Mathematical Inequalities over Hypercomplex Structures and Infinities with Related Paradoxes

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Invariants being the non-trivial norm over every branch of theoretical and mathematical physics, the strange nature of computations being analyzed over variables, structures, operators, and parameters, that when produced or try to produce something explainable in the domain of physics, the ways through which those explanations are done gets rigorous and weird which gives us a notion that, advanced mathematical physics is nothing more than an extreme abstract approach shouldered by a physicist to make the reality explainable in a way that gets either beyond the common perceptions or humans or beyond the areas that need to be investigated as physicists most of the times lost their tracks in mathematical analysis and progress due to extreme or over-complexified nature of physical laws that are attenuated in the minds of mathematicians taking them the world beyond normal comprehension as to be explained for justifying physical reality. Therefore, concerning and keeping in mind all the strangeness – we are providing examples, proofs, and theorems to perform a prescription showing that the physics with the involved mathematics is too weird to make sense also the underline beauty relating those mathematics are opening the doorway to the most obscure, unexplored and extreme corners of nature that are beyond, the physicists all though the pasts tried, succeed in some while failed in most, to make the most courageous effort to see and write down in theories the elegant and hidden structures of this nature, or in a sense the universe with the notion of beyond the universe – the multiverse.

TOPOLOGY – CANTOR – HILBERT – STRINGS – INFINITY – BLACK HOLES

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This paper has been produced to create specific contents as related to the 'PAPER TITLE' where most data are taken from corresponding authors' research papers. And, some that are there have been taken from several posts written by the corresponding author over several media/blogs. As those articles are written long ago, appropriate citations for those couldn't be found; but citations are given covering those comprehensively.

I. Topology

Is this even possible – Equivalence classes to be established for +1 ≡ -1 Geometries of the universe constructed through topological structures over algebraic groups which will lead to establishing class-equivalence else duality?[4]

For +1 Geometry –

Specially defined Calabi–Yau manifolds having the hypersurfaces of $degree\,5$ in $\mathbb{P}^4$ satisfying the non–trivial canonical bundle Λ^3_X where the embedding holomorphic map $\psi : X \longrightarrow \mathbb{P}$ with the Kähler form ω for holomorphic line bundle X giving a strictly positive parameter $\ell^{\otimes k}$ $\exists k > 0$ representing ℓ through the first $Chern$ class $H^2(X, \mathbb{Z})$. When for every Kähler class $[\omega]$, the $de\,Rham$ Cohomology class exists with the compact form (X, ω) $\forall$ potential spaces satisfying $H^2_{dR}(X)$ with the $\partial\bar{\partial} - lemma$ for a harmonic form giving us the $(1,1)^+ - form$ Kähler potential $i\frac{1}{2}\partial\bar{\partial}_\rho$. Taking all this in effect and making it established through various conjectures, axioms, ideals, theorems – an equivalence class is shown between the structures: Kähler-Manifold, Calabi-Yau-Manifold, Hyperkähler-Manifold, Quintic-3-Fold, Kummer Surface, K–3 Surface, De Rahm Cohomology Class $(Hol(\Omega(\mu,\nu))$. The extreme case considered here is the exclusion of Complex hyperbolic Kähler – represented by $\mathbb{C}^n$ $\exists n = -1$. In course of making this paper the non–trivial aspects concerning the topological structures in aspects of string theory, the compact Kaḧler with a Ricci–flatness if explained concludes this[1] –

