

“ $\Omega > 1$ ”

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

May 2016.

Forthcoming Meetings.

OUAC.

The next “Clubnight” is on Tuesday 3rd May.

BAA.

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

Highlights of the Month.

5 th /6 th	Peak of eta Aquarids meteor shower.
9 th	Transit of Mercury!
22 nd	Mars at Opposition.
Mid-May.	Start of the new season of Noctilucent clouds.
Jupiter	Prominent object moving in evening skies.
Saturn	Approaching Opposition on 3 rd June.

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.

Earth.

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.

Mid-month sees the return of the Noctilucent Cloud season. 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 are very photogenic.

ISS.

From mid-month the ISS will begin a series of Morning passes. 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 -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	04 ^h 31 ^m	11 ^h 59 ^m	19 ^h 28 ^m
08	04 ^h 18 ^m	11 ^h 59 ^m	19 ^h 39 ^m
15	04 ^h 07 ^m	11 ^h 58 ^m	19 ^h 50 ^m
22	03 ^h 57 ^m	11 ^h 59 ^m	20 ^h 01 ^m
29	03 ^h 50 ^m	11 ^h 59 ^m	20 ^h 10 ^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.

Current (30th April) low activity.

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

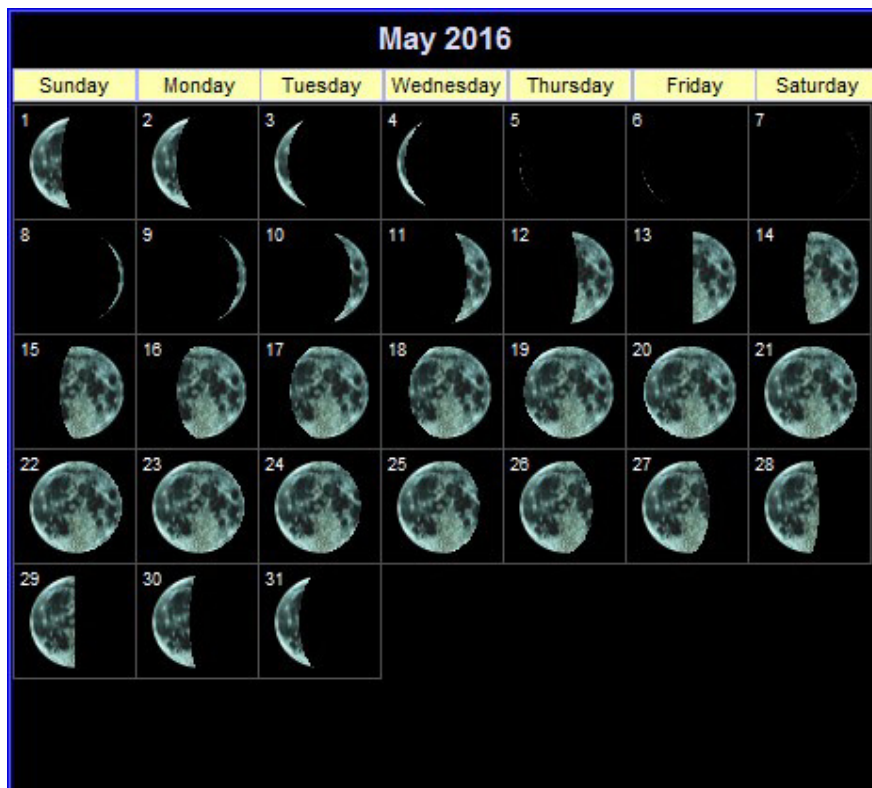
Keep in touch with the Solar Dynamics Observatory satellite at <http://sdo.gsfc.nasa.gov/>

Add the “Spaceweather” and the “Soho Lasco C3” websites to your “favourite” websites.

The Moon.

Phases:

New	06 ^d 19 ^h 30 ^m
First Quarter	13 ^d 17 ^h 02 ^m
Full	21 ^d 21 ^h 14 ^m
Last Quarter	29 ^d 12 ^h 12 ^m



Produced using LunarPhase Pro.

The Moon continued.

