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M108 THE SURFBOARD GALAXY
Measuring variation in the extinction

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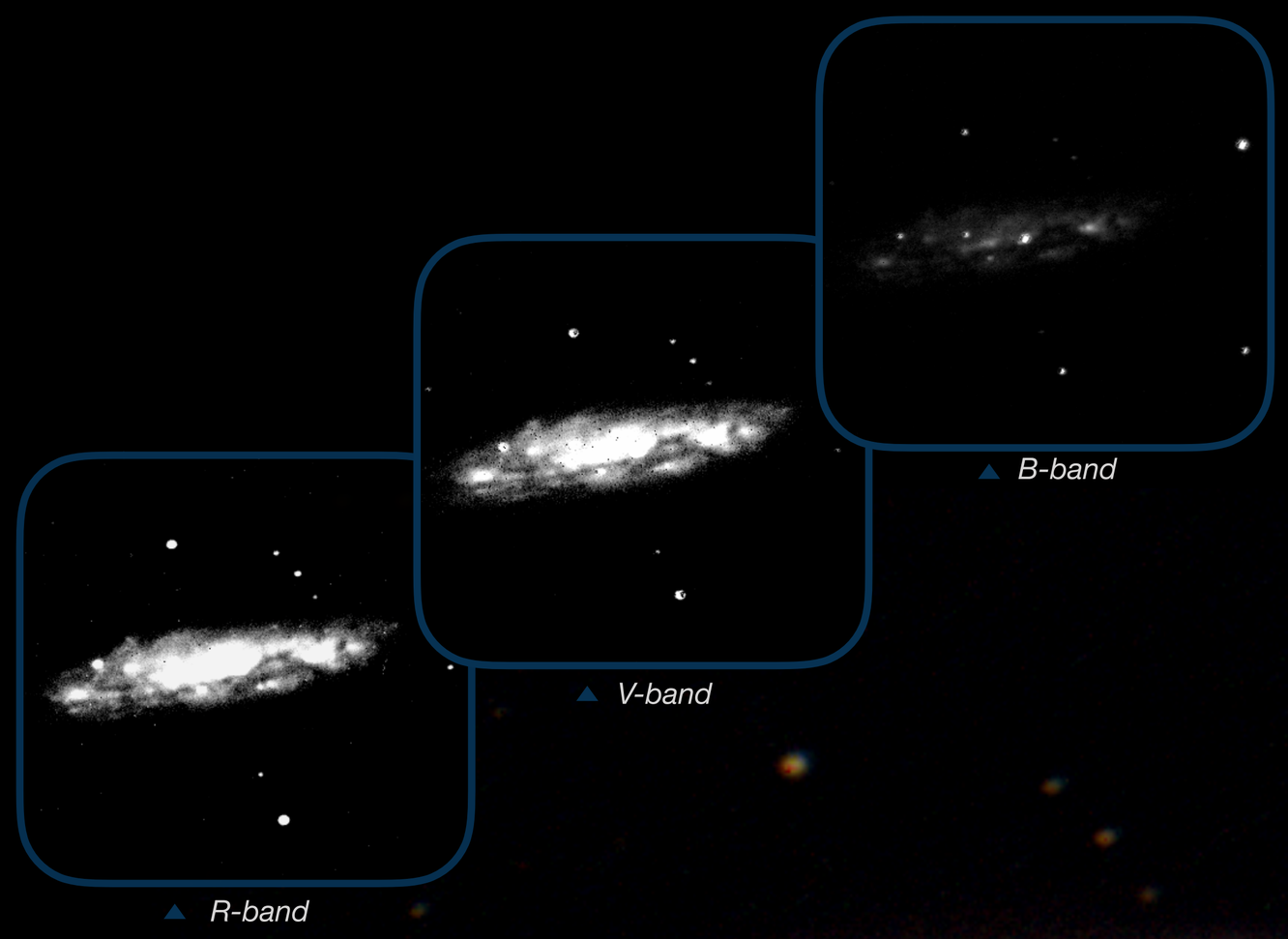
Introduction

Presence of dust in the interstellar medium in every galaxy causes the light of the stars or other background objects to get dimmed since it is either absorbed or scattered by the dust. In this project, it is intended to determine the variation in the extinction of one of the Messier object, namely, the M108 galaxy, nicknamed surfboard galaxy. M108 is an edge-on galaxy and has the morphological classification of a SBc, which means it is a barred spiral galaxy with widely distributed arms. The variation in the extinction of this galaxy is derived by comparing the ratio of the two Balmer lines, H_α and H_β to the corresponding ratio at zero extinction.



