Journal of High Energy Physics, Gravitation and Cosmology, 2022, 8, 1102-1109
https://www.scirp.org/journal/jhepgc
ISSN Online: 2380-4335
ISSN Print: 2380-4327

The Big Bang Influence in a Cosmological Wave Complex

Ivan Nilsen

Insvivia Technologies AS, Hidrasund, Norway
Email: ivan.nilsen@live.no

How to cite this paper: Nilsen, I. (2022) The Big Bang Influence in a Cosmological Wave Complex. *Journal of High Energy Physics, Gravitation and Cosmology*, **8**, 1102-1109.
https://doi.org/10.4236/jhepgc.2022.84077

Received: August 16, 2022
Accepted: October 17, 2022
Published: October 20, 2022

Abstract

The Big Bang theory states that the universe was created from pure energy, although matter, in general, is also pure energy and there is no known physical existence that is not pure energy in accordance with the mass-energy equation. All known energy is situated in a field, and it can be questioned whether also the Big Bang was situated in a field in the primordial moment it inflated into the subsequent cosmic expansion that so far lets us observe a 93-billion-light-year-wide spherical volume of the universe. In this study, the Big Bang's gravitational influence, particularly in the form of an externally radiated gravitational wave, is considered in connection to its situation in a surrounding field with a different expansion rate than itself. The results suggest that the least possible size of the universe can be predicted by the expression of the gravitational wave produced by Big Bang, revealing that the universe has a significantly greater size than the observable, and further that Big Bang might be the production of only one of many cosmic galaxies situated together in a cosmological wave complex (CWC) where the amplitude is self-maintained by inflations.

Keywords

Gravitational Waves, Big Bang, Inflation, Cosmological Wave Complex, Cosmic Expansion, Dark Energy

1. Introduction

To this day, we have no tools to identify any real size of the universe beyond the cosmological horizon and what is known as the observable universe. The observable universe is known to have a diameter of 93 billion light years, and an age of 13.8 billion years. Predicting any size or age of the real universe beyond the observable is by many considered impossible. However, this is not necessarily the case as our increasing knowledge of physics also gives us new tools to define indirect phenomena that possibly can identify that the universe must have a least possible size outside our observable universe as a causally connected part of a larger cosmological system.

The Big Bang theory [1] [2] is the prevailing model for explaining the creation of the universe, where the very early universe commonly is described as a cosmic inflation [3] [4] [5], although the events triggering the creation are considered unknown. The physical laws do not apply to the earliest moments of the universe. It is still unknown whether the fundamental interactions can be unified to a grand unified theory [6] or not, and if so, whether they can be unified with the gravitational field to a complete unified field theory that could bring us closer to the physical conditions of the primordial moments of the universe. The lack of mentioned knowledge is however not important to the Big Bang influence in a cosmological wave complex, hereinafter named the CWC, if the existence is present. In this paper, the existence of a CWC is considered as illustrated in **Figure 1**, and how the Big Bang influence would characterize the CWC and its size.

In current models, the Big Bang location and influence on a surrounding gravitational field is irrelevant due to the inability to identify whether such a field even exists, and accordingly, that it is not obeying the same expansion as the Big Bang itself. An infinite universe is popularly considered as a real possibility although it is scientifically impossible to define infinity with mathematics. The possible infinity can in that sense be considered irrelevant to theories aiming to predict how the Big Bang would influence a field that has a different expansion rate, that is not expanding at all or that is even contracting.

This study will particularly consider the Big Bang's mass and energy content in relation to its peak expansion velocities, and the magnitude of its gravitational influence on the surrounding field derived there from. In general, gravitational waves [7] [8] are a product of the acceleration or deceleration of mass, which is assumed to obey the same nature in the surrounding field, where the Big Bang itself is part of a CWC. Further, the least possible size of such a CWC is assumed to be predictable by the size of the gravitational wave produced by the Big Bang.

Figure 1. Scale levels of the universe.

2. The Surrounding Gravitational Field

In the primordial moment of the universe, all mass and energy were according to existing models collected in a single point, as the precursor that led to Big Bang. Different theories and hypotheses have attempted to characterize this precursor in comparison to black holes in our observable universe, with potential similarities and differences. The nature of a black hole is that the flow of time is radically slowed in comparison to the surrounding field, assumably to a near zero level. If the surrounding field did not exist, then this difference would not be present, and the flow of time in the black hole would have nothing to be compared with or characterized as fast or slow in this relationship.

