

“ $\Omega > 1$ ”

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

January 2020.

A Very Happy New Year and Best Wishes for 2020 to all readers!

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 Sheridan or myself before the meeting starts.

Highlights of the Month.

- 2nd** This evening provides a chance to observe/image the **Lunar “X” and “V”**.
- 4th** Peak of **Quadrantids** meteor shower.
- 5th** **Earth** at Perihelion.
- 10th** A **Penumbral Lunar Eclipse**. See notes below.
- 10th** **Mercury** at Superior Conjunction.
- 13th** **Saturn** in Conjunction with the Sun.
- 13th** **Ceres** in Conjunction with the Sun.
- 13th** **Pluto** in Conjunction with the Sun.
- 27th** Close conjunction between **Venus and Neptune**.
- Mercury.** Reappears low in the WSW evening twilight towards the end of the month.
- Venus.** Brilliant object low in the SW twilight sky. See note for 27th.
- Mars.** Low in the SSE predawn sky.
- Jupiter.** Reappears low in SE dawn sky towards the end of the month.
- Saturn.** Conjunction with the Sun on 13th. Not observable.
- Uranus.** Well placed in Aries for evening observation.
- Neptune.** An early evening object low in SW. See note for 27th.
- Comet C/2017 T2 PanSTARRS** is well placed for northern observers. See notes below.
- Betelgeuse (alpha Ori)** is an irregular variable and since October 2019 has been declining in brightness reaching a low of mag (V) +1.12 on 7th December. Currently this is the faintest it has been during more than 25 years of continuous monitoring so worth following developments!

Forthcoming Meetings.

OUAC.

Please note that the next “Clubnight” is on **Tuesday 7th January.**

BAA.

Full details of BAA meetings at: www.britastro.org

“European Astrofest 2020.”

Friday 31st January and Saturday 1st February.

Kensington Conference & Events Centre, London.

A few minutes walk from High Street Kensington Underground Station.

Details at: europeanastrofest.com and the current issue of *Astronomy Now*.

Software.

A very useful item of Planetarium software is “**Stellarium**” and it’s **FREE!**

Go to the website and download it and the associated user manual.

1. The Solar system.

Note all times shown are UT.

Earth.

Perihelion 05^d 07^h 49^m 147,091,144 km.

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 morning passes during the first week of the month. Commences a series of evening passes in the fourth week of the month.

Go to the “Heavens Above” website and set-up for your location.

Alternatively go to “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 | 08 ^h 11 ^m | 12 ^h 05 ^m | 16 ^h 00 ^m |
| 08 | 08 ^h 09 ^m | 12 ^h 09 ^m | 16 ^h 08 ^m |
| 15 | 08 ^h 04 ^m | 12 ^h 11 ^m | 16 ^h 19 ^m |
| 22 | 07 ^h 57 ^m | 12 ^h 14 ^m | 16 ^h 30 ^m |
| 29 | 07 ^h 48 ^m | 12 ^h 15 ^m | 16 ^h 43 ^m |

Produced using Starry Night Pro v.6.

The Sun.

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 additional care if your telescope has plastic components. Plastic melts!

If you have or have access to observe in h-alpha the rewards are much greater.

The Sun continued.