Apsides:

Perigee	06 ^d 04 ^h	Diameter. 33' 24"	Distance. 357,827km.
Apogee	18 ^d 22 ^h	Diameter. 29' 26"	Distance. 405,932km.

For northern observers:

The waxing crescent Moon is very well placed providing excellent opportunities for observing and imaging this phase.

The waxing gibbous Moon is well placed.

The Full Moon is less well placed.

The waning gibbous Moon is less well placed.

The waning crescent Moon is becoming better 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.

Date. ZC No. Name. Mag. Time.

No major "Highlights" this month.

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

Observing Opportunities and Challenges.

On 4th and 5th (very difficult) try locating the very thin crescent Moon very low in the SE dawn skies **before sunrise**.

On 7th (very difficult) & 8th try locating the very thin crescent Moon in the NW evening twilight **after sunset**.

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

The Planets.

Mercury.

Inferior Conjunction on 9th when a rare Transit across the Solar disc takes place.

Timings as follows:

First contact: 11^h 12^m 18^s. Ingress starts.

Second contact: 11^h 15^m 30^s.

Greatest Transit: 14^h 57^m 25^s.

Third contact: 18^h 39^m 12^s.

Fourth contact; 18^h 42^m 24^s. Egress over.

All the above times taken from the BAA *Handbook* are UT so add one hour to convert to BST.

The complete transit is visible from the UK so even allowing for our variable weather there is a very good chance see part of the event.

The 12" disc is unlikely to be spotted without optical aid.

Please make the most of opportunities to obtain a series of images of the event. Key stages are initial contact, greatest transit and final contact. Between these stages images taken every 30 minutes or so will provide a worthwhile record. Keep a record of location, equipment used, timings, camera settings and observing conditions. Don't forget visual observation and associated notes and sketches!

Reports and images for the Club Website and the June "Clubnight" will be most welcome!

Remember the transit involves observing the Sun so 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.

For more information see the BAA *Handbook*, May issues of *Astronomy Now* and *Sky at Night* (includes article on astrophotography of the transit) magazines.

Excitement over!

Later in the month Mercury reappears low in E dawn twilight mid-month but difficult to spot.

Moon close on 7th.

Date.	Mag.	Dia.	Phase.	Rise.	Transit.	Set.
24	+1.9	11"	0.16	03 ^h 33 ^m	10 ^h 44 ^m	17 ^h 56 ^m
31	+1.00	9.1"	0.28	03 ^h 14 ^m	10 ^h 28 ^m	17 ^h 43 ^m

Keep in touch with data and images from the Messenger Spaceprobe at <http://messenger.jhuapl.edu>

Venus.

Too close to the Sun to be observed as it approaches Superior Conjunction on 6th June.

Moon close on 6th.

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

Mars.

At Opposition on 22nd.

Although low declination does not favour N hemisphere observers make the most of opportunities to observe and image.

Moon close on 21st/22nd.

Date.	Mag.	Dia.	Phase.	Rise.	Transit.	Set.
01	-1.5	16"	0.98	21 ^h 43 ^m	01 ^h 48 ^m	05 ^h 49 ^m
22	-2.1	18"	1.00	19 ^h 54 ^m	00 ^h 01 ^m	04 ^h 01 ^m
31	-2.00	19"	1.00	19 ^h 03 ^m	23 ^h 06 ^m	03 ^h 14 ^m

The Mars **Curiosity** and **Opportunity** rovers continue their exploration of the Martian surface and return excellent data and images.

Mission details and progress are on the appropriate NASA websites.

Jupiter.

Well placed for evening observation and imaging.

Fine aspect in S Leo. Worth a wide field image

Excellent target for imaging.

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

Moon close on 14th/15th.

Date.	Mag.	Dia.	Phase.	Rise.	Transit.	Set.
01	-2.6	41"	-	13 ^h 38 ^m	20 ^h 22 ^m	03 ^h 09 ^m
31	-2.1	37"	-	11 ^h 44 ^m	18 ^h 26 ^m	01 ^h 12 ^m

Saturn.

Approaching Opposition on June 3rd.

