

Extreme Chaos and Complexity in Primordial Black Holes; Order and Patterns in Black Holes Resulting in the Creation of Dark Energy and Dark Matter ; Continuous Expansion of the Cosmos Fueled by Dark Energy ; the Big Crunch

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Abstract:- Extreme Chaos exists in black holes and has existed in the early universe in primordial black holes. All Chaotic systems settle to Complexity and subsequent pattern forming order, with an attractor and with the probability of reverting back to the early Chaos .. This paper proposes that such Chaotic environments in primordial black holes resulted in the formation of Complexity in the nature of dark energy , which is repulsive, and furthermore, to dark matter , which is attractive in nature . Consequently, all dark matter and dark energy have been created in black holes. The predominance of dark energy has fueled the expansion of the universe., which is expected to continue, till its value turns negative and gives rise the Big Crunch.

I. EXTREME CHAOS IN PRIMORDIAL AND OTHER BLACK HOLES

More disorder is present in a single black hole than all the stars put together. The quantity of disorder is measured by a number called entropy. The measure of entropy is greater when the disorder is greater . In the Universe, all the stars together contribute approximately 10^{79} units of entropy or 1 with 79 zeros following .However, this number is meager when compared to the entropy in black holes .

Stephen Hawking , in 1970, showed that random radiation is radiated by black holes. It has been termed Hawking radiation. Such radiation implies a highly ordered external state. Hawking calculated that the entropy of a black hole increases with its surface area.

It has been estimated that a single supermassive black hole of the type found in the center of galaxies could possess 10^{91} units of entropy , a trillion times that of all the stars of the Universe.[1]

Assuming the inclusion of a supermassive black hole in every galaxy, the total entropy of the Universe is calculated at 10^{102} . This would be closely related to the number of possible ways of arranging matter and energy in the Universe - a staggering number to the order of $(2^{10^{102}})$.

The ensuing disorder cannot be explained by collapsing stars forming a black hole. A possibility is that such a collapsing ball through the extra entropy generated by the random nature of quantum physics transforms into an arrangement of matter having the maximum disorder. Here particles travel at high speeds in all directions.

II. PRIMORDIAL BLACK HOLES AS THE ORIGIN OF DARK MATTER

Current research suggests that black holes in our universe were created immediately after the Big Bang and account for all dark matter, which arose in the black holes. They are the primordial black holes . Thus , during the early universe, instead of the creation of baryonic matter, dark matter was created., as Stephen Hawking had suggested in the 1970s.[2].

The question that may be solved is why would supermassive black holes grow as fast and huge in the early universe? The mass of a galaxy has been found to be proportional to the mass of the supernova black hole at its center.

Primordial black holes may be the source of supermassive black holes. This idea originates from the model suggested by Stephen Hawking and Barnard Carr , who proposed that in the first fraction of a second after the Big Bang very small fluctuations in the density of the Universe may have created an undulating landscape with 'lumpy regions ' that possessed extra mass . Those lumps would ultimately collapse into black holes.

The model constructed by Capellati, Natarajan and Hassinger suggest that the first stars and galaxies in the Universe would have formed around black holes. They may have grown by feasting on other stars or merging with other black holes.[2]

Distant, dim sources scattered around the Universe have exhibited excess infrared radiation., which may bear the signature of primordial black holes.

III. DARK ENERGY AND BLACK HOLES

The universe is filled with dark energy, the energy that is present in the fabric of space. Dark energy constitutes 68% of the matter in the Universe, whereas dark matter comprises 27% , and visible matter 4.9%.The acceleration of the expansion of the Universe is caused by dark energy, which is a repulsive force.

Dark energy is detected by the rate at which the Universe expands and its effect on the rate at which galaxies and galaxy clusters form through gravitational instability. In black holes dark energy has an influence over the Hawking radiation.[3] Dark energy lowers the temperature of Hawking radiation , thus making the black hole possess a longer life time.

In the early Universe, dark energy was negligible.[4]. The current rate of expansion detected is faster than in the past and at present, the Universe is dominated by dark energy. It has been estimated by some researchers that in the last few billion years dark energy has prevailed in quantity, thus preventing more galaxies and clusters of galaxies from forming .

