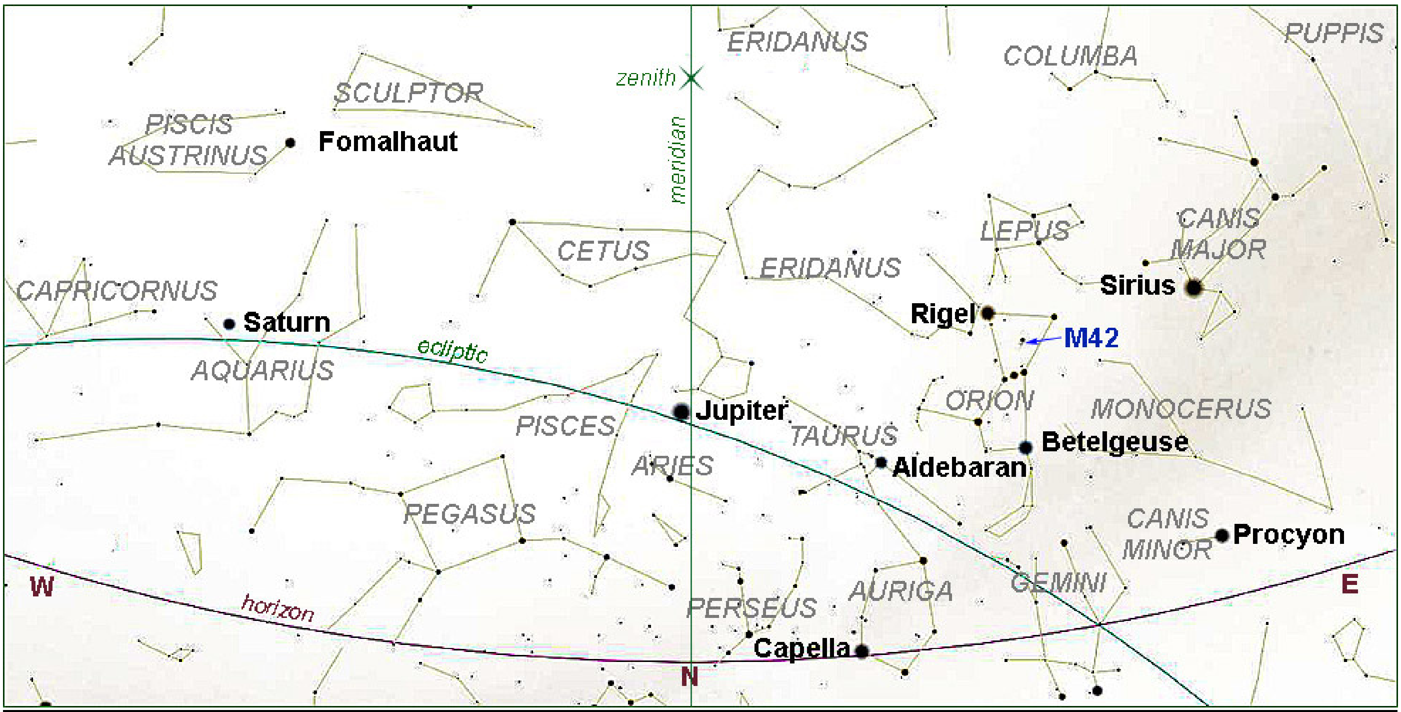
SKYNOTES from Hermanus

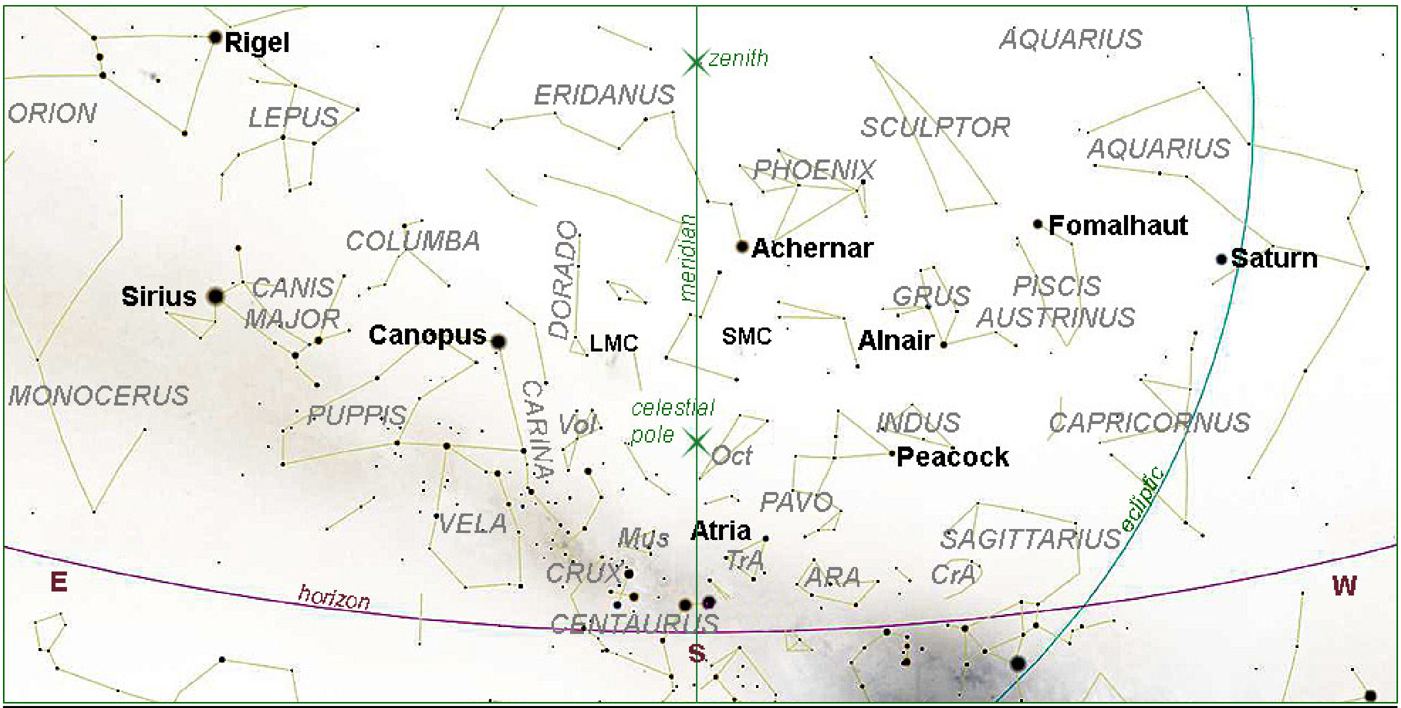
DECEMBER 2023

SKY CHARTS

EVENING SKY DECEMBER 8th at 22h00 (NORTH DOWN)



EVENING SKY DECEMBER 8thAT 22h00 (SOUTH DOWN)



THE SOLAR SYSTEM

PLEASE NOTE: all events are as predicted from **HERMANUS**, Western Cape, South Africa.

HIGHLIGHTS for DECEMBER FROM THE SKY GUIDE 2023

Date	Time	Item
2		**December Phoenicid** meteor shower (see page 4)
4	20h44	**Moon** at apogee (404 347 km)
		Mercury at eastern elongation
		Last quarter Moon
7		**Puppid-Velid** meteor shower (see page 4)
		Neptune stationary
9		**Halley's Comet** reaches aphelion (35.1 au)
13	01h32	**New Moon**
		Moon southernmost (-28.2º)
		Mercury stationary
14	20h56	**Mercury** sets with the **Moon** (4.3%) trailing by 8.2º
		Geminid meteor shower (see page 4)
16	20h54	**Moon** at perigee (367 899 km)
		Mercury crosses ecliptic
19		**First quarter Moon** passes 1º south of **Neptune**
20	19h19	**Mercury** at perihelion (0.307 au)
21	21h05	**Vesta** at opposition
22	05h27m06s	*December Solstice*
	20h30	**Moon** (82%) passes 4.9º north of **Jupiter**
		Mercury at inferior conjunction
23	21h30	**Moon** passes 5.1º NNE of **Uranus**
	04h22	**Mercury** nearest **Earth** (0.676 au)
27	02h34	**Full Moon**
		Moon northernmost (+28.1)
31		**Jupiter** stationary

The **Moon** and **Jupiter,** although not visible at closest approach (during daylight), will keep close company throughout the evening of December 23rd. At about 21h00, Jupiter and his four Galilean satellites cross the meridian at an altitude of 39º. **Callisto** is to the west of Jupiter at 9.5' while **Io** is close in at 1' to the east. **Europa** and **Ganymede** are closely paired at 3.5' further east. Despite the proximity of the moon, these satellites should be visible in a small telescope.

