

“ $\Omega > 1$ ”

“Sky-Notes” of the Open University Astronomy Club.

December 2021.

Seasonal Greetings to all our readers!

Forthcoming Meetings.

OUAC Clubnight.

“Clubnights” have resumed!

The next “Clubnight” will be held on Tuesday 7th December.
Sports Pavilion Activity Room. Meeting starts at 19:30.

Highlights of the Month.

4 th	Venus greatest illumination.
4 th	Total Eclipse of the Sun. No phase visible from UK.
13 th /14 th	Peak of the Geminids meteor shower. See notes below.
21 st	Winter (N Hemisphere) Solstice.
22 nd - 23 rd	Peak of the Ursids meteor shower. See notes below.
Mercury.	Very low in SW evening twilight. Best at end of month. See notes below.
Venus.	Prominent object low in the SW early evening sky.
Mars.	Low in the ESE predawn sky.
Jupiter.	Low in the SW evening sky.
Saturn.	Low in the SW early evening sky.
Uranus.	Well placed for evening through midnight observation.
Neptune.	Well placed for early evening observation.

Recent Events.

If you have any images and/or reports of recent events please contact Sheridan so that he can put them on the Club website.

If you wish to present them at a “Clubnight” meeting please contact Adrian or myself before the meeting starts.

Software.

A very useful item of Planetarium software is “Stellarium” and it’s FREE!
Go to their website and download it and the associated user manual.

1. The Solar system.

Note all times shown are UT.

Earth.

Winter (N Hemisphere) Solstice 21^d 15^h 59^m.

Aurora.

Long hours of darkness improve the opportunity for observing potential aurora.

Keep tuned to the www.spaceweather.com site for updates.

Subscribe (free!) to the UK AuroraWatch website to receive alerts.

ISS.

Completes a series of evening passes in the first week of the month.

Commences a series of morning passes at the end of the third week of the month.

For details of this and other “Bright Satellites” go to the “Heavens Above” website and follow the instructions to set-up for your location.

Alternatively go to the “spaceweather” website and click the “Flybys” button and follow the instructions to set-up forecasts for your location.

Add to your “favourites”.

Sunrise and Sunset.

Bedford.

Latitude 52° 6.9’N Longitude 0° 28.1’W

Date.	Rise.	Transit.	Set.
01	07 ^h 48 ^m	11 ^h 51 ^m	15 ^h 53 ^m
08	07 ^h 57 ^m	11 ^h 54 ^m	15 ^h 50 ^m
15	08 ^h 04 ^m	11 ^h 57 ^m	15 ^h 50 ^m
22	08 ^h 09 ^m	12 ^h 01 ^m	15 ^h 52 ^m
29	08 ^h 11 ^m	12 ^h 04 ^m	15 ^h 57 ^m

Produced using “Starry Night Pro”.

The Sun.

Observing.

To prevent permanent damage to your eyes avoid looking at the Sun directly and never with binoculars or a telescope unless special (expensive!) filters are used. The safest way is the simplest – project the image of the Sun onto grey or white card. Take care if your telescope has any plastic components. Plastic melts!

Solar Cycle 25 is gathering pace. Activity is above predictions which may indicate Solar Max will occur earlier than predicted.

Keep in touch with the Solar Dynamics Observatory satellite at <http://sdo.gsfc.nasa.gov/>

Add the “Spaceweather” and the “Soho” websites to your “favourite” websites.

The Moon.

Phases:



Produced using "LunarPhase Pro".

New	04 ^d 07 ^h 43 ^m	Total Solar Eclipse. Not UK.
First quarter	11 ^d 01 ^h 36 ^m	
Full	19 ^d 04 ^h 35 ^m	
Last quarter	27 ^d 02 ^h 24 ^m	

Apsides:

Perigee	04 ^d 10 ^h	Diameter. 33' 59"	Distance. 356,793km.
Apogee	18 ^d 02 ^h	Diameter. 29' 55"	Distance. 406,316km.

Observing.

Observe the regions along the terminator (sunrise and sunset on the Moon) where the low angle of the Sun highlights lunar topography. A basic lunar map is all you need to get started. *Sky & Telescopes* "Lunar 100 Card" is another good starting point. If you are starting out on astronomical photography and/or imaging the Moon provides an excellent target.

The Moon continued.

For northern observers:

The waxing crescent Moon is becoming better placed.

The waxing gibbous Moon is very well placed.

The Full Moon is very well placed.

The waning gibbous Moon is very well placed.

The waning crescent Moon is becoming less well placed.

Observing and Imaging opportunities.

