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Curvatures and Dynamics of the Universe

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Abstract-Without a doubt the universe is all about dynamics, but the curvature and the topology in which dynamics resides is not easy to comprehend. The question whether the universe has a positive curvature given by the spherical surface, or a negative curvature given by the saddle shape surface, or perhaps it has zero curvature, still puzzles scientists. As of today, there are no methods which give the conclusive answer to this question. Nonetheless, studying these topologies and their curvatures is an important exercise, as an improved answer to the puzzle may offer a better understanding of whether the universe is open or closed, and if it expands or contracts. In this report the question is addressed by using the globotoroid theory.

Keywords- *Curvature, Dynamics, Globotoroid*

I. INTRODUCTION

One of the great mathematicians Henri Poincaré, and the founder of algebraic topology, proposed a conjecture that helps understand the shape of the universe [1]. His conjecture is the basic question: What shape can a 3-dimensional space have? The Poincaré's answer is elegant as it postulates that every simply connected 3-dimensional manifold is homeomorphic to the 3-dimensional sphere. This was proved not too long ago by Perelman while examining the Ricci flow properties [2,3,4]. Thus, since torus has a hole it is not simply connected and cannot be homeomorphic to the 3-dimensional sphere. Every torus is homeomorphic to the 3-dimensional torus.

These ideas are also of interest in study of the globotoroids [5,6]. By letting the globotoroid be defined with the set of 3 ordinary differential equations (ODE), the 4-dimensional spacetime derived from the Einstein's theory of General Relativity may be reduced to the 3-dimensions. In the latter case, the time being the 4th-dimension is implicitly imbedded into the three spacetime variables that determine the globotoroid patterns and their dynamics. Among these are the continuous dynamic transformation of a torus into a globe, or a sphere, which appears to violate the Poincaré conjecture. Not so! Here the spheres are simply connected in the sense of 'almost everywhere', Figure 1A). This is because every globotoroid globe contains two tiny dimple regions, or the poles, resulting from the wormhole interconnection, and these regions cannot be shrunk to a point. Technically, as long as the wormhole is present, the globotoroid globes are homeomorphic to tori.

When now the mass particles are introduced, the 3-dimensional globotoroid space expands into the 4-dimensional spacetime [7]. This forms the 4-dimensional globotoroid system in which a particle motion is derived from the classical Newtonian mechanics, with the angular momentum being the major force. In addition, this 4-dimensional spacetime system is stitched with the wormhole which helps navigate orbital particles through a continuum of energy states guided by the cyclic loxodrome [6]. Although much simpler in formulation, the model is somewhat analogous to the Einstein-Vlasov kinetic system [8]. In any case, when matter entirely engulfs the globotoroid, Figure 1B), the poles close up and the wormhole vanishes, making the spinning globe fully compliant with the Poincaré conjecture. In this instance the globotoroid topologically could appear as the solid 2D-sphere.

To further examine these globotoroid properties in terms of curvatures, and whether the resulting topologies are open or closed, the dynamics of two distinct globotoroid models are examined. It is demonstrated how different globotoroid dynamics create positive, zero and negative curvatures, and how the resulting topologies may be open, or closed. For instance, the conventional thinking is that the positive curvature results into the closed universe which contracts, but with the wormhole being present this may have to be further clarified.

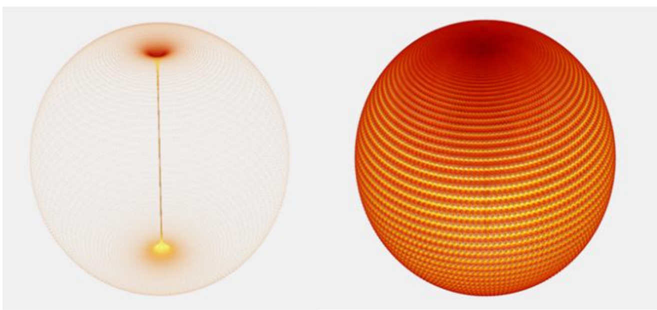


Figure 1. The Globotoroid and the Poincare conjecture

II. THE GLOBOTOROID MODELS

In the previously reported studies, a special emphasis was made to introduce a unique property of the globotoroid models, which is the absence of singularities. These models have no singular solutions, and instead they form a wormhole like manifold, or a wormhole, which dynamically inflates, or deflates, the 3-dimensional spacetime object identified as the globotoroid. These models are:

