

“ $\Omega > 1$ ”

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

June 2015.

Forthcoming Meetings.

OUAC.

The next “Clubnight” is on Tuesday 2nd when Mike Frost will present “"Jeremiah Horrocks and New England”.

Please note that there will be no “Clubnight” in July and August. Summer Break then back in September.

BAA.

Full details of this and other BAA meetings at: www.britastro.org

Other.

Saturday 20st June.

Webb Deep Sky Society Annual Meeting.

IOA, Maddingley Road, Cambridge.

Full details at www.webbdeepsky.com

Highlights of the Month.

The Moon tracks past Venus and Jupiter from 19th to 21st.

Mercury emerges into the dawn sky reaching Greatest Elongation W (22°) on 24th.

Venus reaches Greatest Elongation E (45°) on 6th. Skirts the edge of M44 on 13th and 14th followed by a very close conjunction with Jupiter on 30th.

Mars. Conjunction with the Sun on 14th.

Jupiter Prominent in W evening twilight. Close conjunction with Venus on 30th.

Saturn. Available for observation during short hours of darkness.

The Summer (Northern Hemisphere) Solstice occurs on 21st.

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.

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.
Add 1 hour to convert to BST.

Earth.

Summer (Northern Hemisphere) Solstice 21^d 16^h 38^m

Aurora.

Short hours of darkness limit 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.

Noctilucent Clouds.

Scan the NW sky about an hour after sunset and the NE sky an hour before sunrise for possible displays. The clouds are distinctive by their silver-blue appearance and very photogenic.

ISS.

Favourable passes during the first half of the month.

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

Iridium Flares.

These satellites produce short lived “Bright events”. Some are very bright in the order of magnitude -8. Take a wide-field image of with an exposure of 20 – 30 seconds to capture an event. Regular observing of events brighter than magnitude -4 will provide useful practice for estimating the magnitude of very bright meteors and Fireballs.

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

Sunrise and Sunset.

Bedford.
Latitude 52° 6.9'N Longitude 0° 28.1'W

Date.	Rise.	Transit.	Set.
01	03 ^h 48 ^m	12 ^h 00 ^m	20 ^h 12 ^m
08	03 ^h 43 ^m	12 ^h 01 ^m	20 ^h 19 ^m
15	03 ^h 41 ^m	12 ^h 02 ^m	20 ^h 24 ^m
22	03 ^h 41 ^m	12 ^h 04 ^m	20 ^h 26 ^m
29	03 ^h 44 ^m	12 ^h 05 ^m	20 ^h 26 ^m

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.

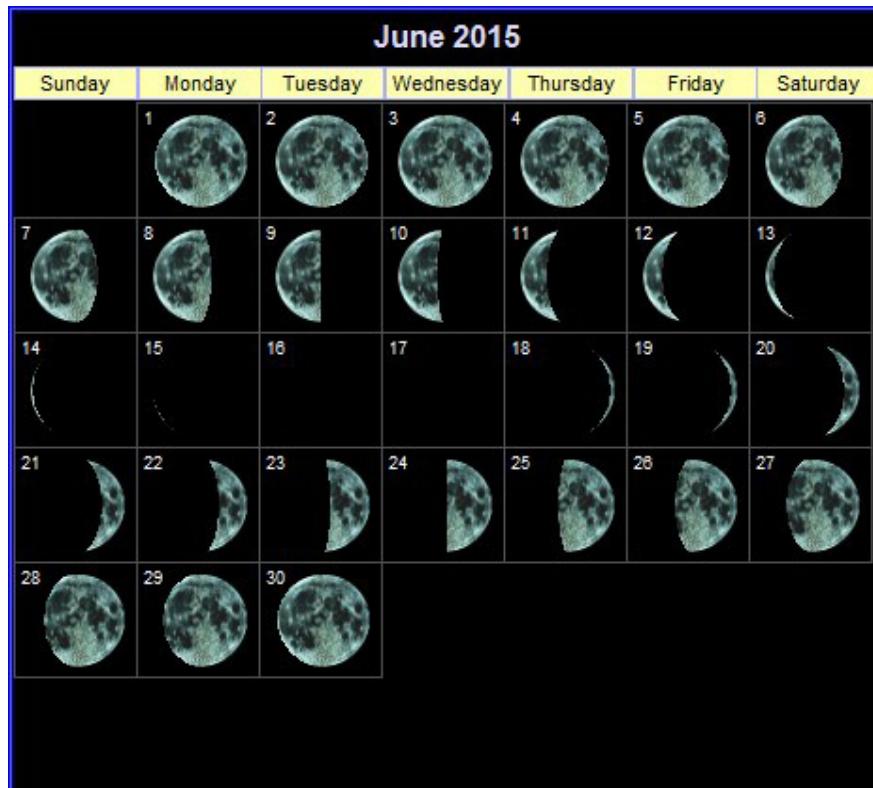
If you are able to observe in h-alpha the rewards are much greater.

