

# “ $\Omega > 1$ ”

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

April 2021.

### Forthcoming Meetings and Events.

#### OUAC.

**Due to the Covid-19 virus restrictions OUAC “Clubnights” and activities are suspended until further notice.**

Fortunately individual activities continue and results and information can be shared.

Autumn 2021 is beginning to show some promise of a return to some form of normal.

### Highlights of the Month.

19 <sup>th</sup>	<b>Mercury at Superior Conjunction.</b>
22 <sup>nd</sup>	<b>Earth Day.</b>
22 <sup>nd</sup>	<b>Peak of Lyrid meteor shower.</b>
23 <sup>rd</sup>	<b>St George’s Day.</b>
25 <sup>th</sup>	<b>Conjunction</b> (about 1°) between <b>Mercury</b> and <b>Venus</b> .
25 <sup>th</sup> to 28 <sup>th</sup>	<b>Mars</b> passes north of <b>M35</b> in Gemini.
27 <sup>th</sup>	<b>Full Moon - “Supermoon”.</b>
30 <sup>th</sup>	<b>Uranus in Conjunction</b> with the <b>Sun</b> .
<b>Mercury.</b>	See notes below.
<b>Venus.</b>	Very low in WNW evening twilight.
<b>Mars.</b>	A moderately bright object in the W to NW evening sky.
<b>Jupiter.</b>	Low in the SE predawn sky.
<b>Saturn.</b>	Low in the SE predawn sky.
<b>Uranus.</b>	In <b>Conjunction</b> with the <b>Sun</b> on 30 <sup>th</sup> .
<b>Neptune.</b>	Emerging into the ESE predawn sky.
<b>Comets.</b>	<b>Comet 2020 R4 (ATLAS)</b> . See notes below.

### 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 the website and download it and the associated user manual.

## 1. The Solar system.

**Note all times shown are UT.**

### Earth.

**22<sup>nd</sup> is Earth Day.**

**23<sup>rd</sup> St George's Day.**

#### **Aurora.**

Shortening hours of darkness reduce the opportunity for observing potential aurora.

Keep tuned to the [www.spaceweather.com](http://www.spaceweather.com) site for updates.

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

#### **ISS.**

The ISS completes a series of evening passes in the first week of April. It will commence a series of morning passes at the end of the month.

Go to the “**Heavens Above**” website and 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	05 <sup>h</sup> 36 <sup>m</sup>	12 <sup>h</sup> 06 <sup>m</sup>	18 <sup>h</sup> 36 <sup>m</sup>
08	05 <sup>h</sup> 20 <sup>m</sup>	12 <sup>h</sup> 04 <sup>m</sup>	18 <sup>h</sup> 48 <sup>m</sup>
15	05 <sup>h</sup> 05 <sup>m</sup>	12 <sup>h</sup> 02 <sup>m</sup>	19 <sup>h</sup> 00 <sup>m</sup>
22	04 <sup>h</sup> 50 <sup>m</sup>	12 <sup>h</sup> 01 <sup>m</sup>	19 <sup>h</sup> 12 <sup>m</sup>
29	04 <sup>h</sup> 35 <sup>m</sup>	11 <sup>h</sup> 59 <sup>m</sup>	19 <sup>h</sup> 24 <sup>m</sup>

### **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 care if your telescope has plastic components. Plastic melts!