The first was introduced in [5], and is given by the 3 ODE equations

$dX(t)/dt=\omega\ Y(t)-AZ(t)\ [X(t)+1]$

$dY(t)/dt=-\omega\ X(t)$:Model I

$dZ(t)/dt=-B+A\ [X(t)+1]^2$,

while the second model is described in [6,7], and is given by $dX(t)/dt=\omega\ Y(t)-AZ(t)X(t)$

$dY(t)/dt=-\omega\ X(t)$:Model II

$dZ(t)/dt=-B+A\ [X(t)^2+Y(t)^2+1]$.

For both models the descriptions are; t is the time, X(t) and Y(t) are referred as the action, or orbital, spacetime variables, the coefficient $\omega=2\pi f$ is the angular frequency with $f>0$ being the frequency of orbits. The spacetime variable Z(t) is the growth variable and is stimulated by the growth parameters A, B>0. The three spacetime variables form interesting solutions in the Euclidean 3-dimensional space, or $\mathbf{R}^3$, also referred to as the 3-dimensional phase space.

As reported previously, both models have singular manifold solutions only when A=B. For Model I) this condition implies that the singularities exist when,

$X=0,\ Y=ZA/\omega$ and $Z\varepsilon\mathbf{R}$:Type I

and for Model II) singular solutions are given by

$X=0,\ Y=0$ and $Z\varepsilon\mathbf{R}$. :Type II

In both instances the condition A=B implies that the phase space is densely packed with concentric spheroids surrounding the singular manifold. That is, all the solutions in the two models form spheroids that are homeomorphic to the 3D-sphere, and as such obey the Poincare conjecture.

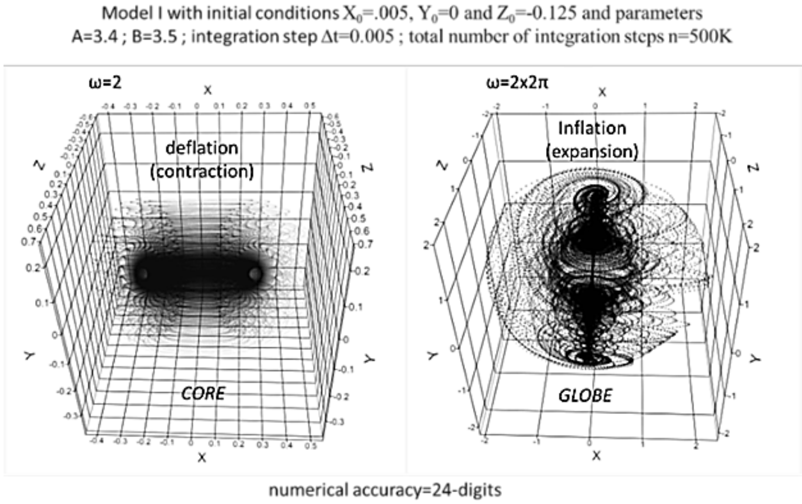
When $A\neq B$, the Type I) and II) singular manifolds transform into the wormholes, which for B<A deflate the spheroids, while for B>A they promote the globotoroid formations. For our purpose the latter is of interest, and in this case the wormhole presence violates the Poincaré conjecture.

Another noticeable difference between the two types of wormholes is that Type I) is frequency dependent, while Type II) is not. For this reason, Type I) is referred to as the wormhole with the rotational momentum, and Type II) as the wormhole with the linear momentum. One can think of Type I) as being a drill bit boring a hole, and Type II) as being a needle piercing a hole through the 3-dimensional spheroid phase space. This observation is important since it rises some phenomenological differences in dynamics of the two globotoroid models.

