

2023

# Astrophotography

TALACAUVERY, COORG, JANUARY 2023

GANESH RAJA M

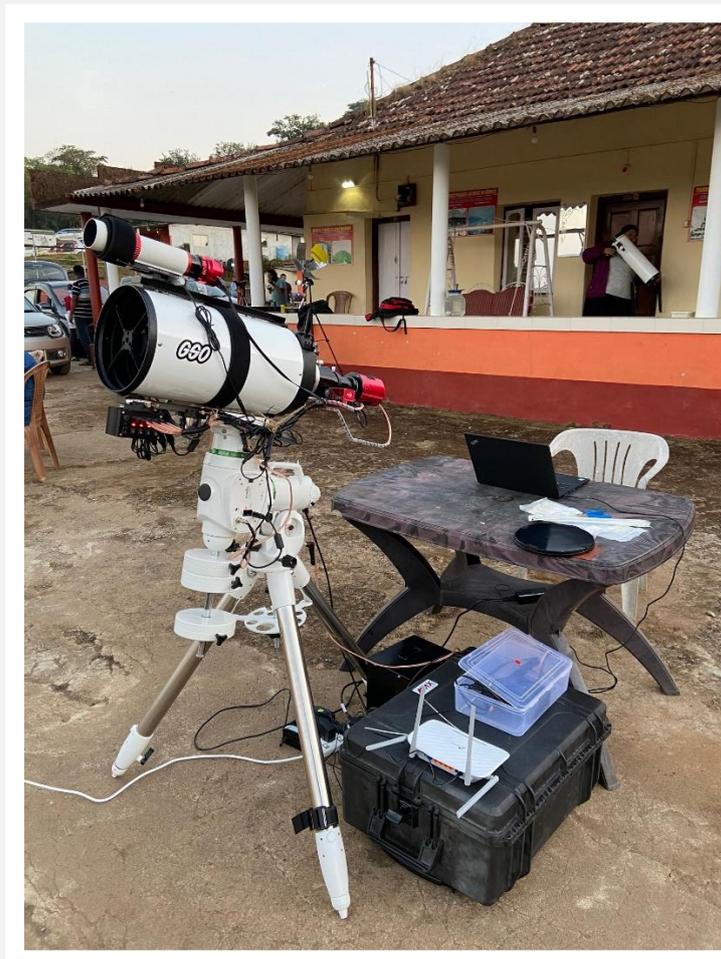
## Equipment and Software Details

### Equipment:

- Skywatcher EQ6-R Pro mount
- GSO RC8 scope
- Astrophysics CCDT67 FR
- ZWO ASI 2600MC Pro main camera
- William Optics 50mm guide scope
- ZWO ASI 224 guide camera
- Intel NUC Mini PC

### Software:

- N.I.N.A for image acquisition – Framing, plate solving, sequence generator
- PixInsight - Calibration, stacking, BlurXterminator, SPCC, EzSoftStretch, Histogram, NoiseXTerminator
- Lightroom for final edits



## **M1 - The Crab Nebula**



The Crab Nebula is a supernova remnant in the constellation Taurus. At the center of the nebula lies the Crab Pulsar, a neutron star 28–30 kilometres across with a spin rate of 30.2 times per second, which emits pulses of radiation from gamma rays to radio waves. The nebula lies about 6500 lightyears from earth, has a radius of about 5.5 light years, and is expanding at a rate of about 1500 kilometers per second.

The Crab Nebula was the first astronomical object recognized as being connected to a supernova explosion. In the early twentieth century, the analysis of early photographs of the nebula taken several years apart revealed that it was expanding. Tracing the expansion back revealed that the nebula must have become visible on Earth about 900 years before. Historical records revealed that a new star bright enough to be seen in the daytime had been recorded in the same part of the sky by Chinese astronomers on 4 July 1054, and probably also by Japanese observers.

