THE EXPANSION OF CLUSTERS
OF GALAXIES

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1. Introduction

The possibility of the expansion of clusters of galaxies has been considered from two points of view. First, if one assumes that the redshift of galaxies reflects velocity of recession, the question arises: do the members of clusters of galaxies participate in the general expansion indicated by the law of redshifts, with the clusters themselves expanding? In a study of this problem, Neyman and Scott [1] developed a statistical kinematic test of the stability of systems of galaxies. In 1953 the test was applied to the twelve galaxies in the Coma Cluster for which the necessary data (radial velocities and magnitudes) were available. There was no indication of expansion.

More recently, the possible expansion of systems of galaxies was considered from a different point of view. The suggestion, emphasized particularly by Ambartsumian [2], is that some systems of galaxies are disintegrating rapidly. This suggestion is motivated partly by the observation that the average mass of galaxies derived through the application of the virial theorem, valid for stable clusters, sometimes appears to be considerably larger than the estimates obtained by other methods, for example, by the study of double galaxies by Holmberg [3] and by Page [4]. The discrepancy has often been interpreted as indicating the presence of large masses of intergalactic material. However, some investigators consider that, at least in some clusters, the discrepancy is too large to be explained entirely by dark matter, although it may indeed be present; they conclude that these clusters are unstable and the virial theorem is not applicable.

The basic assumption underlying this argument is that the various galaxies for which divergent estimates have been obtained by different methods have average mass of the same order of magnitude. This may well be true. However, a priori it is not evident that, for example, the members of small systems of