FUTURE ONSET OF DECELERATION OF THE EXPANDING UNIVERSE

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The expansion of the Universe is one of the most important topics of discussion in cosmology. When the Universe is expanding, the expansion rate will change with cosmic time either through acceleration or deceleration. Hence, those changes can be discovered by using experimental data. Otherwise, it can be used as a suitable mathematical model related to the expansion of the Universe. The main purpose of this study is to explain the expansion of the future onset of deceleration with cosmic time. Robertson Walker metric and Einstein's field equations were used as major equations to obtain the relevant expressions. Non-vanishing Christoffel symbols and Ricci tensor components were obtained by using the Robertson Walker metric. Then, two independent equations with four unknown variables were obtained using modified Einstein's field equations. Here, the pressure of the Universe is considered to be zero (zero models) as the matter is distributed to space with the big bang. Moreover, the Universe is assumed to continue as a spherical shape throughout the expansion. All the calculations depended on four-dimensional space-time coordinates. Three boundary conditions were used to support calculations. The appropriate model solution of R (radius of the Universe) was used to explain the main objective of this study. The variation of expanding rate of the Universe graph was plotted using the second derivative of the model. Then, cosmic time of future onset of deceleration was obtained when $\ddot{R} = 0$. According to the calculations, the future deceleration of the expanding Universe will start from 1.85×10^{16} s (0.58 billion years) after the present epoch. Thus, the deceleration in the present, past and future can be explained using this model. The Supernovae observations are the evidence to verify this graphical explanation.

Keywords: Einstein's field equations, Expansion of the Universe, Onset of deceleration, Robertson Walker metric