A Study on Comparision of Clusters of Galaxies (ACO 1831, ACO 1367, ACO 2374, ACO 23)

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Abstract- *George Abell discover that the distant galaxies have red shift from his observations.*

It means that the farthest galaxy moves faster than nearer galaxy. In Order to measure dimension of phonology the bigger unit, cluster of galaxies is used. In cluster of galaxies different galaxies one gravitationally bound together. Also its spreads in all direction the cluster of galaxies defined there are few galaxies are visible prominently. So Abell classified cluster of galaxies and formed catalogue its known as Aco with ra (right ascension) dec(declination).

Keywords- Redshift,clusters,SDSS telescope.

I. INTRODUCTION

In Cosmology the Big Bang theoryis the basic one. Dinosaurs first appeared on the Earth about 250 million years ago, an unimaginably long time in human terms, but only a small fraction of the 13.7 thousand million years since the Big Bang. All but the nearest clusters of galaxies to us are so far away that light has been travelling since before the dinosaurs to arrive at our telescopes now.These nearby clusters are many hundreds of light years away, and this means that light has taken hundreds of million of years to travel through space and reach us. In other words, when we look at cluster of galaxies, we are not just looking at object which are a long distance away, we are also looking back a long distance in time.

II. GALAXIES

Galaxies are collections of millions to thousands of million of stars held together in space by gravity, They come in different sizes and shapes. Two of the commonest luminous types are elliptical galaxies and spiral galaxies. Galaxies are not scattered randomly throughout the universe, but are often found in “clusters” which are in turn pans of larger groupings called“superclusters"

III. CLUSTERS OF GALAXIES

Clusters are larger than groups. although there is no sharp dividing line between the two when observed visually clusters appear to be collections of galaxies held together by mutual gravitational attractions. However, their velocities are too large for them to remain gravitationally bound by their mutual attractions, implying the presence force either an additional invisible mass component, or an additional attractive force besides gravity, X-ray studies have revealed the presence of large amounts of intergalactic gas known as the intracluster medium This gas is very hot between 10^7k and 10^8k and hence emits x-rays in the from of bremsstrahlung and atomic line emission, The total mass of the gas is greater than that of the galaxies by roughly a factor of two. However s this is still not enough mass to keep the galaxies in the cluster. Since this gas is in approximate hydrostatic equilibrium with the over all cluster gravitational field, the total mass distribution can be determined. It turns out the total mass deduced from this measurement is approximately six times larger than the mass of the galaxies or the hot gas, The missing components known asDark matter and its nature is unknown. In typical cluster perhaps only 5% 0m“total mass is in the form of galaxies, may be 10% form of hot x-ray emitting gas sand the remainder is dark matter. Brownstein and Moffat use a theory 0fmodified gravity to explain x-ray clusters masses without dark matter.

INFORMATION ON GALAXIES IN CLUSTER:-

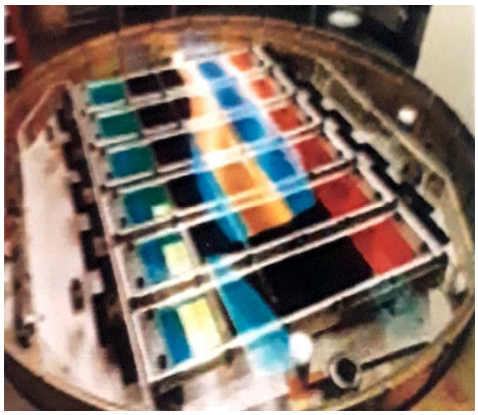
Galaxies are not stationary in space, but move at speeds of hundreds of km per second. Because galaxies are packed much closer together inside clusters than outside there is a good chance that many of those inside clusters will have

already collided and merged. Furthermore, it is thought that when galaxies merge they form elliptical or lenticular galaxies, even if one of the original galaxies was a spiral. Look out for galaxies in your cluster which are colliding. or at least coming so close that the gravity of each is distorting the other.

IV. THE SDSS INSTRUMENTS

The SDSS survey collects data with modern, digital detectors. An enormous way of CCD detectors takes images, and a pair of spectrographs, fed by optical fibers, collects spectra.

The CCD Camera



The inner sanctum of the SDSS telescope contains what may be the most complex camera ever built. The camera includes 30 electronic light sensors called charge-coupled devices (CCDs) like the one at left, each two inches ssquare. The CCDs are arranged five to a column, and scientists encase each column in a vacuum-sealed chamber. To enhance sensitivity, liquid nitrogen cools each chamber to -80 degrees Celsius.