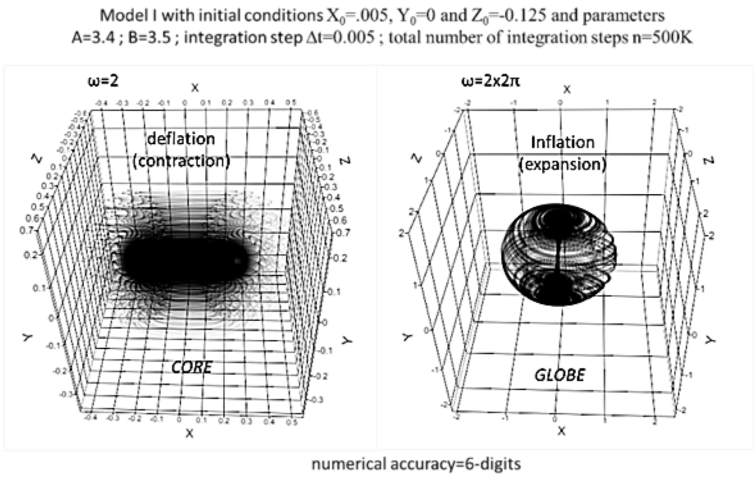
For instance, when the Euler ODE solver is used to simulate Model I), the results obtained are depicted in Figure 2. Similarly, the Model II) simulations given in [7] are replicated in Figure 3. From the two figures it now appears that the Model I) is dynamically more complex. This is because the wormhole with rotating momentum can inflate or deflate the globotoroid by simply increasing or decreasing the angular frequency ω.

In addition, the numerical accuracy makes the process of inflation sensitive in both models, while deflation remains insensitive. As a result, the inflated globe and the toroid core behave dynamically different, the toroid core being more robust.

So far, the globotoroid with the spherical globe is introduced, and before addressing its potential ramifications in cosmology and physics one more topology will be covered. This is the pringle, or the saddle, shaped topology. Again, this shape is homeomorphic to the 3D-torus, and to see this we consider the model with the linear momentum wormhole. The simulated ODEs now have modified growth terms, and the modifications together with the corresponding simulations are presented in Figure 4. Thus, by simply flipping the signs in front of the action variables X(t) or Y(t) one forms the saddle shaped globotoroid, which qualitatively exhibits the same features as the spherical globotoroid. Most importantly it preserves the linear momentum wormhole which supports the pringle shaped toroid core encased by the 3d-saddle shaped globe. During the process of deflation toroid solutions contract and approach the pringle shaped limit cycle, while in the inflation mode toroid solutions expand and are limited by the saddle shaped globe.



(a)



(b)

Figure 2. Different realizations of Model I) as the function of frequency and the numerical accuracy.

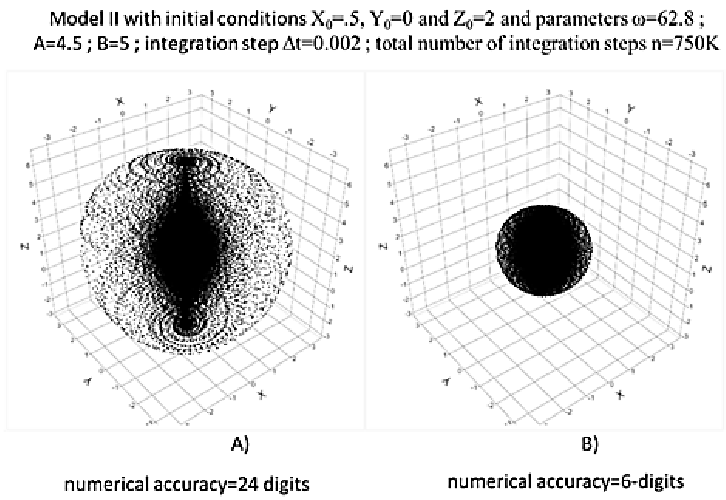
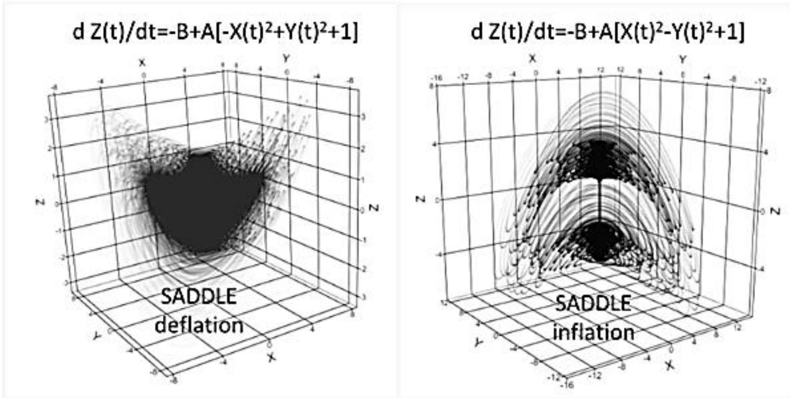