On 2nd and 3rd try locating the very thin crescent Moon very low in the SE dawn skies **before sunrise**.

On 5th and 6th try locating the very thin crescent Moon low in the SW evening twilight **after sunset**.

Lunar Occultations.

Unlike the gradual disappearance of a planet (small disc) a star vanishes instantly demonstrating that it is a point source of light as viewed from the earth. For all occultation events start observing 10 to 15 minutes before the predicted time to identify the required star and to allow for slightly different time if you are not at Greenwich. Use an accurate watch to record the time that *you* observe the occultation remembering that times are UT not BST. Enter details in your observing log.

Details of occultations can be found in current *BAA Handbook* and monthly periodicals such as *Astronomy Now* and *Sky at Night*.

The Planets.

Mercury.

A poor evening apparition for northern observers. It will be more easily spotted in the last week of the month using Venus as a guide.

4° S of Venus on 29th.

Moon close on 4th.

Date.	Mag.	Dia.	Phase.	Rise.	Transit.	Set.
25	-0.7	5.3''	0.89	09 ^h 23 ^m	13 ^h 07 ^m	16 ^h 50 ^m
31	-0.7	5.8''	0.79	09 ^h 25 ^m	13 ^h 22 ^m	17 ^h 18 ^m

Venus.

Brilliant object low in the SW early evening sky.

Make the most of opportunities to observe and image the rapidly waning crescent with increase in apparent diameter as Venus heads towards **Inferior Conjunction on 8th January 2022.**

Greatest brilliance -4.7 on 4th.

4° N of Mercury on 29th.

Moon close on 7th.

Date.	Mag.	Dia.	Phase.	Rise.	Transit.	Set.
01	-4.7	39''	0.28	11 ^h 11 ^m	14 ^h 51 ^m	18 ^h 31 ^m
31	-4.3	60''	0.03	08 ^h 41 ^m	13 ^h 01 ^m	17 ^h 21 ^m

Mars.

Low in ESE predawn sky.

5° N of Antares on 26th.

Small disc so not easy to observe/image surface details.

Moon close on 3rd and 31st.

Date.	Mag.	Dia.	Phase.	Rise.	Transit.	Set.
01	+1.6	3.8''	0.99	06 ^h 12 ^m	10 ^h 37 ^m	15 ^h 02 ^m
31	+1.5	4.0''	0.98	06 ^h 10 ^m	10 ^h 06 ^m	14 ^h 03 ^m

Jupiter.

Low in the SW early evening sky.

Moon close on 9th.

Date.	Mag.	Dia.	Rise.	Transit.	Set.
01	-2.3	38''	12 ^h 23 ^m	17 ^h 11 ^m	22 ^h 00 ^m
31	-2.1	35''	10 ^h 34 ^m	15 ^h 33 ^m	20 ^h 31 ^m

Saturn.

Low in the SW early evening sky west of Jupiter.

Moon close on 8th.

Date.	Mag.	Dia.	Rise.	Transit.	Set.
01	+0.7	16''	11 ^h 45 ^m	16 ^h 02 ^m	20 ^h 26 ^m
31	+0.7	15''	09 ^h 54 ^m	14 ^h 19 ^m	18 ^h 44 ^m

Uranus.

Well placed in Aries for evening through midnight observation.

Moon on 15th.

Date.	Mag.	Dia.	Rise.	Transit.	Set.
01	+5.7	3.7''	14 ^h 33 ^m	21 ^h 56 ^m	05 ^h 23 ^m
31	+5.7	3.7''	12 ^h 33 ^m	19 ^h 55 ^m	03 ^h 20 ^m

Neptune.

Located in Aquarius moving into SW early evening skies.

Moon close on 11th.

Date.	Mag.	Dia.	Rise.	Transit.	Set.
01	+7.9	2.3''	13 ^h 07 ^m	18 ^h 45 ^m	00 ^h 27 ^m
31	+7.9	2.3''	11 ^h 10 ^m	16 ^h 48 ^m	22 ^h 26 ^m

Dwarf Planets.

- Ceres.** A 7th mag object well placed in Taurus.
Eris. A mag +18.7 target located in Cetus.
Haumea. A mag +17.3 CCD target located in Boötes about 5° W of Arcturus.
MakeMake. A mag +17 CCD target in Coma Berenices. Low in the E predawn skies.
Pluto. Mag +14.5 object located in Sagittarius. Becoming lost in SW evening twilight.

Asteroids. (Approx magnitude +10.5 or brighter).

