High Mass and High Redshift Elliptical Galaxies and Interpretations of Hubble's Constant

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Recent surveys of high red shift elliptical galaxies (Z=2.3 or a look back time of 10.7 Gyr) have shown masses similar to nearby galaxies but sizes that are much smaller. Nearby elliptical galaxies of comparable mass would have a radius about 5 times larger. This defies current theories of galaxy formation. It also hints at a non conventional interpretation of Hubble's constant.

Keywords: high red shift, elliptical galaxies, Hubble's constant, cosmological coincidences

Introduction

Contemporary theories of galaxy formation start with a fairly uniform distribution of matter after the big bang. The matter coalesces mostly due to gravity. Objects like galaxies should increase in mass and become more compact over time.

Van Dokkum et al [1] measured the radius and mass of several high red shift galaxies (z=2.3)and found them to have a median effective radius of 0.9 kpc. Nearby galaxies of similar mass have radiuses of about 5 kpc. Therefore the high red shift galaxies, which are assumed to be much younger, are actually much more compact. This is the opposite of what standard theory would predict.

Hubble's constant is the change in redshift per distance. The redshift is generally interpreted as a velocity imparted to all particles by the big bang. In that case it should only be observed among objects whose motion is only weakly affected by gravity. But the above data and other studies suggest that Hubble's constant might have a different interpretation.

Discussion

If we use the red shift and the typical interpretation of Hubble's constant, the high redshift, compact galaxies are being observed at about *one fifth* the present age of the universe (13.6 billion years) according to standard big bang cosmologies. So there exists a coincidence. These galaxies are about *one fifth* the radius of local galaxies and about *one fifth* their age. The simplest explanation could be that the galaxy is expanding at the same rate as the universe. Or more generally, galaxies and the universe are self similar.

By itself, this may not seem like much of a coincidence. But one of the authors (Mueller[2]) has calculated evidence for Hubble's

constant acting at scales from the size of the earth upward. These include, but are not limited to:

1) The expansion of the earth's radius as measured by satellite and inferred from earth expansion models is proportional to the expansion rate inferred from the Hubble constant.
2) If the slowing of the earth's rotation rate is calculated in (1/seconds) instead of the usual [(seconds/day)/year] we get Hubble's constant.
3) The increase in the lunar orbital radius per radius is equal to Hubble's constant.
4) If the anomalous acceleration of Pioneer 10 is recalculated as a velocity change per distance we also get Hubble's constant. But, it should be noted that a literal application of Hubble's relationship would yield a redshift instead of the observed blue shift.

While several of these phenomena have had other explanations, these coincidences could also be explained by postulating that expansion is universal. Or they could be hinting at a universe that is governed by undiscovered rules of self similarity at all scales that are dominated by gravity.. (For a more extensive discussion of cosmological coincidences, see Kokus[3])

Summary

While conventional models of galaxy growth may eventually be able to explain this enigma, the enigma may be hinting at undiscovered secrets of nature and that it is time for us to start looking for them.

References

[1] Pieter G. van Dokkum et al, 2008 "Confirmation of the remarkable compactness of massive quiescent galaxies at z~2.3," Astrophysical Journal, 677:L5-L8

[2] Volkmar Mueller, 2009 "Does cosmological expansion exist on a smaller scale?" New Concepts in Global Tectonics Newsletter 50:18-22.

[3] Martin Kokus, 1994 "Cosmological coincidences," Apeiron 20:1-5.