Figure 3. The inflation results for Model II) as a function of numerical accuracy

Modified growth term in Model II with initial conditions X_0=.001, Y_0=0 and Z_0= -.125 and parameters ω=62.8 ; A=4.5 ; B=5 ; integration step Δt=0.0002 ; total number of integration steps n=1,500K



A) numerical accuracy=24 digits

B) numerical accuracy=24 digits

Figure 4. The deflating and inflating saddle type globotoroids

III. THE GLOBOTOROID CURVATURE CHARACTERISTICS

It is apparent that the spacetime simulations of the 2 models cover a wide variety of topologies of interest, with the positive, zero and negative curvatures being are clearly observed in the results presented. However, the connection between the globotoroid topology, curvatures and dynamics in the two models may be ambiguous.

We address this by applying the Gaussian constant K to characterize the globotoroid curvatures. For instance, a torus exhibits points at which the curvatures are K>0, K=0 and K<0. Furthermore, by using the Gauss-Bonnet theorem [9], one can integrate over the entire surface of torus to obtain the total curvature, which is 0 and is equal to the Euler characteristics of torus. Also, note that for the outer half of torus surface K>0, and for the inner half K <0. Moreover, independent of how a torus is bent or deformed, and as long as the hole is preserved, the total curvature is a topologically invariant number, and is always 0.

This curvature concept is now used for the 2 globotoroid models. For both models we first let A=B. and the phase space becomes densely populated with spheroids, for which the total curvature is >0. Interestingly, this also holds for the saddle shaped spheroids introduced by the model modifications in Figure 4. One can verify this by solving the model in the figure for any A=B combination. Clearly, here the topology and the total curvature value are different from the conventional saddle surface for which K<0.

Next, by letting B>A all spheroids morph into tori, and the globotoroid is formed. The morphing process is accomplished through a wormhole, which because of its hyperbolic nature introduces curvature K<0. As a result, the total curvature of each globotoroid state is 0, implying the total globotoroid curvature is also 0, as it should be if the globotoroid and the toroids are homeomorphic.

Furthermore, since for B>A the globotoroids have no singular solutions, a question is what are the long-term repercussions of a wormhole being present. This is of interest only when the globotoroid states inflate, as for deflation the long-term behavior is limited by the limit cycle at the center of the robust core. The model details of the long-term inflation result for Model I) are illustrated in Figure 5. Here, 35x106 points are computed for one loxodromic solution which expands from the core center and is entrapped by the fractal globe surface. Similarly, the long-term simulations of Model II) and its modified version defined in Figure 4, are reported in Figure 6. In this case the loxodromic solution does not remain confined to the globe surfaces for all times, and the wormhole eventually pierces the globe. Hence, the long-term wormhole effects are different for the two globotoroid models.

The primary difference in the two models is in the wormhole type. As mentioned, the Type I) depends on ω, which carries the rotational momentum. Therefore, independent of how high the globotoroid state is, there always will be enough of rotation present to inject the loxodrome back onto the limiting globe. By passing through the wormhole, however the choking, described in [5,6], randomizes the solution and the fractal surface appears. The solution points over the globe surface eventually engulf the globotoroid interior, Figure 5D), making the Poincaré conjecture plausible.