- The holomorphically symplectic manifolds which in the case is a Hyperkähler manifold where $Sp(n)$ is satisfied by taking the sub-parameters of the norm $\left(M_{(x)}; I, J, K\right)$ with compact Kähler satisfying (M, I) is a Hypercomplex manifold, being equivalent to Hyperkähler manifold which is indeed a simply connected Calabi – Yau manifold satisfying $Sp(n)$ as $1 = H^{2,0}\left(M_{(x)}\right)$ which in turn gets equivalent to lower dimensional Riemann manifold suffice the value to be ≥ 2. With the Fujiki observation $\forall \mu = 2$ applied to ${M_{(x)}}^{[\mu]}$, the complex projective space $\mathbb{CP}^1$ gives the Calabi – Yau space with the solutions of the Hilbert polynomial $\coprod\left(\partial_{Sh}, (\cap^R/\mathcal{J})|_{\partial_{Sh}}\right) \equiv \mathbf{P}^n{}_{\cap^R/}$ taken over the Quartic variety $\mathcal{Q}_{\mathbb{P}^3}$ for every point $\rho_\times$ in $\mathbb{P}^2$ of $[16_6] - Ideals$ with points $1,2,3,4 \in \times$ gives the pointwise intersections of every hypercomplex surfaces stated as Kummer surface being rationally equivalent to the other hypercomplex manifolds. Thus, every General K – 3 Surface over the Picard Lattice norms though $\mathbf{Pic}\left(\mathcal{X}_{\ell_*}\right) \subset^{group} H^2\left(\mathcal{X}_{\ell_*}, \mathbb{Z}\right)$ with $Artin\,Supersingular\;K - 3\,Surface$ via Picard number $\rho_* = 22$ $\forall p > 0$ where in the special case if $p > 2$ for every $\mathcal{X}_{\ell_*}$ then the Artin – Invariant 2 states that: K – 3 Surface ≅ Kummer Surface. Any $closed\;2 - form$ represents Kähler Class $\kappa^{(1,1)}_{H^2(M_{(x)},\mathbf{R})} \in$ De Rahm Cohomology Class for $\mathrm{Hol}\left(\Omega(\mu,\nu)\right)$[1].

    - Every compact Kähler IS a non-singular cubic 3-fold Fano surface – Investigating $H^n(M, \mathbb{R})$ mod $H^n(M, \mathbb{Z})$ $\forall n = odd$ in $\mathbb{C}T^*$ for every compact Kähler with Hodge $h^{1,0}$ is indeed a cubic 3–fold Fano–surface dual to Picard–Albanese form. Any Jacobean variety $\mathcal{J}$ when associated with the algebraic curve $\mathcal{C}$ then the $\mathbb{C}T^*$ holds the algebraically closed field via the compact Riemann surface where the $K - isomorphic$ polarized forms contain the $\mathcal{J}(\mathcal{C})$ with $g \geq 2$ would feature a Kähler or Hyperkähler form obeying Torelli's theorem. Thus, taking $g = 2$ from $g \geq 2$ the Abelian form Abe_2 $\subset^{moduli\;\;spaces}$ $M_2, M_{1,1} \times M_{1,1}$ where through proper investigation of $H^n(M, \mathbb{R})$ mod $H^n(M, \mathbb{Z})$ $\forall n = odd$ in $\mathbb{C}T^*$ the non–singular 3–folds are unirational provided the line bundles over that cubic 3–fold is a Fano–surface where the smooth structures $\mathcal{S}$ are preserved over $\mathbb{P}^4 \xrightarrow{morp\ hisms} Grassmanian\ \mathcal{G}(2,5)$[2].

- Imaginary cycles of permutations for *genus* $g = 3$ in complex – Considering a semi–state configurations taking genus $g = 3$ for any complex geometries generalized over $(+1)$ and (-1) structures with the fibers $\mathscr{F}^{\times} \exists \times = \infty\ \forall \mathscr{F} \cong \bigoplus^k$ where $k = \coprod_{\ell=\infty} \left(g_1^{\mathscr{F}^{\times}}, g_2^{\mathscr{F}^{\times}}, g_3^{\mathscr{F}^{\times}}\right)^{\ell} / \sim$ defined through classes $[\mathcal{O}_O]$. Imaginary cycles being observed in *middle genus* for both left and right chirality over the vibrations of *unidirectional–cycles* enumerating over those fibers[3].

For -1 Geometry –

The sectional curvature of any Riemann manifold when takes the value -1 then, Euclidean geometry transformed over Hyperbolic geometry with the associated space as Gauss–Bolyai–Lobachevsky space where in dimension–3 any performed cusp defined in terms of Fuchsain model over Riemann prescriptions segregates hyperbolic geometry from dimensions–3 than higher degree generalizations. Thus, for any hyperbolic 3–spaces, operating through 'drill and fill' gives the surgery of Dehn in geometric topology through –

- Establishing the connectivity all through $-1: CH^n\ \forall, \exists\ n = -1$ over the Bolyai–Lobachevsky prescriptions of $\mathbb{R}^n$ space-injecting Gromov–Groups $\mathbb{R}(-1)\ \forall$ having non–negatively connected $\partial > 0 \iff CAT(\sum \rho^k) - space = \sum \rho^k, \exists\ k > 0, \exists n = -1\ \forall$ connected space satisfying $k/\sqrt{\pi}$ when subject to Dehn surgery gives $(j)R^n - 3 - folds\ \exists (j) \Longrightarrow R,$ gives the Mostow rigidity theorem $\forall n\ in\ R^n$ makes a diffeomorphism to Teichmüller space with the isomorphism stack of Dim_{6g-6} $\forall\ genus\ g > 1$[4].