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

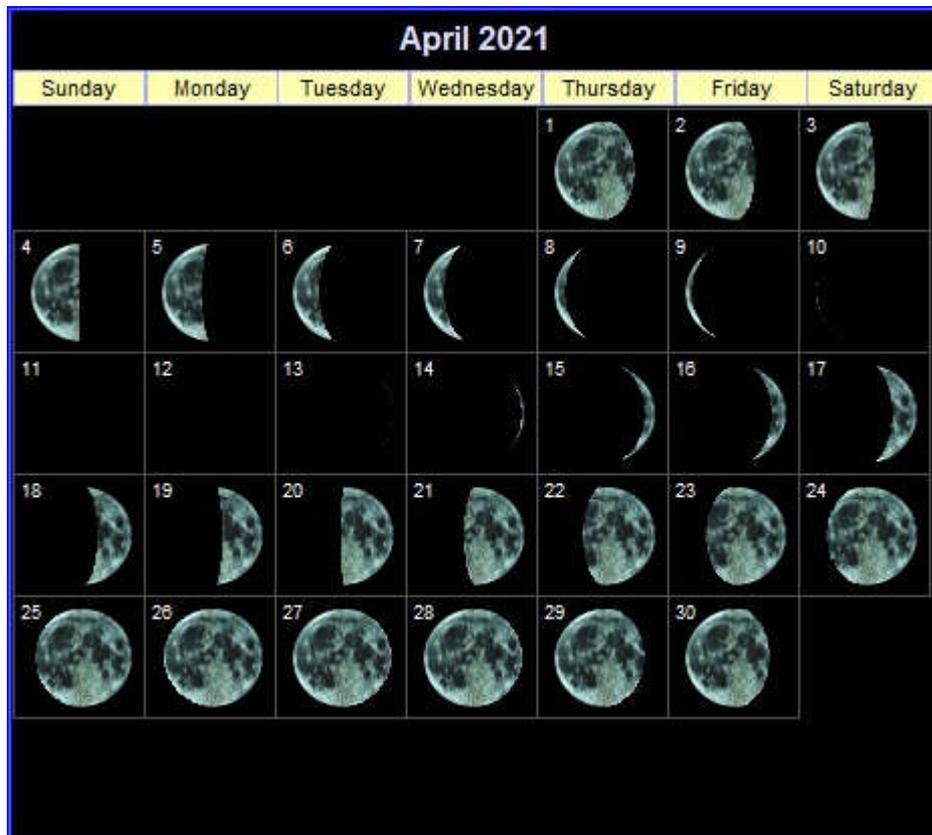
New **Solar Cycle 25** is slowly spluttering into life.

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:



Produced using LunarPhase Pro.

Last Quarter	04 <sup>d</sup> 10 <sup>h</sup> 02 <sup>m</sup>	
New	12 <sup>d</sup> 02 <sup>h</sup> 31 <sup>m</sup>	
First Quarter	20 <sup>d</sup> 06 <sup>h</sup> 59 <sup>m</sup>	
Full	27 <sup>d</sup> 03 <sup>h</sup> 32 <sup>m</sup>	<b>A "Supermoon".</b>

## Apsides:

Apogee	14 <sup>d</sup> 17 <sup>h</sup>	Diameter. 29' 55"	Distance. 406,120km.
Perigee	27 <sup>d</sup> 15 <sup>h</sup>	Diameter. 33' 56"	Distance. 357,937km.

## The Moon cont.

### For northern observers:

- The waxing crescent Moon is very well placed.
- The waxing gibbous Moon is well placed.
- The Full Moon is becoming 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 & Telescope* "Lunar 100 Card" is another good starting point. If you are starting imaging the Moon provides an excellent target.

### Opportunities and Challenges!

- On 10<sup>th</sup> and 11<sup>th</sup> (difficult) try locating the very thin crescent Moon very low in the ESE dawn skies **before sunrise**.
- On 13<sup>th</sup> and 14<sup>th</sup> try locating the very thin crescent Moon in the W evening twilight **after sunset**.
- The 13<sup>th</sup> to 20<sup>th</sup> provide excellent opportunities, if clear, to observe and image the thin crescent to First Quarter Moon. Note the prominent Earthshine with the thin crescent Moon.

## 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.

### Key.

- Disappearance is behind the **D**ark limb = **DD**.
- Disappearance is behind the **B**right limb = **DB**.
- Reappearance is behind the **D**ark limb = **RD**.
- Reappearance is behind the **B**right limb = **RB**.

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

## The Planets.

### Mercury.

An unfavourable morning apparition for northern observers prior Superior Conjunction due to the current low angle of the Ecliptic.

**Superior Conjunction** on 19<sup>th</sup> May.

May just be spotted in the last week of the month low in the WNW evening twilight.

On the 25<sup>th</sup> it will be about 1° N of Venus. Try spotting it in binoculars **after sunset**.

**Do not sweep the horizon until the Sun has completely set!**

Moon close on 11<sup>th</sup>.

