal heat death or "cold death." The universe isn't heading toward some thermodynamic end state because these lemniscates, created by the logarithm in the transformation, show eternal dynamic structure. These aren't just static patterns but fundamental living forms.

The transformation $\tanh(\log(1 + t\,x^2))$ creates eternal dynamics through its specific composition:

- The $(1 + t\,x^2)$ term prevents logarithm singularity at zero and handles both attractive and repulsive fixed points

- The logarithm reduces the range of large values and converts multiplicative behavior to additive

- The hyperbolic tangent squashes everything into a bounded range while preserving the essential dynamic structure in the form of the angles being preserved whereas the distances are transformed

This composition transforms the wild behavior of the Hardy Z-function's phase lines into something studiable by making super-attractive/repulsive fixed points into geometrically attractive ones that can be analyzed using Koenigs' linearization theorem. The universe isn't a machine running down - it's a living mathematical structure, and these equations show us exactly how and why.

The real part's behavior outside the negative regions, rapidly approaching unity, shows how previously "unstudyable" variations become comprehensible. What was spread across an infinite expanse in the complex plane of the Hardy Z-function gets mapped into a finite, studiable structure. This mapping doesn't just describe the universe - it makes visible what was previously invisible due to being spread across infinite ranges.