Keep in touch with the Solar Dynamics Observatory satellite at <http://sdo.gsfc.nasa.gov/>
Add the “Spaceweather” and the “Soho Lasco C3” websites to your “favourite” websites.

The Moon.

Phases:

Full	02 ^d 16 ^h 19 ^m
Last Quarter	09 ^d 15 ^h 42 ^m
New	16 ^d 14 ^h 05 ^m
First Quarter	24 ^d 11 ^h 03 ^m



Produced using LunarPhase Pro.

Apsides:

Perigee	10 ^d 05 ^h	Diameter. 32' 18"	Distance. 369,713km.
Apogee	23 ^d 17 ^h	Diameter. 29' 33"	Distance. 404,136km.

The Moon continued.

For northern observers:

- The waxing crescent Moon is well placed.
- The waxing gibbous Moon is becoming less well placed.
- The Full Moon is less well placed.
- The waning gibbous Moon is less well placed.
- The waning crescent Moon is 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. Disappearance is behind the dark limb (DD) of the Moon unless otherwise stated. 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*.

Opportunities and Challenges.

On 14th and 15th (very difficult) try locating the very thin crescent Moon very low in the NE dawn skies **before sunrise**.

On 17th (difficult) and 18th try locating the very thin crescent Moon in the NW evening twilight **after sunset**.

From 19th to 21st the crescent Moon tracks past Venus and Jupiter.

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

The Planets.

Mercury.

Reappears low in ENE dawn twilight at start of month.

Greatest Elongation W (22°) on 24th.

Not a favourable apparition for UK observers.

Moon close on 14th & 15th.

Date.	Mag.	Dia.	Phase.	Rise.	Transit.	Set.
14	+1.85	10"	0.16	03 ^h 12 ^m	10 ^h 47 ^m	18 ^h 22 ^m
24	+0.55	8.1"	0.36	02 ^h 44 ^m	10 ^h 30 ^m	18 ^h 18 ^m

With fuel exhausted the Messenger Spaceprobe completed its very successful mission and was crashed into Mercury. Keep in touch with returned data <http://messenger.jhuapl.edu>

Venus.

Brilliant object dominating W evening twilight.

Greatest Elongation W (45°) on 6th.

Skirts the edge of M44 on 13th and 14th.

The crescent Moon tracks past Venus and Jupiter from 19th to 21st.

Very close Conjunction with Jupiter at end of month passing 21 arcminutes S on 30th. Both planets will have similar apparent diameter with Venus a distinct crescent and Jupiter slightly gibbous.

Imaging opportunities abound!

Observe and image the waning crescent with increasing apparent diameter up to inferior conjunction on 15th August.

Using suitable filters, IR and UV, it is possible to image details in the Venusian atmosphere. Excellent guide by Damian Peach in the June issue of *Astronomy Now*.

Moon close on 20th.

Date.	Mag.	Dia.	Phase.	Rise.	Transit.	Set.
01	-4.3	22"	0.53	06 ^h 56 ^m	15 ^h 17 ^m	23 ^h 38 ^m
06	-4.3	23"	0.50	07 ^h 05 ^m	15 ^h 18 ^m	23 ^h 30 ^m
30	-4.4	32"	0.34	07 ^h 38 ^m	15 ^h 03 ^m	22 ^h 27 ^m

Mars.