Date.	Mag.	Dia.	Phase.	Rise.	Transit.	Set.
01	-0.5	5.3''	0.86	05 <sup>h</sup> 25 <sup>m</sup>	11 <sup>h</sup> 09 <sup>m</sup>	15 <sup>h</sup> 53 <sup>m</sup>
30	-1.2	5.6''	0.85	04 <sup>h</sup> 53 <sup>m</sup>	12 <sup>h</sup> 49 <sup>m</sup>	20 <sup>h</sup> 47 <sup>m</sup>

### Venus.

Difficult to spot low in WNW evening twilight.

Try spotting it in binoculars **after sunset**.

**Do not sweep the horizon until the Sun has completely set!**

On the 25<sup>th</sup> it will be about 1° S of Mercury.

Moon close on 12<sup>th</sup>.

Date.	Mag.	Dia.	Phase.	Rise.	Transit.	Set.
25	-3.9	9.8''	0.99	05 <sup>h</sup> 05 <sup>m</sup>	12 <sup>h</sup> 31 <sup>m</sup>	19 <sup>h</sup> 58 <sup>m</sup>
30	-3.9	9.8''	0.99	04 <sup>h</sup> 58 <sup>m</sup>	12 <sup>h</sup> 36 <sup>m</sup>	20 <sup>h</sup> 15 <sup>m</sup>

### Mars.

A moderately bright object in the W to NW evening sky.

Distinctly gibbous disc.

Small disc size makes surface detail more difficult to observe and/or image.

Moon close on 17<sup>th</sup>.

Date.	Mag.	Dia.	Phase.	Rise.	Transit.	Set.
01	+1.3	5.3''	0.91	07 <sup>h</sup> 57 <sup>m</sup>	16 <sup>h</sup> 23 <sup>m</sup>	00 <sup>h</sup> 50 <sup>m</sup>
30	+1.6	4.6''	0.93	07 <sup>h</sup> 15 <sup>m</sup>	15 <sup>h</sup> 46 <sup>m</sup>	00 <sup>h</sup> 18 <sup>m</sup>

The successful landing of the **Perseverance** rover opens a new chapter in the exploration of the Red Planet.

Details and progress of this and a number of other Landers and orbiting spacecraft are on the appropriate mission websites.

## Jupiter.

Low in the SE predawn sky.

Excellent object for observation and imaging although its current low declination does not favour northern observers.

Moon close on 7<sup>th</sup>.

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

Date.	Mag.	Dia.	Rise.	Transit.	Set.
01	-2.1	35''	04 <sup>h</sup> 19 <sup>m</sup>	09 <sup>h</sup> 06 <sup>m</sup>	13 <sup>h</sup> 52 <sup>m</sup>
30	-2.2	37''	02 <sup>h</sup> 35 <sup>m</sup>	07 <sup>h</sup> 31 <sup>m</sup>	12 <sup>h</sup> 26 <sup>m</sup>

## Saturn.

Low in the SE predawn sky.

With the Rings almost wide open it presents a spectacular sight.

Excellent object for observation and imaging although its current low declination does not favour northern observers.

Moon close on 6<sup>th</sup>.

Date.	Mag.	Dia.	Rise.	Transit.	Set.
01	+0.8	16''	03 <sup>h</sup> 53 <sup>m</sup>	08 <sup>h</sup> 18 <sup>m</sup>	12 <sup>h</sup> 44 <sup>m</sup>
30	+0.7	17''	02 <sup>h</sup> 03 <sup>m</sup>	06 <sup>h</sup> 31 <sup>m</sup>	10 <sup>h</sup> 59 <sup>m</sup>

## Uranus.

Becoming lost in the W evening twilight in the first week of the month.

Conjunction with the Sun on 30<sup>th</sup>.

Moon close 13<sup>th</sup>.

Date.	Mag.	Dia.	Rise.	Transit.	Set.
01	+5.9	3.4''	06 <sup>h</sup> 30 <sup>m</sup>	13 <sup>h</sup> 48 <sup>m</sup>	21 <sup>h</sup> 07 <sup>m</sup>

## Neptune.

Emerging into the E predawn skies towards the end of the month.

