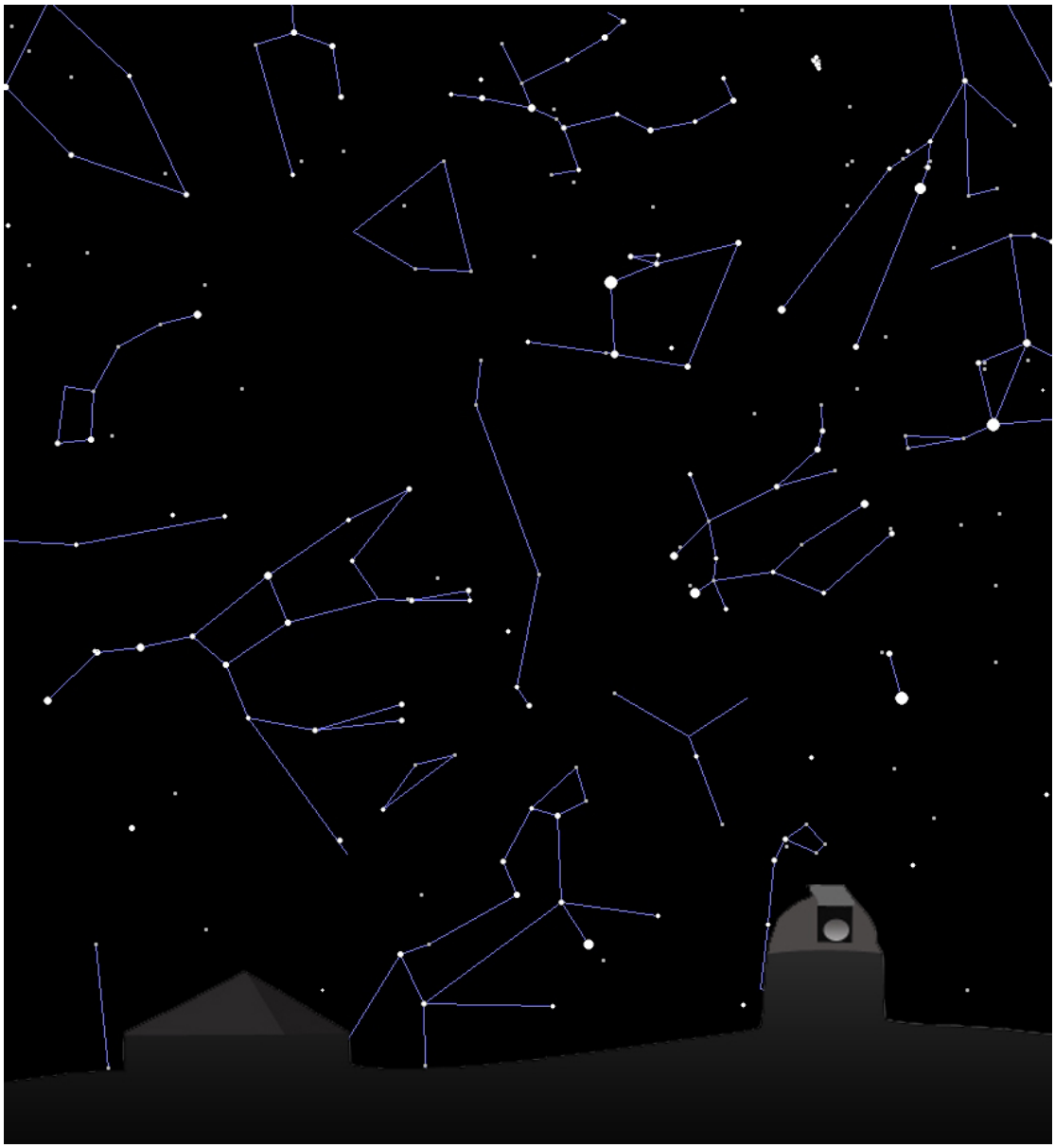
Wynyard Planetarium & Observatory



Spring Observing Notes

Tour of the Sky with the Naked Eye

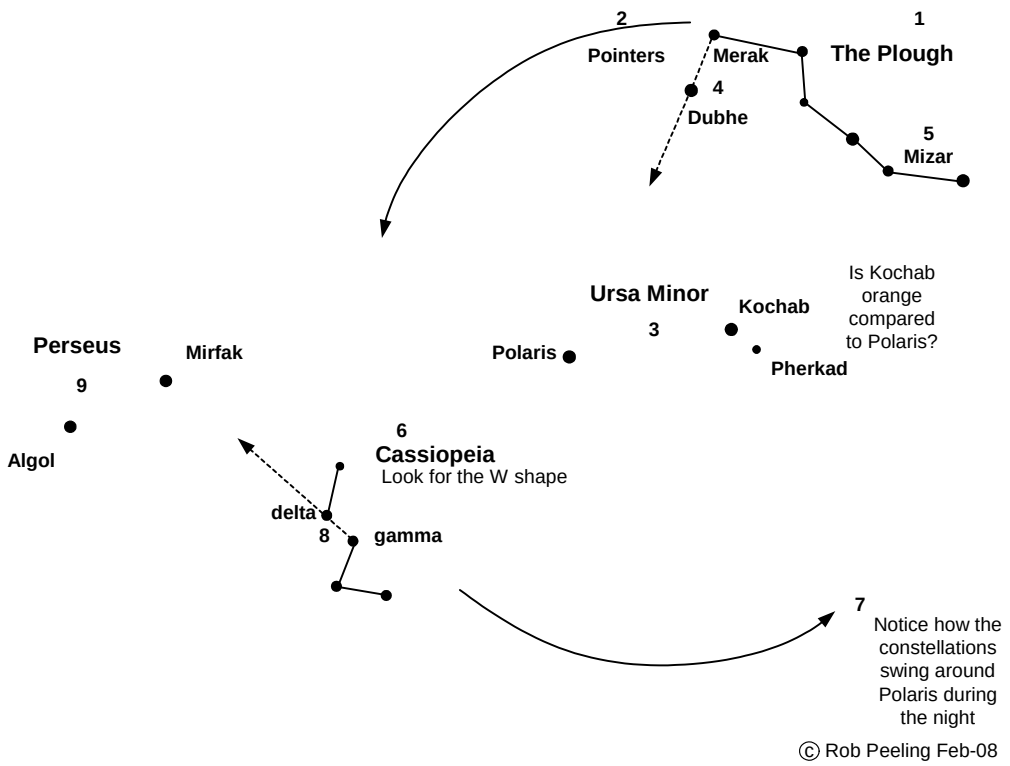


Figure 1: Sketch of the northern sky in spring

North

1. On leaving the planetarium, turn around and look northwards over the roof of the building. Now look nearly straight above yourself and somewhat to your right and find a group of stars like the outline of a upside-down with its handle stretching to the right. This is the Plough (also called the Big Dipper) and is part of the constellation Ursa Major, the Great Bear. The top two stars are called the Pointers.

2. Use the Pointers to guide you downwards, to the next bright star. This is Polaris, the Pole (or North) Star. Note that it is <u>not</u> the brightest star in the sky, a common misconception.

3. Polaris, Kochab and Pherkad mark the constellation Ursa Minor, the Little Bear. To the right of Polaris are two prominent but fainter stars. These are Kochab and Pherkad, the Guardians of the Pole. Look carefully and you will notice that Kochab is slightly orange when compared to Polaris. Check with binoculars. Not all stars are white. The colour

shows that Kochab is cooler than Polaris in the same way that red-hot is cooler than white-hot.

4. The lower pointer (nearest Polaris) is named Dubhe. The other star is Merak. Many star names are Arabic in origin due to the Islamic astronomer Al Sufi who published his "Book of Fixed Stars" in the 10th Century.

5. The second star inwards from the end of the 'handle' is zeta Ursae Majoris or Mizar. Look carefully close to the left and slightly below Mizar. Can you see a faint star? Its name is Alcor. There is a story that seeing Alcor was an Arabic test for eyesight. If so, then it wasn't a very hard test. It is a better test for how clear the night sky is though. If you can't see Alcor then it's probably not a good night to look for other things either.

