Astronomical Image Processing

Final Report

Main objective

Our goal project goal is to enhance astronomical pictures for a better visualization and aesthetic purposes. The user is able to input .fits images (3 or 2 images in the total) and their respective wavelength. The system will process the images and apply a logarithm filter on each one of them, and by apply color according to their wavelength. Following the chromatic order, the picture with the lowest wavelength will receive color blue, the picture with the highest gets red and the middle one gets green. After the processing, the application will overlay the images in a single one and show the final enhanced image, which can also be saved as a PNG image.

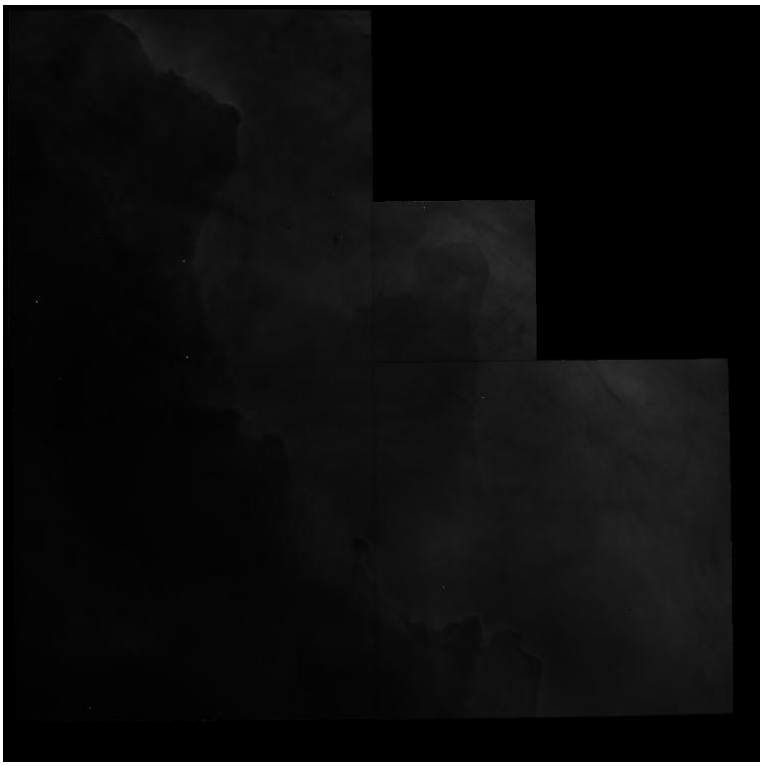
Description of input images

The input images are going to be taken from this website, which made those datasets publicly available for education purposes. Those images are FITS files of the astronomical object taken through different wavelength filters. FITS is the most commonly used digital file format in astronomy and unlike many image formats, FITS is designed specifically for scientific data and hence includes many provisions for describing photometric and spatial calibration information, together with image origin metadata. Obs.: the input images showed here were converted to PNG.

