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Flash Talk: Modified Chaplygin gas with recent observations in $f(Q,B)$ gravity

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In this work, we explore the cosmological dynamics of a modified gravity framework based on the function $f(Q, B) = \delta Q^2 + \beta B$, where Q denotes the nonmetricity scalar and B is the boundary term that relates Q to the Ricci scalar. The matter sector is modeled using the Modified Chaplygin Gas (MCG) with the equation of state $p = A\rho - \frac{D_1}{\rho^\alpha}$, allowing the model to interpolate between early-time matter behavior and late-time cosmic acceleration. By deriving an analytical expression for the Hubble parameter $H(z)$, we perform a parameter estimation using Markov Chain Monte Carlo (MCMC) techniques in conjunction with the latest cosmological observations: 46 Hubble parameter measurements, 15 BAO data points, DESI DR2 BAO data and the Pantheon+ Type Ia supernovae compilation. The best-fit values are obtained as $H_0 = 72.2814^{+3.4702}_{-4.5209}$ km/s/Mpc, $A_s = 0.6964^{+0.0779}_{-0.1258}$, $\alpha = 0.0027^{+0.0225}_{-0.0209}$ and $A = 0.0024^{+0.0702}_{-0.0464}$. The deceleration parameter transitions at redshift $z_{tr} \approx 0.946$, while the present-day value is $q_0 = -0.789$. The model yields an age of the Universe $t_0 \approx 13.53$ Gyr and a present EoS parameter $\omega_0 \approx -0.691$, which reflects the late-time acceleration consistent with observational bounds. These results demonstrate that the MCG scenario within $f(Q, B)$ gravity provides a viable and observationally consistent framework for explaining the late-time accelerated expansion of the Universe.

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