V. CHOOSE A CLUSTER

1.Look briefly at several clusters and choose one to study:

Out of 500 cluster of galaxies. We must select a cluster of galaxy, for that we' have followed procedure given in the **noodlel page**..

Import the names and coordinates of clusters into Excel:

*Clik the link of **list of cluster** on the **galaxies before the Dinosaurs webpage**

An Excel spreadsheet opens containing the names and coordinates of over 500 clusters in the Abell catalogue.

select and copy the cluster data:-

* As shown, the cells containing data should already be selected (If they aren't select them now ~ not the whole of the three columns,just the data.)
* Type ctrl—c (cmd-e) to copy the data

Open the SDSS Image List Tool:-

* Switch to your web browser and go to the following web address: cas.sdss.org/astro/en/tools/chart/list.asp (or just click this link ifreading this on computer.

paste the cluster data Into the image list Tool:-

*Click anywhere in the area shown by the red Circle above left, then type
Ctrl-A (Cnd — A) (Select all) followed by
Delete (Back space) (delete existing data)
Ctrl -V (Cmd - V) (paste).

Download thumbnail images :-

* Click the **Get Images** button.

Explore the images:-

You will now see thumbnails of the centers of 25 clusters

* use the zoom control to zoom out until You can see the whole of each cluster as far as you are able to judge.
* Click on any thumbnail to see a magnified View in the SDSS Navigate Tools (0n some Computers you may need to click the Get image button in the Navigate Tool).
* You will need to zoom out again
* To look at a different cluster, go back to the image List Tool window and click and click a different thumbnail.
* To see different selections of thumbnails Click on one of the page links at the top.

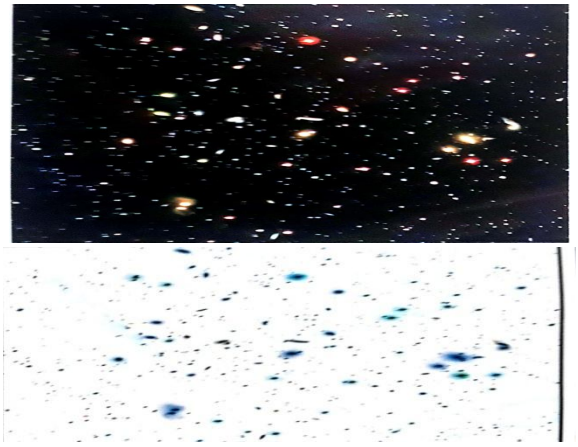
*look at a 578 cluster and pick few (four)cluster of galaxies that we would like to study in more detail.

Name of the our cluster of galaxies:-

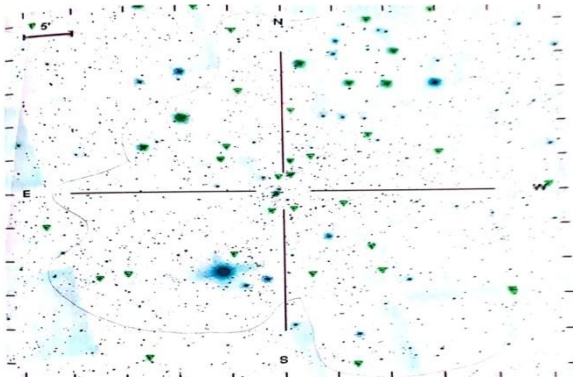
*** Aco 1831**
Ra = 209.8 Dec = 27.983333
*** Aco 1367**
Ra = 176.125 Dec = 19.8333
*** Aco 2374**
Ra = 325.725 Dec = -8.08333
*** Aco 23**
Ra = 5.45 Dec = -0.883