6. Roughly continuing the line from the Pointers, through Polaris but swinging a little upwards is another bright group of stars low in the sky to your left. They lie in a 'W' shape tipped on its side. This is the constellation Cassiopeia.

7. Continue the tour but look north again after at least 30 minutes and note how the Plough and Cassiopeia seem to have swung round Polaris slightly. This is caused by the Earth spinning on its axis to create day and night. Polaris lies on the axis (more or less directly above the north pole) and this is why it is called the Pole Star.

8. The middle star in the 'W' of Cassiopeia is called gamma Cassiopeiae. Instead of using names, astronomers can also indicate a star by various numbering schemes or catalogues. Using Greek letters followed by the latin name of the constellation is a system originally devised by the German astronomer Johann Bayer in 1603, in his star atlas *Uranometria*. Using this system the next star out, at the bottom of the left-hand 'V' of the 'W' is delta Cassiopeiae.

9. Now use gamma and delta Cassiopeiae to point the way westwards (to your left) to the next bright star. This star is called Mirfak and is the brightest star in the constellation of Perseus. Below Mirfak is another bright star called Algol, the Demon Star. If you watch at the right time (times can be found using the internet), the Demon will very slowly wink at you! It takes about 8 hours from start to finish. This happens because a larger, fainter companion star is passing in front of

the bright star usually seen. This type of system is called an eclipsing binary.

