For the specification of ξ ,now we assume that the fluid obeys an equation of state of

the form $p = \gamma\varepsilon$, (23)

where $\gamma(0 \le \gamma \le 1)$ is constant.

Thus, given $\xi(t)$ we can solve the cosmological parameters. In most of the investigation involving bulk viscosity is assume to be a simple power function of the energy density (Pavon, [32]; Maartens, [56]; Zimdahl, [57])

$$\xi(t) = \xi_0 \rho^m, \quad (24)$$

where ξ_0 and m are constant. If $m = 1$ Equation (24) may correspond to a relative fluid (Weinberg[9]). However, more realistic models (Santos, [58]) are based on m lying in the regime $0 \le m \le \frac{1}{2}$.

Using (24) in (21), we obtain

$$8\pi p = K_1 T^{2(1-2n)} + \frac{K_2}{T^{2(\alpha+1)}} + 8\pi\xi_0\varepsilon^m(2n+1)\sqrt{\frac{T^{2(1-2n)}}{(n-1)(\alpha-2n+2)} + \frac{\beta}{T^{2(\alpha+1)}}} - \Lambda \quad (25)$$

We consider the two model corresponding to *m=0* and *m=1*

3.1. Model- I :

When $m = 0$, Equation (24) reduces to $\xi(t) = \xi_0 =$ constant. Hence in this case Equation (25), with the use of (22) and (23), leads to

$$8\pi\varepsilon(1+\gamma) = (K_1+K_3)T^{2(1-2n)} + \frac{[K_2+\beta n(n+2)]}{T^{2(\alpha+1)}} + 8\pi\xi_0(2n+1)\sqrt{\frac{T^{2(1-2n)}}{(n-1)(\alpha-2n+2)} + \frac{\beta}{T^{2(\alpha+1)}}} \quad (26)$$

Eliminating $\varepsilon(t)$ between (26) and (22), we have

$$(1+\gamma)\Lambda = (K_1-\gamma K_3)T^{2(1-2n)} + \frac{[K_2-\gamma\beta n(n+2)]}{T^{2(\alpha+1)}} + 8\pi\xi_0(2n+1)\sqrt{\frac{T^{2(1-2n)}}{(n-1)(\alpha-2n+2)} + \frac{\beta}{T^{2(\alpha+1)}}} \quad (27)$$

3.2. Model-II

When $m = 1$, Equation (24) reduces to $\xi(t) = \xi_0\varepsilon$. Hence in this case Equation (25), with the use of (22) and (23), leads to

$$\varepsilon = \frac{1}{8\pi\left[1+\gamma-\xi_0(2n+1)\sqrt{\frac{T^{2(1-2n)}}{(n-1)(\alpha-2n+2)} + \frac{\beta}{T^{2(\alpha+1)}}}\right]} \times \left[(K_1+K_3)T^{2(1-2n)} + \frac{[K_2+\beta n(n+2)]}{T^{2(\alpha+1)}}\right] \quad (28)$$

Eliminating $\varepsilon(t)$ between Equation (28) and (22) , we have

$$\Lambda = \frac{1}{\left[1+\gamma-\xi_0(2n+1)\sqrt{\frac{T^{2(1-2n)}}{(n-1)(\alpha-2n+2)} + \frac{\beta}{T^{2(\alpha+1)}}}\right]} \times \left[(K_1+K_3)T^{2(1-2n)} + \frac{[K_2+\beta n(n+2)]}{T^{2(\alpha+1)}}\right] - \left[K_3 T^{2(1-2n)} + \frac{\beta n(n+2)}{T^{2(\alpha+1)}}\right] \quad (29)$$

equation (27) and (29) , we observe that If $\alpha > 0, n > 0$ positive cosmological constant is a decreasing function of time and approaches a small value in the present epoch.