It can be questioned whether it really is possible that the Big Bang could have an edge where there is no gravitational influence beyond that edge. Although infinity is by concept an edgeless phenomenon, a field with just a slightly different expansion rate will automatically incorporate a non-edgeless wave production from the Big Bang that should be equivalently for other points of expansion like Big Bang in the same common field that make up the CWC. When such phenomena occur, it will impact the further evolution of the CWC and may continuously grow in extent to a stabilized level, which could have happened long before Big Bang, as a possible beginning of the CWC we live in today. Hence, each point of inflation will reflectively contribute to maintain the waveness of the CWC and stabilize its amplitude.

A gravitational wave cannot move faster than the speed of causality C. The C is a physical constant, and its value in the surrounding field is unknown. By assuming that the Big Bang-expansion is moving faster than C of the surrounding field, the gravitational wave is produced as an effect of acceleration. In other words, the surrounding field will be forced to deform, and the energy of the deformation is transformed to a gravitational wave that subsequently will propagate into the deep space of the CWC.

3. The Gravitational Wave from Big Bang

To this day, we do only have classical theory for describing gravity and gravitational waves. Without the ability to quantize gravitational phenomena, we cannot define the exact propagation potential of a gravitational wave based on its characteristics, although we have scenarios of measurable gravitational waves produced within our observable universe as a reference we can scale-up to the influence of Big Bang. We do not know the overall mass and energy that were collected in the primordial moment of Big Bang, but the observable matter and energy makes up the least possible amount it must have contained.

The peak power of a gravitational wave P_g is a product of the acceleration of mass $M_{\odot}$, measured by the squared velocity v^2, times the mass $M_{\odot}$ that is accelerated by that velocity:

$$P_g = M_{\odot} \times v^2$$

As the gravitational wave propagates, the power is distributed and drops off the inverse square of the length of propagation. This means that the potential length of propagation L_p of a gravitational wave increases proportional to its power:

$$L_p = P_g = M_{\square} \times v^2$$

The gravitational wave observation GW190521 [9] is located 5.3 Gpc from our solar system, and was produced by a merger of two black holes with a combined mass of $151 M_{\odot}$. The observable universe is estimated to have an overall mass in excess of $1.3 \times 10^{23} M_{\odot}$, which equals to 1.16×10^{21} times more mass than the mass that produced the GW190521-wave.

In order to calculate the potential length of propagation L_p for the Big Bang-event, based on only the observable matter, it can be expressed as the following formula where GW190521 is used as the reference:

$$L_p = \left(\frac{BP_g}{P_g}\right) \times D = \left(\frac{BM_{\square} \times Bv^2}{M_{\square} \times v^2}\right) \times D$$

where BP_g is the estimated least peak power of the gravitational wave produced by Big Bang, $BM_{\odot}$ is the observable matter from Big Bang, Bv^2 is the estimated expansion velocity of Big Bang, and D is the observed distance for reference.

By assuming the Big Bang expansion velocity to be at least 10^{14} times greater than the event producing GW190521, the least possible L_p can be estimated with the following calculation:

$$\left(\frac{\left(1.3 \times 10^{23} M_{\square}\right) \times 10^{28}}{151 M_{\square} \times 10^{1}}\right) \times \left(5.3 \times 10^{9} \text{ pc}\right)$$

$$= \left(\frac{1.3 \times 10^{51}}{151}\right) \times \left(5.3 \times 10^{9} \text{ pc}\right) = 1.16 \times 10^{58} \text{ pc}$$

The CWC will thereby need a radius of at least 1.16×10^{58} pc in order to have a distant location where the P_g is similarly measurable as GW190521 was in our solar system. This is based on a similar absorption rate through the CWC as through our observable universe, and the assumption that the gravitational wave will propagate homogenously in all directions.

A CWC-radius of 1.16×10^{58} pc will imply a minimum age of the CWC of 3.78×10^{58} years by assuming that the location for the gravitational wave absorption is already existing, which means a far older universe than the estimated 13.8 billion years for the observable universe.

4. A Cosmic Galaxy

As continuously new inflations occur in the CWC, new gravitational waves are produced. This will control the distribution of energy and separate the creation of matter from each other. Each point of matter-creation is in this study considered as a cosmic galaxy, which means that the observable universe is part of one cosmic galaxy, and that Big Bang were the precursor of this cosmic galaxy which we live in today. Although other cosmic galaxies may be unreachable due to the large distances, they are still causally connected within the CWC and in common controlled by the gravitational waves that characterize the distribution of cosmic galaxies.

As a possible solution to that the universe seems fine-tuned for the existence of molecular matter and life, different multiverse-theories [10] [11] [12] [13] and hypotheses have been proposed where the variation of physical constants within the different parallel universes entails that our fine-tuned universe must exist. Within a CWC, this is however not necessarily possible, because the amplitude will stabilize within certain levels, and the physical constants derived from different zones of the CWC do not necessarily have that big variation potential.

Although another cosmic galaxy can be considered as a parallel universe, it is still possible that the entire CWC can be part of something even bigger, and it is as a theory not in conflict with multiverse-theories.

