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On the Hubble constant tension and its evolution.

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The Hubble constant (H0) tension between Type Ia Supernovae (SNe Ia) and Planck measurements ranges from 4 to 6 Ï. To investigate this tension, we estimate H0 in the ÎCDM and w0waCDM models by dividing the Pantheon sample, a collection of 1048 SNe Ia, into 3, 4, 20, and 40 bins. For the first two divisions, a presence of SNe Ia in the hundreds for each bin is required to effectively account for systematic effects while the last two are required to test for results independence on the bin divisions. 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 Î©0m. 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)Î±, where Î± is the evolutionary parameter and H'0=H0 at z=0. We find that H0 evolves with redshift, showing a slowly decreasing trend, with Î± coefficients in the order of 10-2, consistent with zero only from 1.2 to 2.0 Ï. A subsequent correction for luminosity distance has been applied and it carries differences of ˜2% at z=11.09 (the redshift of the farthest galaxy so far discovered) with the standard ÎCDM luminosity distance. We measure locally a variation of H0(z=1)-H0(z=0)=0.4 km s-1 Mpc-1 in 3 and 4 bins. Interestingly, in the extrapolation of H0 to z=1100, the redshift of the last scattering surface, we obtain values of H0 compatible in 1 Ï with Planck measurements independently of cosmological models. Thus, we have reduced the H0 tension from 54% to 72% for the ÎCDM 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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