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EFFECT OF DARK ENERGY ON THE ANGULAR SCALES OF THE ANISOTROPY SPECTRUM

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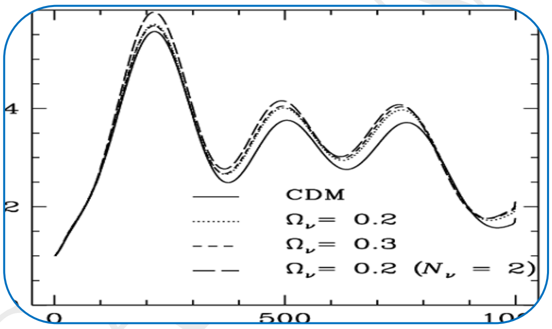
ABSTRACT :



Universe is increasing in its size due to gravitational force of repulsion and this force is a big part of this cosmos. Astronomers were trying to detect the phenomenon which occurs for distant supernovae to take finger prints by which the universe is expanding and were expecting that the speed of expansion should be slowed down but research showed reverse result. It means that the bodies were accelerating when they were going far away from each other and this lead to the concept known as Dark Energy. The researchers concluded that more than half of the universe is made up of this dark energy. Also a new type of force is assumed known as repulsive gravitational force due to this dark energy. Many theorists also believe that there exists a constant for this type of phenomenon known as cosmological constant, but cannot be accepted as the total cause for the happening of the same. This gravitationally repulsive dark energy may have spectacular effects on fundamental physics. Besides the suggestions that the universe is full of evenly spaced of Zero-Point quantum energy. There are also theories which state that some particles which have a mass of 10-39 times smaller than electrons, which leads to some changes in Einstein's general theory of relativity. As expected for the value Zero-Point energy density the researchers came to surprise that this value comes a factor below. The only proof for this cosmic acceleration is the, supernovae which recently occurred and were detected by the individual astronomer teams to accept the dark energy existence. Another proof for dark energy is also seeing in precision measurement of Cosmic Microwave Background (CMB) with data from the Wilkinson Microwave Anisotropy Probe (WMAP). It also comes true from the data of two extensive projects which charts the large scale distribution of galaxies which are the two degree field (2DF) and Sloan Digital Sky Survey (SDSS) respectively.

KEYWORDS : *Gravitational Force, Dark Energy, Zero-Point Quantum Energy.*

INTRODUCTION

Two-thirds of the cosmos is made of dark energy. Earlier it was thought that the expansion of the universe was slowing down but subsequently it was observed that the 2 expansion was speeding up. Cosmologists have built up a description of the phenomenon responsible for the acceleration called dark energy. The universe is filled with a uniform sea of quantum zero-point energy, or a condensate of new particles that have a mass that is much smaller than that of the electron. Supernova data is an evidence for the cosmic acceleration, and the reason to accept dark energy. Precision measurements of the cosmic microwave background (CMB), including data from the Wilkinson Microwave Anisotropy Probe (WMAP), have recently provided circumstantial evidence for dark energy. The same is true of data from two extensive projects charting the large-scale distribution of galaxies - the Two-Degree Field (2DF) and Sloan Digital Sky Survey (SDSS). By combining data from WMAP, SDSS and other sources researchers have reported evidence for a phenomenon known as the integrated Sachs-Wolfe effect. It has been found that the gravitational repulsion of dark energy has slowed down the collapse of overdense regions of matter in the universe. The universe has expanded from the hot, dense cosmic cloud created in the Big Bang to the much cooler and more rarefied collection of galaxies and clusters of galaxies that is seen today. Some evidence also available and proved by combining WMAP, SDSS etc. to prove the same. There are four independent researchers groups who have reported evidence for the phenomenon which is known as integrated Sachs-Wolfe effect. These researchers found the repulsive gravitational force due to dark energy slows down the collision of over dense region of matter in the universe. So, the concept of existence of dark energy has become more satisfactory. In 1920, physicist Edvin Hubble discovered the cosmic expansion which is the single striking phenomenon of universe. He described that not only astronomical bodies move due to gravitational force of their neighbor bodies but also the large scale structures of the universe are stretched due cosmic expansion. There is an analogy for describing this as the motion of raisins which are backing in a cake. As the cake size increases the distance between the adjacent raisins which are all around to each other also increases.

