Review of: "A Robust Assessment of the Local Anisotropy of the Hubble Constant"

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Potential competing interests: No potential competing interests to declare, except that I also work in this area and am a co-author on the Pantheon+ paper whose data this work is based on.

This paper uses the Pantheon+ data set to test some cosmological models and look for inhomogeneities. Before doing a full review of the results or going into any great detail, it might be worth pointing out some considerations regarding the analysis technique.

Important: When discussing predictions of "LambdaCDM," one should always be careful because LambdaCDM does not give a prediction for observables without specifying what parameters within LambdaCDM are being considered. Which parameters are being considered in Table 1, for example? After Eq. 4 is a sentence implying that the Planck best-fit values are used, but that is not representative of all of LambdaCDM, just one measurement of the parameters of LambdaCDM. Therefore, the discussion could be couched in terms of whether this analysis is consistent with Planck, but not whether it's consistent with LambdaCDM.

Note that if the paper is using the Planck best-fit version of LambdaCDM for comparison, then the shape of the magnitude-redshift relation will not match the best fit for the supernovae. Repeating the analysis for the best fit for the supernovae themselves would be expected to show less redshift dependence and might be interesting to look at.

Very important: Mean magnitudes in redshift bins should not be compared to theory, for two reasons. Firstly, it is statistically always better to work with individual supernovae. Secondly, if binning is necessary, then it is critical that the binning uses a *weighted* mean; i.e., the calculation of the mean is weighted taking into account the uncertainty (inverse variance) of each data point. It is not clear if this paper uses a weighted mean or not.

Note that Pantheon+ provides three redshifts - observed, CMB, and Hubble diagram - each with an extra layer of correction. The observed values are raw data, the CMB has been corrected for the CMB dipole, and the Hubble diagram redshifts have additionally been corrected for peculiar velocities. Here, the Hubble diagram redshifts were used, but when considering questions of homogeneity, it might be better to use the CMB-frame redshifts. That's because ideally, if the peculiar velocity correction were perfect, then there would be no trace of inhomogeneity after the correction had been made. Any residuals are as likely to be an over- or under-correction rather than true structure. (We don't expect the corrections to be perfect as the peculiar velocity models are still quite uncertain – but they do help.)

Finally, the paper discusses tired light models. It should be noted that tired light models do not predict time dilation, which has been observed, and therefore they should be ruled out on that basis.