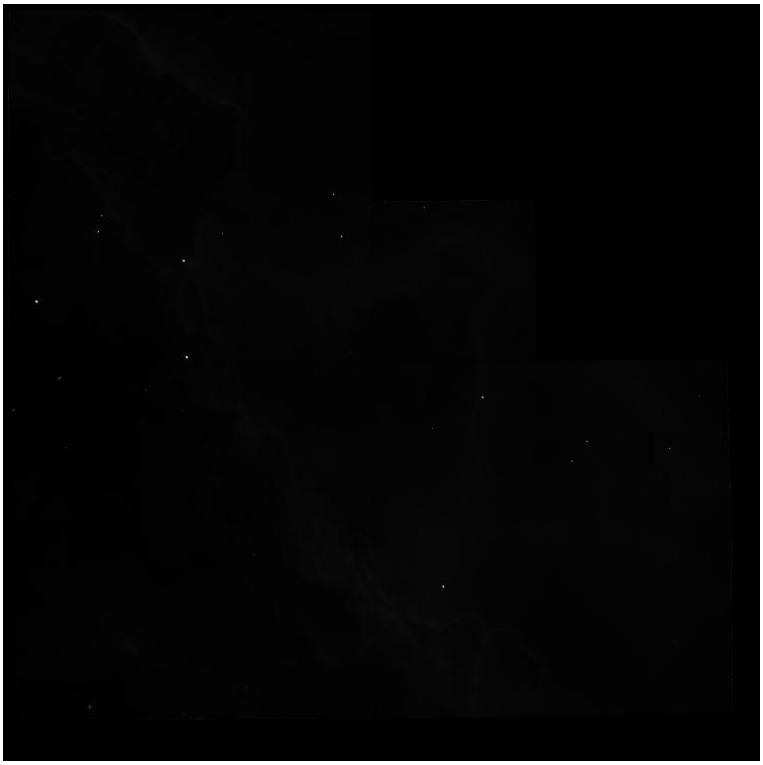
“Raw” pictures

1) 502 nm

2) 656 nm

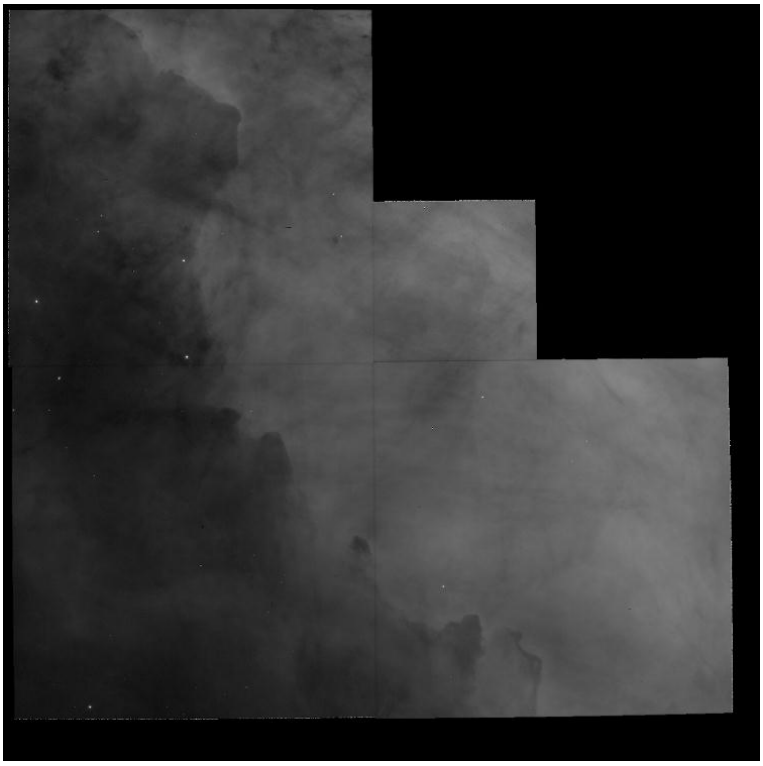


3) 673 nm

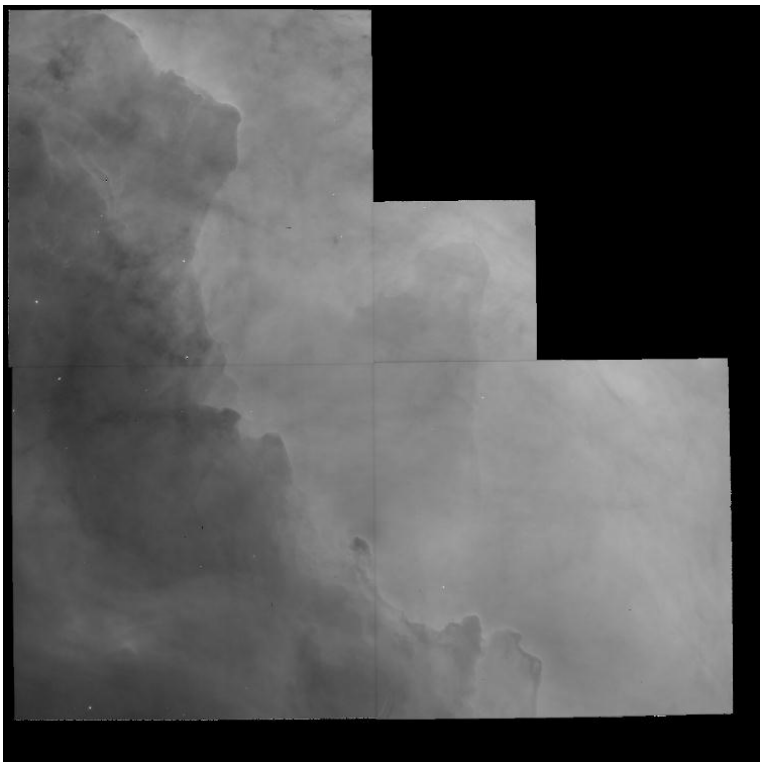


After applying a logarithm filter

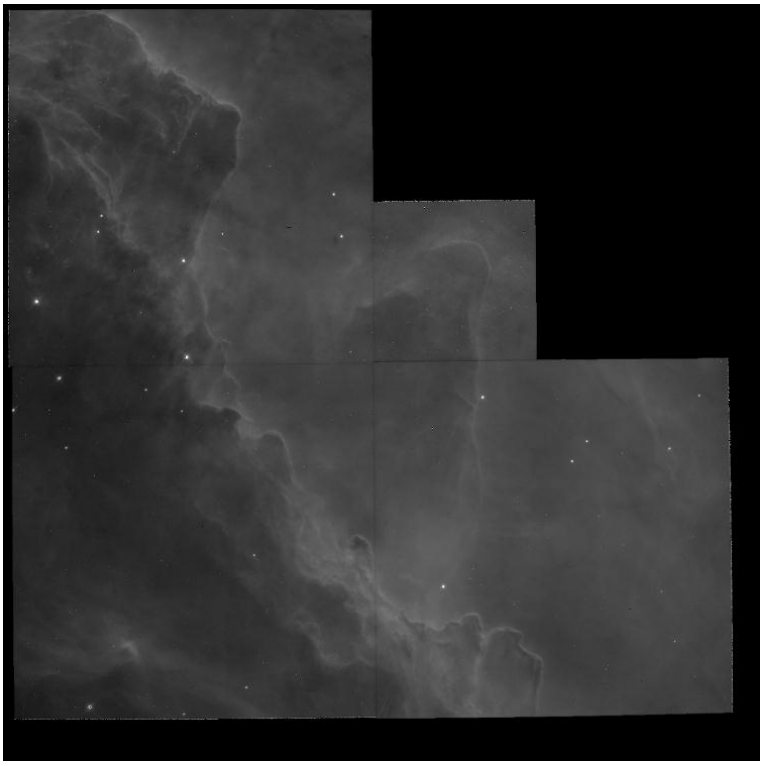
1) 502 nm



2) 656 nm

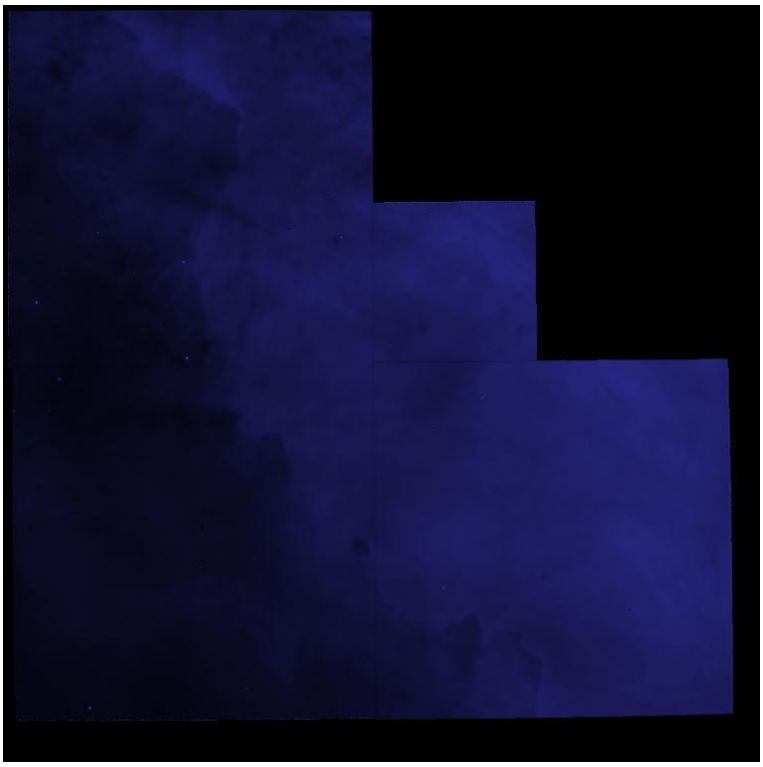


3) 673 nm

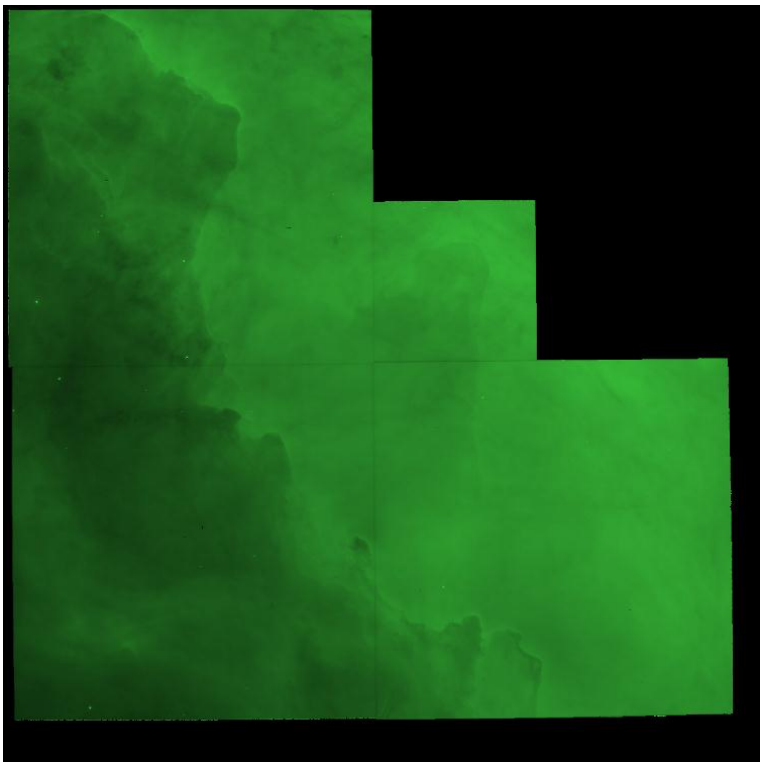