In visible light, the Crab Nebula consists of a broadly oval-shaped mass of filaments. The filaments are the remnants of the progenitor star's atmosphere, and consist largely of ionised helium and hydrogen (the prominent red color of the filaments), along with carbon, oxygen, nitrogen, iron, neon and sulfur. The filaments' temperatures are typically between 11,000 and 18,000 degrees, and their densities are about 1,300 particles per cm<sup>3</sup>.

### **Date:**

23rd January 2023, 10:15PM

### **Exposure Details:**

Total integration of 3:30 hours

Lights - 42 x 300 seconds

Darks – 25

Flats - 25

## NGC 1532 and NGC 1531 - Haley's Coronet Galaxy



NGC 1531 and NGC 1532 are a pair of interacting galaxies located 70 million light years from earth. NGC 1532, the deformed foreground spiral galaxy laced with dust lanes is so close to its companion — NGC 1531, the background galaxy with a bright core just above the centre of NGC 1532 — that it gets distorted. One of its spiral arms is warped and plumes of dust and gas are visible above its disc.

### Date:

22nd January 2023, 9:20PM

### Exposure Details:

Total integration of 2:00 hours

Lights - 24 x 300 seconds

Darks - 25

Flats - 25

## **M63 - Sunflower Galaxy**



M63 also known as Sunflower Galaxy is a spiral galaxy in the northern constellation of Canes Venatici. It is located 27 million light years from earth. It has a radius of 49000 light years and is estimated to have 400 billion stars.

Unlike grand-design spiral galaxies, flocculent spiral galaxies do not have well defined spiral arms. Instead, they appear to have many discontinuous arms. M63, is one such flocculent spiral galaxy. Although it only has two arms, many appear to be winding around its yellow core. The arms shine with the radiation from recently formed blue stars and can be more clearly seen in infrared observations. By imaging flocculent spiral galaxies like M63, astronomers hope to gain a better understanding of how stars form in such systems.

### **Date:**

24th January 2023, 2:00AM

### **Exposure Details:**

Total integration of 2:30 hours

Lights - 30 x 300 seconds

Darks - 25

Flats - 25

## NGC 4631 and NGC 4656 - Whale and Hockey Stick Galaxies



NGC 4631 and NGC 4656 in Coma Berenices were discovered by William Herschel in 1787. NGC 4631, The Whale at top right, is an Sc-type galaxy and one of the largest edge-ons known to us. Its highly irregular shape is due to distortion caused by its companion, the elliptical dwarf NGC 4627 The Pup, riding atop its 'momma's' back. The two are interrelated as evidenced by a bridge of hydrogen gas between them. NGC4631 contains a center starburst which is a region of intense star formation. The strong star formation is evident from the strong emission of hydrogen. This galaxy is situated 30 million light years from earth.

To the bottom left is NGC 4656-4657, two interacting galaxies known collectively as the Crowbar or Hockey Stick. The irregular shape is considered to be due to the interaction between the two galaxies.

### **Date:**

23rd January 2023, 12:30 AM

### **Exposure Details:**

Total integration of 3 hours 25 minutes

Lights - 37 x 300 seconds

Darks - 25

Flats - 25

## **NGC 4565 – The Needle Galaxy**



NGC 4565 (also known as the Needle Galaxy or Caldwell 38) is an edge-on spiral galaxy about 30 million light-years away in the constellation Coma Berenices. It displays a bright yellowish central bulge that juts out above the dust lanes.

This bright galaxy is one of the most famous examples of an edge-on spiral galaxy, oriented perpendicularly to our line of sight so that we see right into its luminous disc. NGC 4565 has been nicknamed the Needle Galaxy because, when seen in full, it appears as a very narrow streak of light on the sky.

### **Date:**

22<sup>nd</sup> January 2023, 1:00 AM

### **Exposure Details:**

Total integration of 2 hours 50 minutes

Lights - 34 x 300 seconds

Darks - 25

Flats – 25

## NGC 891 – The Silver Sliver Galaxy



NGC 891 (also known as Caldwell 23, the Silver Sliver Galaxy, and the Outer Limits Galaxy) is an edge-on unbarred spiral galaxy about 30 million light-years away in the constellation Andromeda. It was discovered by William Herschel on October 6, 1784. The galaxy is a member of the NGC 1023 group of galaxies in the Local Supercluster. It has an H II nucleus. The object is visible in small to moderate size telescopes as a faint elongated smear of light with a dust lane visible in larger apertures.

