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Galaxy Colors In The NDWFSJ1428p3346

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ABSTRACT

Keywords galaxy: Photometry - surveys - catalogues The J1428p3346 region of space was analyzed using a (DIMENSIONS HERE) area of the regions K-band and a (DIMENSIONS HERE) area of the R-band to identify any stellar objects that exist within the region. All identified objects had their coordinates recorded and compared between bands to determine if they were real. Each object located also had their stellarity determined as well as a value calculated for their R-K color band. These values were used to determine any patterns that might exists between the objects magnitudes and their R-K values.

1. INTRODUCTION

Find the 10 brightest objects in the K-band, Find the 10 brightest objects in the R-band, Find the magnitudes and R-K colors for each, Determine what the objects are (galaxy, star, etc..), Produce a histogram of the # of galaxies VS. magnitude and determine any patterns that exist, Produce a plot of R-K colors VS. K-band magnitude and determine any patterns that exist

Other such studies have examined looked at the similar sources and complied optical identifications (). Ideally, We would like to study a larger grouping of images and examine there magnitudes to determine the prevalence of any patterns that emerge. It would be interesting for our any future forays into Astronomy for us to have a sense of whether or not the magnitudes of various objects that we observe are typical of stars and galaxies of these kinds. In this paper, we discuss the properties and relationships that exist with our two optical K and R band image counterparts taken from the NOAO Deep-Wide Field Survey (NDWFS). The NDWFS data covers a 0.675° Right Ascension (RA) of the K-band near-infrared range. In the first section of the paper we briefly describe the methodology used to complete the aforementioned objectives. In the second section of the paper we discuss the results of our findings, and in the third section, we summarize our results and understanding.

2. METHODOLOGY

We were required to download the R-Band and K-Band images of the JM28p3346 field within the NOAO Deep Wide-Field Survey database. We were also required to download and run SExtractor on the K-Band and R-Band images in detection mode to generate their catalog of band sources. Initially, our group removed artifacts from both the R-Band and K-Band by increasing the detection threshold just enough to remove the unnecessary objects that were in the image. In order to do this, we opened up terminal and ran two commands "$ sex NDWFSJ1428p3346_K_01_sci.fits -CHECKIMAGE_TYPE OBJECTS" and "$ sex NDWFSJ1428p3346_R_03_sci.fits -CHECKIMAGE_TYPE OBJECTS". After this, we created three catalogs in which each one had the sole purpose of locating the ten brightest K-Band sources and then locating each of those objects respectively in the R-Band image. The first catalog was "test.cat" which consisted of the x-coordinate, y-coordinate, and magnitude value as parameters of K-band image. The second catalog was "test2.cat which consisted of only the magnitude of the K-Band image. Last but not least, the third catalog was "testr.cat" which consisted of the x-coordinate, y-coordinate, and magnitude value as parameters of R-band image.

Once we have acquired the the respective R-Band sources, we collected its x and y coordinate as well as manually find its magnitude in the testr.cat catalog. We were able to do this by matching the K-Band and R-Band coordinates using the "world coordinates system" in DS9. We also had both R-Band and K-Band images loaded in separate frames. When selecting the frame that the K-Band image is in, we manually had to go into our "test2.cat" catalog to search and find the largest magnitude, which resulted in the largest negative value. Once we retrieved that magnitude, we went into our "test.cat" catalog where we located that specific magnitude's x and y coordinate by using its line number from the "test2.cat" catalog. Next, we located the coordinates in the K-Band image then used Frame¿Match¿Frame¿WCS in order to locate that specific location in the R-Band image. Finally, we recorded its x and y coordinate then used "testr.cat" catalog to search for those coordinates and took down the respective magnitude. Our group repeated this same methodology when we were required to find the ten brightest R-Band sources.

For our detection of galaxies we were able to use the "CLASS_STAR" command in the SExtractor output parameters along with a neural network (CITE NEURAL NETWORK HERE) to determine the stellarity index of an object. The result is that every objects had a stellarity index from 0 to 1 associated with it. For our measure of figure: 1 we considered a galaxy to be anything under 0.2 stellarity index, since we wanted to be reasonably certain we had identified a galaxy since a stellarity closer to 0 indicates a higher confidence an object is a galaxy. for figure: 2 we considered anything less than 0.5 to be galaxy like and anything over 0.5 to be star like. To reduce the number of artifacts we detected we doubled the "DETECTION_THRESHOLD" and "ANALYSIS_THRESHOLD" parameters from 1.5 to 3 which seemed to do a decent job. We were afraid to increase it much further for fear of removing faint but legitimate objects. Artifacts had little impact on our brightest objects, since we manually verified their validity. Using the "-CHECKIMAGE_TYPE OBJECTS" command was useful for checking what specifically was detected.