Superalgebraic Groups – Any quantum groups can be filtered via PBW algebra over a graded algebra where the structure representation for any supercommutator $[i, j]$ when reduced asserts a linear monomial of a canonical origin. Thus, being independent on the swapping order, isomorphism can be seen for any injective takeovers giving the map $\psi: \mathcal{L} \longrightarrow U(\mathcal{L})$ with the Lie $\mathcal{L}$ through the $U(\mathcal{L})$ group. This, somehow satisfies a direct connectivity over $OSp(m,n) \cap OSp(n,m)$ in Kac–Moody algebras.

- Any injective takeovers giving the map $\psi: \mathcal{L} \longrightarrow U(\mathcal{L})$ having Lie $\mathcal{L}$ through the $U(\mathcal{L})$ with coefficients γ summing over the supercommutator $[i, j]$, there exists an uniqueness for every K–modules where a mapping over Tensor algebra takes an adjacent endomorphism for the same coefficient γ. It's being shown that there exists a Cartan sub–algebra over restrictions to the $ad(\mathfrak{h})$ representation over $\mathfrak{h}$, Any $\boldsymbol{Z}_2$ graded Hopf Algebra takeovers the Lie superalgebra having the universal enveloping representation showing orthosymplectic groups $OSp(m,n)$. Symmetric relations are being observed in Hopf fashion categorizing the Kac–Moody algebra in five Exceptional Lie groups for every roots $\wedge$ representing $\mathfrak{h}$ taking summation over $\mathcal{G}_{\times}$[5]

II. Infinity

Black Holes – Black holes are called nature's photocopier: Why? The answer is a bit more complex than what you think about it.

- Suppose there are two persons A and B. B is going inside a black hole and A is there to observe the position of B in Space and Time. So, B starts her journey and is slowly approaching the event horizon of the black hole. The more B is close to the event horizon the more B feels her weight gain and the more B speeds up due to the immense gravity. And when B will cross the event horizon, then she is in a point of No Return because to move out of Black Hole you need to have an escape velocity near about or equal to the speed of the light in vacuum. So as B is approaching towards the event horizon, her speed is increasing exponentially. But from A's perspective speed of B is actually slowing down as she is reaching near to the black hole. This is because of Time dilation. The duration of 1 second got dilated away into millions of seconds and hence B is closing or slowing down from A's perspective. Now B crosses the event horizon. This is the most crucial moment in Cosmological Astrophysics for the Black Hole study because – The Black hole will create a clone of B which remained stuck in the event horizon and the actual B is going inside the black hole. At the event horizon time becomes almost stand still hence according to the perspective of A, B is not moving at all. She has become a stature but in reality, B is actually inside the black hole. What A see is the exact same copy of B being fixed at the event horizon. Now, what A sees is just a mere reflection of the colour of light that the cloth or suite of B represents. The colour can be of any colour. But as the gravity is very high in a black hole, hence the light rays carrying the reflections of B just got a stretched wavelength of a very low frequency and A will see the B's copy as being slowly turned into red. This is called gravitational red-shifted. Now, ultimately the light waves are so stretched away by gravity that it goes beyond the visible spectrum of light. So, B vanishes away. This Process is called Black Hole Cloning[6,7,8].

Cantor's Infinite Paradise – Cantor's slash (diagonalization) argument where he showed how to measure infinity?

- Infinity can be infinitesimal or infinite / some infinity is bigger than others while some are smaller than others/infinity can be split into many infinities – But how? Infinity is bigger than what you think. Some infinity are much bigger than other infinities. Even there are successive levels of infinity which you can count by mathematics. Infinity always tends to increase and it will increase exponentially without any boundaries such that the end of infinity is represented by a much bigger infinity. The infinity paradox is thousands of years old. Now, we will provide you with the Cantor's diagonal slash method to represent infinity.