NGC 891 looks as the Milky Way would look like when viewed edge-on (some astronomers have even noted how similar to NGC 891 our galaxy looks as seen from the Southern Hemisphere) and, in fact, both galaxies are considered very similar in terms of luminosity and size; studies of the dynamics of its molecular hydrogen have also proven the likely presence of a central bar. Despite this, recent high-resolution images of its dusty disk show unusual filamentary patterns. These patterns are extending into the halo of the galaxy, away from its galactic disk. Scientists presume that supernova explosions caused this interstellar dust to be thrown out of the galactic disk toward the halo.

The galaxy is a member of a small group of galaxies, sometimes called the NGC 1023 Group. Other galaxies in this group are the NGCs 925, 949, 959, 1003, 1023, and 1058, and the UGCs 1807, 1865 (DDO 19), 2014 (DDO 22), 2023 (DDO 25), 2034 (DDO 24), and 2259. Its outskirts are populated by multiple low-surface brightness, coherent, and vast substructures, like giant streams that loop around the parent galaxy up to distances of approximately 50 kpc (163,000 lightyears). The bulge and the disk are surrounded by a flat and thick cocoon-like stellar structure. These have vertical and radial distances of up to 15 (48000 lightyears) kpc and 40 kpc (130,000 lightyears), respectively, and are interpreted as the remnant of a satellite galaxy disrupted and in the process of being absorbed by NGC 891.

### Date:

21<sup>st</sup> January 2023, 7:45 PM

### Exposure Details:

Total integration of 3 hours

Lights - 36 x 300 seconds

Darks - 25

Flats – 25

## NGC 4038/4039 Antenna Galaxies



The Antennae Galaxies (also known as NGC 4038/NGC 4039 or Caldwell 60/Caldwell 61) are a pair of interacting galaxies in the constellation Corvus. They are currently going through a starburst phase, in which the collision of clouds of gas and dust, with entangled magnetic fields, causes rapid star formation. The Antennae Galaxies are undergoing a galactic collision. Located in the NGC 4038 group with five other galaxies, these two galaxies are known as the Antennae Galaxies because the two long tails of stars, gas and dust ejected from the galaxies as a result of the collision resemble an insect's antennae.

About 1.2 billion years ago, the Antennae were two separate galaxies. NGC 4038 was a barred spiral galaxy and NGC 4039 was a spiral galaxy. 900 million years ago, the Antennae began to approach one another, and 600 million years ago, the Antennae passed through each other. 300 million years ago, the Antennae's stars began to be released from both galaxies. Today the two streamers of ejected stars extend far beyond the original galaxies, resulting in the antennae shape. Within 400 million years, the Antennae's nuclei will collide and become a single core with stars, gas, and dust around it. Observations and simulations of colliding galaxies suggest that the Antennae Galaxies will eventually form an elliptical galaxy.

### Date:

21<sup>st</sup> January 2023, 1:45 AM

### Exposure Details:

Total integration of 1 hours 35 minutes

Lights - 19 x 300 seconds

Darks - 25

Flats - 25

## **Abell 1367 Leo Cluster**



The Leo Cluster (Abell 1367) is a galaxy cluster about 330 million light-years distant in the constellation Leo, with at least 70 major galaxies. The galaxy known as NGC 3842 is the brightest member of this cluster. Along with the Coma Cluster, it is one of the two major clusters comprising the Coma Supercluster, which in turn is part of the CfA2 Great Wall, which is hundreds of millions light years long and is one of the largest known structures in the universe.