West

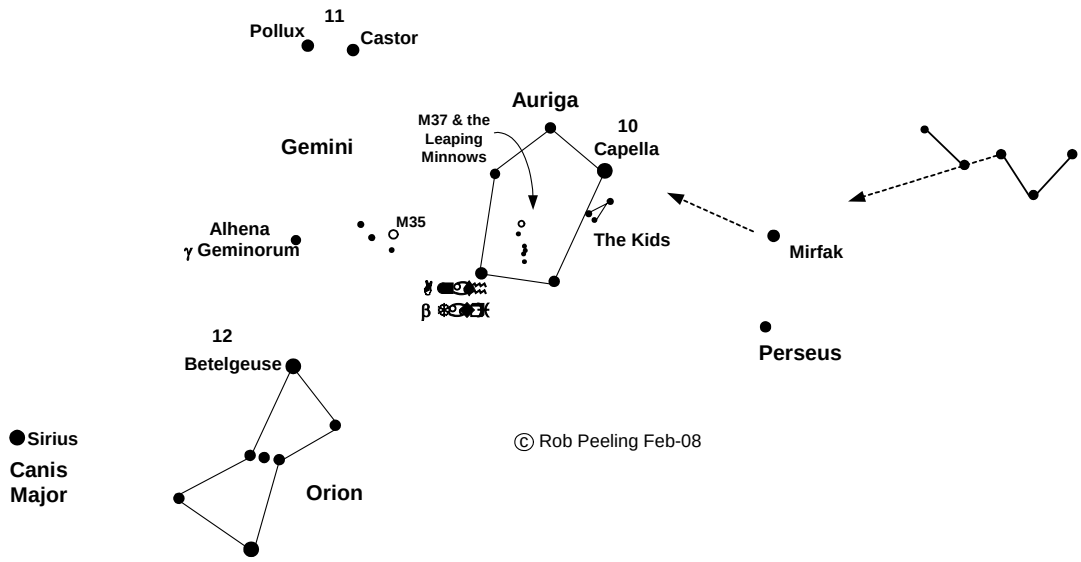


Figure 2: Sketch of the western sky in spring

10. From Mirfak complete your turn to face westwards by continuing to the left away from Cassiopeia and Mirfak to the to a brighter star which is Capella in the constellation Auriga. Capella is the 6th brightest star in the sky. I always think it shows a distinct lemony hue. The constellation appears as a distorted pentagon of 5 stars. Starting from Capella and working clockwise, the third star you come to is the lowest in the sky and is strangely assigned to Taurus. This star is called Alnath or beta Tauri. Close under Capella is a small triangle of stars. These are the Haedi or Kids. Auriga is a rich constellation for binoculars.

11. Still further over in the west are two more bright stars, Castor and Pollux marking the heads of the twins at the left-hand end of the constellation of Gemini. Castor is the nearer one to Capella. Castor is an interesting star system. In a small telescope, Castor can easily be seen to be two stars. These orbit each other with a period of about 450 years and are separated by about four times the distance between the Sun and Pluto. However a spectroscope shows that each member of the pair is itself a pair. The visible stars are more massive than our Sun, the invisible companions are rather smaller than our Sun. If that wasn't

enough then nearby another faint star is visible in a telescope. This is also part of the Castor system and once again a spectroscope show there are actually two stars. In this case both are the smallest type of star, red dwarfs. So Castor is a sextuplet.

12. Underneath the Twins is the unmistakeable constellation of Orion, the Hunter. The line of three bright stars making the Hunter's belt is obvious. Four more bright stars mark his shoulders and knees. Look carefully at the left shoulder. You should see that the star has a definite orange tint to it. This star is Betelgeuse and it is a red supergiant. This means the star has run out of hydrogen fuel and has started using helium instead, which is a key milestone in the countdown to stellar death. The star has swelled up enormously and the surface is quite cool which is why it is reddish in colour. If Betelgeuse replaced our Sun in the Solar System, all the planets out to Mars and most of the asteroid belt would be *inside* the star. To the left of Orion is the brightest star in the sky, Sirius. You will need to look soon after dark because Sirius and the bottom of Orion set early in the spring.

South

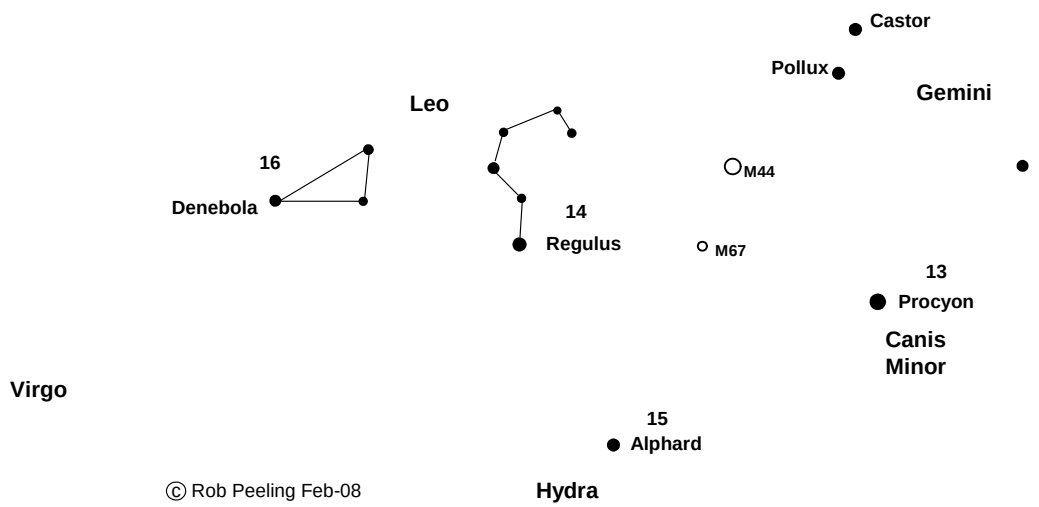


Figure 3: Sketch of the southern sky in spring

13. Now turn anti-clockwise again to look south, away from the planetarium. Beneath Castor and Pollux is the next bright star. This is Procyon in the constellation of Canis Minor, the little dog. Procyon is a nearby star with a white dwarf (a dead star) orbiting it.