For the case of Model II), the Type II) wormhole is independent of ω, and as such supports the linear momentum. Thus, at high globotoroid states the loxodrome solution loses the spin, and subsequently skips injecting itself back onto the limiting globe. Instead, the solution pierces through the globe and continues to follow the wormhole path along the Z-direction to -∞, Figure 6. Here, the Poincaré conjecture does not hold.

The evaluations of the long-term trends for the model coefficients stated are predicated on solving ODEs with numerical accuracy, typically, 64 digits or higher. This is necessary in order to reach the high globotoroid states buried deep inside the wormhole. If the numeric accuracy is dropped, say to 24 digits or less, the high states may not be reached and the expanding solution will lock itself onto the globe surface. In this case evidences of the fractal behavior in Figure 5, or the wormhole piercing in Figure 6, will not be present. However, for different model coefficients this performance may occur even at the reduced numerical accuracy values. In any case, the thing to remember is that although the two inflation models may have initially very similar dynamics, in the long-term they can produce different outcomes. For instance, it may be tricky to answer if the limiting globe remains long-term open, or it is closed.

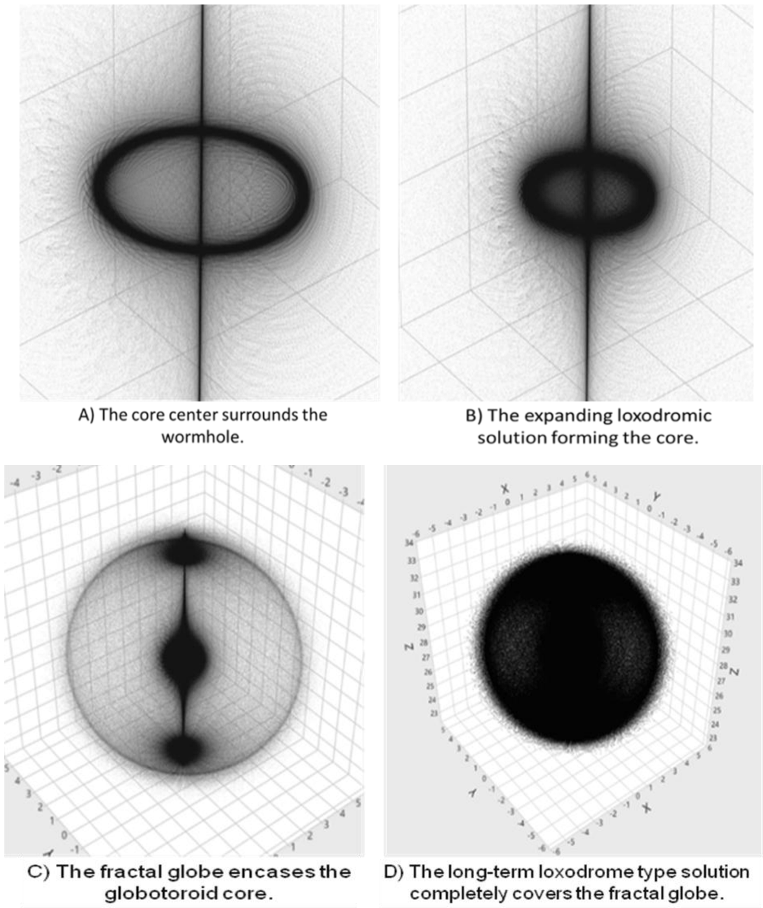


Figure 5. The Model I) simulation with 35x106 points

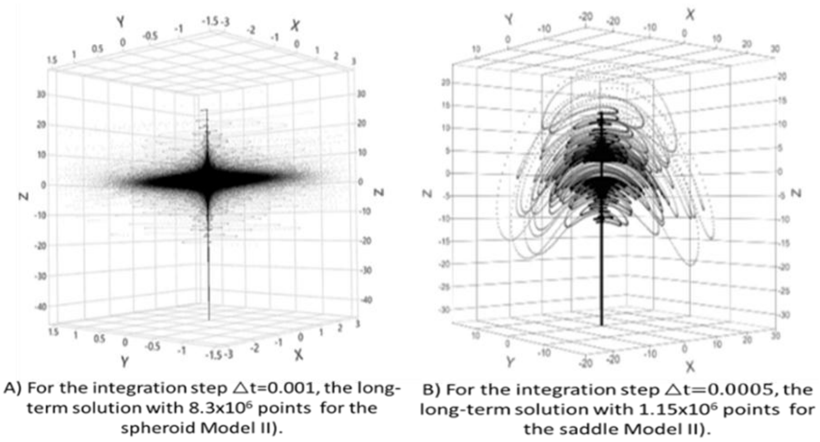


Figure 6. For the numerical accuracy=64 digits, the long-term solutions expose the piercing wormhole