The life cycle of a cosmic galaxy is divided in two main periods, the contraction phase and the expansion phase, illustrated in **Figure 2**. The contraction phase will involve a gravitational collapse leading to an implosion at the end, which creates the precursor for the following inflation that initiates the expansion phase.

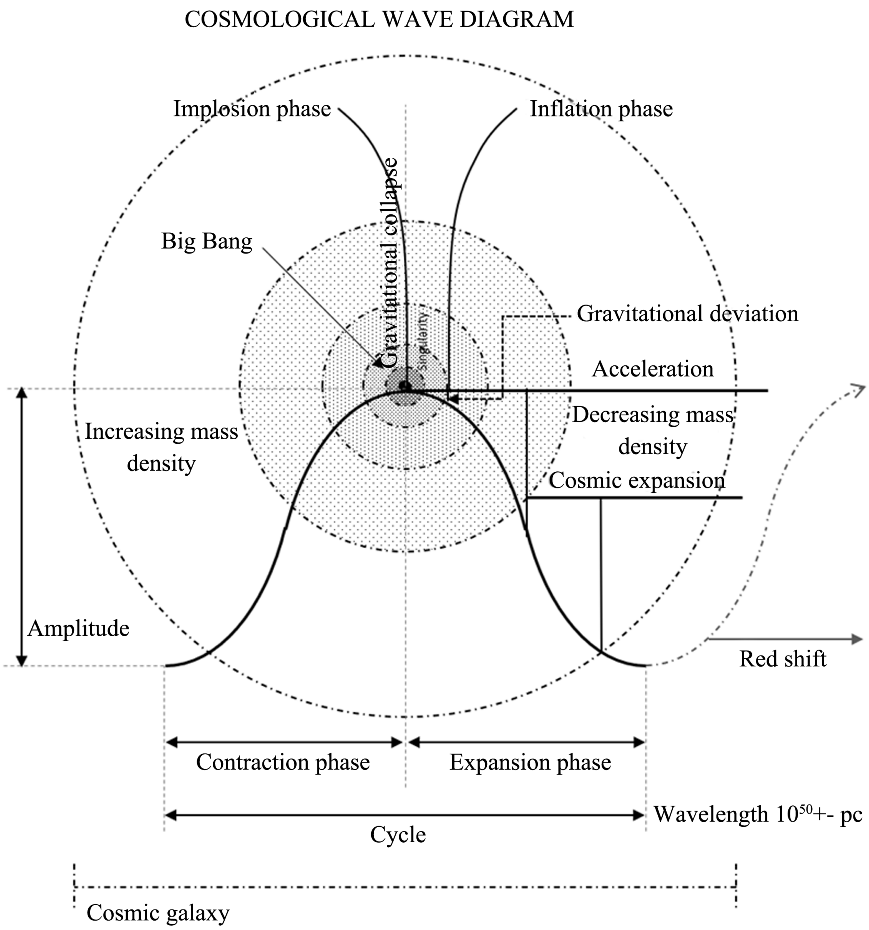

Figure 2. Cosmological wave diagram.

5. Dark Energy

To explain the observed cosmic expansion of the current observable universe, current models depend on the existence of dark energy [14] [15] [16]. Persistent attempts to identify dark energy, both theoretically and empirically, have not yet succeeded, and it is an open question whether it is caused by something local, cosmological, or driven by other phenomena.

While the density of normal matter and dark matter is decreasing due to the cosmic expansion that spreads it out, the amount of dark energy is volumetrically constant, and therefore, the percentage of dark energy is continuously increasing. In other words, as new space enters our universe, that new space already contains the same amount of dark energy as the space we had from before.

The universe considered as a CWC opens the possibility for dark energy to be described as an effect of the gravitational wave which controls the cosmic galaxy we live in. The galaxies in our cosmic galaxy are not moving away from each other, but the space between them is not only predominated but completely governed by the gravitational actions in the CWC and must grow if the cosmic galaxy is situated in an expansion phase.

6. The Size of the Universe

Given that the external gravitational wave produced from Big Bang is homogenously propagating into the deep space of the CWC, the least possible volumetric size of the universe can be estimated with the volume of sphere-formula:

$$V = \frac{4}{3}\pi r^3$$

Based on the estimated CWC-radius of 1.16×10^{58} pc, the volumetric size can be estimated in cubic parsec pc^3 with the following calculation:

$$\frac{4}{3}\pi\left(1.16\times10^{58}\ \text{pc}\right)^3 = 6.53\times10^{174}\ \text{pc}^3$$

Compared to the volume of our observable universe of $1.22 \times 10^{31}\ \text{pc}^3$, this implies that the universe has a least possible size that is 5.35×10^{143} times greater than the observable universe. The amount of that space that is filled with matter and cosmic galaxies depends on the wavelength and characteristics of the gravitational waves that controls the distribution of matter and energy.