3. RESULTS

Using S-extractor to identify galaxies we were able to create a plot depicting the number of galaxies vs their measured K-band magnitudes (see figure: 1). For this part we considered everything under 0.2 on the stellarity index to be considered a galaxy. These galaxies represent the vast majority of the objects that we detected and a general pattern does indicate most of these galaxies are between magnitudes are 15 to 17. We can note that these findings seem to hold up with other studies done on the NOAO Deep Wide-Field survey (THE ARTICLE ANNA GAVE US) in that most of the galaxies detected in are between brightness magnitudes of 10 to 20 in the K-Band. The sum total of our galaxies are between magnitudes 11 and 19 which are consistent with the previously mentioned studies. There are a few things that should be noted however. Despite our best efforts to reduce the number of artifacts that would be detected by S-extractor, it seems almost a certainty that some small number will have slipped through the cracks. However, even when we made the detection parameters absurdly strict, the general pattern remained. Any artifacts that did get through only seem to amplify the peak but the general trend and scale remain the same.

When we found our 10 brightest K-band objects and 10 brightest R-band objects, 5 of them overlapped which left us with a total of 15 distinct objects of interest. From there we created a plot of their R-K Color vs K-band Magnitude

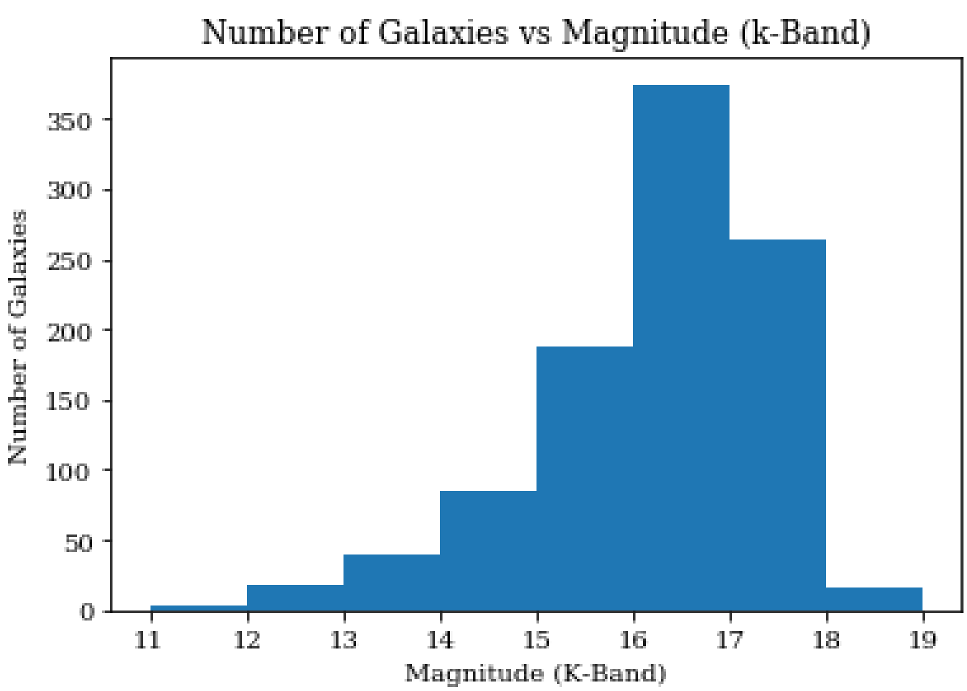

Figure 1. The number of galaxies VS. Magnitude (K-band) in 1 magnitude bins. There are 988 galaxies with their K-Band magnitudes identified. The region represented is:(ADD COORDINATES AND SKY SCALE). Most of the galaxies are between 15 to 18 magnitudes which is supported by (THE ARTICLE ANNA GAVE US).