IV. DISCUSSION

So far, we covered the curvatures and the associated dynamics characterizing the 3-dimensional globotoroid forms. In addition, in [7] it was shown how the globotoroid with the entrapped mass particle catalyzes the 4-dimensional dynamical system in which the angular momentum is the governing force. Thus, by infusing matter into the globotoroid a more realistic representation, referred to as the universe, is obtained. In this globotoroid universe there are large numbers of mass and massless particles which continuously manage their existence by negotiating with energy states. How does this work?

First, we need to clarify what is here meant by a particle. The particle can be massless, or it can have mass. When it is massless the total momentum is zero and the 4-dimensional dynamic representation reduces to the 3-dimensional phase space model. Without the momentum massless particles are driven by the phase space velocity, which is high at the globe and slows down while transiting the wormhole. However, due to the absence of a singularity the phase space velocity is never zero [7].

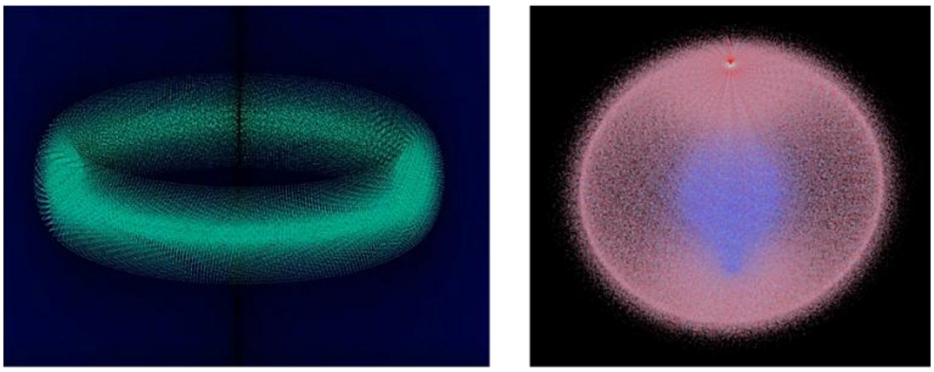
In contrast, for the mass particle the total momentum is greater than zero and the 4-dimenssional globotoroid system emerges. Here, both the angular and the linear momentum can exist at the same time. The angular momentum being the major driving force, makes the mass particle velocity behave inversely to the phase space velocity. The velocity of mass particle accelerates to high speeds while passing through the wormhole, and it slows down at the globe. As a result of this motion the particle spins throughout the phase space, which ultimately creates the 4-dimensional globotoroid system [7]. These differences between the mass and the massless particle types allow the particles to coexist independently of each other.

One can further argue that infusion of mass particles forms the spinning 4-dimensional globotoroid system, which by itself may be viewed as a particle. This argument can be taken retrogressively from the macro to micro organization of matter. In the macro organization a mass particle can be as large as any celestial object, while the micro organization may contain small mass particles, as well as nearly massless subatomic particles. In this report we primarily focus on the 4-dimensional macro organizations.

When the globotoroid is infused with matter, the mass particles tend to agglomerate at the core where the states are dense and stable. By having a bird’s eye view of this core one, in general, will not be able to spot individual particles. Instead, the mass particles form the spinning belt, Figure 7A), which is similar to that observed in images of the newly born stars. Moreover, when the belt inflates and the globotoroid is entirely infused a compact spinning spheroid emerges and suppresses the wormhole presence, Figure 7B). In this spheroid the mass density distribution tends to decreases from the core, and reaches its lowest values at the limiting globe. Hence, the core will tend to spin faster than the globe, which is the characteristic found in making of stars and planets.