    - Consider a positive set of natural numbers – ζ = {... 1,2,3,4,5,6,...1000,...2000,...}. It is difficult to represent a set in a base-10 number system because of the redundancy and diversity of its characters. So, it will be much easier to consider a set {ζ} as a base-2 binary number system in which every number can be expressed as 'in' or 'out'... Or 0, 1. We don't need to do the decimal to binary conversion. We just denote the numbers explicit of the binary rule and we will randomly express any decimal to any binary form without the need for actual conversion {actual conversion is meaningless here}

    - Consider 3 subsets of the master set ζ... $§^1,§^2,§^3$.
      $§^1$=000000000000000000

$§^2$=111111111111111111
$§^3$=101010101010101010

- Now let's consider the three subsets $§^1,§^2,§^3$ as another small subset of ζ... That is Φ. Now Φ has 1 single element 'η' which can be represented by taking the diagonal numbers of $§^1,§^2,§^3$ from far left up to 3 digits and then placing 0's after that. So, n $Φ^1$=011000000000000000. Hereafter arranging the $§^1,§^2,§^3$ with $Φ^1$ –

    - We see,
      $§^1$=000000000000000000
      $§^2$=111111111111111111
      $§^3$=101010101010101010
      $Φ^1$=011000000000000000

    - Now take another subset of ζ... As 'μ'. Like the diagonal slash up to 4 digits and place 0's after that –We find,
      $μ^1$=011000000000000000

    - Now arranging all the 3 subsets together, –
      $§^1$=000000000000000000
      $§^2$=111111111111111111
      $§^3$=101010101010101010
      $Φ^1$=011000000000000000
      $μ^1$=011000000000000000

- One can get another subset, again another subset, again another subset – But the property of elements are not in the normal logic of mathematics. They seemed to be different.

    - Thus, it can be said –
      $\{§^1,§^2,§^3\} = Ψ^1$
      $\{Φ^1\} = Ψ^2$
      $\{μ^1\} = Ψ^3$

Thus, $Ψ^3 > Ψ^2 > Ψ^3$. One can actually measure infinity by the Hebrew alphabet " Aleph" But here we have used " Psi" instead of " Aleph" Thus, one can measure infinity. The indices are increasing because the present one has been composed by taking a composed function of the previous one[9,10,11].

Hilbert's Infinite Hotel Paradox – Properties of infinity: There is Infinity over Infinity; Infinity can be greater than infinity, and Infinity can be less than infinity. The Infinity of rational numbers is always higher than real numbers. Furthermore,

- Fibonacci Series: 1, 1, 2, 3, 5, 8, 13, 31…….. (Here Every 3rd number is the sum of two numbers)
- A little modification: 1, 1, 2…. 1, 1, 2, 1…. 1, 1, 2, 1, 3…. 1, 1, 2, 1, 3, 2, 3…. 1, 1, 2, 1, 3, 2, 3, 1… (Here 2 is 1+1, then the 2nd 1 of 1+1 repeats, again 3=1+2, then

the 2 of 1+2 repeats, again 3 is 2+1, then the 1 of 2+1 repeats and now infinity is gradually increasing and deceasing simultaneously.

- Suppose one puts a number in a box and takes out its square: What will happen? You put 1 and take out 1 as 1 is the square of 1. You then put 2, then 3, then 4 and takes out 2, you put 5, then 6, then 7, then 8, then 9 and take out 3… In this sequence, the series is actually increasing but eventually, it will end up null as every number has its square Number. But from the finite perspective, we see that the series is increasing but from the infinite perspective, the series is getting empty slowly.

    - Now, imagine there is a hotel, which is infinitely booked having an infinite amount of rooms. There came a finite number of people. The hotel manager will simply tell the borders to shift to the other room in N+1 Formulae and all the finite guests are accommodated.

    - Now, there came an infinite number of guests, then N+1 Formulae is not applicable as this process will tend to infinity as the borders are infinite. Here 2N formulae are used like; the person from the 1st room will move to the 2nd room, the person from the 2nd room will move to the 4th room, the person from the 4th room will move to the 8th room and thereby continuing this process; all the borders are accommodated in the hotel.

        - There lies no whole number between any two consecutive numbers like between 6 and 7, 7 and 8, 8 and 9… So on. But for the number to be fraction or rational there lies many numbers corresponding to the remaining number…. For 7. There are 7/1, 7/2, and 7/3……. For 8 there are 8/1, 8/2, and 8/3…. So on.

        - Now, suppose there came an infinite number of rational, guests like 1/2, 2/4, 3/8, 4/16, 5/32, 6/64, etc…. In the Formation of {(N+1)/2N}. In this case, some rooms will remain empty like 1/2 = 2/4…. And so on. But a problem will arise after accommodating all borders there must be 1 border that will remain without any room.

