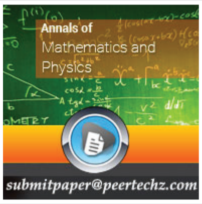
Peertechz


Annals of Mathematics and Physics
submitpaper@peertechz.com

MATHEMATICS AND PHYSICS GROUP

ANNALS OF Mathematics and Physics OPEN ACCESS JOURNAL

ISSN: 2689-7636 DOI: https://dx.doi.org/10.17352/amp

Prospective Study

Algebraic Cubic Equation *vs.* Freedman Equations for the Geometry of our Universe

S Kalimuthu*

Kanjampatti P.O, Pollachi Via, Tamil Nadu 642003, India

Received: 01 June, 2020
Accepted: 09 September, 2024
Published: 10 September, 2024

***Corresponding author:** S Kalimuthu, Kanjampatti P.O, Pollachi Via, Tamil Nadu 642003, India, E-mail: owlskalimuthu@gmail.com

Keywords:: Freedman equations; Application of algebra; the shape of our universe

MSC 08C99, PACS numbers: 98.70.Vc, 98.80.-k, 98.80.Es

https://www.mathematicsgroup.us

Abstract

In 1921 the famous Russian mathematician Alexander Freedman proved by analyzing Einstein's general relativity that the geometry of our Universe has three possibilities namely Euclidean, Hyperbolic, and Spherical. Various cosmological experimental and observational probes of BOOMERanG, NASA's WMAP, and ESA's PLANCK mission revealed that the shape of our universe is flat. But to this day, there is no mathematical formulation for the geometry of our universe. In this short work, the author attempts to show that the geometry of our universe is Euclidean.

A brief journey of general relativity

Einstein felt a compelling need to generalize the principle of relativity from inertial motion to accelerated motion. He was transfixed by the ability of acceleration to mimic gravity and by the idea that inertia is a gravitational effect. These ideas were finally issued in a theory of static gravitational fields in 1912 [1]. The predictions of general relativity like Black holes, gravitational waves, gravitational lensing, the expansion of the universe, dark matter, frame dragging, the orbit of the planet Mercury and the different rates clocks run in a gravitational field have been verified to a very high degree.

General Relativity predicts that light rays passing by massive bodies are delayed because the rays, bent by the body, travel a greater distance and therefore take longer. The time delay was confirmed in 1976 by bouncing radar signals off the radar transponders of Viking landers on Mars.

Another confirmed prediction of general relativity is that time dilates in a gravitational field, meaning that clocks run slower as they approach the mass that is producing the field. This has been measured directly and also through the gravitational redshift of light [2,3].

Many scientists did not accept Einstein's ideas at first. But confirmation of his theory came in 1919 when astronomers documented the deflection of starlight by the Sun's gravity. Einstein had predicted this phenomenon, but he could not foresee the fame that would follow.

Einstein predicted that violent events, such as the collision of two black holes, create ripples in space-time known as gravitational waves [4]. In 2016, the Laser Interferometer Gravitational-Wave Observatory (LIGO) announced that it had detected such a signal for the first time

In 1957, Physicist John Archibald Wheeler introduced the name "wormhole". It can be picturised as a tunnel or bridge with two ends at different points in space-time. It might be separate points in location or time. Wormholes are fundamentally based on the general theory of relativity [5-7].

The Pound–Rebka experiment measured the relative redshift of two sources situated at the top and bottom of Harvard University's Jefferson Tower. The result was in excellent agreement with general relativity. This was one of the first precision experiments testing general relativity.

Citation: Kalimuthu S. Algebraic Cubic Equation *vs*. Freedman Equations for the Geometry of our Universe. Ann Math Phys. 2024;7(3):246-247.
Available from: https://dx.doi.org/10.17352/amp.000130

Proof

The density parameter Ω, the curvature parameter k, and the Hubble parameter H are related as [7]

$(1 - \Omega) = - kc^2 / H^2R^2$ (1)

If omega is less than 1, k is less than 1

If omega is equal to 1, k is zero

If omega is greater than 1, k is +1.