- Vesta (4).** Emerging low in the SE predawn sky at the end of the month.
Isis (42). Located in Taurus. Mag +10.7 at opposition on 9th.
Nysa (44). Located in Taurus. Mag +9.1 at opposition on 10th.
Kalliope (22). Located in Gemini. Mag +10.2 at opposition on 29th.

Charts and details of asteroids one month either side of opposition are available at:

http://britastro.org/computing/charts_asteroid.html

See also the *BAA Handbook*, monthly periodicals and “Heavens above” website..

Comets.

Comet 2021 A1 (Leonard). A morning object tracking rapidly through Boötes, Serpens Caput and Ophiuchus in the first half of the month. After that it will be an object for Southern Hemisphere observers.

Passes close to globular cluster **M3** on the morning of **3rd**.

Closest approach to the Earth is on the 12th when it may be a 4th mag object.

Comet 2019 L3 (Atlas). An 11th mag object tracking from Lynx into Auriga (just) and then Gemini during the month.

67P/Churyumov-Gerasimenko. A 10th mag object tracking through northern Cancer during the month.

Comet 19P/Borrelly. Tracks northwards from Sculptor into Cetus during the month. It may be a 9th mag object at the end of the month.

Good coverage of the above in the December issue of *Astronomy Now*.

The “Heavens above” website gives very useful details of comets currently available for observation/imaging.

Charts and details of selected comets are available at:

http://britastro.org/computing/charts_comet.html

See also the *BAA Handbook* and/or monthly periodicals.

Meteor Showers.

The **Geminids** are active from 4th to 17th with peak activity on 14th at 02:00, ZHR = 100+. A fine shower with many “bright events” possible. At the peak moonlight interferes until moonset at about 03:00.

The **Ursids** are active from the 17th to 26th with peak activity on 22nd, ZHR = 10.

An under-observed shower which has produced unpredicted outbursts in the past so worth monitoring. Unfortunately moonlight interferes.

There are always **Sporadic** events and the chance of a brilliant fireball. The latter should be recorded and reported.

See earlier note for using Iridium Flares as magnitude comparisons for “Bright Events”.

Near Earth Objects.

Please refer to www.spaceweather.com for updates.

Eclipses.

A **Total Solar Eclipse** takes place on 4th. No phase is visible from the UK.

2. Deep Sky.

Abbreviations used.

M = Messier object. (Shown in **bold**).

NGC = New General Catalogue. IC = Index Catalogue. (Extension of the NGC).

ds = double star. ts = triple star. ms = multiple star. vs = variable star.

gc = globular cluster. oc = open cluster. pn = planetary nebula.

en = emission nebula. rn = reflection nebula. sg = spiral galaxy.

eg = elliptical galaxy. lg = lenticular galaxy. ir = irregular galaxy.

pg = peculiar galaxy. snr = super nova remnant. ly = light year.

The magnitude of an object is shown in brackets e.g. (6.5).

All magnitudes are + unless otherwise shown.

2.1 Variable Stars of the month.

Beta (β) Persei, Algol. Range 2.2 to 3.4, period 2.7 days. Well placed for nightlong observation. Minima at “social hour” occurs on 13^d 21.8^h and 16^d 18.6^h.

Delta (δ) Cephei. Range 3.5 to 4.4, period 5.37 days.

The prototype for the Cepheid class of variable stars. Their period-luminosity relationship has led them to being used as “standard candles” in measuring distances to nearby galaxies.

Mu (μ) Cephei. Range 3.7 to 5.0, approximate period 755 days.

A semi-regular variable star famous for its striking red colour being fittingly called “Herschel’s Garnet Star”. It is the reddest naked eye star visible from the northern hemisphere. Its colour may show signs of variability.

U Ori. Well placed for nightlong observation. At minimum (+12) in December so follow its rise towards max (+6.3) in May 2021.

2.2 Double Stars of the month.

Gamma And. See notes below.

Gamma Ari. See notes below.

Struve (Σ) 326 Ari. See notes below.

Alpha Cas. See notes below.

Iota Cas. See notes below.

Eta Cas. See notes below.

Sigma Cas. See notes below.

Delta Cep. See notes below.

Struve (Σ) 2816 & 2819 Cep. See notes below.

Struve (Σ) 2840 Cep. See notes below.

8 Lac. Quadruple system. See notes below.

Eta Peg. See notes below.

Pi^{1&2} Peg. See notes below.

57 Peg. See notes below.

Zeta Psc. See notes below.

35 Psc. See notes below.

51Psc. See notes below.

Iota Tri. See notes below.

Struve (Σ) 239 Tri. See notes below.