REVIER OF LITERATURE;-

A different effect of dark energy is seen at the largest angular scales of the anisotropy spectrum. As photons of the CMB move towards us, they pass through gravitational potential wells of matter. Because of expansion, in part directed by dark energy, the depth of the potential well may change while the photon is in it. The outcoming photon will therefore be either more or less redshifted than when it entered, depending on whether the potential well has deepened or become shallower. The phenomenon is known as the integrated Sachs-Wolfe effect, and leads to a small correlation between the matter distribution and the CMB anisotropy. Cross-correlating CMB data with galaxy catalogues reveals the effect (Frieman et al., 2008). Just as the CMB has a characteristic angular scale imprinted in the temperature anisotropy power spectrum, so does the large scale structure have a characteristic length scale imprinted in the matter anisotropy power spectrum. Baryon acoustic oscillations are periodic fluctuations in the density of the baryonic material, caused by sound waves involving baryons and photons in the early universe. After the two components decouple due to expansion, the photons diffuse while the baryons caught in an oscillation stay fixed at the sound horizon at that particular time. Since the baryonic overdensity attracts more matter as time goes on, the characteristic length scale of the sound horizon at decoupling can be used as a standard ruler. This can then be compared to the observed size of matter fluctuations today. A bump is seen in the two-point correlation function of galaxies at about 150 Mpc, which can be held up against theories of structure formation to constrain H0 (Eisenstein et al., 1998).

MATERIAL AND METHOD:-

Since altering the dark energy equation-of-state affects observable values as it will also affect the cosmological parameter values obtained by fitting equations to those ob- servable values. In this section the method used to calculate the effect will be discussed. Mock data are produced to simulate fiducial cosmologies. The mock data are then fitted with a framework cosmology providing the specific forms of the cosmological equations. In this way, marginalized posterior probability distributions, i.e. expectation values and uncertainties, are obtained for each cosmological parameter. probability dis- tributions/expectation values and errors when analyzing a fiducial cosmology with a framework cosmology. The goal of this analysis is to investigate how well the framework model can recover the fiducial values of the cosmological parameters used to create the mock data. Alternatively, one could ask whether the choice of a specific wDE in the framework cosmology causes a bias in parameter determination when the choice does not match the fiducial cosmology. There are different ways of making sure that the posterior distribution is well-sampled. One of the most common ones is the Gelman-Rubin convergence diagnostic (Gelman and Rubin, 1992), which requires at least two chains. For each chain, one must first discard the burn-in. The Gelman-Rubin method then consists of comparing the ’within-chain variance’; treating each chain separately, with the ’between-chain variance'; treating all chains as a single one. If the chains have converged, these two entities should agree to within some tolerance. Quantitatively, this means that the ratio between the two variances, the so-called 'potential scale reduction fac- tor' R, should not exceed 1 by more than a certain amount. It is common to express convergence in terms of R — 1. Once the sample of the posterior distribution has been obtained one can, for each cosmological parameter, average over all other parameters to estimate the marginalized posterior probability distribution. The Monte Carlo Markov Chains method of course requires data sets to calculated the like- lihood from. Producing the mock data is the subject of the following section.

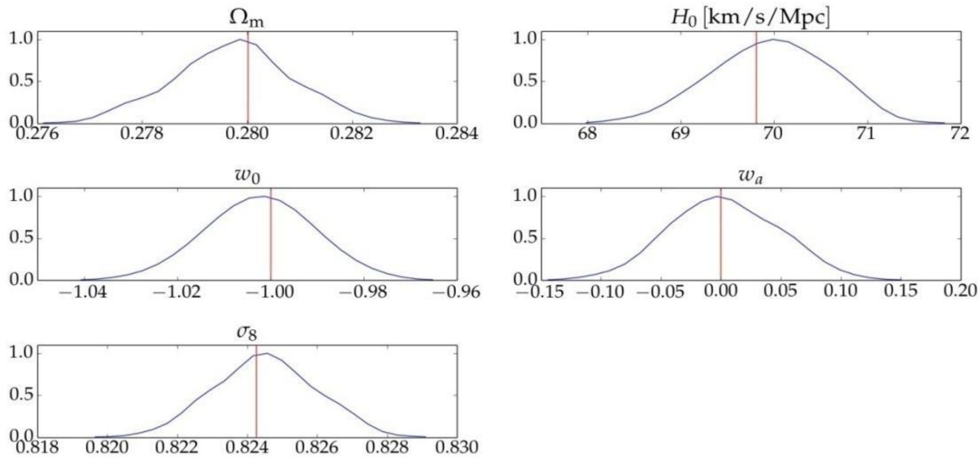


Figure 1: Marginalized posterior probability distributions of case 1: ⇤CDM fiducial cosmology, CPL framework cosmology, using only WL. Red lines indicate fiducial values used to produce the mock data.

