Scientific
Research
Publishing

Kähler Dark Matter, Dark Energy Cosmic Density and Their Coupling

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Abstract

We utilize homology and co-homology of a K3-Kähler manifold as a model for spacetime to derive the cosmic energy density of our universe and subdivide it into its three fundamental constituents, namely: 1) ordinary energy; 2) pure dark energy and 3) dark matter. In addition, the fundamental coupling of dark matter to pure dark energy is analyzed in detail for the first time. Finally, the so-obtained results are shown to be in astounding agreement with all previous theoretical analysis as well as with actual accurate cosmic measurements.

Keywords

Kähler Topology, Dark Matter, E-Infinity, Super Strings, Golden Mean Computer, Kerr Black Hole Geometry, Accelerated Cosmic Expansion, Fractal Cantorian Spacetime

1. Introduction and Background Information

In many previous publications [1]-[80], we considered the major problems of dark energy as well as the related quest to elucidate the missing mass of the universe which was dubbed "Dark Matter" [6] [38] [39]. In short it was found that a highly accurate estimate of these densities may be found by equating the Lorentzian Gamma factor γ of Einstein's equation of maximal energy ($E = mc^2$ as given for $\gamma = 1$ where m is the mass and c is the velocity of light) to the ratio of the Betti number b_2 of Einstein's 4D smooth manifold ($b_2 = 1$) and that of a K3-Kähler manifold $b_2 = 22$ [81]-[108]. Thus inserting in E leads to an ordinary energy density [2] [44]

$$E(O) = \frac{b_2(\text{Einstein})}{b_2(k3 - \text{Kähler})} mc^2$$
$$= \frac{1}{22}(mc^2)$$

(1)

This is almost 4.5% of Einstein's classical energy density E = mc² from which one is naturally led to conclude that the "hidden" or missing energy density of the universe must be equal to 1 − (1/22) = 21/22 *i.e.* 95.5% of that of Einstein's maximal energy in an astounding agreement with the highly accurate measurements of COBE, WMAP, Type L_2 Supernova and Planck [1]-[10]. Furthermore, comparing the result with other theoretical derivations, for instance the exact transfinite one obtained from the multiplicative five dimensional value of a zero set quantum particle ϕ^5 and additive five dimensional value of an empty set quantum wave 5ϕ [24] [27] namely

$$E(O) = \left(\phi^5/2\right)mc^2 = mc^2/(22+k)$$
$$E(D) = \left(5\phi^2/2\right)mc^2 = mc^2\left(21+k/22+k\right) \qquad (2)$$
$$= 1 - E(O),$$

we find that setting the transfinite irrational tail $k = \phi^3\left(1-\phi^3\right) = 0.18033989$ equal zero leads to the very same result obtained using the Betti numbers b_2 of the said K3 Kähler manifold [2] [44]. From the above it was concluded sometime ago that b_2 measures the amount of "space" voids in the manifold [10] [24] [28] [50] [52]. Consequently since the classical Einstein spacetime manifold is a smooth voidless manifold for which $b_2 = 1$ and K3-Kähler manifold is a highly non-smooth four dimensional structure with $b_2 = 22$, we see that the topological index b_2 is a quite accurate measure for the fractal ruggedness involved for any manifold [81]-[86]. Therefore the used ratio $E\left(Einstein\right)/b_2\left(Kähler\right)$ will account for the reduction of $E = mc^2$ to $E(O) = mc^2/22$ and its dissection into two components as expressed in the by now reasonably well known equation

$$\begin{aligned} E &= E(O) + E(D) \\ &= \left(mc^2/22\right) + mc^2\left(21/22\right) \\ &= mc^2 \\ &= E\left(Einstein\right) \end{aligned} \qquad (3)$$

In the preceding equation E(D) makes no distinction between the dark matter and the pure dark energy components of E(D). By contrast in the present derivation we show how the topology of K3-Kähler and its various Betti numbers can discriminate between not only ordinary and dark energy but also between dark matter and pure dark energy. This remarkable result will be achieved here by utilizing the signature of K3-Kähler τ and the entire set of all non-zero Betti numbers [24] [81]-[86]. In addition we will be able to reveal the subtle coupling between dark matter and pure dark energy [2]-[35].

2. Analysis

The present analysis rests almost entirely on the intuitively understandable fact that similar to the distinction between the zero set and the various empty set with increasing degree of emptiness used in E-Infinity theory [83]-[103] the various topological Betti numbers measure subtly different degrees of ruggedness caused by the "voids" in the

manifold [96] [101] [116]. In the spirit of the above, the heuristic dissection of E (Einstein)

$$
\begin{aligned}
E\left(\text{Einstein}\right) &= \left(mc^2/22\right) + mc^2\left(21/22\right) \\
&= E\left(O\right) + E\left(D\right) \\
&= mc^2
\end{aligned}
\tag{4}
$$

may be rewritten to become

$$
\begin{aligned}
E\left(\text{Einstein}\right) &= E\left(O\right) + E\left(DM\right) + E\left(PDE\right) \\
&= \left(mc^2/22\right) + mc^2\left(5/22\right) + mc^2\left(16/22\right)
\end{aligned}
\tag{5}
$$