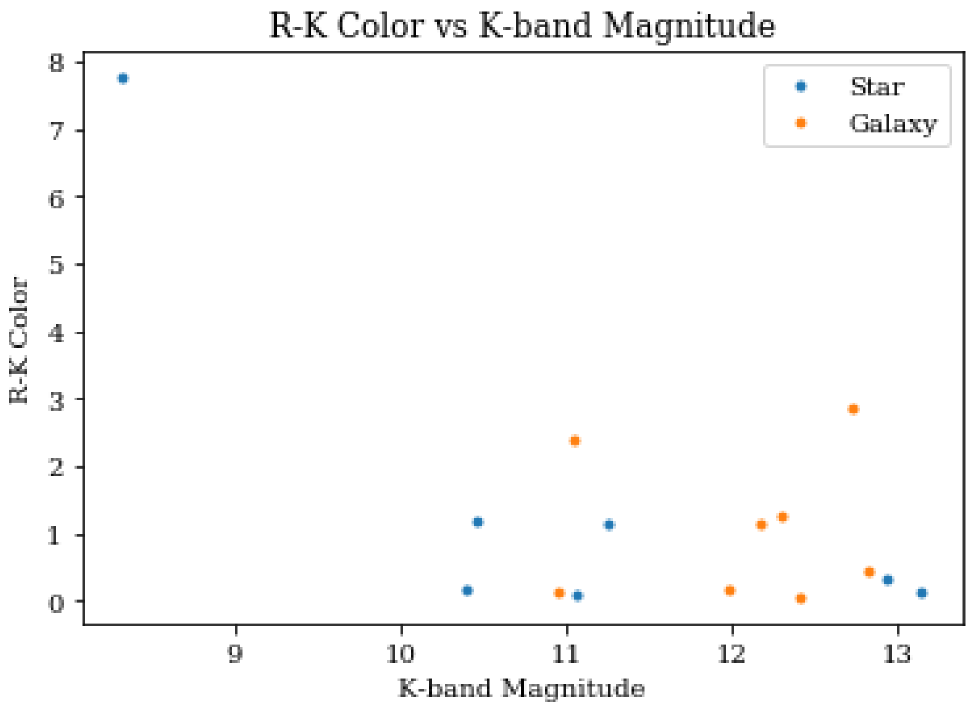

Figure 2. The R-K values for the top 15 brightest objects from the R and K Bands vs their K-Band magnitudes. The region represented is:(ADD COORDINATES AND SKY SCALE). Most of the objects in question are between R-K colors of 0 to 3 and K-band Magnitudes of 10 to 13.5.

which is shown by figure: 2. There are 8 galaxy-like objects and 7 star-like objects, which with one exception are clustered around R-K Color 0 to 3 and K-band Magnitude 10 to 13.5. These brighter objects make up a clear minority compared to the rest of the objects that we detected with these 15 brightest objects containing a good number of the total stars we found (97% of the objects we detected are galaxies). No clear pattern emerges from the R-K Color vs K-Band Magnitude, but this may be due to the limited scope of the number of objects to plot. A more clear pattern for example may emerge if objects with K-band magnitudes around 15 to 17, around which most of the typical objects reside, were included. This leaves room for further research. The outlying object around the R-K color of 8, upon further inspection appears to have been detected as a grouping of several objects in the R-band and should not be seen as indicative of any pattern or trend.

4. CONCLUSION

Upon setting out to find the 15-20 brightest sources in the J1428p3346 region of space taken from the NOAO Deep Wide-Field Survey database, we were tasked with the assignment of locating ten of the brightest sources in the K-band image, as well as the ten brightest sources in the R-band image which were then analyzed to determine which were galaxies or stars. With both images being freed of any unwanted and insignificant artifacts, catalogs of bright sources were created upon running these images through SExtractor. With the use of these catalogs and DS9, we sifted through these sources, locating the brightest within each catalog, taking down each individual bright sources coordinates to then locate within the respective R-band or K-band image. Going through these sources one at a time, we would locate the source with its respective coordinates, and then locate that same source in its opposing image; meaning that if we were working in K-band, we would find that source in the R-band image, and vice versa in order to then take down its coordinates and locate its magnitude in order to see if it too was a bright source in the opposing image. With a total of 15 sources found which were bright sources in both the K-band and R-band images, the next step was to calculate the R-K value. With the R-K value, all that was done was that the R-band magnitude was subtracted from its respective K-band magnitude. With the stellarity index calculated for each source, we were then finally able to determine which of the 15 sources found were galaxies or stars. We were able to determine that a stellarity index less than 0.5 indicates a source to be galaxy-like, and stellarity index greater than 0.5 indicates a source to be star-like.

Our final results indicated that we found 8 galaxy like objects, and 7 star like objects.

Upon coming across these final results, we found that maybe more could've been done and began to wonder what we could find with looking at a larger portion of the sky. Would a pattern then emerge? Would finding more viable sources lead to there being more star-like or galaxy-like objects? This of course could be asnwered with more research and testing of larger images of the sky.