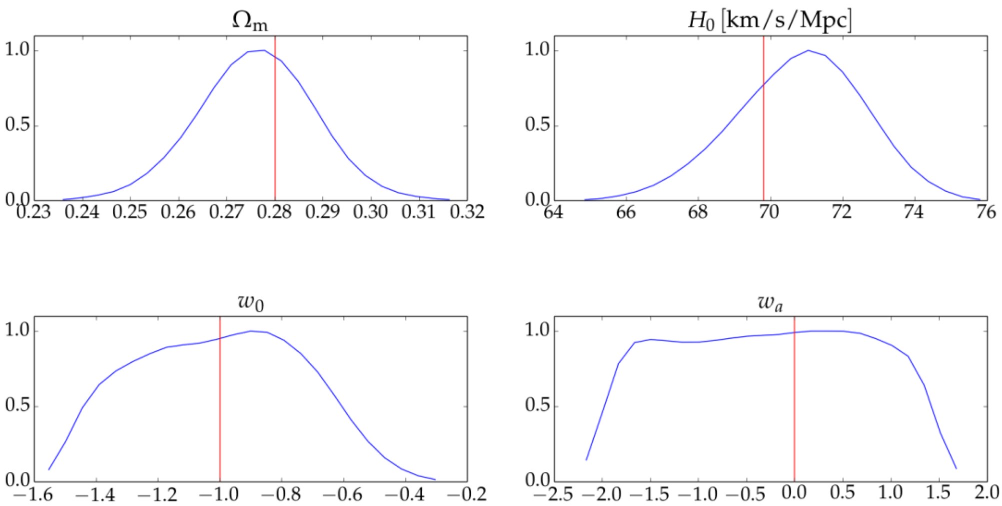
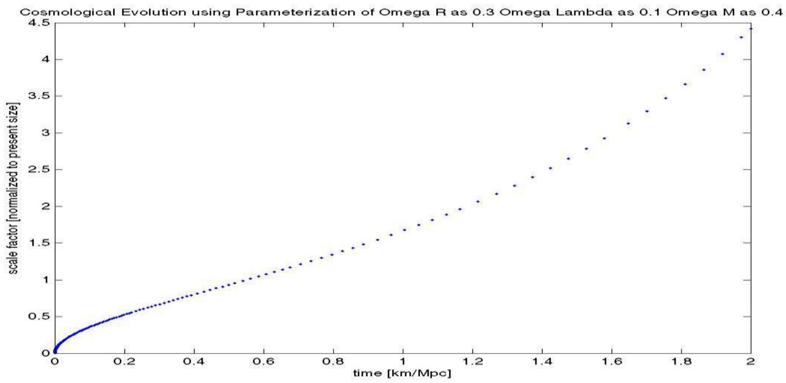


Figure 2: Marginalized posterior probability distributions of case 2: ⇤CDM fiducial cosmology, CPL framework cosmology, using SNe Ia and RD. Red lines indicate fiducial values used to produce the mock data. Notice that o8 is not calculated, since weak lensing data are not included.

CONCULSION

Discussion of the results of simulation obtained for cosmological evolution using parameterization of omega R as 0.3, omega M as 0.2 and varying omega lambda is given below.



Above graph as shown is the cosmological evolution using parameterization of omega R as 0.3, omega lambda as 0.1 and omega M as 0.4. Above graph gives relationship between scale factor [normalized to present size] and time [km/Mpc]. As it can be seen from the graph that scale factor varies exponentially with time. As from above graph it can be observed that when time is 0.2 the corresponding value of scale factor is 0.5. Moving further it can be seen that when time becomes equals to 1 the corresponding scale factor becomes nearly equals to 1.5. As one moves further to the graph it is observed that when time becomes equal to 1.8 the corresponding scale factor becomes nearly equals to 3.8.

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