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On the Hubble constant tension in the SNe Ia Pantheon sample

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The Hubble constant (H0) tension between Type Ia Supernovae (SNe Ia) and Planck measurements ranges from 4 to 6 σ. To investigate it, we estimate H0 in the ΛCDM and w0waCDM models by dividing the Pantheon sample, a collection of 1048 SNe Ia, into 3, 4, 20, and 40 bins. A preliminary consistency check is performed, considering the compatibility of contours for 3 and 4 bins with the ones of the total Pantheon sample through a 2-D analysis where the nuisance parameters are H0 and Ω0m. For each bin, a 1-D Monte Carlo Markov-Chain analysis for H0 with the D'Agostini method is performed in order to extract the value of H0, considering a fiducial absolute magnitude of SNe Ia M~-19.25. We will show the MCMC application through the Cobaya package for Python. We fit the extracted H0 values with a function describing the redshift evolution: g(z)=H'0/(1+z)^α, where α is the evolutionary parameter and H'0=H0 at z=0. We find that H0 evolves with redshift, showing a slowly decreasing trend, with α coefficients in the order of 10^-2, consistent with zero only from 1.2 to 2.0 σ. Interestingly, in the extrapolation of H0 to z=1100, the redshift of the last scattering surface, we obtain values of H0 compatible in 1 σ with Planck measurements independently of cosmological models. Thus, we have reduced the H0 tension from 54% to 72% for the ΛCDM and w0waCDM models, respectively. If the decreasing trend of H0 is real, it could be due to astrophysical selection effects, such as the stretch evolution, or to modified gravity, such as the f(R) theories.

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