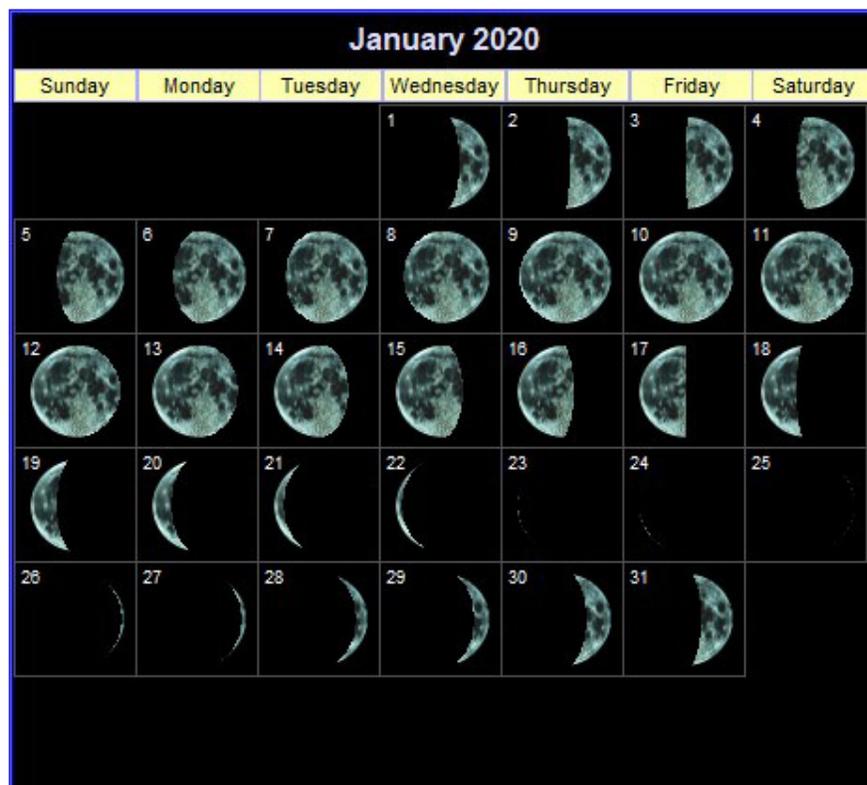
The very low activity of Solar Minimum continues.

However! At the time of completing these notes (24th December) two new sunspot groups appeared, one in the S hemisphere and one in the N hemisphere. As yet they are unnumbered but their polarity and latitude indicates that they are members of new Solar Cycle 25. A pleasant Christmas present for solar observers!

Keep in touch with the Solar Dynamics Observatory satellite at <http://sdo.gsfc.nasa.gov/>
Add the “spaceweather” and “Soho” websites to your “favourite” websites.

The Moon.

Phases:



Produced using Lunar Phase Pro.

| | |
|---------------|---|
| First Quarter | 03 ^d 04 ^h 45 ^m |
| Full | 10 ^d 12 ^h 58 ^m |
| Last Quarter | 17 ^d 12 ^h 58 ^m |
| New | 21 ^d 21 ^h 42 ^m |

If you use the BAA *Handbook* Please note that the “Phases of the Moon” table (p.27) in the 2020 BAA *Handbook* is erroneously a reprint of the 2019 data.
A corrected table is included in the December 2019 *Journal* (p.361).

The Moon cont.

Apsides:

| | | | |
|---------|---------------------------------|-------------------|----------------------|
| Apogee | 02 ^d 01 ^h | Diameter. 29' 32" | Distance. 404,576km. |
| Perigee | 13 ^d 20 ^h | Diameter. 32' 39" | Distance. 365,963km. |
| Apogee | 29 ^d 21 ^h | Diameter. 29' 29" | Distance. 405,389km. |

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 well placed.

The waning crescent Moon is less well placed.

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 photography and/or imaging the Moon provides an excellent target.

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.

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

Observing/Imaging Opportunities and Challenges!

On the evening of the 2nd there is a chance to observe/image the Lunar "X" and "V".

On 22nd and 23rd try locating the very thin crescent Moon very low in the ESE dawn skies **before sunrise**.

On 25th and 26th try locating the very thin crescent Moon in SW evening twilight **after sunset**.

If you can take images of the above so much the better.

The Planets.

Mercury.

Superior Conjunction 10th.

Watch for its reappearance low in the SW evening twilight towards the end of the month.