Most dense galaxy clusters are composed mostly of elliptical galaxies. The Leo Cluster, however, mostly contains spiral galaxies, suggesting that it is much younger than other comparable clusters, such as the Coma Cluster. It is also home to one of the universe's largest known black holes, which lies in the center of NGC 3842. The black hole is 9.7 billion times more massive than the Sun.

### **Date:**

21<sup>st</sup> January 2023, 1:45 AM

### **Exposure Details:**

Total integration of 1 hours 35 minutes

Lights - 19 x 300 seconds

Darks - 25

Flats - 25

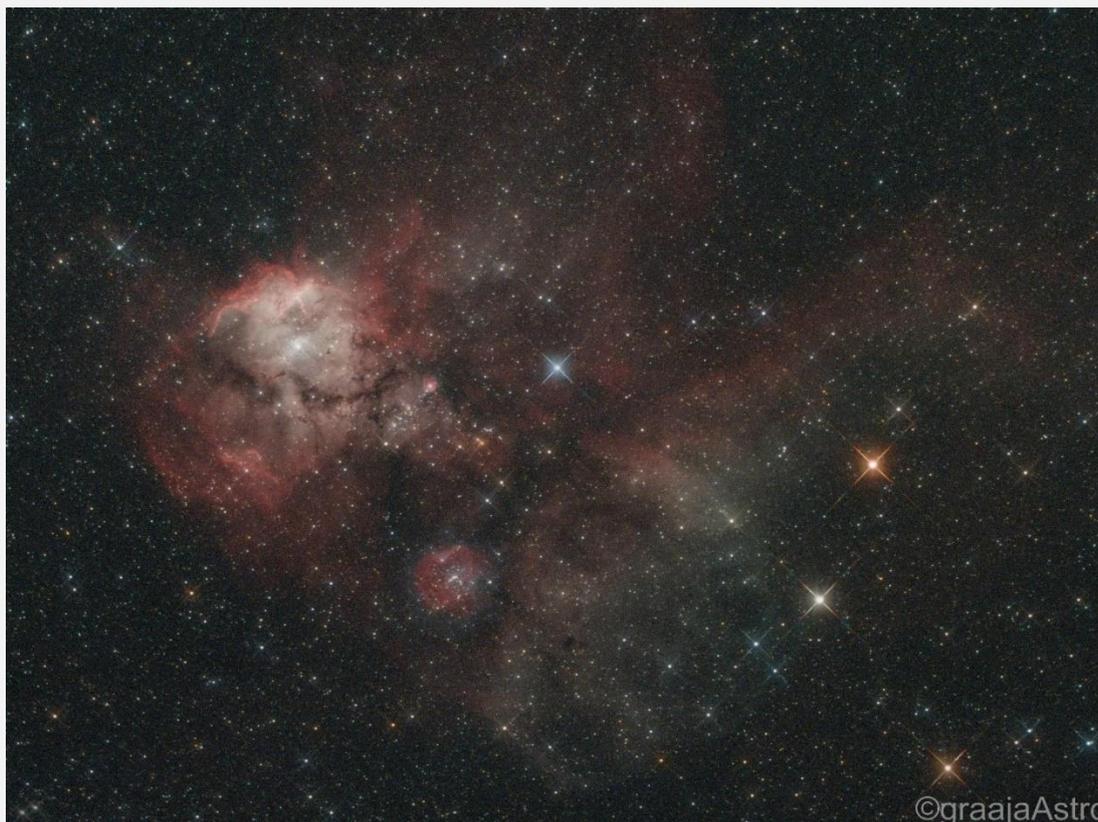
## NGC3842



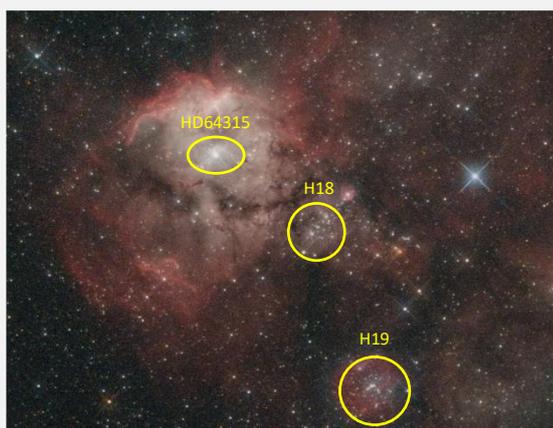
NGC 3842 is an elliptical galaxy in the constellation of Leo. It is notable for containing one of the largest black holes ever detected, reported to have a mass of 9.7 billion solar masses. It is around 330 million light-years distant from Earth.