14. Almost due south and to the left of Procyon and the Twins is the star Regulus in the constellation Leo. The stars above it turn appear to form a backwards question mark which astronomers refer to as the 'Sickle'. This is an example of an asterism, a pattern or shape outlined by stars as opposed to a constellation which is a formally defined patch of sky which contains the stars and any associated asterism. The Plough and the W of Cassiopeia are also asterisms – the constellations themselves cover much wider areas of sky.
15. The rest of the southern sky beneath Leo and Procyon looks pretty blank and uninteresting with just one moderately bright star in the middle of the blankness. This star is Alphard, the 'lonely one' and it belongs to the constellation of Hydra which straggles through much of this area.

16. A triangle of stars to the east (left) of the Sickle marks the backside of Leo, the brightest star is called Denebola. Further east and lower down is the dim constellation of Virgo. With the coming of spring telescope owners start getting very excited. This is not because they are getting unusually frisky but because the constellations of Leo and Virgo are absolutely stuffed full of galaxies.

East

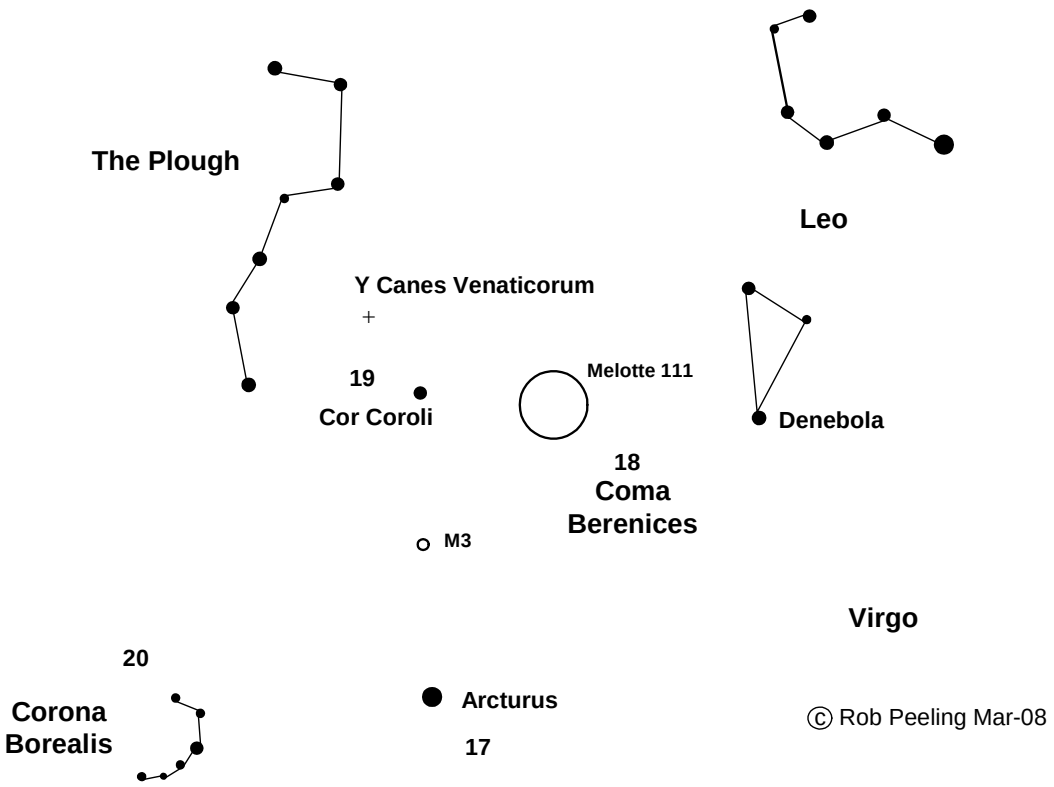


Figure 4: Sketch of the eastern sky in spring

17. Another quarter-turn anti-clockwise and you are facing east. More or less due east is a bright yellowish star called Arcturus which is in the constellation Bootes. It is the fourth brightest star in the whole sky. It is unusual because unlike our Sun and most other visible stars, it does not orbit in the disk of our galaxy. Instead it is diving through the disk. This is because it is a member of the galactic halo, old stars that form a cloud around the main disk of our Milky Way galaxy.

18. Between Arcturus and the tail of Leo lies the faint constellation of Coma Berenices. Uninteresting to the naked eye this constellation is a continuation of the happy hunting ground for galaxy spotters.

19. Above Arcturus and "under" the handle of the Plough is a fairly bright star called Cor Coroli (Charles's Heart) in the constellation Canes Venatici, the Hunting Dogs. The star was given its name by the 2nd Astronomer Royal, Edmund Halley (yes, the comet is named after him) in honour of King Charles I. Was he after some research funding?