4. Some Physical Aspects of the Model

The straight forward calculation leads to the following expression for the scalar of expansion θ for the shear σ of the fluid for the metric (20)

$$\theta = (2n+1)\sqrt{\frac{T^{2(1-2n)}}{(n-1)(\alpha-2n+2)} + \frac{\beta}{T^{2(\alpha+1)}}} \quad (30)$$

$$\sigma = (2n+1)\sqrt{\frac{7}{18}\left(\frac{T^{2(1-2n)}}{(n-1)(\alpha-2n+2)} + \frac{\beta}{T^{2(\alpha+1)}}\right)} \quad (31)$$

The expansion factor θ decreases as a function of T and asymptotically approaches zero with ε and p also approaches zero as $T \to \infty$

Particular Model

If we set $n = 2$ the geometric space time (20) reduces to the form

$$ds^2 = -\left[\frac{1}{2(1+40\pi l)T^4} + \frac{\beta}{T^{8(1+20\pi l)}}\right]^{-1} dT^2 + T^4[dX^2 + dZ^2] + T^2[dY - Xdz]^2, \quad (32)$$

The pressure and density for model (32) are given by

$$8\pi p = -\frac{208\pi l}{3(1+40\pi l)T^6} + \frac{16\beta}{3}\frac{(34\pi l+3)}{T^{2(5+80\pi l)}} + 40\pi\xi\sqrt{\left[\frac{1}{2(1+40\pi l)T^6} + \frac{\beta}{T^{2(5+80\pi l)}}\right]} - \Lambda \quad (33)$$

$$8\pi\varepsilon = \frac{(13-40\pi l)}{4(1+40\pi l)T^6} + \frac{8\beta}{T^{2(5+80\pi l)}} + \Lambda \quad (34)$$

4.1. Model- I :

When $m = 0$, Equation (24) reduces to $\xi(t) = \xi_0 =$ constant. Hence in this case Equation (33), with the use of (23) and (34), leads to

$$8\pi\varepsilon(1+\gamma) = \frac{(39-952\pi l)}{12(1+40\pi l)T^6} + \frac{8\beta(60\pi l+9)}{3T^{2(5+80\pi l)}} + 40\pi\xi_0\sqrt{\left[\frac{1}{2(1+40\pi l)T^6} + \frac{\beta}{T^{2(5+80\pi l)}}\right]} \quad (35)$$

Eliminating $\varepsilon(t)$ between Equation (34) and (35) , we have

$$(1+\gamma)\Lambda = \frac{2(39-536\pi l)+(39-120\pi l)\gamma}{12(1+40\pi l)T^6} + \frac{8\beta(68\pi l - 3\gamma + 6)}{3T^{2(5+80\pi l)}} + 40\pi\xi_0\sqrt{\left[\frac{1}{2(1+40\pi l)T^6}+\frac{\beta}{T^{2(5+80\pi l)}}\right]} \quad (36)$$

4.2. Model-II :

When $m = 1$, Equation (24) reduces to $\xi(t) = \xi_0\varepsilon$. Hence in this case Equation (33), with the use of (23) and (34), leads to

$$\varepsilon = \frac{1}{8\pi\left[1+\gamma-5\pi\xi_0\sqrt{\left[\frac{1}{2(1+40\pi l)T^6}+\frac{\beta}{T^{2(5+80\pi l)}}\right]}\right]} \times \left[\frac{(39-952\pi l)}{12(1+40\pi l)T^6}+\frac{8\beta(68\pi l+9)}{3T^{2(5+80\pi l)}}\right] \quad (37)$$

Eliminating ε between equation (37)and (34)

$$\Lambda = \frac{1}{\left[1+\gamma-5\pi\xi_0\sqrt{\left[\frac{1}{2(1+40\pi l)T^6}+\frac{\beta}{T^{2(5+80\pi l)}}\right]}\right]} \times \left[\frac{(39-952\pi l)}{12(1+40\pi l)T^6}+\frac{8\beta(68\pi l+9)}{3T^{2(5+80\pi l)}}\right] - \left[\frac{(13-40\pi l)}{4(1+40\pi l)T^6}+\frac{8\beta}{T^{2(5+80\pi l)}}\right] \quad (38)$$

Some Physical aspect of the model

The scalar of expansion θ and the shear σ of the model (32) is given by

$$\theta = 5\sqrt{\left[\frac{1}{2(1+40\pi l)T^6}+\frac{\beta}{T^{10(1+16\pi l)}}\right]} \quad (39)$$

$$\sigma = 5\sqrt{\left[\frac{7}{36(1+40\pi l)T^6}+\frac{7\beta}{18T^{10(1+16\pi l)}}\right]} \quad (40)$$