Moon close on 25th.

| Date. | Mag. | Dia. | Phase. | Rise. | Transit. | Set. |
|-------|------|-------|--------|---------------------------------|---------------------------------|---------------------------------|
| 31 | -1.4 | 5.6'' | 0.86 | 08 ^h 26 ^m | 13 ^h 12 ^m | 18 ^h 02 ^m |

Venus.

Now dominates the SW evening twilight.

Close conjunction with Neptune on 27th.

Moon close on 28th.

| Date. | Mag. | Dia. | Phase. | Rise. | Transit. | Set. |
|-------|------|------|--------|---------------------------------|---------------------------------|---------------------------------|
| 01 | -4.0 | 13'' | 0.82 | 10 ^h 07 ^m | 14 ^h 32 ^m | 18 ^h 58 ^m |
| 31 | -4.1 | 15'' | 0.74 | 09 ^h 09 ^m | 14 ^h 51 ^m | 20 ^h 33 ^m |

Mars.

Low in the SE predawn sky.

Still a very small disc for obserig/imaging.

About 4 ½° N of Antares (+1.0) "Rival of Mars" on 18th.

Moon close on 20th.

| Date. | Mag. | Dia. | Phase. | Rise. | Transit. | Set. |
|-------|-------|-------|--------|---------------------------------|---------------------------------|---------------------------------|
| 01 | +1.6 | 4.3'' | 0.96 | 04 ^h 50 ^m | 09 ^h 06 ^m | 13 ^h 22 ^m |
| 31 | +1.49 | 4.8'' | 0.93 | 04 ^h 41 ^m | 08 ^h 34 ^m | 12 ^h 26 ^m |

The Mars **Curiosity** rover continues to return excellent data and images.

Mission details and progress is on the appropriate NASA website.

Jupiter.

Emerging low in the SE dawn sky towards the end of the month.

Moon close on 23rd.

See BAA *Handbook* and/or monthly periodicals for satellite phenomena.

| Date. | Mag. | Dia. | Rise. | Transit. | Set. |
|-------|------|------|---------------------------------|---------------------------------|---------------------------------|
| 24 | -1.8 | 32'' | 06 ^h 48 ^m | 10 ^h 41 ^m | 14 ^h 34 ^m |
| 31 | -1.9 | 32'' | 06 ^h 26 ^m | 10 ^h 20 ^m | 14 ^h 14 ^m |

Saturn.

Not observable.

Conjunction with the Sun on 13th.

Moon close on 24th.

| Date. | Mag. | Dia. | Rise. | Transit. | Set. |
|-------|------|------|-------|----------|------|
| - | - | - | - | - | - |

Uranus.

Well placed for evening observation.
Moon close 4th.

| Date. | Mag. | Dia. | Rise. | Transit. | Set. |
|-------|------|-------|---------------------------------|---------------------------------|---------------------------------|
| 01 | +5.8 | 3.6'' | 12 ^h 15 ^m | 19 ^h 21 ^m | 02 ^h 27 ^m |
| 31 | +5.8 | 3.5'' | 10 ^h 17 ^m | 17 ^h 23 ^m | 00 ^h 34 ^m |

Neptune.

Sinking into the SW early evening skies.
Close conjunction with Venus on 27th.
Moon close 28th.

| Date. | Mag. | Dia. | Rise. | Transit. | Set. |
|-------|------|-------|---------------------------------|---------------------------------|---------------------------------|
| 01 | +7.9 | 2.3'' | 11 ^h 00 ^m | 16 ^h 30 ^m | 22 ^h 00 ^m |
| 31 | +7.9 | 2.2'' | 09 ^h 03 ^m | 14 ^h 35 ^m | 20 ^h 06 ^m |

Dwarf Planets.

Ceres. Not observable. **Conjunction** with the Sun on 13th.
Eris. A CCD target object in Cetus.
Haumea. A CCD target located in Bootes.
MakeMake. A CCD target in Coma Berenices.
Pluto. Not observable. **Conjunction** with the Sun on 13th.