20. To the left of Arcturus you will easily spot a semi-circle of stars. This is the constellation Corona Borealis or Northern Crown.

Observing With Binoculars

Within the constellation discussed there are objects which repay more detailed inspection with either binoculars or telescopes. Note that they are all worth looking at with telescopes also.

North (refer to figure 1)

Mizar/Alcor – multiple star system in Ursa Major

Have at another look at Mizar and Alcor using binoculars. Can you spot a faint star between them but to one side to form a triangle? This was called Sidus Ludovicianum in 1723 by the courtiers of Emperor Ludwig V who erroneously believed it had appeared suddenly (perhaps they needed to butter up the Emperor).

West (refer to figure 2)

M35 – open cluster in Gemini

Look at the area of sky between Betelgeuse and the twins Castor & Pollux. Roughly where the twins' feet should be is the third brightest star in Gemini after Castor & Pollux which is gamma

Geminorum or Alhena. Now look to the right about 1/3rd of the way from Alhena towards beta Tauri/Alnath for a short line of three stars and centre your binoculars on the lowest star of the three. Above it at roughly 12 o'clock you should see a faint fuzzy patch, which is M35. With a telescope the cluster will resolve into individual stars. M35 contains ~200 stars and is young at ~110 million years old. M35 is the Messier number of this object. The Messier catalogue was compiled by Frenchman Charles Messier in ~1780 as a list of 110 fuzzy objects he didn't want to mistake for the comets he was searching for. Ironically his list of reject objects is now the most used reference to some of the most beautiful and interesting objects in the sky for modern observers.

Figure 5: Charles Messier

<u>An asterism & open clusters in Auriga</u>

Centre your binoculars on the star Alnath or beta Tauri and sweep gently slightly up and to your right, roughly a quarter of the way to bright Capella. Two quite distinct, bright curves of stars should

come in view. This is the asterism called the Leaping Minnows. Look above the left-hand group in the asterism for a small milky grey patch. This is the open cluster M37. Now look below and to slightly to the left of the same group for another, smaller fuzzy patch which is M36. Keep scanning past M36 and look for a third patch, M38, nearer the size of M37. Like M37, M36 & M38 are open clusters. All three are worth closer inspection with a telescope.

South (refer to figure 3)

M44 – Praesepe or the Bee-Hive, an open cluster in Cancer

Centre your binoculars on the middle of the triangle made up by Regulus, Procyon and Pollux in the constellation, Cancer. Close to this centre point you should find the large, bright open cluster M44, also known as Praesepe or the Beehive. In Chinese constellations Praesepe has the more alarming name of **Tseih She Ke**; "Exhalation of Piled-up Corpses". At a dark site, such as out on the North Yorks moors it is possible to see M44 with the naked eye. A low power lens is needed with a telescope to fit the entire cluster into the field of view. M44 lies to close to the ecliptic which is the path across the sky travelled by the Sun, Moon and the planets. This means the occasional astronomical treat with M44 and a planet or the Moon visible in your binoculars at the same time. The Moon goes by once a month and so in winter and spring when Cancer is in the sky there should be an opportunity to catch the two together.

Figure 6: Open Cluster M44, Praesepe

East (refer to figure 4)

La Superba - Y Canes Venaticorum

La Superba was given its name by the 19th Century pioneer of astronomical spectroscopy (splitting a star's light into a spectrum or rainbow to study its workings in detail), Father Angelo Secchi who was a Jesuit priest and director of the Vatican Observatory. He was inspired by the star's unusually deep orange-red colour. The star's latin name indicates it to be a star that varies in brightness with time. La Superba's temperature is believed to be about 2800 K, making it one of the coldest true stars known. It is an example of a particular type of dying star called a carbon star because its atmosphere contains large amounts molecules containing that element. The carbon containing molecules have the effect of cutting out much of the blue light of the star (hence the colour) and giving the spectrum a strange chopped up appearance. At the planetarium we have been able to repeat Father Secchi's efforts at observing the spectrum and see its strangeness for ourselves. To find La Superba, centre your binoculars on the star Cor Coroli and sweep very carefully about 1/3rd of the way towards the first star outwards of the Plough's handle. You will need to examine the field very carefully but once found, La Superba's colour stands out and leaves you in no doubt that you've found the right star.

M3 – A globular cluster in Bootes

Charles Messier himself in 1764 discovered this large ball of ½ million stars. It lies 33,900 light years away which places it outside the main spirals of our Milky Way galaxy but is still part of the overall system. M3 orbits the galaxy in the halo. The stars in it are some of the oldest stars in our galaxy at around 8 billion years old (i.e. these stars formed long before our Sun and the planets round it even existed). It appears as a small fuzzy blob in binoculars much as Messier would have seen it when he discovered it. Most telescopes are powerful enough to show it splitting into individual stars. To find it you will need a clear, dark night with no moon. Scan about halfway along a line drawn between Arcturus and Cor Coroli and with patience you will find it.