2.3 This Month's Constellations - Double Stars/Star Clusters/Nebulae/Galaxies.

Andromeda (And).

Gamma (γ) (2.2, 5.1) is a fine double star. The brighter component is golden-yellow with its companion a greenish-blue. Arguably second only to Albino in Cygnus.

NGC205 (**M110**) (8.0) eg. A satellite galaxy of M31 visible as an elongated "smudge" in small telescopes.

NGC221 (**M32**) (8.2) eg. A satellite galaxy of M31. Visible as a fuzzy star in small telescopes.

NGC224 (**M31**) (3.5) sg. The Great Andromeda Spiral Nebula. Increasing aperture reveals more and more detail although increasingly smaller areas of the galaxy fill the eyepiece. 8" telescopes should reveal NGC206 as a hazy patch. It is a large area of star formation. 12" scopes will reveal one or two of M31's large population of globular clusters.

NGC404 (11.9) lg. Located 6' NW of β And. The 2nd magnitude star tends to drown the faint glow of the galaxy. Use high power to push the star out of the field of view for best results.

NGC752 (5.7) oc This large open cluster is located about 4 degrees south of γ .

NGC891 (10.1) sg. Located about 3 degrees east of γ is seen almost edge on. Bright central bulge. Moderate apertures will reveal a narrow dust lane bisecting the long axis. A fine object.

NGC7640 (12.5) sg. Seen nearly edge-on.

NGC7662 (8.6) pn. "The Blue Snowball". Rather small making it difficult to distinguish from nearby faint stars. High magnification on an 8" telescope will reveal an elliptical ring with a dark centre. Large apertures will show a faint second outer ring of nebulosity and the 13th magnitude central star.

Aries (Ari).

Gamma (γ) (4.8/4.8 separation 7.7") ds. Fine equally bright bluish-white pair of stars. Accidentally discovered by Robert Hooke in 1664 while searching for a comet.

Lambda (λ) (4.9/7.7 sep. 37.4") ds. Wide pair of pale yellow and pale blue stars.

Struve (Σ)326. (7.6/9.8 sep. 5.9") ds. Beautiful orange and dull red pair of stars.

NGC772 (10.3) sg. Located almost 2° ESE of γ .

NGC877 (11.9) sg.

NGC972 (11.4) sg.

Cassiopeia (Cas).

Alpha (α) (2.2/8.9 sep. 64.4") ds. Fine orange and blue pair. Part of a multiple system.

Iota (ι) (4.6/6.9/8.4 sep. AB 2.5", AC 7.2") ts. Beautiful white, yellow and blue triple system.

Eta (η) (3.4/7.5 sep. 12.9") ds. Superb gold and garnet pair. The colours are very subjective. What do you see?

Sigma (σ) (5.0/7.1 sep. 3.0") ds. Bluish white and yellow pair in a superb field.

NGC129 (6.5) oc.

NGC147 (9.3) eg. A satellite galaxy of M31.

NGC185 (9.2) eg. A satellite galaxy of M31.

NGC278 (10.9) eg. Located a few degrees SE of NGC185.

NGC457 (6.4) oc.

NGC581 (**M103**) (7.4) oc. Fine object.

NGC7654 (**M52**) (6.9) oc. Fine rich cluster.

NGC7789 (6.7) oc.

IC1805 (6.5) oc.

IC1848 (6.5) oc.

Cepheus (Cep).

Delta (δ) Cephei, 3.5 to 4.4 over a period 5.37 days, is the prototype for the Cepheid class of variable stars which because of their period-luminosity relationship has led them to being used as "standard candles" in measuring distances to nearby galaxies. Pale blue +6.1 companion.

Mu (μ) Cephei 3.7 to 5.0 approximate period 755 days is a semi-regular variable star. It is more famous for its striking red colour being fittingly called "Herschel's Garnet Star". It is the reddest naked eye star visible from the northern hemisphere. Its colour may show signs of variability.

Struve (Σ) 2816 ts (5.7/7.5/7.5, sep 12"/20"). Fine triple with Struve (Σ) 2819 ds (7.4/8.6, sep 13") in same field. All contained in the large, sparse and nebulous open cluster IC 1396!

Struve (Σ) 2840 ds (5.6/6.4, sep 18"). Very fine greenish/bluish pair.

Open clusters - NGC188 (8.1), NGC6939 (7.8), NGC7510 (7.9), NGC7762 (10.0). Planetary Nebula NGC40 (10.7).

Spiral galaxy NGC6946 (8.9) in the same 1° field as oc NGC6939. Two types of object for the price of one!

