Star Clusters in Interacting Galaxies: A Study of Dwarf Merger 1529-26

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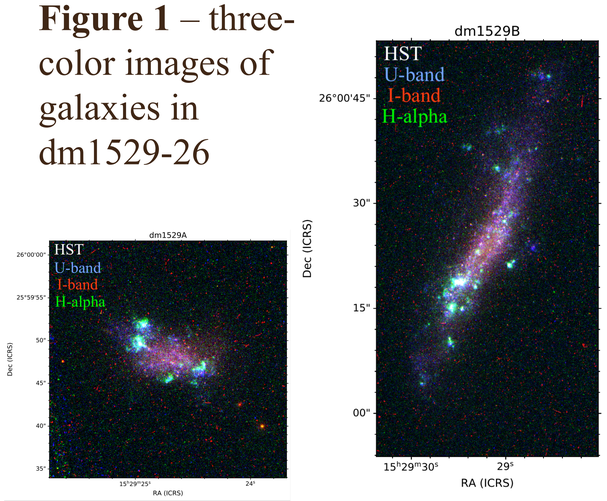
I. Introduction

Most galaxy mergers in the early universe consisted of mergers between dwarf galaxies. (De Lucia et al. 2006; Fakhouri et al. 2010) Studying these smaller galaxies is thus important to our knowledge of the early universe and galaxy formation.

Some of these dwarfs appear to show more large ('super') star clusters than is expected by their star formation rates. (Weidner et al. 2004) Professor Stierwalt's theory to explain this states that dwarf–dwarf interactions are responsible for these disproportionately high numbers of super star clusters.

We started the investigation of this theory in our research, by examining dwarf galaxy pairs at different separations and deriving their star clusters' properties, mainly age and mass. My project relates to the dwarf merger I examined, dm1529-26.

Figure 1 – three-color images of galaxies in dm1529-26

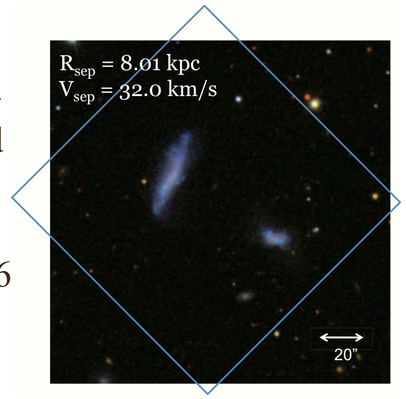


II. Methods

My analysis was based on images of dm1529-26 from the Hubble Space Telescope Wide Field Camera 3 through three filters with light from different wavelengths: in the I (infrared), U (ultraviolet), and H-alpha bands. Firstly, I created a three-color image of both galaxies in dm1529-26 by coloring and combining the three images using the aplpy and astropy packages in python.

I then identified star clusters in the brightest (I band) filter using Source Extractor (Bertin, E. & Arnouts, S. 1996) and ruled out the clusters which were not as prominent in other filters. I used the python astropy and photutils packages to measure the magnitude of brightness of each cluster in each filter in order to measure the color (the relative brightness in each filter) of each source. In the time remaining for this project, I plan to compare this color and magnitude to existing stellar population models in order to derive the age and mass of the clusters, using the Starburst99 data package (Leitherer et al. 1999; Leitherer et al. 2014) and the StarburstPy python wrapper.

Figure 2 – Broadband optical image of dm1529-26



III. Results

The three-color images obtained of each galaxy in dm1529-26 are shown in Figure 1. The bright green parts (showing H-alpha emission) near the outskirts of the galaxies could suggest the presence of young stars, indicating star forming regions. The redder parts of the galaxies (showing I band radiation) suggest older stars, likely spread across the galaxies. Both these observations will be tested though our imminent stellar population modelling.

In the star cluster identification process, I found 28 star clusters in the smaller of the two galaxies in dm1529, here referred to as dm1529A. I found 182 star clusters in the larger galaxy, dm1529B. Both galaxies are shown in their I band filters in Figure 3, overlaid with blue circles representing the locations of the clusters.

IV. Conclusions and Future Work

The galaxies in dwarf merger 1529-26 appear to have approximately 210 star clusters in total, the relative colors of which indicate the presence of star-forming regions in the outskirts of, as well as older stars spread across, each galaxy.

These observations, combined with the masses and ages of the star clusters to be derived in the last week of this project, can be used beyond this research in comparison with other dwarf galaxies. This will enable us to test the theory that dwarf galaxy mergers influence super star cluster formation and will add to our understanding of galaxy formation in the early universe.

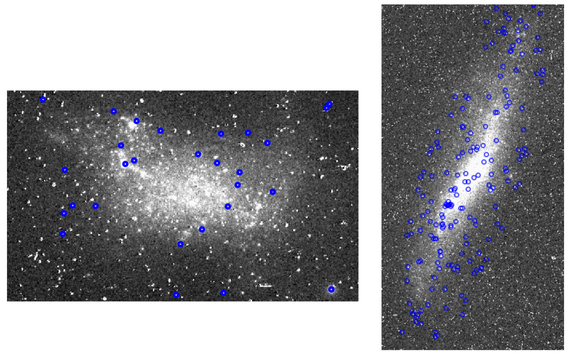


Figure 3 – dm1529-26 galaxy images in the I band filter with star cluster locations encircled in blue

V. Literature cited

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