Moon close 9<sup>th</sup>.

Date.	Mag.	Dia.	Rise.	Transit.	Set.
30	+7.9	2.2''	03 <sup>h</sup> 19 <sup>m</sup>	09 <sup>h</sup> 01 <sup>m</sup>	14 <sup>h</sup> 44 <sup>m</sup>

## Dwarf Planets.

**Ceres.** Not observable. **Conjunction with the Sun on 7<sup>th</sup>.**

**Eris.** Too close to the Sun to be imaged.

**Haumea.** A 17<sup>th</sup> mag CCD target located in Boötes. At Opposition on 17<sup>th</sup>.

**MakeMake.** A CCD target in Coma Berenices.

**Pluto.** A mag +14 CCD target in Sagittarius.

**Asteroids.** (Approx mag +10.5 or brighter).

<b>Vesta (4).</b>	A 6 <sup>th</sup> mag object well placed in Leo.
<b>Metis (9).</b>	Located in Virgo. Mag +9.5 at opposition on 4 <sup>th</sup> .
<b>Bellona (28).</b>	Located in Virgo. Mag +10.9 at opposition on 24 <sup>th</sup> .

Charts and details of asteroids one month either side of opposition are available at:  
[http://britastro.org/computing/charts\\_asteroid.html](http://britastro.org/computing/charts_asteroid.html) (Note underscore between charts and asteroid).

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

**Comets.**

**Comet 2020 R4 (ATLAS).**

During the month it tracks rapidly through Aquila, Hercules, Corona Borealis and Boötes. It passes closest to Earth on 23<sup>rd</sup> as it tracks rapidly through southern Hercules when it may be an 8<sup>th</sup> or 9<sup>th</sup> magnitude object. One for “early risers”.

Charts and details of selected comets are available at:  
“Heavens above” website.

BAA website [http://britastro.org/computing/charts\\_comet.html](http://britastro.org/computing/charts_comet.html) (Note underscore between charts and comet).

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

**Meteor Showers.**

The **Lyrids** are active between 14<sup>th</sup> to 30<sup>th</sup> with peak activity on 22<sup>nd</sup>, ZHR = 15. Best observed “early hours” to dawn. **Favourable once the Moon has set.**

The **eta Aquarids** are active from 19<sup>th</sup> April to 28<sup>th</sup> May with peak activity on 5<sup>th</sup> – 6<sup>th</sup> May, ZHR = 40. A fine “Southern” shower. **Favourable as Moonlight does not interfere.**

There are always **Sporadic** events and the chance of a brilliant **Fireball**. The latter should be recorded and reported. The importance of reporting such events was perfectly demonstrated with the recovery of recent “Winchcombe meteorite”.

**Near Earth Objects.**

Please refer to [www.spaceweather.com](http://www.spaceweather.com) for updates.

**Eclipses.**

No Lunar or Solar 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 ( $\beta$ ) Persei, Algol.** Range 2.2 to 3.4, period 2.7 days. Sinking into the NW by late evening. Favourable minima at “social hours” occur on 19<sup>d</sup> 22.1<sup>h</sup> and 22<sup>d</sup> 18.9<sup>h</sup>.

**Delta ( $\delta$ ) 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 ( $\mu$ ) 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.** Sinking into the SW early evening sky. About max mag (+6.3) in April/May, then begins slow fade to minimum (+12.0) in December 2020. Take the opportunity to observe and/or image while at max.

### 2.2 Double Stars of the month.

**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.

**Alpha Leo.** See notes below.

**Gamma Leo.** See notes below.

**54 Leo.** See notes below.

**12 Lyn.** See notes below.

**38 Lyn.** See notes below.

**Gamma Vir “Porrima”.** See notes below.

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

### Canes Venatici (CVn).

$\alpha$  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  $5^{\circ}$  east of  $\chi$  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  $\beta$  CVn and move  $3^{\circ}$  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  $\alpha$  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  $5^{\circ}$  east and slightly north of M94. Stellar nucleus in an oval core surrounded by fainter halo.

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  $\eta$  UMa at the end of the Plough and move about  $4^{\circ}$  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).