It is well worth visual observing around the days of opposition as at opposition the rings appear much brighter – the “**Seeliger effect**”. The reasons for the phenomenon are complex involving backscatter of sunlight, polarization and interference effects.

Fine aspect with rings “open”.

Although low declination does not favour N hemisphere observers make the most of opportunities to observe and image.

Excellent target for imaging.

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

Moon close on 22nd/23rd.

Date.	Mag.	Dia.	Phase.	Rise.	Transit.	Set.
01	+0.2	18"	-	22 ^h 10 ^m	02 ^h 21 ^m	06 ^h 28 ^m
31	+0.0	18"	-	20 ^h 02 ^m	00 ^h 15 ^m	04 ^h 23 ^m

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

Uranus.

Emerging into the E predawn skies at the end of the month.
Moon close 5th.

Date.	Mag.	Dia.	Phase.	Rise.	Transit.	Set.
31	+5.9	3.4''	-	02 ^h 05 ^m	08 ^h 51 ^m	15 ^h 38 ^m

Neptune.

Emerging into the SE predawn skies during the month.
Moon close 2nd/ 3rd and 29th/30th.

Date.	Mag.	Dia.	Phase.	Rise.	Transit.	Set.
15	+7.9	2.3''	-	02 ^h 00 ^m	07 ^h 22 ^m	12 ^h 44 ^m
31	+7.9	2.3''	-	00 ^h 58 ^m	06 ^h 20 ^m	11 ^h 42 ^m

Dwarf Planets.

Ceres. Too close to the Sun for observation.

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.

Asteroids. (Approx mag +10.5 or brighter).

Vesta (4). Too close to the Sun for observation.

Flora (8). Located in Ophiuchus. Mag +9.4 at opposition on 11th. Passes N of M9 mid-month.

Interamnia (704). Located in Sagittarius. Mag +10.4 at opposition on 18th. Not well placed for N observers.

Eleonora (354). Located in Serpens Caput. Mag +10.7 at opposition on 26th. Passes S of eta Ser (+3.3) on 22nd – 23rd.

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.

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 **eta Aquarids** are active from 24th April to 20th May with peak activity on 5th – 6th May, ZHR = 40. A fine “Southern” shower. Associated with Halley’s Comet. Predawn observation with little 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.

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. Favourable minima at “social hours” occur on 23^d 20.5^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.

Alpha CVn. See notes below.

2 CVn. See notes below.

24 Com. See notes below.

35 Com. See notes below.

Delta Crv. See notes below.

Epsilon Hya. See notes below.

Xi UMa. See notes below.

Zeta UMa “Mizar”. See notes below.

Gamma Vir “Porrina”. See notes below.

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 5° 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.

Canes Venatici (CVn).

α CVn ds. +2.9/+5.5, separation 19.6". Cor Coroli (Heart of Charles), A fine bluish-white and white double star.

2 CVn ds. +5.8/+8.10, separation 11.4". Fine contrasting deep yellow and pale blue pair.

25 CVn ds +5.0/+6.9, separation 1.8". Pale yellow pair almost in contact in a 6" (150mm) telescope.

NGC4111 (10.7) sg. Almost stellar nucleus in a bright core surrounded by an elongated halo.

NGC4151 (11.2) sg. Barred spiral with a bright nucleus.

NGC4215 (10.5) ir. Located south and slightly west of NGC4244.

NGC4244 (10.7) sg. Spiral galaxy seen edge-on appearing as a needle of faint light. Fine object whose appearance brightens with increasing aperture.

NGC4258 (**M106**) (8.3) sg. Large inclined galaxy located about 5° east of χ UMa on the borders of Canes Venatici and Ursa Major.

NGC4395 (11.0) sg. Bright core with a low surface brightness circular halo.

NGC4449 (10.5) ir. Appears almost rectangular making it an unusual object to view.

NGC4485 (12.5) ir and NGC4490 (10.1) sg. Interacting pair of galaxies.

NGC4631 (9.7) sg and NGC4656 (10.4) pc. are a fine example of a pair of interacting galaxies, both edge-on to our view, located mid-way between Cor Coroli and the Coma star cluster. One end of NGC4656 has a distinct hook which may be glimpsed in 8" telescopes under good seeing conditions.