SUGGESTED EVENING OBSERVATION WINDOW

(Lunar observations notwithstanding)

Date		*Moon*	*Dusk end*
1st December	*Rises*	**23h40 (84%)**	**21h23**
15th December	*Sets*	**22h39 (5%)**	**21h37**

SOLAR SYSTEM VISIBILITY

2023 DECEMBER 8				*When and Where visible?*
Sun Length of day	Ophiuchus 14 hours 23 minutes	Rise: Transit: Set:	05h24 12h35 19h46	**Never look at the sun without** ***SUITABLE EYE PROTECTION!***
Mercury Magnitude Phase Diameter	Sagittarius -0.2 49% 7”	Rise: Transit: Set:	06h47 14h05 21h22	**Low in the west after sunset**
Venus Magnitude Phase Diameter	Virgo -4.1 70% 16”	Rise: Transit: Set:	03h14 09h47 16h20	**“The Morning Star”**
Mars Magnitude Phase Diameter	Ophiuchus +1.4 100% 4”	Rise: Transit: Set:	05h01 12h09 19h17	**Too close to the sun**
Jupiter Magnitude Diameter	Aries -2.8 47”	Rise: Transit: Set:	16h25 21h52 03h23	**All night**
Saturn Magnitude Diameter	Aquarius +0.9 17”	Rise: Transit: Set:	11h14 17h51 00h32	**Evening**
Uranus Magnitude Diameter	Aries +5.6 4”	Rises: Transit: Set:	17h32 22h45 04h01	**All night**
Neptune Magnitude Diameter	Aquarius +7.9 2”	Rise: Transit: Set:	13h07 19h17 01h32	**Evening**
Pluto Magnitude	Sagittarius +14.5	Rise: Transit: Set:	08h31 15h41 22h50	**Evening**

Phase: In a telescope, the inner planets (Mercury, Venus and Mars) appear to us in phases, depending on the angle of the Sun’s illumination, as does the Moon. The **angular diameter** is given in arc seconds.

Transit: When an object crosses the **local meridian** it is said to ‘transit’. The local meridian is an imaginary line from the horizon directly north passing overhead through the *zenith* to the horizon directly south.

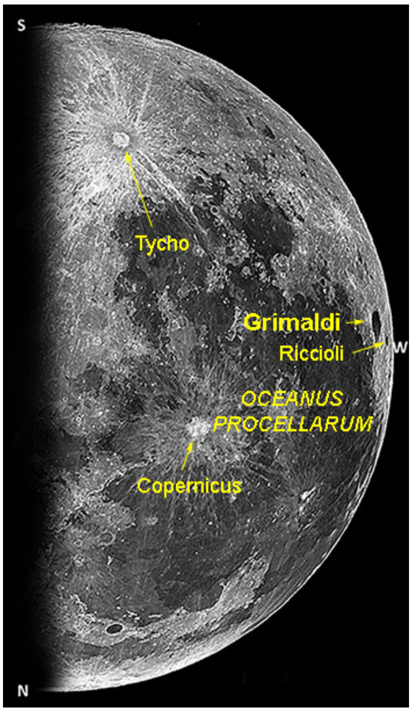
Magnitude: we are accustomed to hearing stars described in terms of ‘magnitude’. For example, the planet Jupiter at magnitude -1.8 is considerably brighter than the star Antares (in Scorpius) at +1.05. The scale is ‘inverse’; the brighter the object, the lower the number. A ‘good’ human eye on a clear night can see down to a magnitude of about +6.

THE MOON

Crater Grimaldi

Some people have asked what that dark spot is over on the western limb. It is indeed a prominent landmark in a seldom viewed area. Not particularly photogenic or remarkable, this crater is featured this month for recognition and identification.

LOCATION- near the western limb of the Moon. It lies to the south-west of **Oceanus Procellarum** with crater **Riccioli** to its north-west.



PHYSICAL FEATURES- The inner rim, 174 km in diameter and heavily worn and eroded by subsequent impacts, forms a low, irregular ring of hills, ridges and peaks, rather than a typical crater rim. However, there are peaks remaining that reach heights of over 2 000 metres. The mare lava floor is the most notable feature of this crater, forming a flat, relatively smooth and featureless surface with a particularly low albedo. The dark shade of the floor contrasts with the brighter surroundings, making the crater easy to locate.

Beyond the basin are the scattered remnants of an outer wall with a diameter of 220 km. The scattered remnants of the outer wall measure 220 km. This exterior rim is more intact to the north and west of the crater than elsewhere. To its southeast is a system of rilles named the **Rimae Grimaldi**. To the north-west, rilles belonging to the **Rimae Riccioli** approach the western edge of Grimaldi's rim.