After choosing the pictures hue

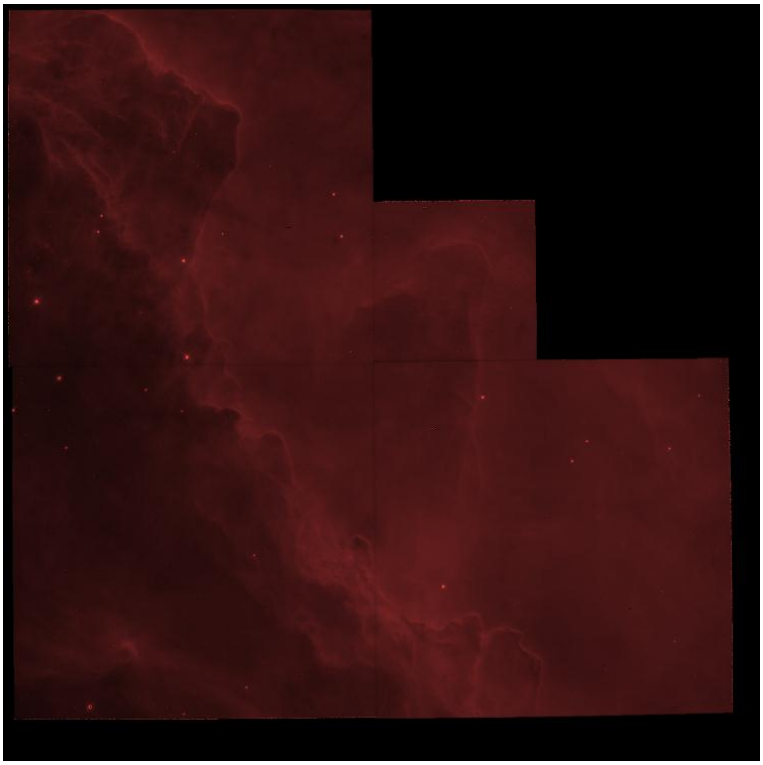
1) 502 nm



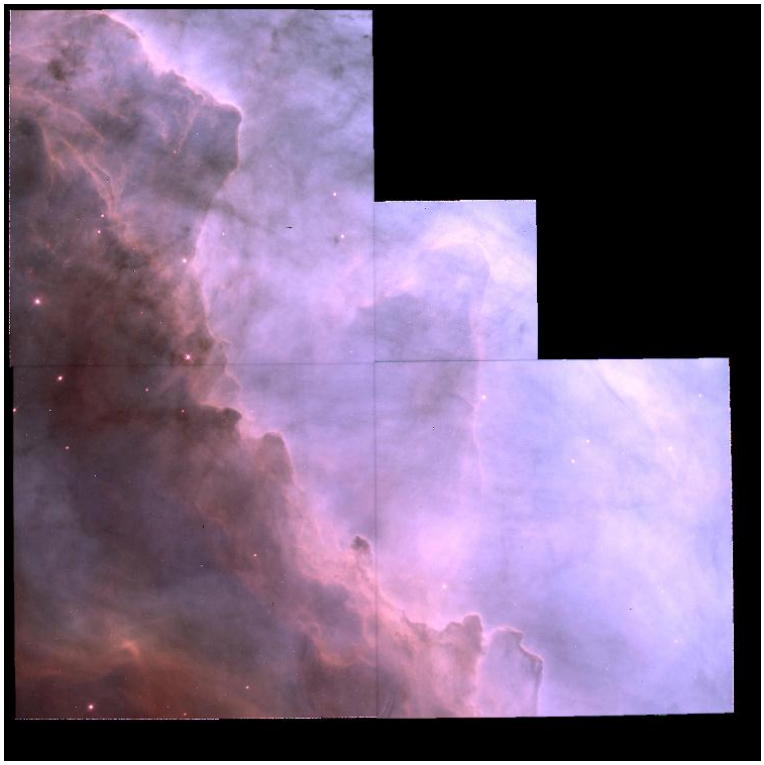
2) 656 nm



3) 673 nm



Final result



Description of steps to reach the objective

- Using the Astropy package, we'll open the FITS files and load their image data on 2-D numpy arrays;
- The image data are float numbers which ranges from -20 to 3000 in most cases, so we're going to normalize each array to get a value range from 0 to 255;
- The images are too dark, so we applied a log filter on each one of them;
- In the HSV space, we'll change the H value according to the image wavelength;
- We're going to overlay all the pre-processed and colored images, using a weighted add function and changing the pictures gamma, in a single image following this order: blue < green < red;
- Show the final result and store it as a PNG file if the user has chosen this option.

References

- https://en.wikipedia.org/wiki/FITS
- http://www.astropy.org/
- http://www.spacetelescope.org/projects/fits_liberator/datasets_archives/

Group 16

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