Not observable.

Conjunction with the Sun on 14th.

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

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

The Opportunity rover continues its exploration.

Mission details and progress are on the appropriate NASA websites.

Jupiter.

An early evening object presenting a fine aspect on borders of Cancer and Leo.

Heading into evening twilight so make the most of the few weeks to observe and/or image.

Very close Conjunction with Venus at end of month passing 21 arcminutes N on 30th. Both planets will have similar apparent diameter with Venus a distinct crescent and Jupiter slightly gibbous.

The crescent Moon tracks past Venus and Jupiter from 19th to 21st.

Imaging opportunities abound!

Moon close on 20th.

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

Date.	Mag.	Dia.	Phase.	Rise.	Transit.	Set.
01	-1.9	35"	-	09 ^h 07 ^m	16 ^h 40 ^m	00 ^h 18 ^m
30	-1.8	32"	-	07 ^h 40 ^m	15 ^h 05 ^m	22 ^h 30 ^m

Saturn.

Located on the borders of Libra and Scorpius.

Just past opposition (23rd May) so available for observation and/or imaging throughout the short hours of darkness although its low declination does not favour UK observers.

Fine aspect with rings “open” presents an excellent target for imaging.

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

Moon close on 1st and 28th.

Date.	Mag.	Dia.	Phase.	Rise.	Transit.	Set.
01	+0.1	19"	-	18 ^h 55 ^m	23 ^h 18 ^m	03 ^h 46 ^m
30	+0.2	18"	-	16 ^h 51 ^m	21 ^h 17 ^m	01 ^h 16 ^m

Don't forget to visit the Cassini mission websites at <http://saturn.jpl.nasa.gov> and <http://ciclops.org>

Uranus.

Emerging low in E predawn skies.

Moon very close 11th & 12th.

Date.	Mag.	Dia.	Phase.	Rise.	Transit.	Set.
01	+5.9	3.4"	-	01 ^h 57 ^m	08 ^h 36 ^m	15 ^h 15 ^m
30	+5.8	3.5"	-	00 ^h 05 ^m	06 ^h 45 ^m	13 ^h 26 ^m

Neptune.

Low in the SE predawn skies.

Moon close 8th & 9th.

Date.	Mag.	Dia.	Phase.	Rise.	Transit.	Set.
01	+7.9	2.3"	-	00 ^h 53 ^m	06 ^h 11 ^m	11 ^h 29 ^m
30	+7.9	2.3"	-	22 ^h 59 ^m	04 ^h 17 ^m	09 ^h 34 ^m

Dwarf Planets.

Ceres. Located in Capricornus. Mag +7.5 to +7.2. Keep in touch with DAWN website.

Eris (2003 UB313). Too close to the Sun to be imaged.

Haumea. A CCD target located in Bootes.

MakeMake. A CCD target in Coma Berenices.

Pluto. A mag +14 CCD target in Sagittarius. Heading towards opposition on 6th July.

Keep in touch with “New Horizons” as it heads towards “Fly-By” on 14th July.

Asteroids. (Mag +10.5 or brighter).

Vesta (4). Located in Pisces. Mag +6.9 to +6.70.

Nemaura (51). Located in Ophiuchus. Mag +10.4 at opposition on 9th. Passes about 1½° S of the globular cluster M10 at the end of the month.

Pallas (2). Located in Hercules. Mag +9.4 at opposition on 12th.

Antigone (129). Located in Serpens Cauda. Mag +9.8 at opposition on 19th.

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 C/2014 Q2 LOVEJOY. At about 8th magnitude now a telescopic object fading slowly as it moves slowly through Ursa Minor. About 2° from Polaris on 1st, ¼° from Kochab (+2.1) at end of month.

A most welcome visitor to the inner Solar System over the last few months

Keep in touch with the Rosetta mission as it closes in on **C67P/Churyumov-Gerasimenko**.

