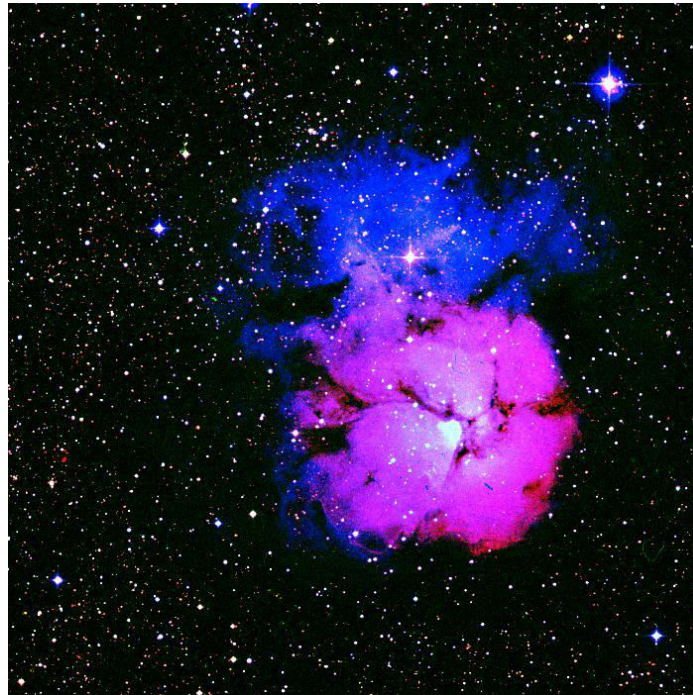


Astronomical Object Analysis using DS9 Software

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Sample Image (M20)



Objects Present within Sample Image

Gas clouds are observed to be present around the bright central region, evident by the emission of light from this location caused by the excitation of gas particles. This gas is likely Hydrogen gas as this is most abundant and ubiquitous throughout the universe (Rowell 2018). The central object is known as the Trifid Nebula which is a stellar birth Nebula, meaning gas is currently in the process of condensing down to begin forming a star. This explains the bright central region as this will be the most dense and hence brightest region of the object. The backdrop comprises many stars far behind the Nebula location with several stars featuring crosshairs indicating they may be part of the foreground, further suggested by these stars having a greater relative brightness compared to the other stars.

Nebula Location and Dimensions

Using the Ds9 software the co-ordinates of the Nebula were found thus:

Right Ascension: 270.675°
Declination: -22.975°

Further, utilising the Ds9 analytical features, the angular extent of the object was found:

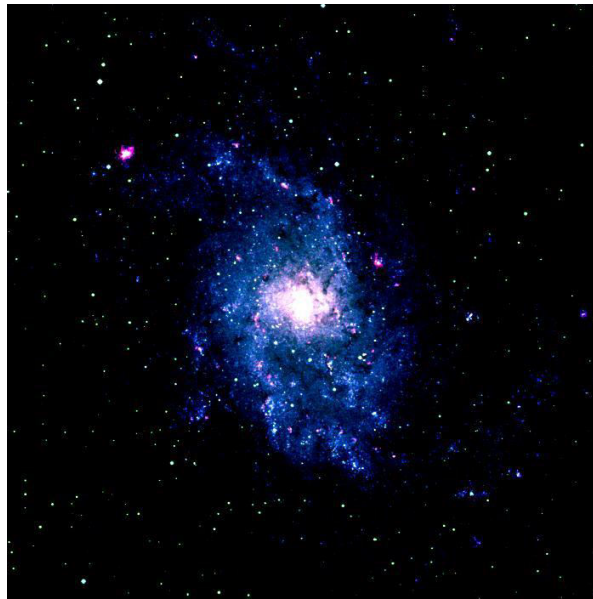
RA: $270.94^\circ - 270.41^\circ = 0.53^\circ$
Dec: $-22.82 + 23.12 = 0.30^\circ$

Image Colours

Red colours represent lower wavelength (and so higher energies via the relation $E = h\frac{c}{\lambda}$) relative to the blue regions. These red colour emissions are likely caused by the spectral lines appearing from ionised and semi-ionised Hydrogen gas within the gas clouds.

Blue colours represent higher energies (again via the aforementioned energy wavelength relation) which are visible due to the blue light being refracted through a greater angle and so being visible at the outer regions of the nebula. Fundamentally this is caused by wavelength dependant Rayleigh scattering which causes the blue light to be refracted by a greater angle compared with higher wavelength red light (Rowell 2018). The blue light likely originates from highly energetic blue giant stars, these being a probable source of high energy blue light.

Individual Image Source Analysis



Objects Present

The dominant object is a two armed spiral galaxy, with numerous less distinct arms on the outside also. The central region is very bright indicating a highly active region of frequent star birth and light emission. Numerous bright patches are also situated in the arms of the spiral galaxy showing the presence of stars with brightness indicating size and intensity of emission. Many background stars are also observed behind the central object.

Location and Angular extent

Location:

RA: 23.462°
Dec: 30.660°

Angular extent:

$$\text{RA: } 23.743^\circ - 23.180^\circ = 0.563^\circ$$

$$\text{Dec: } 30.809^\circ - 30.510^\circ = 0.299^\circ$$

Defects within Image

For a defect we expect a bright section only apparent in one of the exposure colours that stands out as being artificial. For the Image in question there are several bright patches on the outskirts of the spiral galaxy however these patches are present in all colours and so are likely an astronomical body and not a defect.

Nature of Galaxy

The observed galaxy is a spiral galaxy (evident by the spiral arms) and is oriented face-on.

The bulge star at the centre is notably brighter than the disc, as expected as the centre of the galaxy is the place of highest activity and energy density. Toward the central bulge, star colours are brighter and toward the edges of the spiral galaxy disc colours become gradually dimmer.

Numerous sections with a greater red colour are visible, believed to be indicative of HII regions within the galaxy. These sections appear scattered uniformly throughout the galaxy with a noticeably bright patch toward the upper left on the end of the top spiral arm of the galaxy.

Extent of Galaxy

Longer dimension extent spans the image window so is 0.563° or 33.78 arc minutes. Shorter dimension spans from Dec: 30.646° to 30.660° so an extent of 0.014° or 0.84 arc minutes.

References

Rowell, G 2018, 'Astrophysics II', lecture notes distributed in the topic 2530 Astrophysics II, University of Adelaide, viewed 13 September 2018, <https://myuni.adelaide.edu.au/courses/38772/pages/lecture-notes-and-useful-resources?module_item_id=1274747>