NGC4736 (**M94**) (8.2) sg. Locate β CVn and move 3° east to locate the tightly wound spiral galaxy which has a very bright core. 16" (40cm) telescopes reveal a hazy ring infilled with dusky mottling surrounding the core.

NGC5005 (10.8) sg. Located to the SE of α CVn. Bright oval core with stellar nucleus.

NGC5033 (11.0) sg. Appears in the same low power wide field as NGC5005.

NGC5055 (**M63**) (8.6) sg. Easily located 5° east and slightly north of M94. Stellar nucleus in an oval core surrounded by fainter halo.

Canes Venatici continued.

NGC5194 (**M51**) (8.4), sg and NGC5195 (9.3). Interacting pair of galaxies. Aptly named the Whirlpool galaxy M51 was the first galaxy to have its spiral structure recognized. (Lord Rosse 1845). To locate the pair use the bright star η UMa at the end of the Plough and move about 4° SW. Both objects are visible in binoculars. A 12" (30cm) telescope will begin to show the subtle spiral structure and the tenuous bridge between the two galaxies.

NGC5198 (11.8) sg. Faint circular halo with faint stellar nucleus.

NGC5272 (**M3**) (6.4) gc. Superb globular cluster easily seen as a fuzzy spot in binoculars. 12" telescopes will almost resolve this cluster to its core. To locate it move about half the distance between Cor Coroli and the first magnitude star Arcturus (0.0). Often observed as a fine end to a tour of this constellation.

NGC5353/5354 (11.0/11.4) sg/sg. Close pair of interacting galaxies.

Coma Berenices (Com).

To the east of Leo a closer inspection of what at first appears to a casual glance to be a large hazy patch reveals a beautiful scattering of moderate to faint stars. This is the Coma star cluster (Mel 111) best seen in binoculars and well worth a wide field image.

2 Com ds (6.0, 7.5) separation 3.6". Use high power when seeing is good.

24 Com ds. (5.0,6.5) separation 20.3" Wide contrasting yellow and blue pair.

35 Com ds. (5.1,7.2) separation 1.2". Yellow and purple (deep blue).

Σ 1615 ds. 6.9/9.7; separation.26.7" Yellowish primary with pale blue companion.

Burnham (β) 800 ds. 6.6/9.7; separation 106". Orange and red pair. A third component (10.5) lies 92.5" north of the primary.

Coma is a fine hunting ground for galaxies plus a very fine globular cluster.

Start your search from the second magnitude star β Leo (Denebola). Move about 6° east to reach a 5th magnitude star.

NGC4192 (**M98**) (10.1) sg. Appears just before reaching the 5th magnitude star. Seen almost edge-on. Low surface brightness so can easily be missed on first inspection.

NGC4254 (**M99**) (9.8) sg. Slightly southeast of the 5th magnitude near M98. Bright nucleus surrounded by an outer haze.

NGC4321 (**M100**) (9.4) sg. From the 5th magnitude star move 5° northeast. Seen almost face on.

NGC4501 (**M88**) (9.5) sg. Located 4° east of M99. Inclined to our line of sight. Broad central glow surrounded by fainter envelope. Stands high magnification well.

Now examine the rest of Coma.

NGC4274 (10.4) sg. Thin streak of light brightening towards its centre.

NGC4725 (9.4) sg. Bright halo brightening further towards centre.

NGC4559 (10.5) sg. Bright oval smudge. Mottled appearance in large telescopes.

NGC4565 (10.5) sg. One of the finest "edge-on" spiral galaxies. Appears as a thin needle of light with the hint of a central bulge. Moderate apertures begin to show a dark dust lane. The North Galactic Pole is located a few degrees to the East.

NGC4826 (**M64**) (8.6) sg. This bright galaxy is located almost halfway between M53 and NGC4565. Nicknamed the "Black-eye galaxy" because of its appearance due to a dust lane which is visible in 6" and larger telescopes.