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 **Ophiuchids** are active from mid May to July with two peaks of activity on 10th June, ZHR = 5, and 20th, ZHR = 5. Weak activity and best seen by southern observers.

The **June Lyrids** are active from 11th to 21st with peak activity on the night of 15th/16th, ZHR = 8. Following high activity in the 1960s rates rapidly declined. Not now well observed so with a New Moon on 16th will be worth observation (if clear!) to ascertain current rates.

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.

No eclipses this month.

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 less well placed for observation as Perseus sinks into the NW by late evening. A Minima at “social hours” occurs on 11^d 22.0^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.

2.2 Double Stars of the month.

Epsilon Boo. See notes below.

Xi Boo. See notes below.

Nu Dra. See notes below.

Alpha Her. See notes below.

Kappa Her. See notes below.

Alpha Lib. See notes below.

Delta SerCp. See notes below.

Alpha Sco. See notes below.

Beta Sco. See notes below.

Alpha UMi. See notes below.

A project for the OUAC Deep Sky Project Group is to image (especially the more colourful) and measure a range of the double stars.

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

Bootes (Boo).

Noted for the first magnitude star Arcturus, distinctly orange, which at magnitude -0.04 makes it the fourth brightest star in the sky (Sun excluded).

Kappa (κ) ds. 4.6/6.6; separation 13.4". White primary with bluish secondary.

Xi (ξ) ds. 4.7/7.0; separation 6.6". Yellow and reddish orange pair.

Epsilon (ε) ds. 2.9/4.9; separation 2.8". Contrasting yellow and bluish pair.

Mu (μ) ts. 4.3/7.0/7.6; separation AB 108.3", BC 2.3". A = yellowish, B = yellowish, C = orange.

Iota (ι) ds. 4.9/7.5; separation 38.5". Yellowish primary with bluish secondary.

Pi (π) ds. 4.9/5.8; separation 5.6". Fine pair of white stars.

There are few bright star clusters, galaxies or nebulae to locate.

NGC5466 (9.1) gc. Although fairly large its low surface brightness object makes this a difficult object in small telescopes. Locate M3 in Canes Venatici and move 40' east.

NGC5248 (10.2) sg. The brightest galaxy in Bootes. Bright round hub surrounded by oval haze. Excellent target for large telescopes (12"+) from dark sites.

NGC5660 (11.8) sg. 1° NW of the brighter NGC5676 which should be located first.

NGC5676 (10.9) sg. Bright nucleus surrounded by slight haze.

NGC5669 (11.2) sg. About 1° SE of NGC5676. Barred spiral seen almost edge-on.

Corona Borealis (Cor).

An easily recognized attractive circlet of moderately bright stars.

Two variable stars of interest are the R CrB and T CrB.

R CrB is normally around 6th magnitude remaining almost constant for even periods of years. However it can abruptly plunge to 14th or 15th magnitude and then slowly recover to the norm, often with "relapses". Well worth a nightly check.

T CrB is a recurrent nova. Normally about 10th magnitude it can suddenly brighten without warning and reach magnitude 2 or 3 as in 1866 and 1946. Lesser "outbursts" occurred in 1963 and 1975. Another well worth monitoring.

Zeta (ζ) ds. 5.1/6.0; separation 6.3". Blue and green pair.

Sigma (σ) ds. 5.6/6.6; separation 7.1". Pale yellow and deep yellow pair.

Struve (Σ) 1932 ds. 7.3/7.4; separation 1.6". Close pair of yellow stars.

Draco (Dra).

Alpha (α) Thuban. Although only a third magnitude object, 5000 years ago Thuban held the distinction of being the Pole Star. Its designation alpha is strange as it is only the seventh brightest star in the constellation.

Mu (μ) ds. 5.6/5.7; separation 1.9". Pair of white stars.

Nu (ν) ds. 4.9/4.9; separation 61.9". Pair of bright white stars.

Psi (ψ) ds. 4.9/6.1; separation 30.3". Pair of yellowish stars.

16 & 17 ds. 5.4/5.5; separation 90.3". Pair of bright white stars.