7. Conclusions

How large the actual universe is compared to our observable universe is outside our current knowledge. However, considered as a CWC, it can be calculated to have a size that makes the observable to a very tiny volume in comparison. This is due to the gravitational wave produced by only the acceleration of the observable matter and energy during the cosmic inflation, which primordially must have significantly deformed the surrounding field to an extent that will provide a potential length of propagation that extents very large distance beyond the cosmological horizon. This requires the CWC to have a corresponding size in order to propagate and absorb the energy of the gravitational wave.

The existence of a surrounding field that was primordial to the creation of our universe, and may have existed long before Big Bang, raises the questions of how long such a CWC could have existed and how it will influence the evolution of the universe in the long-time perspective as a possible stabilization of cosmological waves and creation of cosmic galaxies. The age of our observable universe is not necessarily a long cosmological epoch compared to the dynamics of a CWC. The dark energy and cosmic expansion may be a sign of the fact that we actually live in a CWC, and that the Big Bang is not directly part of an infinite expanding universe, although the CWC still can be part of an even larger universe that also could be infinite.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

[1] Ashtekar, A., Pawlowski, T. and Singh, P. (2006) Quantum Nature of the Big Bang. *Physical Review Letters*, **96**, Article ID: 141301. https://doi.org/10.1103/PhysRevLett.96.141301

[2] Linde, A., Linde, D. and Mezhlumian, A. (1994) From the Big Bang Theory to the Theory of a Stationary Universe. *Physical Review D*, **49**, 1783-1826. https://doi.org/10.1103/PhysRevD.49.1783

[3] Linde, A. (1982) A New Inflationary Universe Scenario: A Possible Solution of the Horizon, Flatness, Homogeneity, Isotropy and Primordial Monopole Problems. *Physics Letters B*, **108**, 389-393. https://doi.org/10.1016/0370-2693(82)91219-9

[4] Guth, A. (1981) *Physical Review D*, **23**, 347-356. https://doi.org/10.1103/PhysRevD.23.347

[5] Vennin, V., Martin, J. and Ringeval, C. (2015) Cosmic Inflation and Model Comparison. *Comptes Rendus Physique*, **16**, 960-968. https://doi.org/10.1016/j.crhy.2015.07.007

[6] Nilsen, I. (2022) On the Relationship between Quarks and Electrons. *Journal of High Energy Physics, Gravitation and Cosmology*, **8**, 681-689. https://doi.org/10.4236/jhepgc.2022.83050

[7] Einstein, A. and Rosen, N. (1937) On Gravitational Waves. *Journal of the Franklin Institute*, **223**, 43-54. https://doi.org/10.1016/S0016-0032(37)90583-0

[8] Castelvecchi, D. and Witze, A. (2016) Einstein's Gravitational Waves Found at Last. *Nature*. https://doi.org/10.1038/nature.2016.19361

[9] Abbott, R. (2020) GW190521: A Binary Black Hole Merger with a Total Mass of 150 M. *Physical Review Letters*, **125**, Article ID: 101102. https://doi.org/10.1103/PhysRevLett.125.101102

[10] Kragh, H. (2009) Contemporary History of Cosmology and the Controversy over the Multiverse. *Annals of Science*, **66**, 529-551. https://doi.org/10.1080/00033790903047725

[11] Steinhardt, P. (2014) Big Bang Blunder Bursts the Multiverse Bubble. *Nature*, **510**, 9.

https://doi.org/10.1038/510009a

[12] Tegmark, M. (2003) Parallel Universes. *Scientific American*, **288**, 40-51. https://doi.org/10.1038/scientificamerican0503-40

[13] Bousso, R. and Susskind, L. (2012) Multiverse Interpretation of Quantum Mechanics. *Physical Review D*, **85**, Article ID: 045007. https://doi.org/10.1103/PhysRevD.85.045007

[14] Peebles, P.J.E. and Ratra, B. (2003) The Cosmological Constant and Dark Energy. *Reviews of Modern Physics*, **75**, 559-606. https://doi.org/10.1103/RevModPhys.75.559

[15] Lonappan, A.I., Kumar, S., Ruchika and Sen, A.A. (2018) Bayesian Evidences for Dark Energy Models in Light of Current Observational Data. *Physical Review D*, **97**, Article ID: 043524. https://doi.org/10.1103/PhysRevD.97.043524

[16] Durrer, R. (2011) What do We Really Know about Dark Energy? *Philosophical Transactions of the Royal Society A*: *Mathematical*, *Physical and Engineering Sciences*, **369**, 5102-5114. https://doi.org/10.1098/rsta.2011.0285