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A new cosmological model including inflation, deceleration, acceleration and deceleration again

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Since Perlmutter and A.G. Riess (1997 & 1998)observed that the Universe expands with an acceleration, many models involving dark energy have been proposed to explain this phenomenon. In this research we present a family of cosmological models with both acceleration and deceleration.We write Einstein's Field Equations in General Relativity in the form,

$$R^{\mu\nu} - \frac{1}{2}\bar{R}g^{\mu\nu} = kT^{\mu\nu} - \Lambda g^{\mu\nu}$$

Here Λ is the cosmological constant. In this research we modified Einstein's Field Equations. We consider Λ to be a variable of cosmic time. We made the assumptions of a homogeneous and isotropic universe based on Mach's principle. We started with the Robertson-Walker metric in spherical polar coordinates. We found the Christoffel symbols to define the Ricci tensor, the curvature scalar and the energy-momentum tensor using the Robertson-Walker metric. Using the Robertson-Walker metric and Energy momentum tensor we solved the modified Einstein's Field Equations for scalar factor $R(t)$ which is called ''radius of the universe.'' We introduce the solution in the form $R = b\sqrt{(1-\cos^3 \omega t)}$, so that it shows the inflation at the beginning.We assume a solution for the universe, which results in inflation, deceleration, acceleration and deceleration again. The age of the universe is estimated to be 13.7 billion years. Taking the present value of the cosmic time t as 13.7 billion years we find the density of the inflationary Universe is $2.0211 \times 10^{-31}\mathrm{g\ cm^{-3}}$and deceleration of the Universe is $9.1822 \times 10^{5}\mathrm{cm\ s^{-2}}$ which agree with the observations. We discussed the redshift of light from extragalactic sources, which arise from the Robertson-Walker metric. The redshift is the ratio of the value of the scalar factor of the universe at present epoch to that at the epoch of emission of light from the extragalactic sources, which is observed at present and is a measure of the expansion of the universe in a given period of time. The scalar factor is increasing with time t at present. However there could be epochs where the scalar factor is decreasing.

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