REVIEW OF RESEARCH
IMPACT FACTOR : 5.7631(UIF) UGC APPROVED JOURNAL NO. 48514 ISSN: 2249-894X

VOLUME - 8 | ISSUE - 4 | JANUARY - 2019

STUDY OF DARK ENERGY AS THE CAUSE OF COSMIC ACCELERATION

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ABSTRACT :

The presence of dark energy severs the simple relation between geometry and destiny, links destiny to an understanding of dark energy, raises the specter of a bleak future for cosmologists, and raises a deep question [Krauss & Turner 1995]: can we ever determine the future of the Universe with certainty? As a thought experiment, ignore the current epoch of accelerated expansion and imagine instead that the Universe has been determined to be matter dominated and that it is flat. We might be tempted to conclude that the Universe will expand forever at an ever-decreasing rate. However, no matter how precise our measurements are, there could be a small cosmological constant lurking below the threshold of detectability. For example, if the vacuum energy density were one billionth of the present matter density, after a factor of 1000 in expansion vacuum energy would come to dominate. If it were positive, exponential expansion would eventually ensue; if negative, the Universe would ultimately recollapse. Only a fundamental understanding of the constituents of the Universe and their relative abundances could deliver certainty about the destiny of the Universe.

KEYWORDS : *Geometry and Destiny, Vacuum Energy Density, Cosmological Constant etc.*

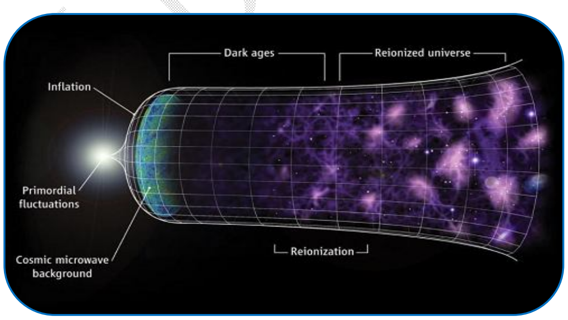
INTRODUCTION

One of the first things one learns in cosmology is that geometry is destiny: a closed (positively curved) Universe eventually recollapses, and an open (flat or negatively curved) Universe expands forever. Provided the Universe contains only matter and = 0, this follows directly from Eq. (2). The presence of dark energy severs this well known connection between geometry and destiny and raises fundamental issues involving the distant future of our Universe [Krauss & Turner 1995].

To illustrate the geometry-destiny connection, we can rewrite Eq. in terms of an effective potential and a kinetic-energy term,

$$V_{eff}(\alpha) + \alpha^2 = 0 \qquad V_{eff}(\alpha) + \alpha^2 = k - \tilde{\Omega} H_0^2 a^{-(1+3wt)}$$

where wT is the ratio of the total pressure to the total energy density (including all components). If wT > -1/3, as would be the case with only matter and radiation, then the second term in Veff increases monotonically from -∞ to 0 as a goes from 0 to ∞ , which means that Veff rises from ∞- to k. For k > 0, there is a value of a where Veff 0, at which point must go to zero and a achieves its maximum value. For k = 0, only vanishes for a ; and for k < 0, remains positive even as a . With dark energy there is a new twist: since the dark energy density decreases more slowly than that of matter or radiation, as the Universe expands dark energy eventually dominates the second term in Veff.



Thereafter, Veff decreases monotonically, since wT wDE < -1/3, approaching - as a . Provided that DE > 0 and that wDE remains negative, if the scale factor becomes large enough for dark energy to dominate, which happens unless M >1 ≫ DE, then the Universe will expand forever, irrespective of k. If dark energy is vacuum energy, acceleration will continue, and the expansion will become exponential, leading to a "red out" of the Universe. To see this, consider the comoving distance to fixed redshift z at time t during the epoch of exponential expansion:

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REVIER OF LITERATURE;-

Shibli et al in their paper entitled "The Foundation of the Theory of Dark Energy: Einstein's Cosmological Constant, Universe Mass-Energy Densities, Expansion of the Universe, a New Formulation of Newtonian Kepler's Laws and the Ultimate Fate of the Universe," have presented a basis of the theory of universe dark energy, a solution of Einstein's cosmological constant problem, physical interpretation of universe dark energy and Einstein's cosmological constant Lambda (=0.29447times10-52m-2), values of universe dark energy density (=1.2622times10-26kg/m3=6.8023 GeV), universe critical density (=1.8069times10-26kg/m3=9.7378 GeV), universe matter density (=0.54207times10-26 kg/m3=2.9213 GeV), and universe radiation density (=2.7103times10-31kg/m3=1.4558 MeV). The translation in this paper depends on geometric displaying of space-time as an ideal four-dimensional continuum astronomical liquid and the force produced when. In such a demonstrating, time is considered to have a mechanical nature so the force related with it is equivalent to the negative of the universe absolute vitality. It is discovered that dull vitality is a property of the space-time itself. Besides, in view of the fluidic idea of dull vitality, the fourth law of thermodynamics is proposed, another plan and physical translation of Kepler's Three Laws are introduced. Besides, in light of the way that what we are watching is only the historical backdrop of our universe, on the Big Bang Theory, Einstein's General Relativity, Hubble Parameter, the assessed age of the universe, enormous swelling hypothesis and on NASA's perception of supernova la, at that point a second-request (illustrative) parametric model is gotten in this proposed paper to portray the quickened development of the universe. This model demonstrates that the universe is moving toward the universe vast skyline line and will go through a basic point that will impact fundamentally its destiny. Considering the breaking balance model and the variational rule of mechanics, at that point the universe will observer an imperceptibly stationary state and an evenness breaking. As result of that, a very massive impu- - lse (Big Impulse of magnitude ~ 1033 x the linear momentum of the universe) will occur soon and, correspondingly, the universe will collapse. Finally, simulation results are demonstrated to verify the proposed models.