NGC 3842 is the brightest member of the Leo Cluster.

## NGC 2467 – The Skull and Crossbones Nebula



NGC 2467, nicknamed the "Skull and Crossbones Nebula", is a star-forming region situated at 4420 light years from earth, whose appearance has occasionally also been likened to that of a colorful mandrill. It includes areas where large clouds of hydrogen gas (hence the red color) incubate new stars. The region is dominated by a massive young star, HD 64315 (marked in picture below), of spectral type O6. Two stellar clusters also exist in the area, Haffner 19 (H19) and Haffner 18 (H18). H19 is a compact cluster containing a Strömgren sphere which is ionized by a hot B0 V-type star. H18 contains a very young star, FM3060a, that has just come into existence and still surrounded by its birth cocoon of gas. The age of H19 is estimated to be 2 Myr, while the age H18 is somewhat controversial, some considering it to be as young as only 1 Myr.



### Date:

21<sup>st</sup> January 2023, 7:45 PM

### Exposure Details:

Total integration of 3 hours

Lights - 36 x 300 seconds

Darks - 25

Flats - 25

## The Core of Rosette Nebula



The Rosette Nebula (also known as Caldwell 49) is an H II region located near one end of a giant molecular cloud in the Monoceros region of the Milky Way Galaxy. The open cluster NGC 2244 or Caldwell 50 (the bright stars in the center of the nebula), is closely associated with the nebulosity, the stars of the cluster having been formed from the nebula's matter.

The cluster and nebula lie at a distance of 5,000 light-years from Earth[5] and measure roughly 130 light years in diameter. The radiation from the young stars excites the atoms in the nebula, causing them to emit radiation themselves producing the emission nebula we see. The mass of the nebula is estimated to be around 10,000 solar masses.

A survey of the nebula with the Chandra X-ray Observatory has revealed the presence of numerous new-born stars inside optical Rosette Nebula and studded within a dense molecular cloud. Altogether, approximately 2500 young stars lie in this star-forming complex, including the massive O-type stars HD 46223 and HD 46150 (the two bright stars on the top right corner of the center), which are primarily responsible for blowing the ionized bubble. Most of the ongoing star-formation activity is occurring in the dense molecular cloud to the south east of the bubble (bottom left in the above picture).

### **Date:**

20<sup>th</sup> January 2023, 9:00 PM

### **Exposure Details:**

Total integration of 1 hour 20 minutes

Lights - 16 x 300 seconds

Darks - 25

Flats - 25

## Comet C/2022 E3



C/2022 E3 (ZTF) is a long period comet from the Oort cloud that was discovered by the Zwicky Transient Facility on 2 March 2022. The comet has a bright green glow around its nucleus which is due to the effect of sunlight on its molecules, especially diatomic carbon and cyanogen. The comet reached its perihelion on 12 January 2023, at a distance of 1.11 AU (166 million km), and the closest approach to Earth will be on 1 February 2023, at a distance of 0.28 AU (42 million km). As the comet is going away from the sun, an anti-tail is forming (the faint structure that extends from the nucleus to the top right corner of the picture).

The comet has an orbital period of about 50,000 years, which means when the comet visited our solar system last time, Neanderthals were roaming the earth.

### Date:

23<sup>rd</sup> January 2023, 5:00 AM

### Exposure Details:

Total integration of 46 minutes

Lights - 23 x 120 seconds

Darks - 25

Flats - 25