A First Look at our Cluster ;-

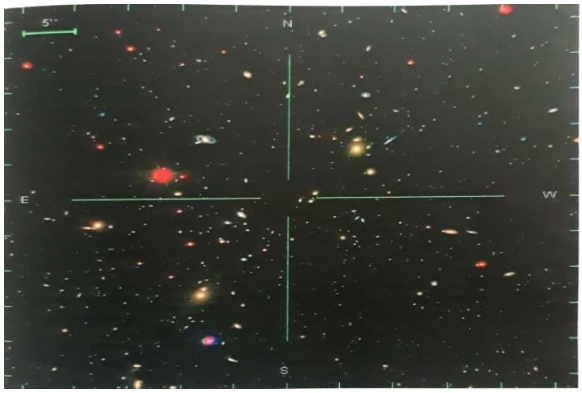
It can be difficult to know by looking at an image where the edge of cluster really is. Fortunately' The SDSS Project has provided another visual tool,finding chart, that makes it easier to decide. In a typical galaxy cluster, there will be many members winch are relatively bright, say magnitude 16 or less. Outside of a cluster galaxies this bright are rare, so one way of detecting how far a cluster extends is to 100k for galaxies which are magnitude 16 or brighter.The instructions below show how we can do this very easily using the finding chart.

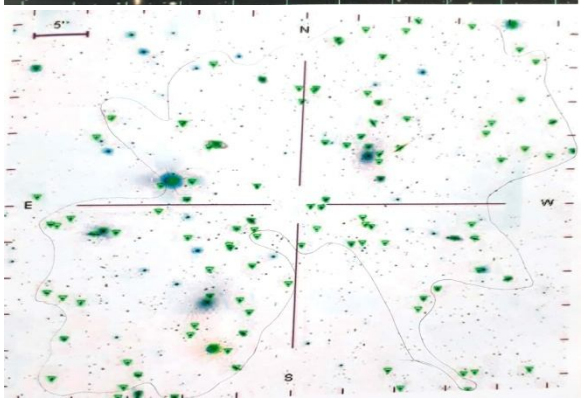


Aco 1831
Ra=209.8 dec=27.9833

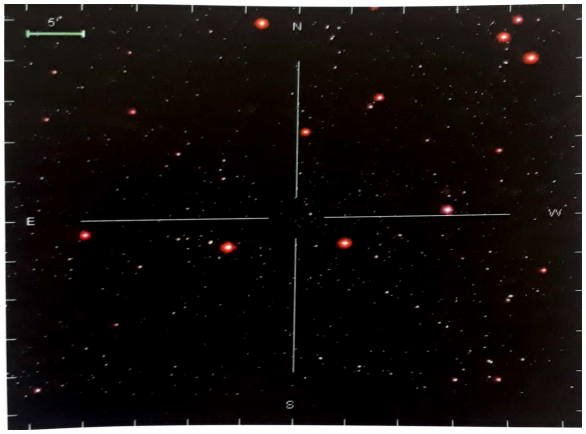


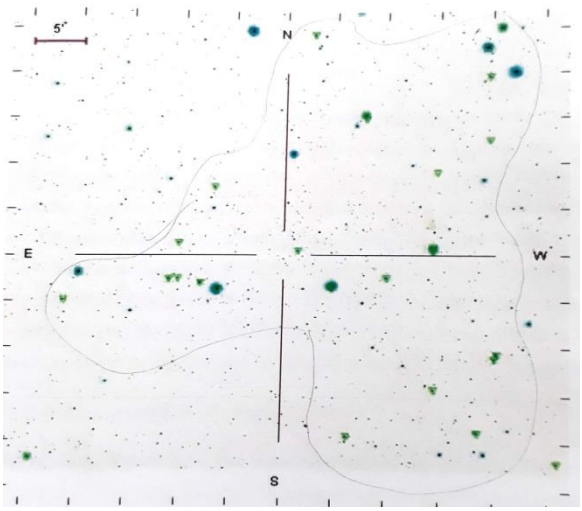
Aco 1367
Ra=176.125 dec=19.833





Aco 23
Ra=5.45 dec=-0.8833





Tools For Collection Data :-

there are two different ways to extract data from the SDSS database ,

They are

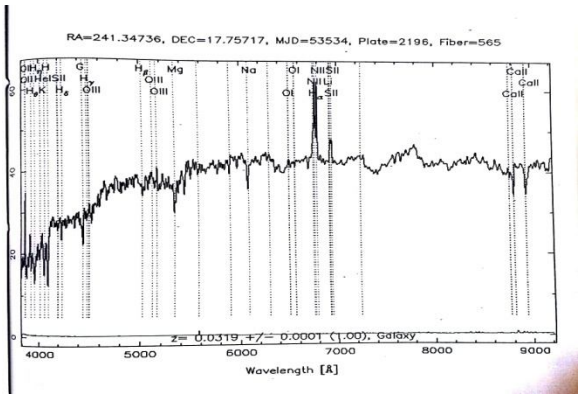
●Extracting data through navigation tool.
● Extracting data through SQL search tool