Why – The infinity of rational numbers is always higher than real numbers. Looking at rational numbers in decimals;

0.5000000000 – 1/2
0.5000000000 – 2/4
0.3750000000 – 3/8
0.2500000000 – 4/16

- Here, from the first line, 1/2… take the first digit 5+1=6.
- From the second line, 2/4 take the second digit 0+1=1.
- From the third line, 3/8 take the third digit 5+1=6.
- From the fourth line 4/16 take the fourth digit 0+1=1.
- So, the border who will never find a room is arranging those digits… 0.6161….. That's infinity[12,13].

III. Paradoxes and Hypothesis

SYNESTIA HYPOTHESIS – According to this hypothesis donut-shaped planets are possible to exist in the universe due to the giant impact collision of 2 spherical planets and the accumulation of particles on the circumference of the impact circle due to centrifugal force.

- To date, no distinctly torus-shaped planet has ever been observed. Given how improbable their occurrence, it is extremely unlikely any will ever be observationally confirmed to exist even within our cosmological horizon; the corresponding search field being approximately $140(c/H^0)^3$ Hubble volumes or $\sim 4.212*10^{32}$ (Light Yrs)^3[14,15].

THE BIRTHDAY PARADOX – If you are there in a group of 23 people (22 + YOU) then there is a 50-50 Probability of the two people having the same Birthday. But, if you are in a group of 75 people (74 + YOU) then there is a Probability of 100% of 2 people having the same Birthday.

- HOW – Your Birthday is the same as that of another person with only a group of 75 People including you when the whole year is of 365 Days (Excluding Leap-Year) making 365 different possibilities of 365 altogether different birthdays. But STRANGE!!! The number is 75, not 365.
- WHY – Consider The 50-50 Possibility. As you have already known that there must have to be 23 people for having the 50-50 probability of having the same birthdays, So, excluding you there must be a group of 22 people having the probability of different Birthdays. Again, excluding you and the second one, there must have been a group of 21 people having the same Birthdays. This process will continue as a series.
  - EXTENSION of the SERIES – 23+22+21+20+19+18+17+16.....
    OR (23*22)/2=253.
    - Now, Think inverse! There must have been 364 different birthdays excluding you as the year is 365. So, the MATH of the Probability regarding 1 ODD BIRTHDAY out of 365 is of (364/365)=0.997260273973.
    - Now, In all the 253 groups, it will be 0.997260273973^253*100(For Percentage)=49.9522846014 which can be taken as 50 Approx.

So, the EVEN Probability is 100-50 = 50. So, there is a 50-50 chance of having the same Probability of the Birthday among 23 people. BY THE SAME WAY YOU CAN COMPUTE 75 or 100% Probability. But, How do you know Whether the Number is 23 for 50-50 Probability or 75 for 100% Probability. Well, Then You have to do a long MATH CALCULATIONS. As there must have been 364 different birthdays excluding you as the year is of 365, So, the First Probability of getting a different birthday among the two is 364/365=.997!!! Very High.

- If the third person joins them then the probability will be (364/365) * (363/365) = .992…
- If the fourth person joins them then the probability will be (364/365) * (363/365) * (362/365) = .983…
- And So On Calculate (23-1=22 Excluding You) subtracted from 365… That is 365-22=343.
    - Continuing the above process 22 times, your answer will be near to .493 or 50%. That is (100-50=50%). Now Extend the series into (75-1=74 Times). You will get a probability of .99 or 100%

No matter how many people you gather together, if the number becomes 23 then there is a 50-50 Probability and if the number is 75 then there is a 100% probability of having a duplicate of yours having the same Birthday[16,17,18].

Arthur C. Clarke's novel "A Fall of Moondust" (1961), A physicist discusses: "If you have a group of more than twenty-four people, the odds are better than even that two of them have the same birthday." Eventually, out of 22 present, it is revealed that two characters share the same birthday, May 2316,17[16,17,18].

Stringlets – A more unified field theory demands a more fundamental object which can make up the vibrating strings in a multiply conjugate attachments that benefits in attaining the unitarity in the form of uniqueness in both the open and closed strings, provided those stringlets can't exist alone but in conjugation makes up the Planck's length with a little difference in the front point boundary of the starting stringlets to the endpoint boundary of the ending stringlets being attached in a loop to form a closed string, or remains unattached to form an open string. The nature of parity can be stated as the difference in the poles of the initial and final arrangements of the stringlets that if is 'opposite' can be attracted to form a loop and if 'unique' can be repulsive to prevent a loop. This paper will discuss the nature of those stringlets in detail which are elastic to provide the freedom of vibration, while the vibrations are taking place using the nodal attachments through the 'points' connecting two stringlets[19,20].

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