Draft version July 24, 2020
Typeset using LaTeX **modern** style in AASTeX63

Determining the Hubble Constant from Observations of Distance Modulus and Redshift for Type Ia Supernovae

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1. ABSTRACT

We present the distance moduli and redshifts for 1048 confirmed Type Ia supernovae (SNe Ia) from Scolnic et. al 2018. These SNe Ia range from $0.01 < z < 2.3$ and are compiled from the Pan-STARRS1 (PS1) Medium Deep Survey, Sloan Digital Sky Survey (SDSS), SNLS, low-z, and Hubble Space Telescope observations. We call this dataset the "Pantheon sample". By fitting a model of distance modulus vs redshift to the data, we obtain values of three parameters that shed light on the universe: mass density Ω_m, equation of state w, and distance modulus offset Δ_{dm} of the model from the data. Using the Markov-Chain Monte Carlo sampling method for 10,000 iterations yields $\Omega_m = 0.337 \pm 0.066$, $w = -1.182 \pm 0.521$, $\Delta_{dm} = 10.634 \pm 0.261$. From these parameters we hope to determine the value of the Hubble constant, H_0. H_0 is related to the speed of expansion of the universe, so by obtaining a precise estimate of the Hubble constant, we hope to gain insight into the history of the universe. With these results, our experiment fails to reproduce the results of Scolnic 2018. In addition, we are unable to separate random error and systematic error in our parameter uncertainties. Further refinement of our sampling algorithm and further processing of Ω_m, w, and Δ_{dm} are needed to determine the Hubble constant, H_0.

Key words: model fitting, Markov Chain sampling, Type Ia supernova, cosmology, distance modulus, Hubble constant

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