40 & 41 ds. 5.7/6.1; separation 19.3". Pair of pale yellow stars.

Struve (Σ) 2155 ds. 6.8/10.1; separation 9.8". Pale yellow and blue pair.

NGC4236 (9.6) sg. Seen almost edge and low surface brightness makes it a test for moderate apertures.

NGC4319 (11.9) sg. Elongated haze with prominent core. A Quasar, Makarian 205 (14.5) lies 40" to the south.

Draco continued.

NGC5866 (**M102**) lg. Elongated object. One of the missing Messier objects.

NGC5907 (10.3) sg. Thin needle of light. A fine edge-on galaxy.

NGC6503 (10.2) sg. Distinctly elongated.

NGC6543 (8.1) pn. The Cats Eye Nebula. Bright small disc with greenish tint. 11th magnitude central star. Draco's "Showpiece object".

Hercules (Her).

Alpha (α) ds. 3.5/5.4 separation 4.7". Orange and blue. The primary is a semi regular variable 3.1 to 3.9 approx period 90 days.

Gamma (γ) ds. 3.8/9.8; separation 41.6". Unequally bright pair of yellow stars. Part of a triple system.

Delta (δ) ds. 3.1/8.2 separation 8.9". White primary with bluish-purple secondary. Part of a multiple system.

Kappa (κ) ds. 5.3/6.5; separation 28.4". Fine pair of yellow stars. Part of a triple system.

Mu (μ) ds. 3.4/10.1 separation 10.1". Yellow primary. Secondary 1" wide pair of red stars. Part of a quad system.

Rho (ρ) ds. 4.6/5.6 separation 4.1". White pair. Part of a triple system.

56 Herculis ds. 6.1/10.6 separation 18.1". Fine contrasting orange and blue pair.

100 Herculis ds. 5.9/6.0 separation 14.2". Matched pair of white stars.

NGC6205 (**M13**) (5.9) gc. Arguably one of the outstanding objects in the northern hemisphere. Just visible to the naked eye from dark sites it appears as a fuzzy blob in binoculars. It stands high power well and the outer edges begin to resolve into individual stars in a 4" (100mm) telescope. Increasing aperture brings greater rewards. Lord Rosse and others using the 72" at Birr Castle in the 19th century observed three dark rifts radiating from the centre. Later visual observers confirmed these. However with the advent of photography the rifts disappeared. In the 1950's the late Walter Scott Houston in his "Sky and Telescope" column revised interest in the "propeller". Responses indicated that visibility of the rifts depended on a careful balance of aperture and magnification. Today a dark sky is probably a key factor.

NGC6207 (11.6) sg. 40" to the NE of M13 and in the same field as a low power widefield eyepiece. This moderately bright galaxy is often overlooked due to the spectacular blaze of the much closer globular cluster.

NGC6210 (9.3) pn. Located about 4° NE of beta (β) Her.

NGC6229 (9.4) gc. Located about 7° NW of M13 and well worth locating and imaging.

NGC6341 (**M92**) (6.5) gc. Slightly fainter and smaller than M13 this globular cluster deserves equal attention. It starts to resolve in a 6" telescope at high power and becomes increasingly impressive with increased aperture.

The area around M13 contains a number of faint galaxies requiring a large (12"+) telescope to explore. Identity of the objects can prove interesting as some are wrongly labelled on some charts and catalogues.

Abell 2151. The Hercules Galaxy Cluster.

Libra (Lib).

Alpha (α) ds. 2.8/5.2 separation 231.0''. White and yellow pair easily seen in binoculars.

Delta (δ) vs. 4.9 to 5.9 period 2.33 days. Algol-type eclipsing binary. Fall to minimum takes six hours.

Mu (μ) ds. 5.8/6.7 separation 1.8''. Pair of white stars requiring high power and good seeing to split.
HN 28 ds. 5.7/8.0 separation 23.0''. Beautiful bright orange and red pair. Fine object for small telescopes.

Struve (Σ) 1962 ds. 6.5/6.6 separation 11.9''. Fine matched pair of yellow stars.