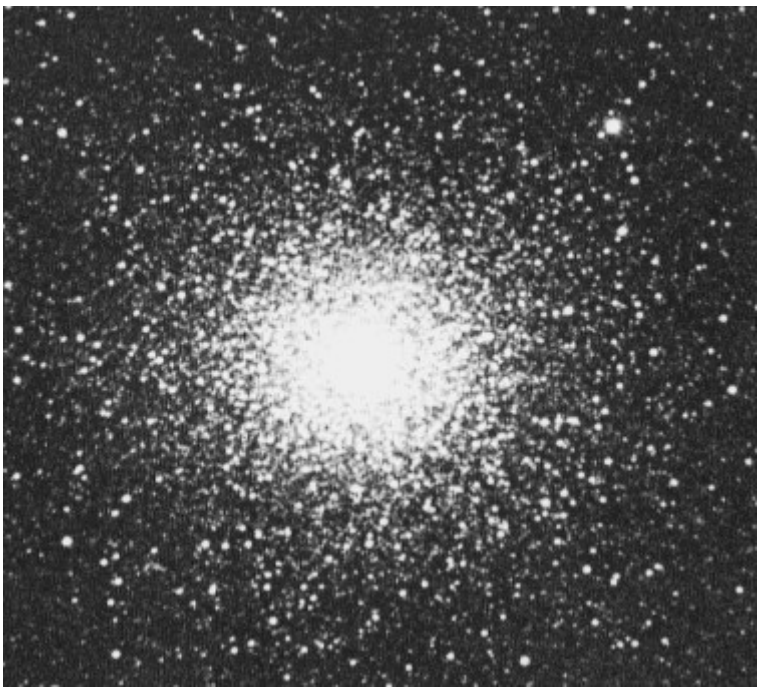


Figure 7: M3 -Globular Cluster in Canes Venatici

Melotte 111 – The Coma Star Cluster

This cluster is impressively large and bright, filling the binocular view. It is the third nearest star cluster to our Sun and only about 260 light years away. It is thought to be about 400 million years old and because the force of gravity is so weak between its stars it is considered likely to disperse completely in the relatively near future – a few tens of millions of years! Scan your binoculars along a line between Denebola and Cor Coroli to find Melotte 111. It is somewhat closer to Cor Coroli than to Denebola. Unusually, the best views of Melotte 111 are with binoculars *not* with telescopes. This is because the cluster covers so much sky.

Observing With a Telescope

Where appropriate, comments have been made on viewing the objects described with a telescope throughout the preceding notes and so only a few additional objects are suggested here.

Mizar – multiple star system in Ursa Major (figure 1)
Look at Mizar with your telescope. Almost any magnification will be sufficient to show it to really be two stars. The two are 500 Astronomical Units (1 AU is the distance from the Earth to the Sun) apart and take 5000 years to orbit each other. What your telescope can't show you is that both stars are themselves pairs. The brighter

one, Mizar A consist of two similar stars, each about 2.5 times our Sun's mass orbiting each other every 20.5 days – they are therefore closer to each other than Mercury is to the Sun. The other pair, Mizar B are about 1.5 times the Sun's mass and orbit each other every six months. All four are considerably hotter and the Sun and the bluish white colour should be noticeable in the telescope. Mizar iwas the first double star to be discovered using a telescope in 1617. The discoverer was Benedetto Castelli (1578 – 1643) who was a friend and student of Gallileo. There is an excellent article detailing the history of study of the Mizar system at http://leo.astronomy.cz/mizar/article.htm.

M81 & M82 – two galaxies in Ursa Major

It is possible to find these galaxies with binoculars but only on a very clear night from the Planetarium site. Start from the Pointers (figure 8) in the Plough and look away to the right of the 'saucepan' for another pair of stars that seem to echo the pointers. Through the finder use the "false pointers" to track up towards the pole to a small triangle of stars, "the cheese". The short side of the triangle points left to two stars fairly close together. Pick the fainter one and aim slightly below and to the left. With a low power lens both galaxies should come in view as faint milky or fuzzy patches. M81 appears as a plump oval while M82 is distinctly elongated and is sometimes called the Cigar galaxy. They are genuinely associated in space about 12 million light years away. Within the last 200 million years they passed close to each other and M82 came off worse and still shows the effects. M82 is an example of a starburst galaxy because it is undergoing a paroxysm of new star formation caused by its close encounter with M81.