If k is -1, the geometry of the universe is open, if it is greater than one, the shape of the universe is closed and the universe obeys Euclidean geometry if k is equal to zero.

I.e if $\Omega = 1$, the universe is Euclidean,

if Ω = less than 1, the geometry of the universe is open,

And if Ω = greater than 1, the universe is closed.

For our convenience, let us assume in (1), $- n = - kc^2 / H^2R^2$

So, $(1 - \Omega) = - n$ (1a)

Applying (1a) and cubing (1) we get that,

$1 - \Omega^3 - 3\Omega (1 - \Omega) = - n^3$

i.e $(n^3 - \Omega^{3)} + 1 - 3\Omega (1 - \Omega) = 0$

By applying the famous algebraic cubic formula $a^3 - b^3 = (a-b)^3 + 3ab\,(a\ b)$ in the first factor of the above relation we obtain that, $(n - \Omega)^3 + 3n\Omega (n - \Omega) = -1 + 3\Omega (1 - \Omega)$

From (1a) we have, $n - \Omega = - 1$

Putting this relation in the above eqn. we have, $n (n - \Omega) = \Omega (1 - \Omega)$ (1b)

Again applying (1a) in RHS, $n (n - \Omega) = - n\Omega$ (2)

From (1a) we also have, $n - \Omega -= -1$

By assuming the above relation in the LHS of (2) we get $- n = -n\Omega$

By simplifying we get that $\Omega = 1$ (3)

As we have previously noted the shape of our universe is flat if Ω is equal to one.

Discussion

But still, there are problems. Theorists have to determine the global shape of our universe.

The global structure of the universe concludes its geometry plus topology. Cosmologists propose various models by using the FLRW metric [8]. It will take more and more refinements and advancements to furnish the complete structures of our universe. Let us recall that the famous French mathematician used to tell us time and again that as long as algebra and geometry are not linked into one, we could not expect serious results. Considering this nice quote, the author applied the algebraic cubic formula to the Freedman equation to find new results. Also, let us remember Einstein's view. Einstein said that differential equations entered into physics as a maiden servant but became a mistress. Special relativity is purely algebra plus geometry. But that is not the case with general relativity. Einstein wished to deduce many physical results in algebraic systems. In this short work, the author attempts to follow both Lagrange's and Einstein's proposals.

References

1. Cornish NJ, Weeks JR. Measuring the shape of the universe. 1998. Available from: https://arxiv.org/pdf/astro-ph/9807311.pdf
2. Luminet JP. The shape and topology of the universe. 2006;21. Available from: https://arxiv.org/abs/0802.2236
3. Aurich R, Lustig S, Steiner F, Then H. Can one hear the shape of the universe? Phys Rev Lett. 2005;94:021301. Available from: https://arxiv.org/abs/astro-ph/0412407
4. Cornish NJ, Spergel DN, Starkman GL. Can COBE see the shape of the universe? Phys Rev D. 1998;57:5982-5996. Available from: https://arxiv.org/abs/astro-ph/9708225
5. Gomero GI. Can we see the shape of the universe? Int J Mod Phys A. 2002;17:4281-4286. Available from: https://arxiv.org/abs/astro-ph/0210279
6. Gomero GI, Reboucas MJ, Teixeira AFF. Signature for the shape of the universe. Int J Mod Phys D. 2000;9:687-696. Available from: https://arxiv.org/abs/gr-qc/0105048
7. Gomero GI. Determining the shape of the universe using discrete sources. Class Quant Grav. 2003;20:4775-4784. Available from: https://arxiv.org/abs/astro-ph/0305071
8. Bayin SS. Is the universe flat? 2013. Available from: https://arxiv.org/abs/1309.5815

Citation: Kalimuthu S. Algebraic Cubic Equation *vs*. Freedman Equations for the Geometry of our Universe. Ann Math Phys. 2024;7(3):246-247. Available from: https://dx.doi.org/10.17352/amp.000130