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About Some Difficulties of Cosmology and New Ideas for Solving Them

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Abstract

The Big Bang (BB) theory is considered an accepted scientific fact, despite some lack of empirical evidence and although there is a set of discrepancies with the observations made of the far universe. New measurements of the Hubble constant suggest implications about the validity of the current Standard Model of cosmology at the extreme scales of cosmos. NASA measured in 2014 that space in the universe seems to have an Euclidean shape. According to Stephen Hawking and Alan Guth, the universe started by a mathematical point, with an infinite amount of energy, which is a non-physical assumption. Problems also exist about the size of the universe observable today. A new model aims to resolve all these problems and offers a new vision of cosmology through the extension of the Einstein's theory of relativity.

Keywords: Cosmology; Universe; Contemporary Physics; Time; Space; Unification; Primordial Dynamic Space Model

Introduction

The current conceptual framework of the universe, and in particular of its birth, is having difficulty in reporting new observational data. In the attempt to save the Big Bang (BB) model, every new discrepancy between theory and observed facts is considered a promise for further empirical research, seen as a progressive approach towards the truth represented by the mathematical model itself.

The BB hypothesis emerged originally as an indirect consequence in the re-modeling of Einstein's theory of general relativity. Einstein thought also that the universe was static in space and time; he subsequently admitted that the addition of the cosmological constant in his equations had no physical justification. When Hubble observed that the universe was expanding, causing Einstein's solution to lose meaning, some mathematical physicists tried to change a fundamental assumption of the model, namely that the universe is the same in all spatial directions but changeable over time.

From the beginning, the BB theory has only spoken of the immediate consequences of an explicitly hypothetical event, saying nothing about the BB itself, hypothesis that cannot be proven. The BB scheme is based on some concrete discoveries, such as the 1929 Edwin Hubble's observation that the universe seems to be expanding and the 1964 detection of the microwave background radiation, observations having a big influence on cosmological theory.

The BB paradigm seems to lack of proven certainties; the theoretical framework has fewer observations than the free parameters to modify them, an alarming signal for every scientific theory.

Most of the observations on the universe occur experimentally and indirectly; current space telescopes produce measurements through an interaction of theoretical predictions and flexible parameters, in which the model is involved in every phase of the process, thus not offering a direct view of anything.

It is therefore not surprising to hear some scientists speaking openly to date about a crisis in cosmology; many key pieces of the BB paradigm are becoming indefensible as scientific theory, because the inflation theory is based on ad hoc mechanisms to be able to accommodate almost all collected data.

A determining function of inflation is to bridge the transition from the initial BB to the physics that we can recognize today; but is it then science in the essence of the meaning, or is maybe a convenient creation?

To explain the observations of galaxies incompatible with general relativity, the existence of "dark matter" has been postulated over time as an unknown and non-visible form of matter that would constitute more than a quarter of all the mass-energy content in the universe. Subsequently, when a series of measurements of accelerating galaxies seemed contrary to the theory, the existence of "dark energy" has been postulated, which would constitute about 70% of the mass-energy of the universe.

All this has led current cosmology to reason in terms of dark matter, dark energy and inflation, each of them linked to the BB paradigm; these choices, however, do not seem to carefully describe the known empirical phenomena, but rather the method of maintaining the mathematical coherence of the cosmological model, adding ad hoc what should exist for the model to hold.

Therefore, to maintain a mathematically unified theory valid for the whole universe, it is necessary to accept that 95% of the universe is filled with unknown matter and energy of which there is no well-founded empirical evidence to date.

The problem with this cosmology is therefore its dependence by the theoretical framework as a necessary assumption for conducting further research, sounding more pragmatic to make new theoretical additions rather than re-thinking the foundations. Contrarily to the scientific ideal of a progressive approach to the truth, it seems therefore that this cosmology is dependent on the theoretical path made so far [1].

Interpreting the Quantum Vacuum

The superfluid quantum vacuum is an idea in evolution which could replace the space-time as the fundamental arena of the universe. Inside this idea, time may be considered as the numerical order of material changes; the vacuum would be timeless, in the sense that time is not its fourth dimension in a physical sense. It is a way to be built also on solid mathematical foundations, despite some attempts not viable to date [2-4].

Current science believes that the observer and all observed physical phenomena exist in time and space. However, recent research seems to show that time measured with clocks can be considered as a mathematical parameter of material change, the movement that flows through space.

