Determination of the Hubble Constant by 1a Supernovae

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The expansion of the universe can be quantified by the Hubble Constant. This constant can be determined through different methods, such as by the cosmic microwave background, the Tully-Fisher relation, or type 1a supernovae. Each method gives different values of the Hubble Constant, which results in a discussion about the value and whether it is a constant at all. That is why I wanted to measure the Hubble Constant through type 1a supernovae on my own. For this purpose, I needed roughly 200 pictures of each 1a supernova. I took these pictures at two different observatories in the Eifel Region in Germany and used the data of a worldwide telescope network (Las Cumbres Observatory), where I was also able to create observing assignments myself. To measure the Hubble constant, I also needed the cosmological redshift. Therefore I took spectra of these supernovae. Then I used these spectra to evaluate the type of each supernova and to determine the value of the cosmological redshift of the supernova by measuring the redshift of the spectral lines. After that, I used pictures of the 1a supernovae, which were made with a blue filter to receive the distance of each supernova. Last, I plotted the velocity of each 1a supernova (which results from the cosmological redshift) against the distance of the respective supernova to obtain the Hubble Constant as (75,0 ± 3,8) km s-1 Mpc-1. With my measurements of low z supernovae, I was able to confirm the discrepancy between the values of the Hubble constant of the early and late universe. I was also able to show that the Hubble Constant can be usefully determined using school resources.

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