Figure 8: The Cigar Galaxy M82 – Hubble Space Telescope

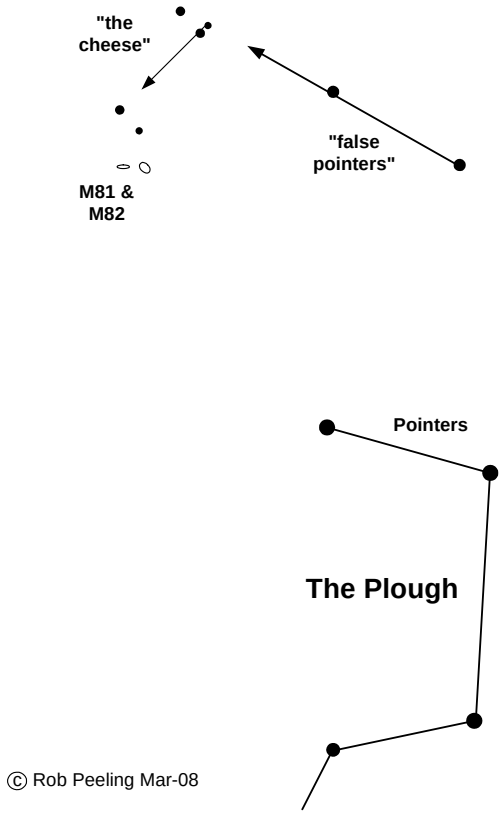


Figure 9: Finding M81 & M82

<u>M51, the Whirlpool Galaxy in Canes Venatici</u>
In 1845, this was the first galaxy to be recognized as a spiral by Lord Rosse using his 6 foot diameter Leviathan telescope at Birr Castle in Ireland. This telescope was the largest in the world from 1845 until 1917 when the 100 inch Hooker telescope at Mount Wilson finally surpassed it. The telescope has been recently restored.

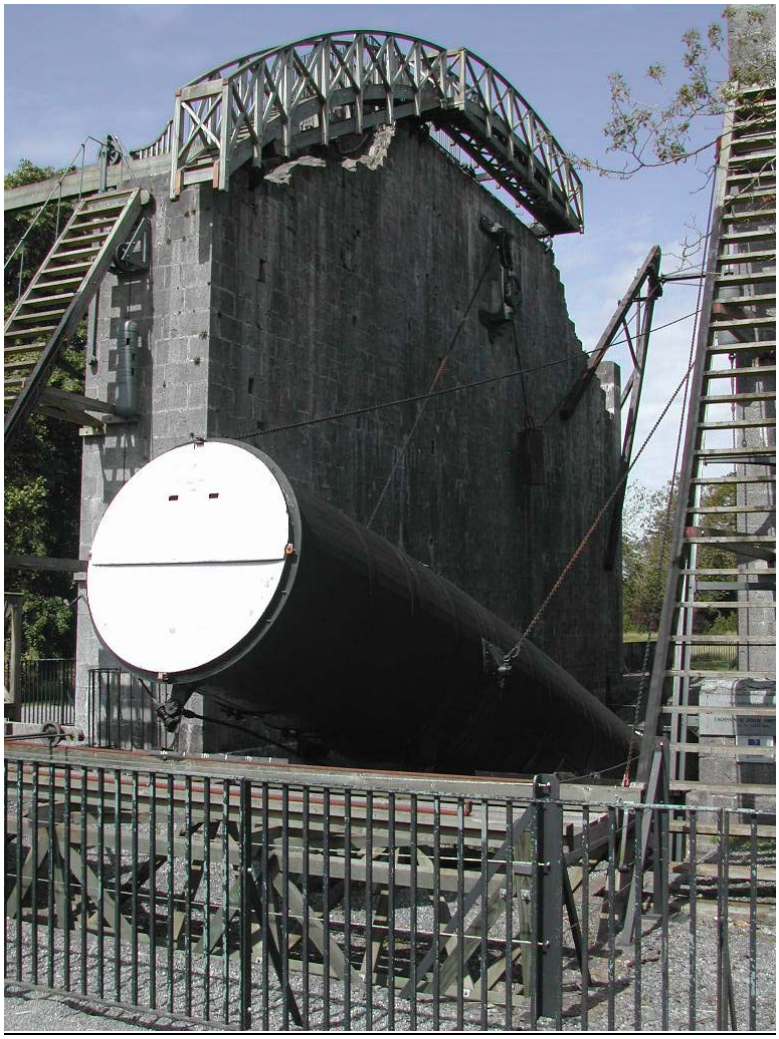


Figure 10: Lord Rosse's telescope at Birr Castle (Rob Peeling)

M51 is actually a double galaxy. A smaller galaxy, NGC 5195 is nearby and actually interacting with M51. If you find M51 then you will most likely spot NGC 5195 also. M51 is found (figure 9) by centring the finder on the last star in the handle of the Plough, Alkaid and then looking 'under' the handle for the nearest brightish star, 24 Ursae Majoris. A little beyond star 24 should a small triangle of faint stars. M51 is near the furthest of these from 24 Ursae Majoris.