5. Special Model

If we set $n = 2$ and $l = -\frac{1}{32\pi}$ equation (19) leads to

$$\frac{B^4}{(\beta B-2)}dB^2 = dt^2 \quad (41)$$

Using the transformation the metric (1) takes the form

$$ds^2 = -\frac{T^4}{(\beta T-2)}dT^2 + T^4[dX^2+dZ^2] + T^2[dY - Xdz]^2, \quad (42)$$

The pressure and density for the model (42) is given by

$$8\pi p = -\left(\frac{26}{T}+\beta\right)\frac{1}{3T^5} + 40\pi\xi\sqrt{\left(\beta-\frac{2}{T}\right)\frac{1}{T^5}} - \Lambda \quad (43)$$

$$8\pi\varepsilon = \left(8\beta - \frac{65}{4T}\right)\frac{1}{T^5} + \Lambda \quad (44)$$

5.1. Model- I :

When $m = 0$, Equation (24) reduces to $\xi(t) = \xi_0$= constant. Hence in this case Equation (43), with the use of (23) and (44), leads to

$$8\pi\varepsilon(1+\gamma) = \left(\beta-\frac{13}{4T}\right)\frac{23}{3T^5} + 40\pi\xi_0\sqrt{\left(\beta-\frac{2}{T}\right)\frac{1}{T^5}} \quad (45)$$

Eliminating $\varepsilon(t)$ between Equation (44) and (45) , we have

$$(1+\gamma)\Lambda = -\left(\frac{26}{T}+\beta\right)\frac{1}{3T^5} - \left(8\beta-\frac{65}{4T}\right)\frac{\gamma}{T^5} + 40\pi\xi_0\sqrt{\left(\beta-\frac{2}{T}\right)\frac{1}{T^5}} \quad (46)$$

5.2. Model-II

When $m = 1$, Equation (24) reduces to $\xi(t) = \xi_0\varepsilon$. Hence in this case Equation (43), with the use of (23) and (44), leads to

$$\varepsilon = \frac{1}{8\pi\left[1+\gamma-5\xi_0\sqrt{\left(\beta-\frac{2}{T}\right)\frac{1}{T^5}}\right]} \times \left(\beta-\frac{13}{4T}\right)\frac{23}{3T^5} \quad (47)$$

$$\Lambda = \frac{1}{\left[1+\gamma-5\xi_0\sqrt{\left(\beta-\frac{2}{T}\right)\frac{1}{T^5}}\right]} \times \left(\beta-\frac{13}{4T}\right)\frac{23}{3T^5} - \left(8\beta-\frac{65}{4T}\right)\frac{1}{T^5} \quad (48)$$

From the equation (46) and (48) we observe that the positive cosmological constant is a decreasing function of time and approaches small value.

Some Physical aspect of the model

The scalar of expansion θ and the shear σ of the model (42) is given by

$$\theta = 5\sqrt{\left[\frac{\beta T-2}{T^6}\right]} \quad (49)$$

$$\sigma = 5\sqrt{\frac{7}{18}\left[\frac{\beta T-2}{T^6}\right]} \quad (50)$$

6. Conclusion

We have presented Bianchi type-II non static cosmological model in presence of bulk stress given by Landau L.D. and Lifshitz E.M. It is found that physically relevant solutions are possible for the Bianchi-II space time with bulk stress in the presence of time varying Λ –term. For solving the field equations we have assumed that the fluid obey an equation of state of the form $p = \gamma\varepsilon$, and bulk viscous fluid is assumed to be the simple power function of mass density given by $\xi(t) = \xi_0\rho^m$. Generally the models are expanding, shearing and non-rotating. The cosmological constant in all models given in section 3.1 and 3.2 are decreasing function of time and all approaches a small positive value at finite large times (i.e., the present epoch). These results are supported by the results from the supernova observations recently obtain by the High-z Supernova team and Supernova Cosmological project [1-7].Thus with our approach, we obtain a physically relevant decay law for the cosmological constant unlike other investigators where adhoc laws were used to arrive at a mathematical expressions for the decaying energy. Thus our models are more general than those studied earlier. In all models, the physical parameters pressure and density are found to be decreasing function of time. Also we find that all the physical quantities the expansion scalar and the shear scalar.

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