NGC5812 (11.2) eg. Circular halo with stellar nucleus.

NGC5878 (11.5) sg. Thin oval haze with stellar nucleus.

NGC5897 (8.6) gc. Diffuse halo with poorly concentrated core.

NGC5898 + NGC5903 (11.4/11.1) sg + sg. Visible in the same field of view 5898 has a round halo with slightly brighter nucleus whereas 5903 is elongated halo with a stellar nucleus.

Ophiuchus (Oph).

Barnard's Star. (9.5). Located at R.A. 17h 58m Dec. +04° 41m. A red dwarf with the largest proper motion of any star in the sky as seen from the Earth.

Lambda (λ) ds. 4.2/5.2 separation 1.5''. White and pale yellow pair. Part of a quadruple system.

Omicron (ω) ds. 5.4/6.9 separation 10.3''. Fine contrasting pair of orange and yellow stars.

Rho (ρ) ds. 5.3/6.0 separation 3.1''. Close pair of blue stars.

NGC6171 (**M107**) (8.1) gc. Granular texture with brighter core in small apertures.

NGC6218 (**M12**) (6.6) gc. Outer reaches resolved in medium apertures showing with a small core.

NGC6254 (**M10**) (6.6) gc. Granular halo with bright core. Outer reaches resolved in small apertures.

NGC6266 (**M62**) (6.7) gc. Bright off centre core with fainter halo.

NGC6273 (**M19**) (7.1) gc. Small bright globular. Outer reaches begin to resolve in small apertures.

NGC6333 (**M9**) (7.9) gc. Large bright core. Nearby is the dark nebula Barnard 64.

NGC6356 (8.4) gc. Requires large apertures to resolve.

NGC6402 (**M14**) (7.6) gc. Requires large aperture to resolve. The most distant of the Messier gc's.

NGC6572 (8.1) pn. Fine bright greenish object.

NGC6633 (4.6) oc. Large, bright but loose open cluster well suited for small aperture.

Scorpius (Sco).

Alpha (α) Antares ds. 1.2/5.4 separation 2.9''. Red-orange primary with fainter greenish companion. Difficult to split requiring very good seeing conditions.

Beta (β) ds. 2.6/4.9 separation 13.6''. Blue-white primary with pale blue companion. Fine object for small telescopes.

Nu (ν) 4.3/6.8 separation 2.3'' ds. Pair of white stars requiring good seeing conditions to split.

NGC6093 (**M80**) (7.2) gc. Fine object unfortunately not well seen from the UK.

NGC6121 (**M4**) (5.9) Fine globular unfortunately not well seen from the UK.

NGC6405 (**M6**) (4.2) oc. Unfortunately it briefly creeps above the southern horizon making it very difficult to observe from the UK.

NGC6475 (**M7**) (3.3) oc. Another fine object that unfortunately briefly creeps above the southern horizon making it very difficult to observe from the UK.

Serpens Caput (SerCp).

Beta (β) ds. 3.7/9.9; separation 30.6". Pale yellow primary with blue secondary.

Delta (δ) ds. 4.2/5.2; separation 4.4". Fine pair of yellow stars.

5 Serpentis ds. 5.1/10.1; separation 11.2". Yellow primary with reddish secondary. Situated in same field as M5.

NGC5904 (**M5**) (5.8) gc. Splendid object which stands high magnification.

NGC5921 (10.8) sg. Faint oval halo with bright core.

Ursa Minor (UMI).

This faint, small kite shaped constellation lies between Ursa Major and α UMi, Polaris the Pole Star. Polaris marks the end of the tail.

Eta (η) at magnitude 4.9 is often used as a convenient test of sky conditions.

Alpha (α) Polaris ds.2.0/8.2; separation 18.4“.

Pi-1 (π^1)ds. 6.6/7.3; separation 31.1". Yellow primary with white companion.

h (Herschel) 2682 ts. 6.7/9.7; separation 26.3". White primary with two blue companions.

See note above for **Comet C/2014 Q2 LOVEJOY**.

PVH.