The fundamental quantum vacuum would be an immediate medium of quantum entanglement information. Considering the classical relation defining the volume density of a substance, if we consider the density as a scalar field, we can re-write the canonical relation, for example in $\Re^3$, thanks to the use of the "del" operator:

$$\vec{\nabla} = \frac{\partial}{\partial x}\vec{u}_x + \frac{\partial}{\partial y}\vec{u}_y + \frac{\partial}{\partial z}\vec{u}_z$$

$$\vec{\nabla}\rho = \frac{m}{V}\vec{u} \qquad (1)$$

where V is the volume of the physical object, m is its mass, $\vec{\nabla}\rho$ has a minimum value ρ_{min} in the center of the object, and ρ_{max} is the density of vacuum at the borders of the universe observable today. We can read the difference in density of the vacuum as the source of its fluctuations in the direction from ρ_{max} to ρ_{min}.

Fundamental and Emergent Time

The cosmic background radiation (CMB) only proves that the existing universal space radiates CMB. The redshift of light from far galaxies may not be due to the expansion of the universe, but originated by an effect called "tired light", in which the light, detaching itself from the strong gravity field of a galaxy, loses part of its energy [5].

Julian Barbour has shown that time has no physical existence [6]; it can therefore be considered a numerical sequential order of events travelling in space. These scientific facts must be taken into serious consideration not only in quantum physics, but also in cosmology [7].

It is therefore important to search for a model of time having a two-way correspondence with time that exists in the universe. Time is deeply linked to the perception and physical experience of the change that flows in the universe.

Nicolas Gisin, speaking about the impact of mathematics on our experience of time, hoped that, contrarily to expectations, future physical theories will not have a higher level of abstraction than quantum field theory (QFT) [8]. Considering the human experience as a basis, and reflecting on a clear mathematical form, this may suggest a model of time closest to the time that the human being "feels" to flow in the universe.

When an observer is observing the movement of an object in space, he does not observe the "duration" but only its "movement"; for the existence of the duration, the observer must "measure" the movement of the object. When the movement is measured by the observer, the duration "enters into existence". A fundamental unit of time, which can be the Planck's time, leads to the numerical sequential order of movement, that we could call *fundamental time*.

When the fundamental time is measured by the observer, it is emerging time, it is a duration that comes into existence [7]. According to this line of thought, time does not flow in the universe "in itself", but it is the epiphenomenon of change.

If there is no physical time flowing in the universe, our experience of linear time flow is based on the neuronal activity of the brain [9]; we experience the change within the framework of psychological time by projecting the linear psychological time "past-present-future" into the physical reality. When the change k comes into existence, the change k-1 is no longer existing and we experience this flow of change within the framework of the psychological time.

Albert Einstein's vision would be realized, when he said: "Time does not have an independent existence apart from the order of events with which we measure it" [10]; "The distinction among past, present and future is only a stubbornly persistent illusion" [11].

About BB Singularities

Alan Guth declared that in inflationary theory the universe started in an incredibly small way; according to Stephen Hawking and James Hartle, it started out by a mathematical point [12,13]. The logical consequence of this scenario is that the energy density and temperature were infinite; with the explosion, the universe began to cool and expand. Unlike mathematics, the use of infinity seems not be a metric term at this level.

If we consider a two-way principle correlating the reality with the modelling of reality, the infinite pressure, infinite density and infinite temperature in the BB model do not have a corresponding element in the model of the universe. Such infinities are currently unproven and result non-falsifiable [14].

About the Space-Time Singularities inside Black Holes

Maxime Van de Moortel developed an idea of space-time with singularities within black holes [15], showing that time has no physical existence in the previously indicated meaning. Universal space is not empty, is full of energy, that we call "primordial dynamic vacuum" energy, with variable density [3].

A hypothesis may be that at the center of a black hole the density of space is not infinite, and inside it the old mass-energy is transformed into new mass-energy. Black holes could therefore be considered as systems of mass-energy replacement of the universe, a process without beginning and end in the hypothesis of a universe as a system in dynamic equilibrium.

Conclusion

Also Einstein had thought of the universe as timeless, namely not flowing through time. NASA's measurements highlighted that the space could be Euclidean, not curved, with infinite volume and quantity of energy [16].

A vision of universe as not created and in dynamic equilibrium can pave the way for creating a new model based on a new approach to the temporal dimension and on the use of the vacuum as basis for describing everything [3].

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