Σ1615 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 5<sup>th</sup> 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. An excellent object to finish with, but 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.

## 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 ( $\gamma$ ) 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.  $\alpha$  Hya is located some 15° SE of the head.

Epsilon ( $\epsilon$ ) 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 12<sup>th</sup> magnitude central star is prominent in 8" and larger telescopes.

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

## Leo (Leo).

This easily recognized constellation is also a fine hunting ground for many moderately bright galaxies providing an excellent area to practice "star-hopping" skills as there are many bright reference stars should you go astray.

Leo contains some fine double stars.

Alpha ( $\alpha$ ) = **Regulus** ds. 1.4/7.7; separation 176.9". Regulus is blue/white, the companion is yellowish.

Gamma ( $\gamma$ ) ds. 2.2/ 3.5; separation 4.4". Deep yellow primary with pale yellow companion.

54 ds. 4.5/6.3; separation 6.5". Pale yellow primary with blue-green companion.

88 ds. (6.4/8.4) separation 15.4". Yellow primary with yellow companion.

90 Leonis ds. 6.0/7.3; separation 3.3". Both stars are bluish-white. A third deeper blue member of the system (8.7) separation 63" in p.a. 234°.

NGC2903 (8.9) sg. A spiral galaxy inclined to our line of sight. One of the brightest galaxies in Leo surprisingly it is not a Messier object.

NGC3190 (11.0) sg and NGC3193 (10.9) eg. Pair of galaxies located mid-way between  $\zeta$  and  $\gamma$ .

NGC3226 (11.4) and NGC3227 (10.8) about 1° east of  $\gamma$  form a close interacting pair of galaxies.

NGC3351 (**M95**) (9.7) sg, NGC 3368 (**M96**) (9.2) sg and NGC 3379 (**M105**) (9.3) eg. An excellent trio in the same low power field located about 3° south of 52 Leo. Close to M105 is NGC 3384 (10.0) eg.

NGC3623 (**M65**) (9.3) sg, NGC3627 (**M66**) (9.0) sg and NGC3628 (9.5) sg. Located about 3° SSE of  $\theta$  form another fine trio in a low power field. NGC3628 is seen edge-on and begins to reveal a dark dust lane at higher power with moderate apertures.

NGC3596 (11.0) sg. Located about a degree east of the M65/M66 group.

NGC3607 (10.0) eg. and NGC3608 (11.0) eg. A close pair of galaxies midway between  $\theta$  and  $\delta$ .

NGC3626 (10.9) sg. Located about one degree east of NGC3607.

NGC3655 (11.9) sg. Located about two degrees southeast of NGC3607.

## **Leo continued.**

NGC3686 (11.4) sg. Located about one degree NNE of NGC3655.

NGC3521 (8.9) sg. "Star-hop" southwards from the M65/M66 group to locate this bright spiral galaxy which is often overlooked as it lies some way south of the main body of Leo. Another object overlooked by Messier?

Two objects belonging to the "Local Group" of galaxies are located in Leo. Both are dwarf galaxies and are extremely difficult to view visually but make excellent targets for CCD imagers.

Leo I is located a mere third of a degree north of Regulus whose light drowns the feeble glow of the small stellar system.

Leo II is located two degrees north of  $\delta$ . It is smaller and fainter than Leo I.

Exploring the triangle of bright stars forming the "back-end" of Leo with a moderate aperture telescope will provide some pleasant surprises for galaxy hunters and useful experience in correct identification. I leave this to you!

A "route" of exploration I enjoy is to start with the "bright" galaxy NGC2903 at the western end of the "Sickle" and follow the curve of the sickle until Regulus is reached, then move to the "underbelly" containing M95/M96 and then to the tail where M65/M66 are located. Finally drop down the hind leg to the bright but rather isolated NGC 3521. Following the above route will lead you to encounter numerous moderately bright galaxies some of which make pleasing groups in the same low power/wide field of moderate aperture telescopes. Don't be afraid to use high magnification once you have located an object.

## **Leo Minor (LMi).**

A small indistinct constellation above the northern borders of "Leo" containing a number of moderately bright galaxies worth locating and providing a good opportunity for you to practice "star hopping" in a small area of sky.