Asteroids. (Approx mag +10.5 or brighter).

Vesta (4). A 7th mag object moving from Cetus into Aries during the month.
Well placed for evening observation.
Nausica (192). Located in Gemini. Mag +10.0 at opposition on 9th.
Davidia (511). Located in Gemini. Mag +9.6 at opposition on 15th.
Astraea (5). Located in Cancer. Mag +8.9 at opposition on 21st.

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* and/or monthly periodicals.

Comets.

Comet 2017 T2 (PanSTARRS).

A circumpolar object and at about mag +10 it is well placed for northern observers as it tracks through Perseus. During the last week of the month it passes north of the “Double Cluster” providing fine imaging opportunities – if clear!

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 **Quadrantids** are active from 1st – 6th January with peak activity on 4^d 09^h, ZHR = 80+. Quite favourable with respect to interference from moonlight.

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

Near Earth Objects.

Please refer to www.spaceweather.com for updates.

Eclipses.

A **Penumbral Lunar Eclipse** occurs on 10th. All the eclipse is visible from UK.

Penumbral eclipse commence (P1) at 17:07.

Penumbral eclipse ends (P4) at 21:12.

2. The 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, excluding double, triple, multiple and variable stars, 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. Becoming well placed by mid evening.

Favourable minima at “social hours” occur on 2^d 19.5^h, 20^d 0.4^h, 22^d 21.2^h and 25^d 18.0^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.

Omicron (\omicron) Ceti Mira.

The classic long period variable star fading from maximum (+3.4) towards minimum in Jun/Jul.

U Ori.

Well placed for nightlong observation. Brightening towards (+6.3) in Apr/May 2020.

2.2 Double Stars of the month.

Beta Cam. See notes below.

Alpha Gem (Castor). See notes below.

Delta Gem. See notes below.

Gamma Lep. See notes below.

Beta Mon. See notes below.

Beta Ori (Rigel). See notes below.

Sigma Ori. See notes below.

Theta-1 Ori (The Trapezeium). See notes below.

Struve 742 Tau. See notes below.

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

Auriga (Aur).

NGC1960 (M36) (6.0) oc. Large bright grouping. In same low power field as M38.

NGC2099 (M37) (5.6) oc. Richest and brightest of the three Messier star clusters in Auriga with 150 stars brighter than 12th magnitude.

NGC1912 (M38) (6.4) oc. Larger than M36. Many bright stars arranged in pairs.

The above are excellent objects for photography. Guided exposures of a few minutes will be necessary. CCD images require much shorter exposures.

NGC1664 (7.6) oc. Fine cluster on the border of Auriga and Perseus.

NGC1778 (7.7) oc. A 6" telescope will show about 20 stars. Larger apertures will reveal more.

NGC1857 (7.0) oc. Hazy patch surrounding an orange 7th magnitude star which interferes with viewing the fainter stars.

NGC1893 (7.5) oc. Fine, though rather sparse cluster. 8"+ telescopes under dark skies may begin to reveal the pale light of the brightest part of the emission nebula IC410 which pervades the star cluster.

NGC1907 (8.2) oc. This small cluster lies just west of M38 appearing as a small smudge of light.

NGC1931 (11.3) en. An 8" telescopes from dark skies should reveal this small pea-nut shaped emission nebula.

NGC 2192 (10.9) oc. Not an easy object probably requiring a 6" telescope to locate and 10"+ to resolve.

NGC2281 (5.4) oc. Handful of stars often overlooked.

IC405 en (6v) The "Flaming Star Nebula". Illuminated by the star AE Aur which is a "runaway star" whose path can be traced back to Orion. At present the star is passing by/through the normally dark dust and gas cloud of IC405 and thus illuminating it. In the future as AE moves away the nebula will again become dark.

Camelopardalis (Cam).