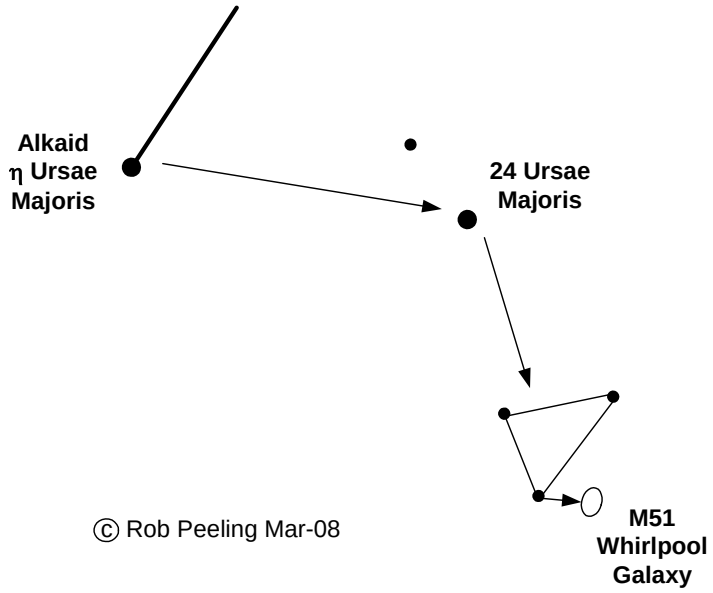
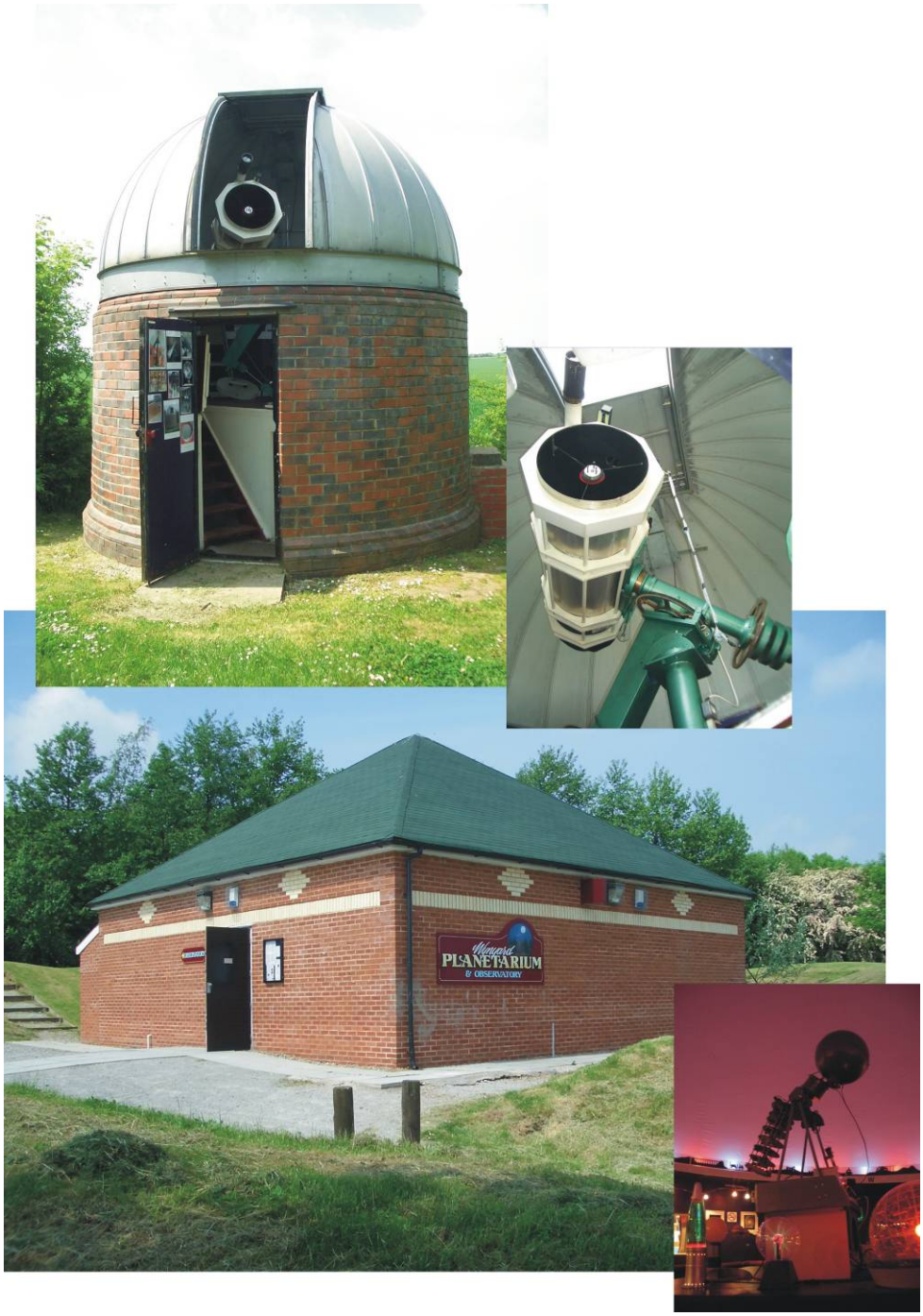


Figure 11: Finding M51- The Whirlpool Galaxy

M67 – One of the oldest open clusters known (figure 3)

Look for the moderately bright star, delta Cancri somewhat to the left and below M44. Keep moving the finder in the same direction to find alpha Cancri, a star of similar brightness which will come into the view of the finder at 1 o'clock roughly as delta Cancri disappears off the edge at 7 o'clock. Now scan to the right using a low power lens in your telescope. As alpha Cancri slips out of view, M67 should just be appearing at the opposite side. This cluster is 2600 light years away, containing ~ 300 stars. It is between 4-5 billion years old making it a similar age to our Sun. Compare this to the age of M35.



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