# Baryonic Tully-Fisher Relation of Perseus-Pisces Supercluster


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## Introduction

Using initial data collected from the ALFALFA survey (Arecibo Legacy Fast ALFA Survey), we searched for galaxies within the Perseus-Pisces Supercluster that matched certain criterion. From these galaxies, we hope to use the Baryonic Tully-Fisher relation, or BTFR, to find distances. These BTFR distances will then be used to calculate the peculiar velocity of each galaxy. From that, we hope to measure the infall velocities onto the Perseus-Pisces Supercluster Ridge.

## Perseus-Pisces Supercluster

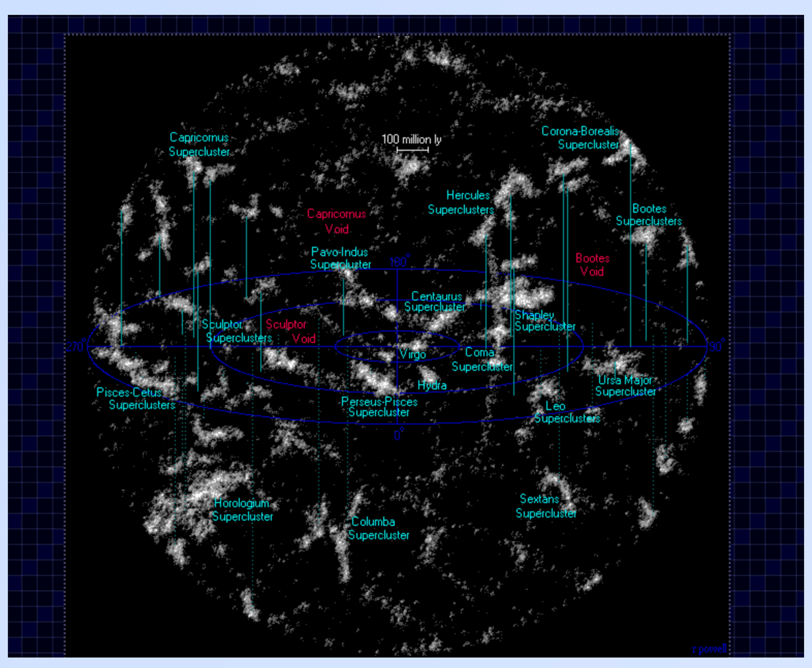

Figure 1. A Map of Distant Superclusters

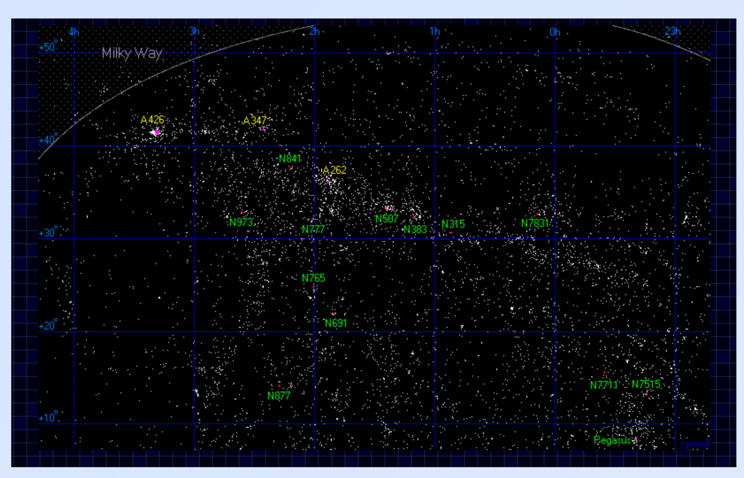

Figure 2. The Perseus-Pisces Supercluster

## Baryonic Tully-Fisher Relation

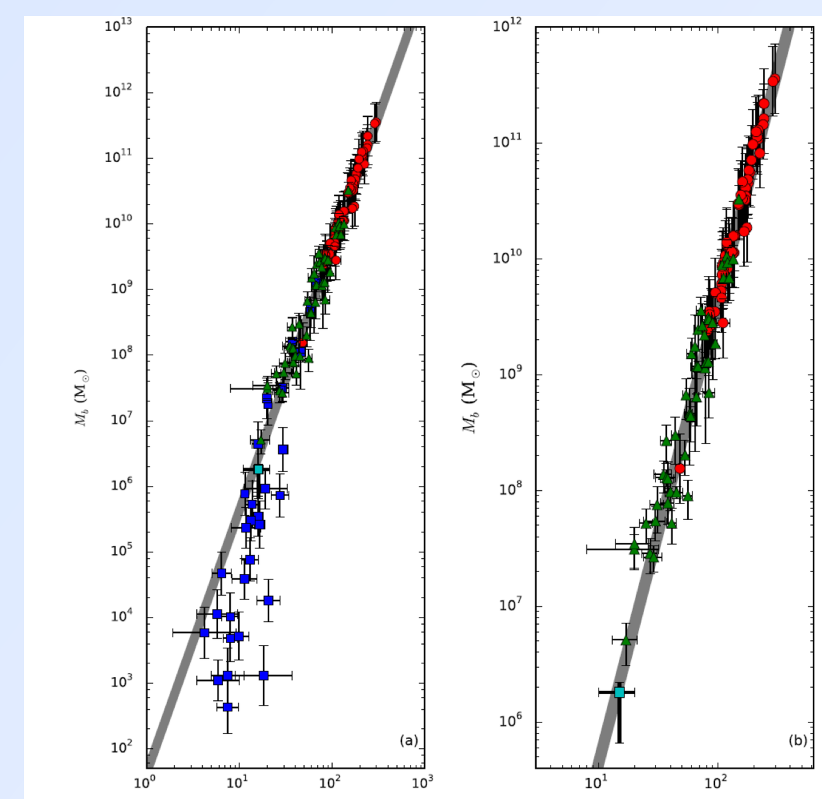

Figure 3. The Baryonic Tully-Fisher Relation

The BTFR is the more recent relationship between rotational velocity and stellar mass. Previous works have examined the relationship between rotational velocity and absolute magnitude, but this replaces absolute magnitude with stellar mass. There is a linear relationship on a log-log plot between baryonic mass and rotational velocity, as seen to the left.

$$\log_{10}(M_{bar})=\alpha\log(V_{rot})+\beta$$

$$M_{bar}=A(V_{rot})^{x}$$

$$M_{bar}=M_{*}-M_{gas}$$

## Data Collection and Refinement

From our original TOPCAT file, we expanded on the current data. In particular, we used data collected from SDSS to calculate necessary values, such as mass-to-light ratio, color, and inclination. With this new data, we then parsed through each individual galaxy to determine if they can be used for analysis. We looked for color, as well as accurate data. To do this, we examined the "picture" taken by SDSS telescopes.