In turn this may be interpreted in terms of the topological invariant of our K3-Kähler, namely [81]-[91]

$$
\begin{aligned}
&b_0 = b_4 = 1, \quad b_1 = b_3 = 0, \\
&b_2^- = 19, \quad b_2^+ = 3, \\
&b_2 = b_2^+ + b_2^- = 3 + 19 = 22 \text{ and} \\
&\tau = b_2^+ - b_2^- = 3 - 19 = -16
\end{aligned}
\tag{6}
$$

to mean that

$$
\begin{aligned}
E\left(\text{Einstein}\right) &= \left(\frac{1}{b_2}\right)mc^2 + \left(\frac{b_0 + b_3^+ + b_4}{b_2}\right)mc^2 + \frac{|\tau|}{b_2}mc^2 \\
&= \frac{mc^2}{22} + \left(\frac{5}{22}\right)mc^2 + \left(\frac{|-16|}{22}\right)mc^2 \\
&= mc^2\left(\frac{1 + 5 + 16}{22}\right) \\
&= mc^2
\end{aligned}
\tag{7}
$$

This is a new profound confirmation of our previous result and reinforces the confidence in the K-(or K3) Kähler gained from its use in superstring theory and E-Infinity theory alike [2]-[108]. In particular one should note that the negative sign of the signature $\tau = -16$ can be interpreted as a clear hint that pure dark energy works in the opposite direction to dark matter and ordinary energy [1]-[80]. It is also note worthy to observe that the above result agrees almost completely with that obtained from the geometry of Kerr black holes [8].

3. The Coupling of Dark Matter to Pure Dark Energy

There is a subtle point in the previous integer approximation of the triple partitions of E-Einstein. The point is that the ordinary energy part E(O) = mc²/22 and the total dark energy part E(D) = mc²/22 may be found directly from the exact transfinite value $E\left(O\right) = mc^2/\left(22 + k\right)$ and $E\left(D\right) = mc^2\left(21 + k/22 + k\right)$ by setting k = 0 and revealing E(O) to be $1/22 \simeq 4.5\%$ and E(D) to be $21/22 \simeq 95.5\%$ of the total energy [2]-[10]. However doing the same for the triple dissection, we do not find E(DM) to be equal to

22% nor E(PDF) to be $\simeq 73.5\%$ as should be because $5/22 \simeq 22.7\%$ and $16/22 \simeq 72.7\%$ [1]-[15]. Thus while our "integer" solution is quite close to the exact value they are not exact nor can they be made exact by setting small irrational tails such as k equal zero similar to the analysis involving two components dissection [1]-[80].

The deeper reason for this mathematical "anomaly" is that the "mathematics" is trying to tell us something of physical value and meaning. This "something" is actually that dark matter and pure dark energy are subtly coupled as the following computation will reveal. To do that we introduce the irrational transfinite correction coupling constant $\Delta = \left(8 + k^2\right)/100$.

Rewriting our previous triadic E using Δ we find:

$$E = mc^2 \left[\frac{1}{22+k} + \frac{5-\Delta}{22+k} + \frac{16+k+\Delta}{22+k} \right] \tag{8}$$

The remarkable fact is that in the above formalism everything falls in place and we find our exact solution that was found long ago using elaborate and occasionally terse reasoning namely that [8] [24]

$$E(O) = mc^2/22 + k \simeq mc^2/22 = 4.5\%$$

$$E(DM) = mc^2 \left(\frac{5-\Delta}{22+k} \right) = (22+k)\% \simeq 22\% \tag{9}$$

$$E(PDE) = mc^2 \left(\frac{16+k+\Delta}{22+k} \right) \simeq 73.5\%$$

exactly as obtained in numerous previous publications [1]-[80] and in full agreement with actual cosmic measurements [1]-[80]. In view of the above one could understand the huge difficulties of detecting dark matter to the extent of doubting its very real existence [132]. The present Author is however of the opinion that there is sufficient observation and theoretical underpinning to convince us that dark energy and dark matter are real [24].

4. Conclusion

By design or providence, superstring theory struck a lucky accord with nature by hitting on the marvelous K3-Kähler manifold. However, the inherent inconsistency of using a classical continuum in the form of vibrating and rotating strings coupled to a fundamental discrete ten dimensional network spacetime might be the reason of the failure of string theory in utilizing this K3-Kähler to its utmost capacity. By contrast when introducing a fuzzy-fractal version of K3-Kähler, we are able to use it beyond the compactification procedure of superstring theory to model spacetime itself. Proceeding in this way, a theory was developed which is essentially an E-Infinity-like theory with a twist. In this theory, the fundamental invariants of K3-Kähler, namely the Betti numbers, the signature and the Euler invariants, play a pivotal role not only in deriving the actually measured cosmic ordinary and dark energy density *i.e.* E(O) and E(D) but also of discriminating between pure dark energy E(PDE) and dark matter E(DM) as well as

revealing its coupled nature.

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