The first direct evidence of dark energy arose from observations of the supernova of 1998 in the accelerated expansion by Riess et al and Perlmutter et al. [5].

It is still not evident, however , how dark energy was first created. It is hypothesized here that since dark energy can pass through black holes without any gravitational hindrance, [6]. It may have first arrived in primordial black holes . Dark energy may have traveled through wormholes connected to supermassive black holes and seeped into our universe after the Big Bang from probably another universe . After the formation of more supermassive black holes and subsequent merger of many of them, dark energy may have spread gradually in our universe and increased the rate of acceleration.

IV. CHAOS AND THE CREATION OF DARK MATTER IN OUR UNIVERSE WITH DARK ENERGY IN PRIMORDIAL BLACK HOLES.

A recent study reveals that Chaos in our Universe would have dominated the Universal realm about 10^{-43} seconds after the Big Bang. It probably lasted for 10^{-36} seconds. During this period , the Universe was expanding from its minute, high temperature and high density initial moments .[7]. The early Chaotic state was followed by rapid expansion called inflation, when the Universe doubled in size 100 times during the fraction of a second.

Primordial black holes were created immediately after the Big Bang and maintained Chaos. The formation of dark matter prior to baryonic matter has been previously discussed . Complexity arose with the accumulation of dark matter. This paper suggests that wormholes were created that led from another Universe and dark energy seeped in.

The onset of Chaos then, gave rise to two factors, first, the bifurcation process leading to the formation of dark matter, and the rise of dark energy. With the expansion of the Universe, dark matter was able to adhere to the galaxies which formed and dark energy permeated the spacetime fabric.[8] . Later, baryonic matter was created in the same but less intense Chaotic process which was responsible for the construction of galaxies and subsequently stars and solar systems as a resulting order that evolved in the Universe with time.

In the early Universe, both sources of dark matter and dark energy arose in primordial black holes and were distributed in the Universe in underlying patterns that revolved around random attractors.

More supermassive black holes emerged with time and more quantities of dark energy appeared from the massive increases in entropy. This increased the expansion of the Universe that dominates in recent periods.[9].

The dominance of dark energy in our Universe at present is the gradual evolution from their quantities driving through black holes, fueled by Chaos and forming a repulsive force. During the expansion of the galaxies they have permeated the spacetime fabric increasingly.

V. THE BIG CRUNCH: WILL IT HAPPEN? CAN ORDER RETURN TO CHAOS?

Observations indicate that dark energy exists and has not changed since the early Universe, although its quantities have increased and it has been instrumental in the expansion of the Universe. The repulsive force of dark energy seems to be greater than the attractiveness of dark matter. Thus the expansion is expected by some researchers to continue indefinitely and the Big Crunch may not occur at all. In a Chaos and order model, the patterns may occur indefinitely. A return to Chaos similar to the birth of the Universe may not then happen.

The current Universe contains 0.01% photons, 0.1% neutrinos, 4.9% normal matter (which is visible) , 27% dark matter and 68% dark energy (both of which are invisible).The large content of dark energy and its repulsive force is expected by some scientists to continue the expansion of the Universe , which may result in a deterministic and predictable pattern involving Complexity and inherent order without reverting to Chaos again.

In the strange world of quantum Physics and elementary particle theory, however, the logic of dark energy always attaining a positive value may not apply, according to the Andre Linde and Renata Kallosh model. [10]. Some of their attempts at describing dark energy estimate a negative value and then slow contraction, which may lead to the Big Crunch. Our model concurs with such a prediction, in that Chaos would lead to Complexity and order, and then again back to Chaos, in a pattern which may see the birth and demise of many Universes.

VI. CONCLUSION

In the early Universe, when primordial black holes began forming, there existed extreme Chaos within them. Consequently, as the bifurcated Chaotic process proceeded, dark matter was formed and dark energy seeped in through the created wormhole, presumably from beyond the spacetime fabric, possibly from another Universe. Through time, the history of the cosmos has revealed a predominance of dark energy, which has fueled the expansion of the Universe, which has been observed currently.

The expansion may not be indefinite, and there is a probability that dark energy may assume negative values in the future, thus leading to gradual contraction and possibly to the Big Crunch. In that scenario, Chaos has given way to ordered patterns and with time the system may proceed to disorder and Chaos within the realms of predictable patterns.

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