Beta (β) ds. (4.0/8.6, sep. 80.8"). Wide yellow and blue pair (AB). From dark sites the system can be seen to be embedded in a streak of dark nebulosity. A third magnitude 11.8", sep (BC) 14.8", component is visible in moderate apertures.

1 ds. (5.7/6.8, sep. 10.3"). White and pale blue pair.

11 & 12 ds. (5.4/6.5, sep, 108.5") White pair. Easy object for binoculars and small telescopes.

29 ds. 6.5/9.5, sep. 25.1". Yellow primary with fainter pale blue secondary.

Struve (Σ)390 ds. 5.1/9.5, sep. 14.8". White primary with fainter purple secondary.

Struve (Σ)1122 ds. (7.8/7.8, sep. 15.4"). Fine pair of equally bright white stars.

Struve (Σ)1625 ds. 7.3/7.8, sep. 14.4". Almost equal pair of yellowish stars.

Struve (Σ)1694 ds. 5.3/5.8, sep.21.6". Easy pair of whitish stars.

NGC1501 (11.5) pn. Bright, large with a blue tint located about 2 degrees south of the open star cluster NGC1502. Resembles the "Eskimo Nebula" in Gemini. NGC1502 (5.7) oc. A fine open cluster. Extending NW of this cluster is a line of 9th and 10th magnitude stars that form "Kemble's Cascade". A beautiful sight in binoculars or a low power wide field eyepiece on small telescopes.

NGC2403 (8.4) sg. Visible in large binoculars. It lies at a distance of 8m light years and is possibly a member of the M81/M82 group.

IC342 (12.0) sg. Once considered to be a member of the Local Group of galaxies. Its low surface brightness makes it a challenge for moderate apertures. This face on spiral galaxy would be an impressive object if it were further away from the plane of the Milky Way.

Gemini (Gem).

Alpha (α) **Castor** ms. 1.9/2.9 sep 4.0". Close visual pair. However each of these is a spectroscopic binary. A more distant ninth magnitude star (red) forms part of an eclipsing binary system. A fascinating family!

Delta (δ) ds. 3.5/8.2 sep 5.8". Yellow primary with bluish secondary.

Kappa (κ) ds. 3.6/8.1 sep 7.1". Orange-yellow primary with bluish companion.

Lambda (λ) ds. 3.6/10.7 sep 9.6". Blue-white primary with bluish companion.

Σ 1108 (Struve) ds. 6.6/8.3 sep 11..5". Yellow primary with bluish companion.

M35 (5.1) oc. Just visible to the naked eye from dark sites. It is a superb object in telescopes. On its western edge lies the more distant open star cluster IC2158.

NGC2129 (10.2) oc. Located about a degree SW of IC2158.

NGC2266 (9.5) oc. Located about two degrees north of ϵ Gem.

NGC2392 (10.5) pn. The "Eskimo nebula" is a fine planetary nebula located about two degrees SE of δ . The nickname is derived from the appearance of a face surrounded by the hood of a parka.

NGC2420 (8.3) oc. Located about two degrees east of the "Eskimo".

Complete this deep-sky tour of Gemini by locating the open star clusters NGC2355 (9.7) and NGC2395 (7.1).

Lepus (Lep).

Lying beneath Orion Lepus is easily recognized by a quadrilateral of four third magnitude stars and contains a variety of deep-sky objects including one Messier object.

Alpha (α) ds; (2.6,11.1; sep. 35.8").

Beta (β) ds; (3.0/7.5; sep. 2.3").

Gamma (γ) ds. (3.7/6.3, sep. 96.3"). Fine yellow and pale orange pair.

Kappa (κ) ds; (4.5/7.4; sep. 2.6"). White and blue companions.

Iota (ι) ds; (4.5/10.8; sep. 12.7").

NGC1974 sg (11.8). Seen almost edge on.

NGC1904 (**M79**) gc (8.0). A fine globular cluster visible as a fuzzy spot in binoculars. Outer edges begin to resolve in 12" (30cm) telescopes.