MATERIAL AND METHOD:-

The exponential decrease of this distance implies that the number of galaxies below a fixed redshift shrinks exponentially. By contrast, in the Einstein-de Sitter model with M = 1, this distance increases as t1/3, so that the number of galaxies with redshift less than a fixed value grows slowly. Alternatively, Eq. 35 implies that the redshift for a galaxy at current distance r grows exponentially. Galaxies beyond the Local Group, r 1-2 Mpc, will be redshifted beyond detectability on a timescale of t - t0 ~ 100 Gyr (e.g., [Busha et al. 2003]). The Milky Way will remain gravitationally bound to the Local Group, which will appear as a static, "island Universe." Even the CMB, the other key evidence of a once-hot, expanding Universe, will be redshifted to undetectability [Krauss & Scherrer 2007]. If dark energy is a scalar field, then eventually the field relaxes to the minimum of its potential; see Fig. 10. If the minimum of the potential energy is precisely zero, the Universe will again become matter dominated and return to decelerated expansion, restoring the link between geometry and destiny. If the minimum of the scalar field potential has negative energy density, the energy of dark matter and of scalar field energy will eventually cancel, leading to recollapse, irrespective of k. If the potential energy at the minimum is positive and larger than a critical value that depends on M (the critical value is zero for M ≤ 1 and small for M > 1), then accelerated expansion will eventually ensue again and as discussed above, the Universe will experience a "red-out." These possibilities are illustrated in Fig. 4.

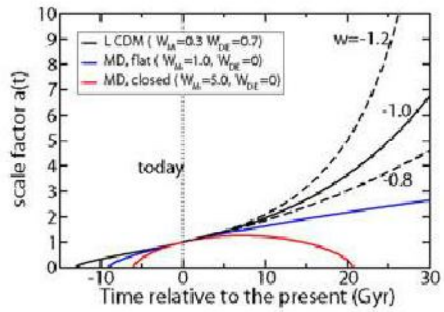

Figure 4. Evolution of the FRW scale factor **in** models with and without dark energy. Upper four curves are for flat models. Dashed curves denote models with w = -0.8 or -1.2 and M = 0.3. MD denotes matter-dominated models.

Finally, the possibility of wDE < -1 deserves special comment. In this case, the energy density of dark energy actually increases with time, DE a, where -3(1 + w) > 0. In turn, the scale factor grows very rapidly and reaches infinite size in a finite time:

CONCULSION

Ten years after its discovery, the acceleration of the expansion of the Universe is now firmly established. The physical origin of this phenomenon, however, remains a deep mystery, linked to other important problems in physics and astronomy. At present, the simplest explanation, vacuum energy, is consistent with all extant data, but theory provides no understanding of why it should have the requisite small value. Probing the history of cosmic expansion with much greater precision (few percent vs. current 10%) offers the best hope of pointing us down the correct path to a solution. An impressive array of experiments with that aim are underway or planned, and we believe that significant progress will be made in the next fifteen years. We conclude with our list of the ten important take-home facts about cosmic acceleration and dark energy, followed by our views on the key open issues and challenges for the future.

STRONG EVIDENCE FOR ACCELERATED EXPANSION.

Since the SN discovery of acceleration, several hundred supernovae have been observed over a broader range of redshifts, substantially strengthening the case both statistically and by reducing sources of systematic error. Further, independent of GR and based solely upon the SN Hubble diagram, there is very strong (5) evidence that the expansion of the Universe accelerated recently [Shapiro & Turner 2006].

DARK ENERGY AS THE CAUSE OF COSMIC ACCELERATION

Within GR, accelerated expansion cannot be explained by any known form of matter or energy but can be accommodated by a nearly smooth form of energy with large negative pressure, known as dark energy, that accounts for about 75% of the Universe.

INDEPENDENT EVIDENCE FOR DARK ENERGY.

In the context of the cold dark matter model of structure formation, CMB and large-scale structure data provide independent evidence that the Universe contains a smooth form of energy which accounts for about 75% of the total and which only came to dominate after essentially all of the observed structure had formed. Thus, structure formation independently points to a negative-pressure (with w -1/3), dark energy accounting for the bulk of the Universe.

VACUUM ENERGY AS DARK ENERGY.

The simplest explanation for dark energy is the energy associated with the vacuum; it is mathematically equivalent to a cosmological constant. However, all attempts to compute the vacuum energy density from the zero-point energies of all quantum fields yield a result that is many orders of magnitude too large or infinite.

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