Extracting data through navigation tool:-

In the navigation tool window we can search the objects found in the database through the objID provided to the object which is a unique one and.we may use the spec objID(Id given for spectroscopic objects) . For every objID a separate window will opens in which the picture of that corresponding object and the spectrum of the object along with the object details and spectroscopic details will appear. From that window we can note the red shit[Z] and the magnitude's [u, g, r, i, z] for our diagram. In the next page a sample data of an object having the obj ID 587739720846934449 in shown, which is the data extracted from the navigation tool by searching the data through the obj ID.

Extracting data through SQL search tool:-

This method of searching the data is found to be hardest. But,this method is useful in retrieving the large amount of data through a single query.For example if we use the SQL server Query as "select' from galaxy" then the query will returns all the rows of data in the galaxy table / view. So, this method is found to be useful than the above two methods



Probe of our cluster of galaxies:-

Shape of the galaxies:

Using the printout with the brightest galaxies marked, sketch the overall shape of the cluster. In our cluster of galaxies are quiet irregular.

Number of galaxies: From the outline of the cluster of the galaxies printout and the magnitudes range G R (5,16) each cluster has following galaxies.

- Aco 1831 has thirty eight galaxies.
- Aco 1367 has one hundred and nine galaxies.
- Aco 2374 has thirty seven galaxies.
- Aco23 has twenty four galaxies.

BRIGHTEST AND FAINTEST GALAXIES:

There will be many other evan fainter galaxies than we can see,infect there will be many so faint that evan the largest telescops cannot see them.If zoom in we will be able to see fainter objects.
How much fainter are the brightest galaxies in our cluster image than the naked eye from a dark location .An increase of 5 magnitudes means 100 time more light reching the telescope, while one magnitude corresponds to 2.5 times more light.

Aco 1831
In zoom level zero we can able to see Eighty two galaxies with naked eye .we can classify thirty two bright galaxies, fifty faintest galaxies,

Aco1367
Has Thirty six galaxies we can Classify fifteen brightest galaxies and twenty one faintest galaxies.

Aco2374

Has One hundred and eleven galaxies, Thirty six brightest galaxies.seventy five faintest galaxies.

Aco 23

Has Forty six galaxies. Twenty four faintest galaxies‘ ‘twenty two bnghlesl galaxies.

VI. HUBBLE’S CLASSIFICATION

By using the Hubble’s classification, we can classified the galaxles In our cluster as shown below.

Aco 18310

●Twelve spiral galaxies.
●Seventeen Elliptical galaxies
●Nine galaxies with a lot of active star formation going on .

Aco 1367

●Forty spiral galaxies.
● Fifty five Elliptical galaxies.
●Seven galaxies with a lot of active star formation going on.
●Seven Irregular galaxies.

Aco 2374

●Nine Spiral galaxies.
● Ten Elliptical galaxies.
● Eighteen galaxies with a lot of active star formation going on.

Aco 23

● Seven Spiral galaxies.
● Ten Elliptical galaxies
●Seven galaxies with a lot Of active star formation going on.

VII. NETERST'NG 0R UNUSUAL GALAXIES

A few of the most interesting galaxies in our cluster like clear spirall arms, edge-on galaxies, colliding galaxies,star and foreground and background galaxies.

Ace 1831

● Four clear spiral arms galaxies.
●One edge-on galaxies.
●Seven galaxies galaxies will actully be foreground or background galaxies.

Aco1367

● Fiveclear Spiral arms galaxies
●Four edge-on galaxies
●Eight galaxies colliding with near by galaxies and star also.
●six galaxies will actually be foreground or backgmund galaxies.

Ace 2374

●Two clear spiral arms galaxies.
●Two edge-on galaxies.
● Two galaxies colliding with near by star.
● Six galaxies will actually be foreground or background galaxies.

Aco 23

● Three clear spiral arms galaxies.
●Four galaxies will be actually be foreground or background galaxies.

Distance of our clusters:-

Knowing the clusters redshift, we can now work out its distance r using this formula based on Hubble‘s law:

$$z = (H_0 /c) r$$

where H0=71km s-1mpc-1 is Hubble‘s constant.

and c=3.00×10 5 km s -1 is the speed of light in a vacuum.

