Astron. & Astrophys. 45, 219 – 221 (1975)

Research Note

Decrease of the Hubble Constant with Distance in the Local Supercluster Anticenter Direction

Gérard Le Denmat and Mariano Moles
Institut Henri Poincaré, Laboratoire de Physique Théorique

Jean Luc Nieto
Institut d'Astrophysique, Laboratoire d'Astrophysique Théorique du Collège de France

Received June 30, 1975

Summary. If one recalibrates the sample of unbiased galaxies given by Sandage and Tammann using the absolute magnitudes given by Van den Bergh, one obtains a significant decrease of the Hubble constant in the Local Supercluster anticenter direction.

Key words: Hubble constant — local supercluster — distance calibration

In recent papers, Sandage and Tammann (1975a, b) have selected and discussed a sample of Sc galaxies and obtained for an unbiased subset $H = 55 \pm 5$ km s^{-1} Mpc^{-1}. This result depends clearly on their calibration of luminosity classes. We are reluctant to accept it, because it gives different values of H for different Sc type luminosity classes, as shown by Jaakkola and Le Denmat (1975). We have therefore recalibrated their sample using the absolute magnitudes given by Van den Bergh (1960), taking $M(\text{Sc I}) = -20.0$, $M(\text{Sc I-II}) = -19.7$, $M(\text{Sc II}) = -19.4$. Now there might be motions in the local supercluster: consequently, in order to study the behaviour of the Hubble constant beyond the local supercluster, we have only considered those galaxies in their sample which lie in the anticenter direction of the local supercluster ($200° \leqq$ supergalactic longitudes $\leqq 320°$). The nearby ones are Sc I, Sc I-II and Sc II galaxies taken from ST's Tables 3 and 4 in Paper V, and the distant ones are Sc I from ST's Paper VI.

To take into account the bias discovered by Sandage and Tammann, and Teerikorpi's selection effect (Teerikorpi, 1975a, b), whose tendency is to increase the value of H at large distances as a consequence of the limiting magnitude problem, we have only considered the nearby galaxies for which $\log v_0 \leqq 3.30$, and the distant galaxies for which $\log v_0 \leqq 3.92$.

As suggested by Le Denmat *et al.* (1975), our results show that the value of H for the nearby galaxies is significantly different to that for the distant ones. To study this problem further, we have calculated the correlation coefficient ϱ of H and D using the unbiased sample over all distances. We find (for 59 objects) $\varrho = -0.56$, which implies a highly significant correlation, with a Student coefficient $t = 5.10$. Figure 1 shows the regression lines $\Delta(H/D)$ and $\Delta(D/H)$ with regression coefficients 0.67 and 0.47 respectively. Such a dependence of H with distance as a consequence of using Van den Bergh's calibration illustrates the importance of calibration in calculations concerning possible variations of the Hubble constant.

We note:

1) Van den Bergh's calibration can be criticized. However, it is coherent—i.e. it gives the same values of H

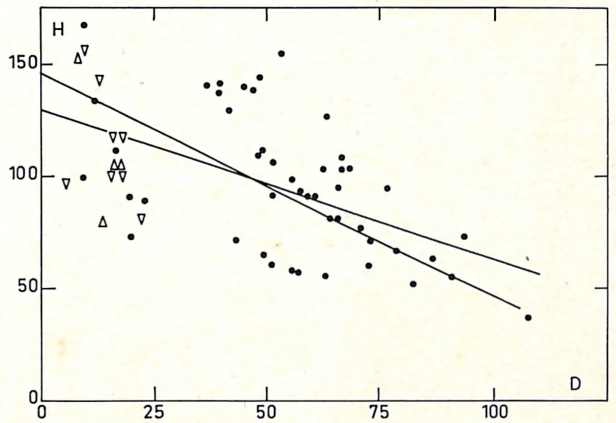

Fig. 1. (H/D) diagram. H is in km s^{-1} Mpc^{-1} and D in Mpc. Filled circles represent all Sc I galaxies normal triangles (△) Sc I-II galaxies, inverted triangles (▽) Sc II galaxies from ST's paper V and VI