A mass concentration (mascon), or gravitational high, has been identified in the centre of Grimaldi (corresponding with the mare). The mascon was mapped at high resolution by GRAIL.

No eclipses, lunar or solar, will be visible from southern Africa in December 2023

METEOR ACTIVITY

Sky Guide 2023	*Maximum Date/Time*	*Moon on max Date/Time*	*Duration*	*Radiant*	*ZHR**	*Velocity Km/sec*
December Phoenicids	December 2 20h30-02h00	77% Rising 23h40	December 1 to 9	In Phoenix 12º NW of Achernar	5	18
Puppid-Velids	December 7 22h30-03h30	32% Rising 01h58	December 1 to 15	18º SE of Canopus	10	40
Geminids	December 14 23h30-03h00	1% Rising 06h21	December 4 to 20	Castor	150	36

* A word of caution regarding predicted Zenithal Hourly Rates:

ZHR is an ideal value. It is by definition the number of meteors a single observer could possibly see during a shower's peak with the radiant directly overhead on a clear, dark night. Most observers,however, will not see as many meteors as the ZHR suggests. Also, the presence of a bright moon can seriously diminish the observation of meteor activity.

For more meteor watching details, please see SGSA 2023, pages 86- 87.

MEMBERS' IMAGES

*Derek Duckitt's processing of the **Orion Nebula** (M42) from the Hubble Space Telescope*

(image oriented to approximately 2023 December 8 at 22h00)

Derek used basically the same Photoshop/Siril procedure as detailed in his presentation at the last Astrophotography meeting on November 23rd.

LOOKING UP

Stargazing events are notoriously subject to the vagaries of the weather and are necessarily scheduled at short notice.

Please consult our website for updates: http://www.hermanusastronomy.co.za

THE ORION NEBULA
M42, NGC 1976

Description	Bright nebula	***Visibility on December 8th 2023***		
Constellation	Orion			
Distance	1 400 ly, 430 pc	*Rises*	*Transits*	*Sets*
Magnitude	+4.0	18h41	01h02	07h19
Apparent size	85.0 x 60.0 arcmin			
Actual size	34.7 ly, 10.6 pc	*Naked Eye*	Yes	
J2000 Dec/RA	-5º 23’ 28” / 5h 35m 17s	*Binoculars*	Yes	
Alt/Az	+39º 3’ 33” / 065º 17’ 52”	*Telescopes*	Yes	

Description

The Orion Nebula, catalogued as Messier 42 or NGC 1976, is one of the nearest star-forming regions to Earth.

Observation

As one of the brightest nebulae in the sky, it is rewarding in telescopes of every size and is perhaps the most studied and photographed deep sky object. M 42 is visible to the naked eye as a hazy patch surrounding Theta Orionis, the middle star in the Sword of Orion, just south of Orion's Belt.

Discovery and History

The Mayans of Central America had a folk tale which suggests that they knew of the Orion Nebula. But despite being visible to the naked eye, the Nebula is not mentioned in any known historical records before the invention of the telescope. Neither **Ptolemy** nor **Al Sufi** noted the nebula, even though they both listed patches of nebulosity elsewhere in the night sky. Around **130** AD, Ptolemy catalogued the brightest stars within the nebula as one bright star, as did **Tycho Brahe** in the late 16th century, and **Johann Bayer** in 1603, who designated them Theta Orionis (θ Ori).

In **1610**, **Galileo** detected a number of faint stars when he first looked at this region with his telescope, but he curiously failed to note the nebula as well. Later, in **1617**, Galileo took a closer look at the star, **θ Ori**, and found it to be a **triple**, (a remarkable achievement considering his equipment. It is now listed as a double) but again he failed to perceive the nebula. This has led to speculation that its illuminating stars have flared up since that time, increasing the nebula's brightness.

The discovery of the Orion Nebula is generally credited to **Nicholas-Claude Fabri de Peiresc**, a French lawyer who turned his telescope to this part of the sky in **1610**. His sighting, however, was only reported in his own personal documents and never published. The nebula was found independently in **1611** by the Jesuit astronomer **Johann Baptist Cysatus of Lucerne**. He was the first to publish note of it, comparing it to a comet he had observed in 1618. The first known drawing of the Orion nebula was created by **Giovanni Batista Hodierna**.

All of these discoveries were apparently lost for some time. Eventually **Christian Huygens**, whose sketch was the first to be published, was credited for its rediscovery in **1656** - both by **Edmond Halley**, who included it in his list of six nebulae in **1716**, and by **Charles Messier**, who added it as the 42nd object to his catalog.