The faint reflection nebula NGC7023 and emission nebula IC 1396 provide a challenge to the observer. A dark clear sky is essential.

Lacerta (Lac).

Struve (Σ) 2876 (7.8, 9.3 sep 11.8") ds. Fine blue and white double.

Struve (Σ) 2894 (6.1, 8.3 sep. 15.6") ds. Yellow primary, blue secondary.

Struve (Σ) 2902 (7.6, 8.5 sep. 6.4") ds. Yellow and white double.

8 Lacertae = Struve (Σ) 2922 (5.7, 6.5 sep. 22.4") Multiple star. Brightest four components are white/blueish white. Has been described as a poor open cluster.

O Struve (Σ) 475 (6.8, 10.8 sep. 15.5") ds. White primary with faint blue companion.

BL Lacertae (14 to 17). Prototype for class of quasi-stellar object (QSO).

Pegasus (Peg).

Eta (η) 2.9/9.9 separation 90.4". Binocular object. Yellow and blue components but telescope required to see colour of secondary. Herschel's "Pendulum Star" - tap telescope gently for the effect.

Pi⁻¹/Pi⁻² (π^{-1}/π^{-2}) 5.6/4.3 separation 7"). Fine binocular object. Pi⁻¹ is a multiple system with 4 companions of 10th to 12th magnitude.

57 Pegasi. 5.1/9.7 separation 32.6". Beautiful orange primary with blue companion.

NGC7078 (**M15**) (6.3) gc superb object.

NGC7331 (9.5) sg. A fine galaxy seen almost edge on. Strange as to why it is not in Messier's catalogue.

About half a degree south is the fascinating group of galaxies "Stephan's Quintet". The brightest member of the group is NGC7320 (12.7).

Many happy hours can be spent wandering around "The Square" to locate many moderately bright galaxies. Use a star atlas such as the excellent "Sky Atlas 2000" to plan your journey.

Continued on next page.

Pisces (Psc).

Alpha (α) (4.2/5.1 sep.1.5") ds. Requires a large aperture telescope using high magnification to split this pair of bluish-white stars.

Zeta (ζ) (5.6/6.2 sep. 23") ds. Fine white and yellow pair of stars.

35 (6.0/7.6 sep 7.6") ds. Fine yellow and blue pair.

51 (5.7/9.5 sep.27.5") ds. Glorious bluish and greenish pair of stars.

65 (6.3/6.3 sep 4.4") ds. Fine matched pair of pale yellow stars.

Wolf 28 (12.3). Van Maanen's Star. One of the few white dwarf stars visible in amateur telescopes.

NGC128 (11.8) sg. Brightest of a group of five galaxies.

NGC488 (10.3) sg. Elongated halo with brighter core.

NGC628 (**M74**) (9.4) sg. Seen face on and hence low surface brightness.

NGC7541 (11.7) sg. Elongated oval with bright core. 3' to the SW is NGC7537 (13.0)

Sculptor (Scl).

Unfortunately this constellation never rises very high for UK observers so that only brief opportunities are presented to track down some deep-sky gems which unfortunately are not seen at their best even from a dark site. I have taken declination -30° as the southern limit for objects. This is almost the declination of the first magnitude star Fomalhaut (+1.16) which will give you a marker as to how low these objects are even at their highest when due south. The suitable observation window is thus fairly restricted!

NGC24 (11.5) sg. Located about two-thirds the way between NGC253 and β Cet.

NGC253(7.1) sg. Seen highly inclined to our line of sight. Increasing magnification reveals mottling due to dust lanes. Head south for the best view of this gem.

NGC288 (8.1) gc. A loose globular which resolves readily with high power. The South Galactic Pole is about a 1° to the SW.

NGC613 (10.0) sg. Elongated and fairly bright.

Triangulum (Tri).

Iota (ι) (5.3/6.9 sep. 3.9") ds. Fine contrasting yellow and blue pair of stars.

Struve (Σ)239 (7.0/8.0 sep. 13.8") ds. Fine pale yellow and pale blue pair of stars.

NGC598 (**M33**) (5.7) sg. Viewed face-on and hence has a low surface brightness making it an elusive object. A good test for sky conditions using binoculars. From dark sites and under good seeing conditions it is just visible to the naked eye and vies with M31 as the most distant object visible to the naked eye. With 8"+ scopes try to locate the vast star cloud NGC604.

NGC672 (11.6) sg. A bright barred spiral galaxy seen somewhat edge-on.

NGC925 (12.0) sg. Steeply inclined to our line of sight makes it fairly bright.

P.V.H.