Rearranging this we get a formula which gives the cluster distance

directly in Mpc:

r= cz / Ho- 47

Now we know hpw far away our cluster in Mpc is

That is Aco 1831 has the distance of 271 .27Mpc

Aco1367 - 97.18Mpc.

Ace 2374 - 224.37Mpc.

Aco 23 — 261.97Mpc.

Size of our cluster :-

Now we know how far away our cluster is, we can estimate its true diameter d in Mpc from its angular size in the sky

The measurement of the angular size, First note the ra,dec value then we move the mouse on the cluster of galaxies. Click the mouse on the South- direction note the dec value and again click the mouse on the same direction note the another value. Similarly we did the process on the North direction and note the values. Subtract these values one by one and multiply all the value. Now we get the value of the vertical line.

Then we measure the horizontal line value by using the ra value on the East —West direction. Let we consider the triangle from the cluster and measure the angle.

This value gives the angular size of the our cluster.

Aco 1831 — 41Mpc
Aco 1367 — 43Mpc
Aco 2374 — 45Mpc
Aco 23 - 44Mpc.43.

This gives the simple rule of thumb:

diameter in Mpc = 0.0003 x distance in Mpc x angular size in arcminutes

A typical spiral galaxy has a radius of the order or 25 kpc (80 kly), while atypical cluster group of galaxies has a radius ol‘the order of 2 Mpc (6.5Mly), (2 Mpc is oten called the 'Abell radius'.).

The diameter value of the our cluster :-

Aco 183l —3.4Mpc
Ace 1367 — 1.3Mpc
Ace 2374 — 3Mpc
Aco 23 — 3.4Mpc

Clusters of galaxies have been found in survey by a number observational techniques and have been studied in detail using many methods.

optical or infrared:-

The individual galaxies of clusters can be studied through optical 01'infrared imaging and spectroscopy. Galaxy clusters are found by optical or' infrared telescopes by searching for over densities, and then confirmed by finding Several galaxies at a similar red shift. Infrared searches are more usefulor finding more distant (higher red shift) clusters.

X-ray:-

The hot plasma emits x-rays which can be detected by x-ray telescopes The cluster gas can be studied using both x-ray imaging and x-ray spectroscopy Clusters are quite prominent in may surveys and along with AGN are the brightest X-ray emitting extragalactic objects.

Radio :-

A number of diffuse structures emitting at radio frequencies have beer found in clusters Groups of radio sources (which may include diffuse structures or AGN have been used as tracers of cluster location. At high redshift imaging around individual radio sources (in this case AGN has been used as trscers of cluster location. At high redshift imaging around individual radio sources (in this case AGN has been used to detect proto- clusterss (clusters in the process of forming).

Sunyaev-Zel’dovicheffect :-

The hot electrons in the intracluster medium scatter radiation from thecosmic microwave background through inverse Compton scattering. This Produces a “shadow” in the Observed cosmic microwave background at some radio frequences.

Gravitational Lensing:-

Clusters of galaxies contain enough matter to distort the observed orientations of galaxies behind them. The observed distortions can be used to model the distribution of dark matter in the cluster

VIII. RESULTS

ACO 1831

- No of galaxies present in this cluster is limited.its formed medium one.
- Red shift of this cluster of galaxies is 0.0642.So its far away us.

Aco 1367

- No of galaxies present in this cluster is High.its thickly formed one and not evolve fully.
- Red shift of this cluster of galaxies is 0.0230.So its nearer to us.

Aco 2374

- No of galaxies present in this cluster is limited.its formed medium one.
- Red shift of this cluster of galaxies is 0.0530.So its far away us

Aco 23

- No of galaxies present in this cluster is low.its Loosely formed one.

- Red shift of this cluster of galaxies is 0.0620.So its far away us

IX. CONCLUSION

We have compared the four clusters of galaxies ACO1832, ACO1367, and AC02374, and AC023 at various red shift. And the result is tabulated. From that we have conclude: These galaxies are different in size and distance. And the one galaxy (AC01367) is hot; the Other three galaxies are cold. One cluster(AC01367) is nearer from us and the other three (ACOl83l, AC02374.AC023) are far away from us and the clusters (AC023) is loosely formed i.e., they i.e.,they have less no of galaxies, the other two (ACO1831, AC02374) formed medium.e., they have limited no of galaxies, the other one (AC0l367) is Thickly‘ formed i.e., they have high no of galaxies.

X. ACKNOWLEDGEMENT

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