

Operationalizing Black-Hole Cosmology Through Iterative Computer Simulations

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Abstract

Operationalizing Black-Hole Cosmology (BHC) through iterative computer simulations will provide data regarding the Cosmic Microwave Background (CMB) temperature fluctuations. These fluctuations provide the most useful data currently being used by cosmologists studying the early universe. The results of these simulations will either substantiate hypothesized BHC predictions or indicate that further research is required. Substantiated predictions would suggest that the universe did, in fact, originate from a black hole existing within a parent universe.

1. Background

In 1927 a scientist by the name of Lematre proposed that our universe was initially extremely dense and hot. He further proposed that the universe then experience a period of rapid expansion. The essence of this belief is what constitutes the Big-Bang theory. Two years later Hubble discovered that the universe is expanding. In 1948 another scientist by the name of Alpher discovered that the theory matches observational data from the lightest particles in the universe. Later on Penzias and Wilson discovered cosmic microwave background (CMB) radiation which came from all directions in the universe. The radiation is remnants left over from the early universe and gives scientists clues as to the origin of the universe. The CMB, however, did not explain why the universe looked so uniform. It was from this dilemma that physicists developed the inflation theory. This theory proposes that the universes uniform appearance can be attributed to its rapid and symmetric expansion shortly following the big bang. This theory accurately predicted the CMB temperature slightly changes with the direction of the sky.

Although Big-Bang cosmology answers many questions it does not accurately explain how the universe was created. Big-Bang cosmology predicts that the universe began as a point of infinite density. This prediction does not make physical sense and consequently indicates that we have an incomplete understanding of the physics of the early universe. Moreover, inflation theorists had to introduce hypothetical types of matter which has never been observed. These theorists also relied on models which were frequently adjusted in order to match their predictions. Furthermore, Big-Bang cosmology does not predict what existed before the big bang.

The answer to this fundamental problem might come from Black-Hole cosmology (BHC). BHC purposes that the universe was created by a black hole which exists within a parent universe. If a star is large enough it can collapse into a black hole due to the the weight of its own gravity. Matter can not escape from a black hole because the escape velocity of a black hole is faster than the speed of light and anything with mass can not travel as fast as the speed of light. Consequently, not even light can escape the black hole hence the name. Matter inside of a black hole collapses until it reaches a certain point of extremely high density. It is at this point that the black hole

can cannot collapse any further and, in fact, bounces outwards (but still can not leave the black hole). After this bounce the black hole would expand into a new region of space which becomes a universe (Pathria 1972, Popawski 2010).

Although BHC may explain the origin of the universe it has yet to generate specific predictions about the observed CMB temperature fluctuations. These fluctuations provide the most important data currently being used by cosmologists studying the early universe.

2. Hypothesis

Black holes should be able to create universes which share similar characteristics with our universe. Dr. Poplawskis mathematical framework only contains one free parameter (particle production rate) which is predicted through graphical data (see Fig. ??). Only having one free parameter makes this theory more stable than inflation theory which has two. Furthermore, if and when quantum gravity is solved then we will know what the particle production rate is. This will either support BHC or indicated that major changes are needed within the mathematical framework.

3. Methodology

In order to operationalize and test the BHC theory the research will be split into two parts. The first part involves writing a computer program the Fortran programming language which will numerically solve a system of two coupled, ordinary, first-order differential equations which describe the dynamics of a closed universe in a black hole (NP, arXiv:1410.3881). These equations are the Einstein-Cartan equations of general relativity with spin and torsion (Sciama 1964) are also modified by quantum particle production from the vacuum of strong gravitational fields near the bounce (Popawski 2014). These equations give the size (scale factor) a and temperature T of the universe as functions of time t (see Fig. 1). Quantum particle production should greatly increase the mass inside of a black hole. The universe may undergo several bounces, but it will eventually have enough mass to expand to infinity.

The second part in operationalizing this theory involves evaluating whether or not hypothesized predictions match the results generated by the computer program. Since the rapid recoil of the bounce could be the cause of universal expan-


sion, the results of the recoil should match observations of the universes size and mass as functions of time, its geometry, and several variables which describe the fluctuations in the CMB temperature. The results obtained from a graphical representation of the data should match the predicted values of the scalar spectral index n_s (see Fig. 2). Results The simulated values of n_s in our model are consistent with the observed CMB value n_s for a small range of a_0 and a wide range of a_0 (m) (See Fig. 3). From this we can make several conclusions. The dynamics of the early universe formed in a black hole depends on the quantum-gravitational particle production rate, but is not too sensitive to the initial scale factor a_0 . Further, inflation (exponential expansion) can be caused by particle production with torsion if α is near some critical value α_c . Since our results for n_s are consistent with the 2015 CMB data we can further support our assertion that our Universe may have been formed in a black hole.

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