IC418 pn (10.7). Very small but bright. Central 10.7 mag star surrounded by pale ring. Use a UHC or OIII filter for best results.

Monoceros (Mon).

This faint and rather indistinct constellation is located between Orion and Canis Minor.

Beta (β) ts. 4.7/5.2/6.1 Sep. AB = 7.3', sep BC = 2.8". Striking triple of bluish white stars.

Epsilon (ϵ) ts. 4.5/6.5 sep. 13.4". Close pair of pale yellow stars. The third mag 12.7 bluish white member is visible in 12"+ apertures.

NGC2244 oc (4.8). Fine open star cluster surrounded by NGC2237-9 "The Rosette Nebula" which is best seen using a UHC filter. Shows well in photographs.

NGC2261 en (10v). "Hubble's Variable Nebula". Located about 2^o southwest of NGC2264 this a fascinating object and well worth monitoring for changes in shape and brightness due to the enveloped variable star R Monocerotis. The triangular wedge appears is almost comet like. Detailed star chart available for telescope owners.

NGC2264 oc + en (4.0) The "Christmas Tree Cluster". A fine open cluster with associated nebula that includes the "Cone Nebula".

NGC2323 (**M50**) oc (5.9). Superb open cluster.

There are many other open clusters in this area of the Milky Way - NGC's 2215(8.4), 2286(7.5), 2301(6.0), 2335(7.2), 2343(6.7), 2353(7.1) and 2506(7.6).

Orion (Ori).

This constellation dominates the winter skies and because it is so easily recognized forms one of the "key constellations" for finding other winter groupings.

Orion's two brightest stars provide a marked contrast. Betelgeuse is distinctly orange in colour. It is a red giant star entering old age. Rigel is a brilliant blue/white star indicating the exuberance of youth. Betelgeuse is slightly variable in brightness, range 0.1 - 0.9 and bears the designation α (alpha) indicating that it was brighter than Rigel, β (beta) (0.1), when stars were given these designations. Rigel is now the brighter of the two so either early magnitude estimates were wrong or Betelgeuse has dimmed slightly.

Beta (β) Rigel ds. 0.1/6.8 sep. 9.5". Brilliant bluish white primary with much fainter bluish secondary.

Eta (η) ds. 3.6/5.0 sep. 1.5". Close pair of white stars.

Delta (δ) ds. 2.0/6.9 sep. 52.6". Blue white primary with pale blue secondary.

Lambda (λ) ds. 3.5/5.6 sep.4.4". White stars. Part of a quadruple system.

Theta-1 (θ) ms. "The Trapezium". AB: 6.7/7.9 sep. 8.8"; CD: 5.1/6.7 sep. 13.4". Superb object!

Iota (ι) ts. 2.8/7.3 sep. 11.3". White primary with pale blue secondary. The third reddish 11th magnitude component is located 50" away.

Sigma (σ) ms. 4.0/10.3 sep. 11.4. Colourful multiple star. Fainter triple star Σ 761 in same field.

Zeta (ζ) Alnitak ds. 1.9/4.0 sep. 2.3". Bluish white stars. Part of a triple system with the Flame Nebula (NGC2024) in the field of view.

NGC1976 (**M42**) en. One of the most famous objects in the sky. Marking Orion's sword the "Great Orion Nebula" is visible to the naked eye as a faint misty patch. A pair of binoculars or small telescope will begin to reveal detail. Increasing aperture and low power bring increasing rewards for the visual observer. Embedded in the nebula is **Theta (θ) Ori**. A group of four young stars, mags 5.4,6.3, 6.8 and 7.0, aptly called "The Trapezium". The whole nebula is a stellar nursery with spectacular images being obtained from large Earth based telescopes and the Hubble Space Telescope. M42 is an ideal target for photography.

NGC1982 (**M43**) en. A small patch of nebulosity on the northern edge of M42.