NGC3003 (11.7) and NGC3021 (12.1) form a close pair. Take care when identifying the identity of this pair as NGC3021 has a higher surface brightness.

NGC3184 (9.7) although just over the border in neighbouring Ursa Major this spiral galaxy is easily located about  $1^\circ$  west of  $\mu$ UMA.

NGC3245 (10.8) Elliptical galaxy.

NGC3254 (11.5) Spiral galaxy seen almost edge-on.

NGC3294 (11.7) Spiral galaxy.

NGC3344 (9.9) Spiral galaxy. It is the largest and brightest galaxy in Leo Minor. A ninth magnitude double star lies  $1'$  to the east which interferes with the view.

NGC3395 (12.1) and NGC3396(12.2) Interacting Spiral and Peculiar galaxies.

NGC3414 (10.7) Spiral galaxy.

NGC3430 (11.5) Spiral galaxy.

NGC(3432 (11.2) Spiral galaxy seen nearly edge-on.

NGC3486 (10.3) Spiral galaxy seen nearly edge-on.

NGC3504 (11.1) Spiral galaxy.

## **Lynx (Lyn).**

5. ds. 5.3/9.8; sep 31.4". Fine yellow and blue pair.

12. ts. 5.4/6.0/7.1; sep 1.7", 9". Fine trio of white stars.

19. ds. 5.6/6.5; sep 14.8". Fine pale yellow and pale blue pair forming part of a quadruple system.

The C (10.9) component lies 74" to the WNW of B. The D component (8.9) lies 215" N of AB.

38. ds. 3.9/6.6; sep 2.7". Fine contrasting white and "rust" coloured pair.

NGC2419 (10.5) gc. Located about 7° north of Castor ( $\alpha$  Gemini) this globular cluster at first appears rather uninspiring. At a distance of 300,000 light years it is one of the most distant objects of its class. Because of its great distance, almost twice that of the Large Magellanic Cloud, it was dubbed the "Intergalactic Tramp" by the eminent astronomer Harlow Shapley.

NGC2683 (9.7) sg. A fine nearly edge-on spiral galaxy located on the borders of Lynx and Cancer about 5° west of  $\alpha$  Lyn.

## **Sextans (Sex).**

A small constellation containing a couple of fine double stars and some interesting galaxies.

35 ds. 6.3/7.4; separation 6.8". Yellow primary with yellow-orange companion.

$\Sigma$ 1441 ds. 6.4/9.9; separation 2.6". Orange primary with fainter yellow companion.

NGC3115 (9.1) is an elliptical galaxy called "The Spindle Galaxy" for its obvious shape which is easily visible in moderate apertures.

NGC3166/3169 (10.6/10.4). A close pair of interacting spiral galaxies in the same field of view.

## **Ursa Major (Uma).**

Zeta ( $\zeta$ ) 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 ( $\xi$ ) 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  $\beta$  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  $\gamma$  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  $\delta$  UMa.

## Virgo (Vir).

Gamma ( $\gamma$ ) Porrima. ds. +3.5/+3.5, separation 1.8". Separation is increasing and the equally matched yellowish pair should be easily resolved.

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

Theta ( $\theta$ ) 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.

$\Sigma$ 1627 ds. 6.6/6.9; separation 20.1". Wide pair of yellow stars.

$\Sigma$ 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.

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.

Locate  $\beta$  (Denebola) Leo and move  $5^\circ$  east to reach a  $5^{\text{th}}$  magnitude star. Move about a degree SE to reach NGC (**M99**) and then move  $2^\circ$  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, "**Makarian's Chain**", curving northeastwards towards M88 in Coma Berenices. Superb in widefield images.

About  $1^\circ$  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  $1^\circ$  east to locate NGC4552 (**M89**) (9.8) and then half a degree northeast to locate NGC4569 (**M90**) (9.5).

Return to M89 and move  $2^\circ$  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  $4^\circ$  south to NGC4472 (**M49**) (8.4).  $4^\circ$  southwest of M49 is NGC4303 (**M61**) (9.7).

To complete our exploration of Virgo Locate the first magnitude star Spica and sweep almost  $10^\circ$  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 $^\circ$