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Winter Research Review

1.Big picture

The first evidence to suggest the presence of dark matter in our universe was the deviation of galaxy cluster dynamics from what would be predicted with only the matter we observe. The technique to estimate the total mass of a cluster uses the velocity distribution of member galaxies. This is only accurate if the velocities of cluster galaxies we observe are distributed the same as randomly drawn test particles of a virially bound system. Several numerical simulations of galaxy clusters have shown that this effect could be as large as 20%. Specifically, Wu et al (2013, MNRAS, 436, 460) claims that the brightest five galaxies have a velocity dispersion significantly smaller than the global value. We will be able to compare our dynamic estimate of mass to other techniques like gravitational lensing, X-ray, and SZ. This will show how well these techniques agree with the dispersion of different luminosity cuts. Cluster cosmology relies the accuracy of cluster mass estimates, meaning this research may have an impact on the analysis of large cluster surveys.

2.Work accomplished

This winter quarter was my first quarter researching meaning a large portion of the time was used getting up to speed on the current understanding of the field. I started with reading various papers on the topic for 3 weeks. After I was through with the papers, I started to get reintroduced to scientific computing techniques. I used python to take data from the Coma Cluster and worked on plotting this data in a productive manner. I started with finding the average velocity of the cluster and found the velocities of the members relative to the average. With these relative velocities I was able to separate the members into groups based on their brightness and color and compare the average velocity of bright and dim galaxies, as well as red and blue galaxies.

3.Plans for spring

My plan for spring is to generalize my code to be able to take data sets of galaxy clusters and find the relative velocities and plot the bright and dim galaxies to compare the differences in the groups. This will allow us to compare ~200 galaxies with ~20,000 members and allow us to look for any trends in the data. I am planning on working through Dr. Davenports’ scientific computing seminar files to become more proficient in scientific computing to help accomplish this.