▲ *B-band*

▲ *V-band*

▲ *R-band*

Data Processing

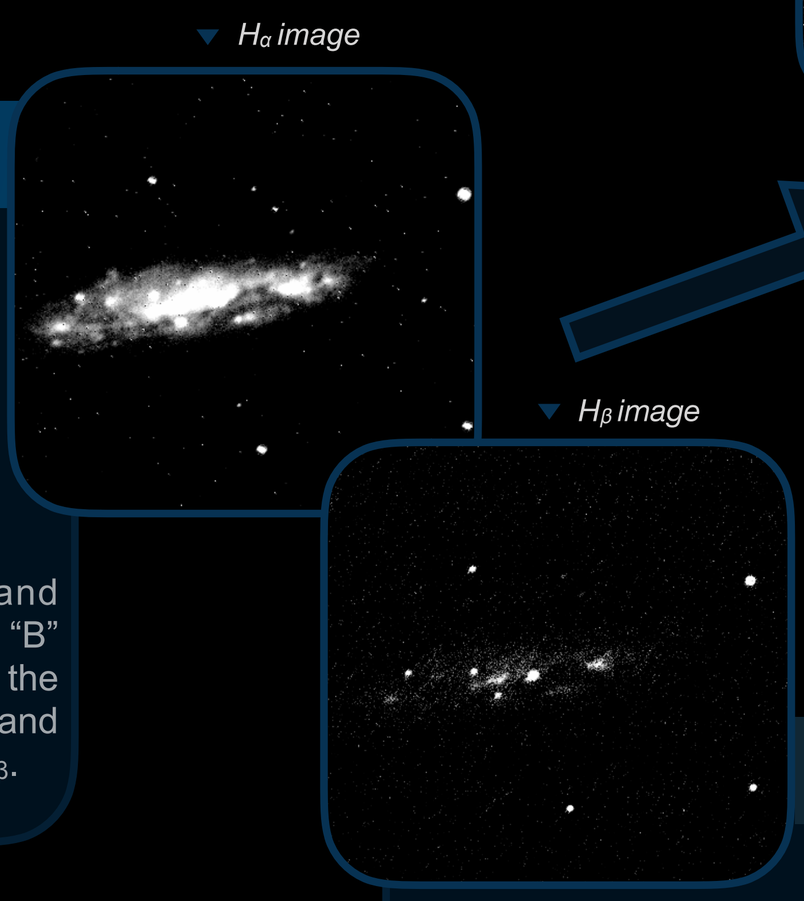
The team spent eight hours observing at the Blaauw Observatory using the 40 cm Gratama reflecting telescope. Images were taken three times according to the following scheme: BVRBVB. We ended the night by taking 5 images in H_α and 19 images in H_β. For each picture, an exposure time of 300 seconds was used. The derived data included as well the calibration images (Dark, Bias, Flat-field) which were later on subtracted from the light frames in order to remove the noise or unwanted artifacts.

Extinction Evaluation

We will review the equation shown below that is used to derive the extinction in the galaxy studied. We are studying the ratio between the Balmer lines H_α and H_β. However, in order to get the most accurate results, few extra steps were taken in the process of reducing our data to remove unnecessary information. We accounted for the background light in each band and subtracted it off (represented by the indices "B" in the following equation), and we removed the scaled contribution of the R-band from H_α and the scaled contribution of the V-band from H_β.

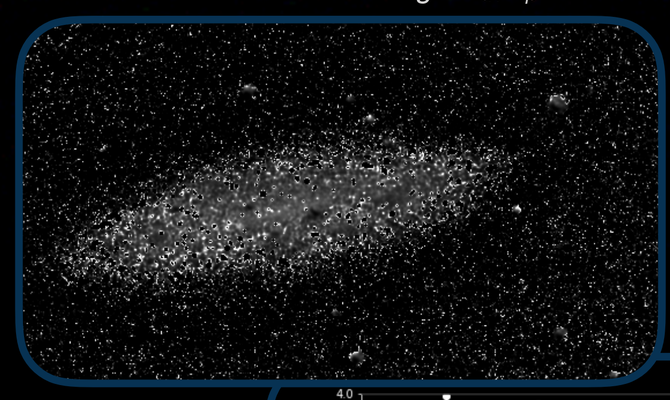
$$\frac{H_\alpha}{H_\beta} = \frac{(H_\alpha - H_{\alpha B}) - f(R - R_B)}{(H_\beta - H_{\beta B}) - f'(V - V_B)}$$

$$f = \frac{< fluxH_\alpha >}{< fluxR >} \qquad f' = \frac{< fluxH_\beta >}{< fluxV >}$$

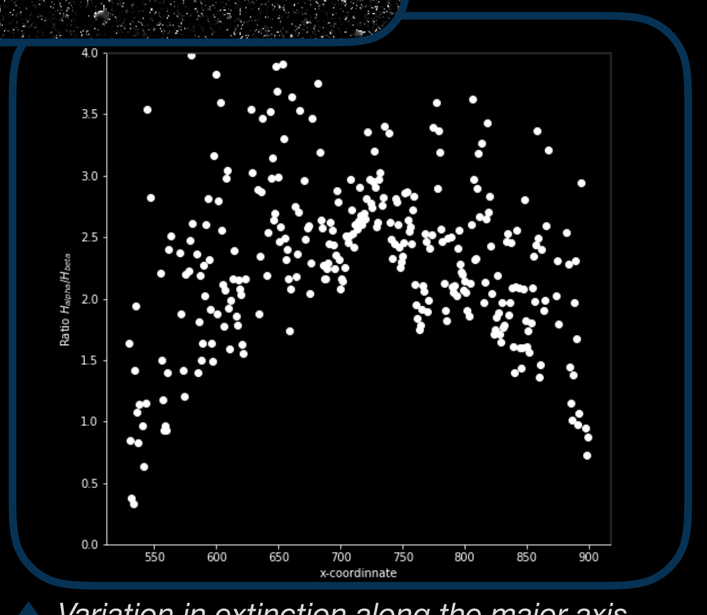


▼ *H_α image*

▼ *H_β image*



▼ *Final ratio image H_α / H_β*



▲ *Variation in extinction along the major axis*

Results & Interpretation

To study the variation in the extinction ratio we have decided to set the center of M108 at the zero value for extinction (which corresponds to the ratio of 2.73). From that, and looking the values of the ratio away from the center (along the major axis), we obtain the graph above. We distinguish a peak in the center of the galaxy around the set-up value of 2.73 and then the ratio diminishes to almost 0 at the edges. Since H_β has a shorter wavelength than H_α, it is more efficiently absorbed by dust. Therefore, the higher the ratio is, the more extinction is present in the galaxy. The graph, clearly shows a higher rate of extinction in the center compared to the edges, which is due to the higher concentration of dust and gas, as one could predict from the pictures above.