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Dynamical system approach of viscous fluid in $f(T)$ gravity theory

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Abstract

In this paper, using the recently introduced $f(T)$ gravity framework, we have analyzed the viscous fluid cosmological model in FLRW cosmological model by assuming a specific form of the bulk viscosity coefficient as, $\zeta = \zeta_0 + \zeta_1 H + \zeta_2 \left(\frac{\dot{H}}{H} + H\right)$ and a non-linear $f(T)$ model particularly, $f(T) = T - \alpha\sqrt{-T}$ where α is the model parameters. Using the phase space technique, we examine the asymptotic behaviour of our cosmological bulk viscous model. We found one stable critical point. Phase space analysis and the geometrical interpretations are given. We discover that according to our model, the Universe evolved from a matter-dominated decelerated phase (a past attractor) to a stable de-Sitter accelerated epoch (a future attractor). The evolution of EoS parameter shows the acceleration phase of the cosmic expansion whereas the negative behavior of viscosity-induced pressure indicates the accelerated expansion of the Universe. Our $f(T)$ cosmological model, with the influence of bulk viscosity successfully describes the expansion history of the Universe and provides a good fit to recent observational data.

Keywords: $f(T)$ gravity field equations, Viscous model, Dynamical system analysis, Energy conditions

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