Charles Messier first noted the nebula in **1769**, along with three of its central stars. The nebula's smaller north-eastern portion, previously reported as a separate object by **Jean-Jacques d'Ortous de Mairan** in **1731**, was also added by Messier as number 43. Messier 42 and 43 were the first deep sky objects observed by **William Herschel**, who in 1789 described them as "an unformed fiery mist, the chaotic material of future suns."

The Orion Nebula's gaseous nature was revealed in **1865**, with spectroscopy done by **William Huggins**. In **1880**, **Henry Draper** took the first photograph of the Orion Nebula with an 11-inch refractor, marking the first historical instance of deep-sky astrophotography.

Amateur Observation

It is very easy to find the Orion Nebula. M 42 is visible to the naked eye under good conditions as a faint nebulosity surrounding Theta Orionis, the middle star in the sword of Orion. Theta Orionis is an extremely wide (135") binocular double, whose western component, **θ1 Ori**, is the famous **Trapezium** multiple star. It is a large object, extending over 1 degree in diameter, and covers more than four times the area of the full moon.

Messier 43 is a bright nebulous arc to the north, detached from the main body of M 42 by a dark lane. This dark nebula extends well into M 42, forming a feature nicknamed the "**Fish's Mouth**". The bright regions to both sides are called the "**wings**". The wing extension to the southeast is called "**The Sword**"; the bright nebulosity below the Trapezium "**The Thrust**"; and the fainter western extension "**The Sail**".

The Orion Nebula contains a very young open cluster, at the end of the Fish's Mouth, known as the Trapezium cluster due to the asterism formed by its four primary stars. Two of these can be resolved into their component binary systems on nights with good seeing, giving a total of six stars.

In the neighbourhood to the north, there are also fainter reflection nebulae, partially reflecting the light of the Great Nebula. They were not noted by Charles Messier, but were later labelled **NGC 1973**, **1975** and **1977**.

The Orion Nebula is also one of the easiest and most rewarding targets for amateur astrophotographers. Regions of red and areas of blue-violet are apparent in long-exposure photographs. The red hue is emitted by ionized hydrogen, particularly H-α emission at a wavelength of 656.3 nm. The blue-violet coloration is light reflected by fine interstellar dust grains from the massive O-class stars at the core of the nebula.

Visual observers have long noted a distinctive greenish tint to the nebula. This greenish appearance was a puzzle for astronomers in the early part of the 20th century but is now known to be caused by radiation from doubly ionized oxygen.

Properties and Evolution

M42 is located at a distance of 1 350 light years, with an uncertainty of about 2%, and is estimated to be 24 light years across.

But the Orion Nebula is just a small illuminated blister on the surface of a much larger cloud of gas and dust that extends over 10 degrees, covering half of the constellation Orion. This much larger nebula is known as the **Orion Molecular Complex** (OMC 1); we happen to see this structure approximately face-on. The Orion Molecular Cloud extends several hundreds of light-years, and includes **Barnard's Loop**, the **Horsehead** Nebula, the **Flame** Nebula, and the reflection nebula **M 78**.

The youngest and brightest stars we now see in the Orion Nebula are thought to be less than 100 000 years old. Some of these newborn stars are particularly massive and emit large quantities of ionizing ultraviolet radiation. The ultraviolet light of these hot stars causes the nebula to glow by fluorescence.

The Trapezium multiple star complex is among the most recent products of star formation in the Orion Nebula. This small group of class O and B stars is also responsible for most of the ultraviolet radiation that ionizes the nebula. Two million years ago, this cluster may have been the home of the "runaway stars" **AE Aurigae**, **53 Arietis**, and **Mu Columbae**, all currently moving away from the nebula at velocities greater than 100 km/s.

Altogether the Orion Nebula contains about 700 stars in various stages of formation. Many of the faint stars around the Trapezium are so young that they are still radiating energy from gravitational contraction and have not yet settled down as stable main sequence stars. Other studies of the Nebula have revealed the presence of about 150 protoplanetary disks, supporting the view that these objects are common around infant stars.

Stellar winds emitted by newly formed stars creates shock waves when it encounters the gas in the nebula. This complex and turbulent motion shapes the gas clouds, leading to gravitational collapse, and triggering additional star formation. Eventually, most of the Orion Nebula's gas and dust will be ejected. The remaining stars will form an open cluster, which gradually disperse under the gravitational influence of other stars as it travels around the galaxy. The Pleiades are a famous example of such a cluster.

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Please keep in touch...

Have a look at our excellent website, edited by Derek Duckitt.

http://www.hermanusastronomy.co.za/

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