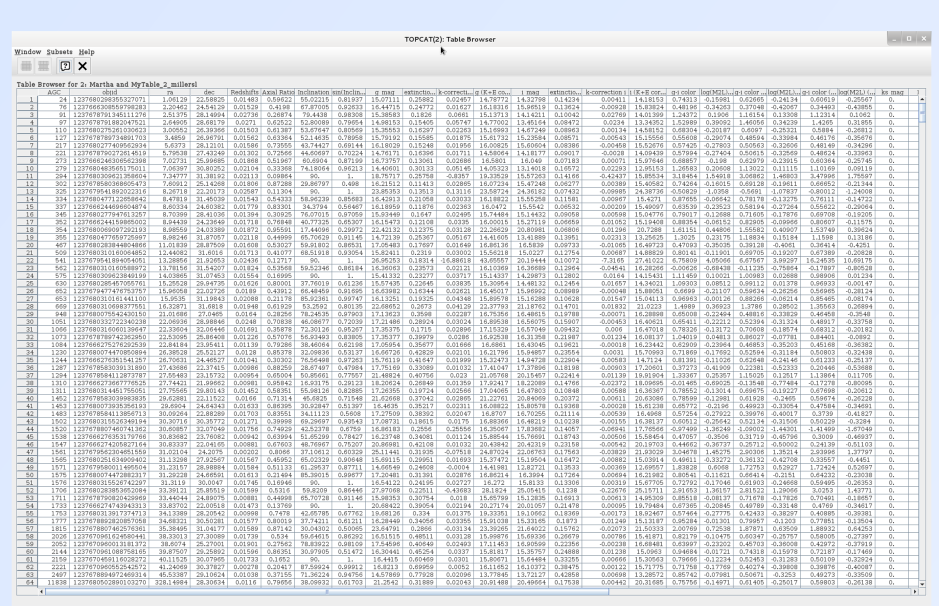

Figure 4. TOPCAT Table of Data Collected and Calculated

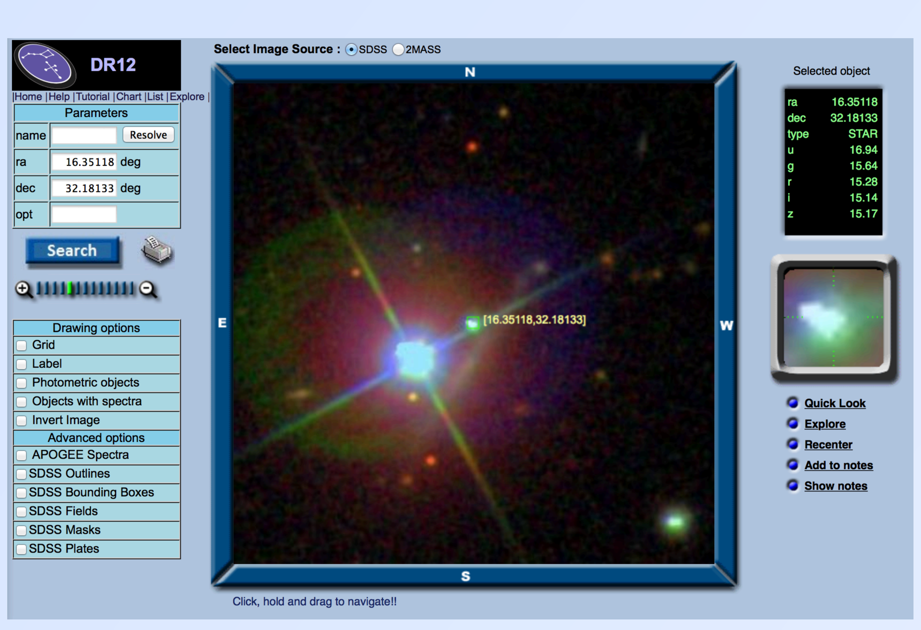

Figure 5. Challenge 1: Data Reported from Wrong Object

Figure 6. Challenge 2: Diffraction Spike Interference

## Results and Conclusion

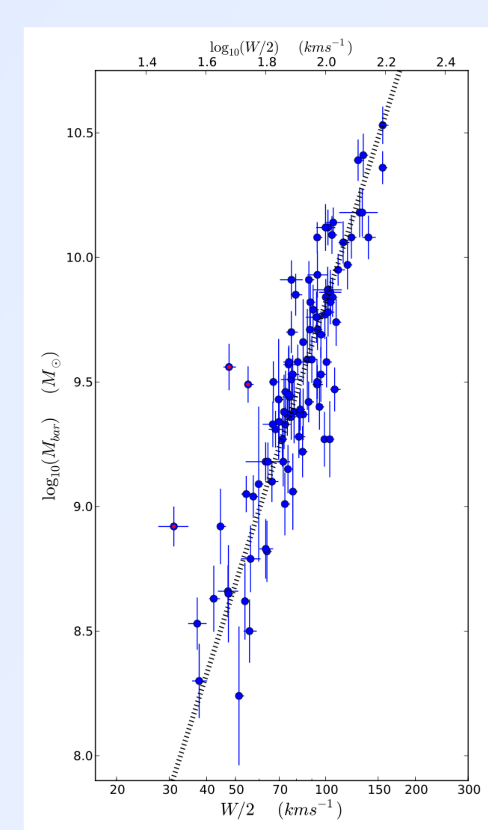

Figure 7. Expected Results

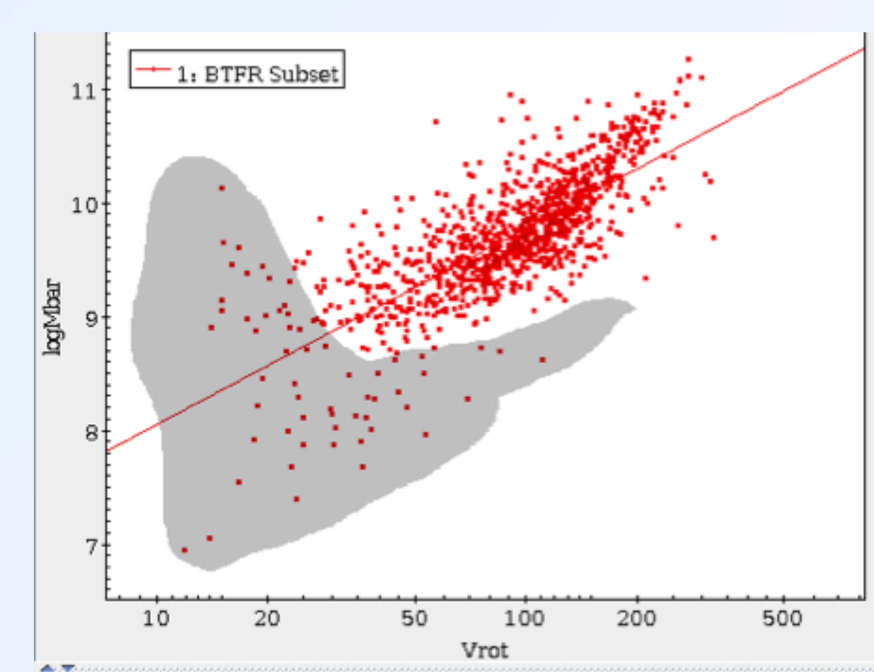


Figure 8. Our Results

The expected results pictured above in Figure 7 illustrate the linear relationship between baryonic mass and rotational velocity. Papastergis, et al, 2016, recorded a slope of $\boldsymbol{\alpha_p=3.58}$ with an error of 0.11. Our results, shown in Figure 8, shows a resulting slope of $\boldsymbol{\alpha_m=1.7279}$. Highlighted in gray is the scattered data.

This scattered data will be the focus of continuing research. As you can see from Figure 7, not much scatter is reported with the BTFR. Furthermore, our slope is much lower than expected, so it is of interest to examine what happens when the effect of the scatter is decreased.

## References


- Atlas of the Universe (Figures 1 and 2)
- Bernstein-Cooper, Cannon et. al 2014 (Figure 3)
- Sloan Digital Sky Survey (Figures 5 and 6)
- Papastergis et. al 2016 (Figure 7)



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