NGC2024 (en), nicknamed "the Flame Nebula", surrounds ζ Ori.

IC434 en is a strip of nebulosity just south of ζ . The famous "Horse's Head Nebula" (Barnard 33) is a small dark intrusion seen dramatically in photographs. It provides one of the biggest challenges to visual observers requiring very dark transparent skies. Responds well to a H-beta nebula filter.

NGC2068 (**M78**) (8.0) rn is a small patch of nebulosity about two degrees NNE of ζ .

NGC2112 (9.1) oc is an open star cluster about two degrees east of M78.

Other open clusters worth locating are NGC2186 (8.7), NGC2169 (5.9) and NGC2175 (6.8) which superimposes a small patch of nebulosity NGC2174.

Long exposure photographs reveal a long arc of nebulosity curving up the east side Orion. This is called "Barnard's Loop" which is extremely difficult to discern visually almost regardless of aperture. Remarkably it has been seen with the naked eye (initially by accident!) from dark sites using O III or UHC filters. The "Loop" is a faint ring of hot gas some 14^o by 10^o with the western part of the ring being less distinct. The "ring" may be due to radiation pressure from the hot young stars in the region of Orion's belt/sword acting on interstellar material. A less favoured school of thought is that it may be a supernova remnant.

Taurus (Tau).

Lambda (λ) vs. Eclipsing binary, range 3.4 to 4.1, period 3.95d.

Phi (ψ) ds. 5.0/8.4 sep 52.1". Fine contrasting deep yellow primary with blue companion.

Σ 495 (Struve) ds. 6.0/8.8 sep 3.8". Fine pair of yellow stars.

Σ 742 ds. 7.1/7.5 sep 4". Fine pair in the same wide field as the Crab Nebula (M1) to the E. Often overlooked when locating M1.

47 Tauri ds. 4.9/7.4 sep 1.1". Very close pair of yellow stars.

T vs. Irregular variable, range 9.4 to 13.5, period erratic.

RV vs. Irregular variable, range 9.5 to 13, period 79d.

RR vs. Irregular variable, range 9.9 to 13, period "chaotic".

M45 - "The Pleiades" or "Seven Sisters" oc. Probably the most famous star cluster. Test your eyesight from a dark site by counting the number of naked eye stars that are visible. Seven should readily be seen. Keen vision will lead you into double figures. A test for moderate apertures is the nebulosity around some of the other brighter stars of the group, especially Merope. Nebula/UHC filters will help.

The Hyades oc. Another naked eye star cluster although more spread out than the Pleiades. The first magnitude star Aldebaran (0.9) is not a member of the cluster and appears brighter as it is closer to us, 21 parsecs - about halfway to the clusters centre. Aldebaran has a faint companion (13.4) separation 30.4". Spotting the companion is not easy even in moderate telescopes.

NGC1514 (10.0) pn. Not an easy object in small instruments. An OIII filter will help.

NGC1554/1555 is a faint variable reflection nebula illuminated by the very young star T Tauri (see above).

NGC1647 (6.4) oc. Rich cluster.

NGC1746 (6.1) oc. Poorer than 1647

NGC1808/1817 (7.0/7.7) oc. a pleasant "double cluster" when observed at low powers.

NGC1952 (**M1**)(8.5) snr. "The Crab Nebula". One of the most studied astronomical objects in recent decades. A "new star" appeared in 1054 and over a few months faded from view. Centuries later the faint oval patch was discovered by Dr John Bevis in 1731 and independently by Charles Messier on 12th September 1758 while observing the comet of that year. Its true nature was not recognized until much later. In 1942 astronomers had speculated that a peculiar star in the nebula might be a neutron star. In 1968 radio astronomers discovered that the central star was a pulsar spinning at 30 times a second i.e. the period of the pulses is 33 milliseconds. The "Crab" is also a strong emitter of X-rays.

Happy and Successful Observing!

P.V.H.