Analysis of a Restricted Sample of Specimens from the Galaxy Zoo

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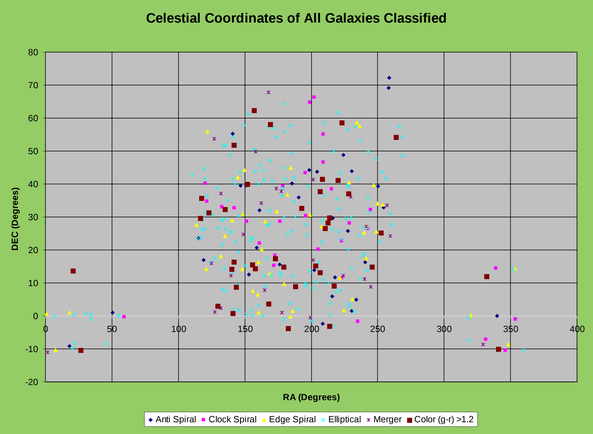
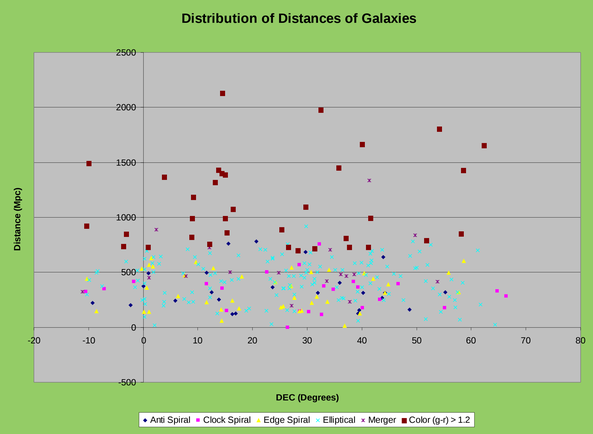
Abstract: The SDSS project Galaxy Zoo was initiated in July 2007. Its goal is to have the general public classify galaxies automatically detected in the SDSS-II data. Using the Galaxy Zoo web interface and the corresponding SDSS-II data, we have classified the galaxy type of over 400 galaxies. We have correlated the galaxy type with the position on the sky, color, and red shift. Due to the isotropic nature of the universe, we do not expect any significant patterns to appear. We have also identified several groupings of galaxies with similar sky positions and distance and determined the fraction of spiral and elliptical galaxies in each; because of galaxy mergers the proportion of elliptical galaxies should be higher in denser groupings. We will report the results of these investigations at the meeting.

SDSS and Galaxy Zoo: The Sloan Digital Sky Survey is a massive undertaking, that when completed, will document, through the use of detailed optical images, more than a quarter of the sky with approximately a million galaxies and quasars. The survey began in June 2005 and should conclude in June 2008. SDSS annually releases data to the public and the Galaxy Zoo project is where amateur astronomers can help classify the galaxies. The Galaxy Zoo project was launched because the human eye can classify the galaxies than computers and many galaxies needed to be classified. Galaxy Zoo provides training for the public and then asks them to help out classifying the galaxies into several categories, ellipticals, clockwise spirals, anticlockwise spirals, edge spirals, and mergers. Over 100,000 people have participated.

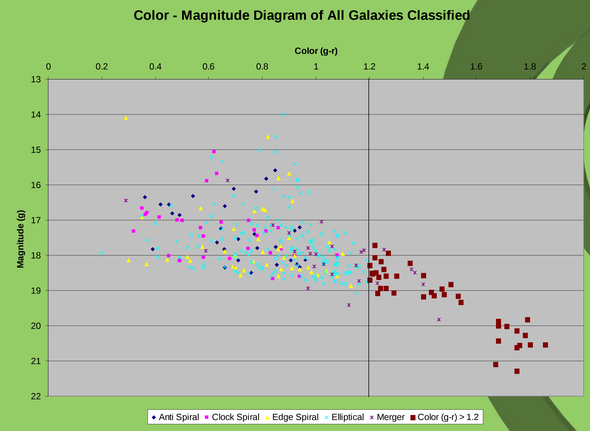


This graph shows the distribution of each galaxy type by right ascension and declination. The results show the isotropic nature of the universe as there is no obvious pattern within each galaxy type or between galaxy types. The majority of the galaxies have positive declination because the survey was planned that way. There is no reason to believe that cameras located in southern hemisphere would find any patterns. This graph documents all of the galaxies used in this project; the distribution is listed in the table.

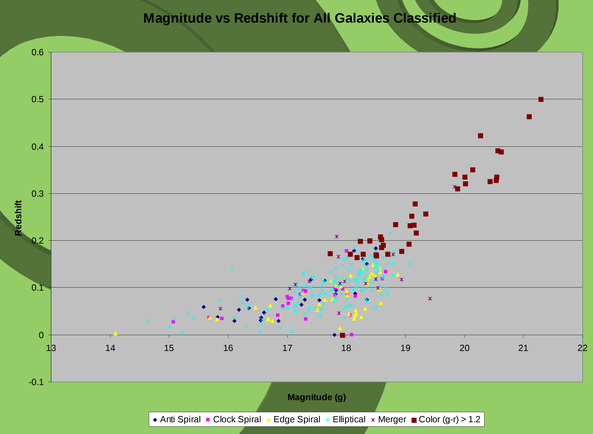
Galaxy Type	Number	Standard Deviation
Elliptical	205	+/- 14.3
Clockwise Spiral	29	+/- 5.3
Anticlockwise Spiral	31	+/- 5.5
Edge Spiral	44	+/- 6.6
Merger	26	+/- 5.1



This graph shows the distribution of each galaxy type by distance and declination. As expected, there are no obvious patterns. The elliptical galaxies are seen at greater distances. This is because elliptical galaxies were easier to spot during the classification process at greater distances than all of the other types. The distances were calculated using Hubble's Law and the Hubble Constant of 70.4 (km/s)/Mpc.[1]



This graph shows the distribution of each galaxy type by color and magnitude. Many different colors and magnitudes were examined but g – r vs. r most clearly illustrated the distribution. Again, as expected, there are no real patterns. The intriguing aspect of this graph is how the reddest galaxies are elliptical galaxies and are seen at fainter magnitudes than all the other galaxies. Elliptical galaxies were easier to spot during the classification process at greater distances than all of the other types because their features are easier to identify when compared to spiral galaxies. The elliptical galaxies have a greater red shift. This could be for two reasons: they contain older stars or because they are further away. The elliptical galaxies with a color (g-r) higher than 1.2 are plotted on each graph with different symbols.



This graph shows the distribution of each galaxy type by magnitude and red shift. There is no discernible pattern demonstrated by this graph. As expected, the elliptical galaxies have a higher red shift when compared to the other galaxies. This is because the elliptical galaxies are further away as demonstrated by the Distribution of Distances of Galaxies graph.

1 D.N. Spergel et al. (2007), "Three-year Wilkinson Microwave Anisotropy Prove (WMAP) Observations: Implications for Cosmology", Astrophysical Journal Supplement Series 170: 377-408. Images from Galaxy Zoo