NGC5024 (**M53**) (7.7) gc. Locate α Com in the southeast corner of the constellation and move just a little to the northeast. Binoculars will show a fuzzy blob. Moderate aperture telescopes will begin to resolve the cluster into individual stars. Before packing up try to locate:-

NGC5053 (8.7) gc. Rather sparse globular cluster located 1° to the ESE of M53. Not an easy object in smaller telescopes which provides the challenge.

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.

Corvus (Crv).

Delta (δ) ds.3.0/9.2; separation 24.2". White primary with faint pale blue secondary.

Struve (Σ) 1669 ds. 6.0/6.1; separation 5.4". Fine pair of yellow stars.

NGC4027 (11.2) sg. Slightly elongated.

NGC 4038/4039 (10.5/10.3) sg/ir. "The Antennae". A fine example of a pair of interacting (colliding?) galaxies.

NGC4361 (10.3) pn. A fine planetary nebula. 8" telescopes should reveal the +13.2 central star.

NGC4782/4783 eg/sg. (11.7/11.5). Another pair of interacting galaxies.

Crater (Crt).

Gamma (γ) ds. 4.1/9.6; separation 5.2". Attractive white primary with blue secondary.

NGC3511 (11.0) sg. Elongated.

NGC3513 (11.5) sg. In the same field as NGC3511. Almost circular.

NGC3672 (11.4) sg. Elongated.

NGC3887 (10.6) sg. Slightly elongated.

NGC3955 (11.3) sg. Highly elongated.

NGC3962 (10.7) eg. Circular halo with bright core.

Hydra (Hya).

This constellation straggles its way across the southern winter/spring skies. The moderately bright stars forming the monsters head are located east of Procyon. α Hya is located some 15° SE of the head.

Epsilon (ϵ) qs. 3.8/4.7/6.8/12.4. Located in the "head" about five degrees south of M67 in Cancer.

NGC2548 (**M48**) (5.8) oc. A fine open cluster containing some 80 stars. To locate form an equilateral triangle (apex south) with M48 as the apex, Procyon and the hydra's head as the other corners.

NGC3242 (8.6) pn. Nicknamed "The Ghost of Jupiter" as it appears similar in size to the planet. Bright bluish object with irregular edges. The 12th magnitude central star is prominent in 8" and larger telescopes.

NGC4590 (**M68**) (8.2) gc. Located about 4° south of β Crv. Not well seen from UK latitudes.

Ursa Major (UMa).

Zeta (ζ) UMa, Mizar ds. +2.3/+4.0, separation 11.8". Closer naked eye inspection shows that Mizar (2.3) has a fainter companion named Alcor (4.0). The pair provides a good test for reasonable eyesight. The pair form an optical double i.e. a line of sight effect and not physically associated. Through large binoculars and small telescopes Mizar itself is shown to have a fourth magnitude companion, separation 14", forming a true binary system. Each is a spectroscopic binary.

Xi (ξ) ds. 4.3/4.8; separation 1.8". Close pair of golden stars.

NGC3031 (**M81**) (6.9) sg. One of the more beautiful spiral galaxies seen almost face on. It hosted a supernova in 1993 that reached about 12th magnitude making it visible in small telescopes.

NGC3034 (**M82**) (8.4) ig or sg? An intriguing object that even in moderate apertures appears "strange". It may be an irregular or small spiral galaxy. Once thought to be an exploding galaxy, current theory favours a "starburst galaxy" ie a galaxy undergoing an intense period of star formation.

M81 and M82 are bright enough to be seen in binoculars and close enough to be viewed in the same low power field of a telescope. They are probably physically associated in space. A photograph with both in the same field of view makes for an interesting comparison.

NGC 3077 (9.8) eg. Visible on the edge of the same field as M81 and M82 at low power.

About 2° SE of β UMa a low power field will reveal two very different deep-sky objects:

NGC3556 (**M108**) (10.7) sg. Seen almost edge-on.

NGC3587 (**M97**) (12.0) pn. The "Owl Nebula". Two dark patches in the ghostly disc give the distinct impression of two large eyes requiring moderate apertures to see. It is one of the faintest of the Messier objects.

