

# LARGE-SCALE STRUCTURE AMONG ABELL CLUSTERS AND COMPARISONS TO MODELS

David J. Batuski  
Space Telescope Science Institute, Homewood Campus  
Baltimore, MD 21218 USA

Jack O. Burns  
Institute for Astrophysics, Univ. of New Mexico  
Albuquerque, NM 87131 USA

Adrian Melott  
Department of Physics and Astronomy, Univ. of Kansas  
Lawrence, KS 66045 USA

In a continuing redshift observation program, we have recently determined or confirmed the redshifts of 32  $R \geq 0$  Abell clusters. With these data added to the previously measured cluster redshifts, there is now a sample of Abell clusters to  $z = 0.085$  that is 92% complete in redshift measurements. The sample consists of 225 clusters in the North and South Galactic Caps, with latitude  $|b| > 30^\circ$  to minimize obscuration effects. The longitude range  $270^\circ < l < 360^\circ$  was also excluded for this sample because of an apparent large spur of galactic absorption.

With these most recent redshift data, we calculated a new two-point correlation function for the  $R \geq 0$  Abell clusters, which shows indications of structure on scales as large as 300 Mpc ( $H_0 = 50 \text{ km sec}^{-1} \text{ Mpc}^{-1}$ ). In particular, there appears to be a sizeable “bump” in the function around 300 Mpc.

The amount of structure present in this sample of Abell clusters has been compared with numerical supercomputer simulations (with  $64^3$  particles) of the isothermal (IS), neutrino (NE), and cold particle (CP) models for large-scale structure, assuming a flat universe and  $H_0 = 50, 75,$  and  $100$ . High-density clusters of particles were identified in each simulation. Correlation and percolation tests were then used to compare the spatial distribution of these high-density points with the apparent superclustering among Abell clusters. While  $H_0 = 50$  gave the best results, none of these models came very close to matching the observations. The NE model appears to form many superclusters, each consisting of a few clusters very densely spaced, quite unlike Abell cluster superclusters with many ( $> 10$ ) member clusters and large spatial extents. The CP and IS models have too many comparatively isolated clusters, and thus show only weak superclustering effects.

We also generated two simulations of the CP model with  $\Omega = 0.5,$  and  $\Omega = 0.2,$  to see if the lower density would cause sufficiently large structure to match the observations. These simulations did indeed contain more clusters with relatively small separations from neighboring clusters (i.e., more apparent superclusters), but these groupings were still not sufficiently large to match the Abell cluster superclusters to within  $2\sigma$  errors in one of our tests.