In these examples the globotoroid addresses two different universe topologies. In Figure 7A) the total curvature is 0 and the universe is open and expanding, while in Figure 7B) it is positive, closed and contracting respectively. Furthermore, in both situational instances the globotoroid objects form gravity which is proportional to the total object mass multiplied by the gravitational constant.

What happens when the infused mass is huge? In this case the globotoroid globe in Figure 7B) may collapses under its own gravity, and the dense massive core coalesces surrounding the emerging cosmic jet, Figure 8. The jet is aligned with the wormhole and contains high energy states that are accessible only by nearly massless and massless particles. This is because the jet generally has a large angular momentum, which rapidly forces bigger mass particles to reach velocities in excess of the speed of light, and this is not permitted [7]. Nevertheless, as the particle mass diminishes and the momentum fades, the jet is infused with more manageable particles. Recall that the massless particles have no momentum and they slowdown inside the wormhole. At the same time the existing nearly massless particles are moving much faster, which brings on the electromagnetic property of the jet that is often expressed as the powerful gamma-ray. The presence of the massless particles is further hypothesized to form the independent dark matter, which overwhelming occupies the universe.



A) The zero total curvature: The cosmic belt, or cloud, surrounding a wormhole that may form a magnetic jet,

B) The positive total curvature: The matter engulfed globotoroid suppresses the wormhole.

Figure 7. The globotoroids contains both zero total and positive total curvatures

By now it should be evident that the jet action described identifies makings of the black hole, which is at the heart of celestial objects such as galaxies and quasars. As a result, we now can theorize the purpose of a black hole. First, observe that the most dominant black hole topology is determined by the wormhole and its hyperbolic geometry, which makes the total black hole curvature <0. This implies that the black hole, in the present context, is an open structure whose purpose is to crush, smolder, and grind up matter, and use the resulting decay to reseed the universe. Consequently, the type of the wormhole supporting this process poses interesting observations.

With the Type I wormhole the jet's angular momentum creates the closed universe in which reseeding is contained, meaning all of the matter within the universe is recycled. In contrast, the angular momentum for high energy states in the Type II wormhole fades, while the remaining linear momentum forms a piercing jet which may allow the decaying matter to leak out of the universe. Whatever the case, the 4-dimensional universe cannot exist without a wormhole being present.

In conclusion, it was demonstrated how the two globotoroid models having identical curvature characteristics can lead to contrasting conclusions about the universe being open or closed. The argument that the curvature alone can determine whether the universe is closed or open, and subsequently whether it contracts or expands, seems somewhat bold. There appears to be more in behavior of the universe which requires deeper understanding of its complex dynamics.

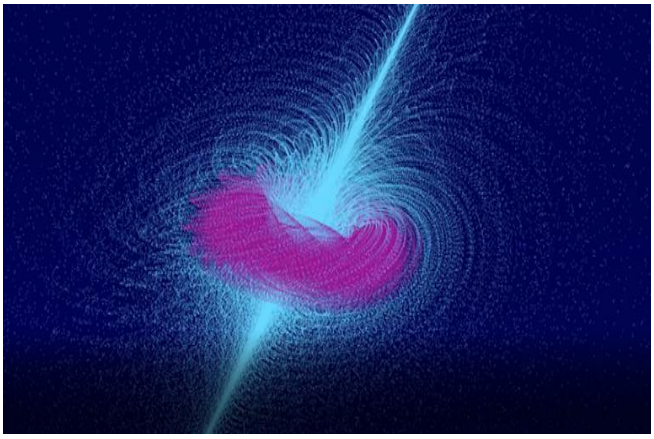


Figure 8. The globotoroid core with the cosmic jet

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His professional calling led him to various research and data sciences positions at DuPont Co. and Emerson Electric Co. He published numerous papers and gave presentations at national and international conferences, primarily on the subject of nonlinear systems. He is also an inventor and has 10 patents.

In 2010 Dr. Samardzija founded an independent research initiative on exploring the subject of globotoroids. In 2011 this effort was named globotoroid.com after his web site www.globotoroid.com. Presently he is an independent researcher and manages all activities for globotoroid.com.

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