NGC3992 (**M109**) (10.6) sg. About a degree SE of γ UMa this object is best observed using high power to remove the bright star (a natural form of light pollution!) out of the field of view.

NGC5457 (**M101**) (7.7) sg. About 6° east and slightly north of Mizar. Although large because it is face-on it has a low surface brightness making observation slightly more difficult than one might at first expect.

M40 A pair of ninth magnitude stars just over a degree NE of δ UMa.

Virgo (Vir).

Gamma (γ) Porrima. ds. +3.5/+3.5, separation 2.4". Separation continues to increase so that the equally matched yellowish pair should be easily resolved.

Phi (ϕ) ds. 4.8/+9.3, separation 4.8". Yellow primary, deep yellow secondary.

Theta (θ) ds. 4.4/+4.9, separation 7.1". Fine white primary with yellow companion. A third component bluish +12.4 lies 93" distant.

17 ds. 6.6/9.4; separation 20.0". Yellow primary with white companion.

54 ds. +6.8/+7.3, separation 5.4". Fine pale yellow pair.

84 ds. 5.5/7.9; separation 2.9". Orange primary with yellow companion.

Σ 1627 ds. 6.6/6.9; separation 20.1". Wide pair of yellow stars.

Σ 1788 ds. 6.5/7.7; separation 3.4". Close pair of yellow stars. Part of a quadruple system.

The Virgo Supercluster of galaxies, which extends into the neighbouring constellation of Coma Berenices, contains in excess of a thousand galaxies. Our own Local Group of galaxies is probably an outlying "village" of this "Grand Metropolis".

Virgo and Coma provide the chance to collect a "hatful" of Messier objects in the same area of the sky. Star hopping skills will be well exercised. One note of caution though - there are numerous other galaxies bright enough to be detected in small and moderate instruments to cause confusion if care is not taken! Correct identification of objects in a crowded field presents a very rewarding challenge.

Virgo continued.

If at any time you get lost in your exploration don't panic or become dejected. Simply return to a known reference point and start again. Confidence is only gained through practice.

I recommend the following as a route for exploration.

Locate β (Denebola) Leo and move 5° east to reach a 5^{th} magnitude star. Move about a degree SE to reach NGC (M99) and then move 2° southeast to reach NGC4374 (M84) (9.3) and NGC4406 (M86) (9.2) easily visible in the same field of view. Scan this field carefully to locate other non-Messier galaxies. Note their positions and sketch the field, then use a suitable star chart to identify them. M84 and M86 form part of an arc of galaxies, "Makarjian's Chain", curving northeastwards towards M88 in Coma Berenices. Superb in widefield images.

About 1° southeast of M84 & M86 is NGC4486 (M87) (8.6) also known as "Virgo A" a powerful radio source. M87 is a giant elliptical galaxy and high resolution images reveal a huge jet of material being ejected from its core. There is evidence for an anti-jet. Radio maps reveal huge structure not detected at visual wavelengths. Current theory for the highly active nature of M87 points to a massive black hole at heart of the galaxy.

From M87 move about 1° east to locate NGC4552 (M89) (9.8) and then half a degree northeast to locate NGC4569 (M90) (9.5).

Return to M89 and move 2° eastsoutheast to locate NGC4579 (M58) (9.8). From M58 sweep just over a degree east to locate NGC4621 (M59) (9.8) & NGC4649 (M60) (8.8) visible in the same low-power field.

Return to M87 and move about 4° south to NGC4472 (M49) (8.4). 4° southwest of M49 is NGC4303 (M61) (9.7).

To complete this exploration of Virgo Locate the first magnitude star Spica and sweep almost 10° west to locate NGC4594 (M104) (8.3) the "Sombrero Hat". The visual effect is caused by the dark dust lane(s) of this galaxy.

For moderate and larger aperture telescopes a final challenge is to locate two "bright" quasars both variable in brightness. A detailed star chart of the areas will be required.

3C273 (11.7 – 13.3) at R.A. 12h 26m. Dec. $+2.3^\circ$

3C279 (11.5 – 17.0) at R.A. 12h 56m. Dec. -5.8°

P.V.H.