

# Astronomy Observation Journal

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June 23, 2015

**Seeing Scale (Antoniadi):**

1. Perfect seeing, without a quiver
2. Slight undulations, with moments of calm lasting several seconds
3. Moderate seeing, with larger air tremors
4. Poor seeing, with constant troublesome undulations
5. Very bad seeing, scarcely allowing the makings of a rough sketch

**Transparency Scale (American Association of Amateur Astronomers):**

1. Do Not Observe - Completely cloudy or precipitating (Why are you out?)
2. Very Poor - Mostly Cloudy
3. Poor - Partly cloudy or heavy haze. 1 or 2 Little Dipper stars visible
4. Somewhat Clear - Cirrus or moderate haze. 3 or 4 Little Dipper stars visible
5. Partly Clear - Slight haze. 4 or 5 Little Dipper stars visible
6. Clear - No clouds. Milky Way visible with averted vision. 6 Little Dipper stars visible
7. Very Clear - Milky Way and M31 visible. Stars fainter than mag 6.0 are just seen and fainter parts of the Milky Way are more obvious
8. Extremely Clear - overwhelming profusion of stars, Zodiacal light and the gegenschein form continuous band across the sky, the Milky Way is very wide and bright throughout

**Target Types:**

- SN Rem - Supernova Remnant
- Neb - Nebula
- Galaxy - Galaxy
- CL+Neb - Cluster with Nebula
- Opn CL - Open Cluster
- Glob CL - Globular Cluster
- Pln Neb - Planetary Nebula
- Satellite - Our Satellite (Moon)
- Planet - Solar System Planet
- Star - Star
- Dbl Star - Double Star
- Mlt Star - Multiple Star

<b>Date:</b>	15/06/2015	<b>Telescopes:</b>	Tele Vue 60 F6
<b>Time:</b>	21:45-0:30	<b>Eyepieces:</b>	TV Nagler 13mm, Vixen 5mm SLV, Bresser SA 2x
<b>Location:</b>	Cambridge, UK	<b>Power, EP, FOV:</b>	28x, 2.2mm, 2.80deg; 72x, 0.8mm, 0.69deg; 144x, 0.4mm, 0.35deg
<b>Altitude:</b>	12m	<b>Filters:</b>	Single Polarising Filter
<b>Temperature:</b>	10C (wind: 5km/h)		
<b>Seeing:</b>	2 - Slight undulations		
<b>Transparency:</b>	5 - Clear		

Target	Cons	Type	Power	Notes
Venus	Com	Planet	72x, 144x +/- SPF	Gorgeous with the Vixen SLV 5mm. The best view of Venus I have ever had so far. Phase was about 45%, and Venus appeared cristal clear without any glare and perfectly focused. The borders were very crisp. At 144x the planet was bigger, but no additional detail was detectable. At both 72x and 144x, I felt that at the center of the visible part of the planet, the colour was just slightly dimmer as if a soft darker cloud was there. Really beautiful. SPF did not help much with the Vixen, so I removed.
Jupiter	Leo	Planet	72x, 144x +/- SPF	Jupiter was visible with North and South Equatorial Belts and four moons. No other detail was detectable. SPF did not help with the Vixen. The planet did not appear much crisp in contrast to Venus. Also here, I preferred the view of Jupiter at 72x (without Barlow). It is as if the barlow lens introduces some imperfections which remove the additional benefit of using a Vixen vs a Nagler. The same can be said for the SPF with the Vixen. Vixen alone gave the best views (without Barlow or SPF).
Saturn	Lib	Planet	28x, 72x +/- SPF, 144x	Saturn was wonderful with the Vixen at 72x. The North Equatorial Belt was detectable particularly when in contrast with the Equatorial zone. The Cassini division was visible on the left and right parts of the rings when the planet was at the centre of the eyepiece. It appeared as a soft grey line which separated more dense rings (B rings) from lighter rings (A rings). The shadow of the planet on the ring or details on the polar region were not visible. Titan was also visible. A SPF did not help and actually degraded the image for Saturn with the Vixen. At 144x, the image degraded and was not as nice as at 72x. At 28x, the planet was very small, but the rings and the empty part between the planets and the rings were visible. Titan at South-West of the planet in the eyepiece was much brighter at this magnification (due to the larger exit pupil) and I felt a small faint dot was detectable at South-East of the planet in the eyepiece. This was closer to the planet than Titan. After checking Saturn's moons positions with Sky and Telescope software application, the only moon at that distance and position was Rhea. I am not sure I saw this moon of magnitude 10. It would be at the limit of my TV60. This dot was more visible with averted vision although it was also detectable via direct vision.

Epsilon	Lyr	Dbl star	72x	The Double Double. It was possible to see the two pairs at 72x, although to me this was not appreciable. The two pairs appeared a little bit more than elongated or just separated, but I much prefer when a double star is clearly and nicely separated. The two pairs were similarly separated. Possibly Epsilon1 (the North pair) was slightly more, but, if so, a tiny bit.
Beta	Lyr	Dbl star	28x	Sheliak. Wonderful colour double star. One orange and one blue. Really beautiful.
Delta	Lyr	Dbl star	28x	Superb multi star system. At 28x it is really bright and proportional to the field of view. I love the triangles and the overall geometry in this system of stars.
HD175634	Lyr	Dbl star	28x	This double star is relatively close to M57 and inside the parallelogram of Lyra. One star is orange, the other is blue. Similar to Sheliak but a bit dimmer.
Beta	Sco	Mlt star	28x, 72x	Acrab or Graffias. Although tight, I prefer this double star at 28x rather than 72x because of the smaller Airy disks. Very nice though. A bigger and bright orange star associated with a smaller blue star.
Omega	Sco	Dbl star	28x, 72x	Not sure If I searched this correctly. The two stars were largely more separated than Acrab double stars. A no substantial difference in colour or size was noticeable though. I did not find this target particularly interesting. Nicer at 28x.
Nu	Sco	Dbl star	28x, 72x	I am not sure I saw this. If so, it appeared as a tight double star with the same colour and quite dim. 28x was better due to the higher image brightness.
Epsilon	Boo	Dbl star	28x, 72x	Izar. I could not split this double star at 28x or 72x. I thought it was easier. Still a very nice yellow bright star. The sky was becoming less transparent on this region of the sky. Therefore I moved North.
M39	Cyg	Opn CL	28x	Quite large open cluster position at North North-East of Deneb. Some stars are faint but still visible without much difficulty with direct vision. The clouds were slowly coming from West. I decided to move to South for the last observations.
M4	Sco	Glob CL	28x	I was not able to detect this cluster. I suspect the reason was that it is too low in the sky for my TV-60 and Antares brightness did not help either. Therefore I decided to focus on the beautiful open cluster of this region of Sky, which was the only area not affected by clouds and actually transparent.
M8	Sgr	CL+Neb	28x	Lagoon Nebula. About 1-1.5 degree large, this is a very nice cluster with nebulosity. I did not have a OIII filter with me, but the nebula was detectable without filter. It appeared a soft gray patch surrounding the cluster. This cluster is quite elongated. Superb.
M20	Sgr	CL+Neb	28x	Trifid Nebula. Positioned at North of M8, M20 is a bit smaller, but still impressive. Also here, the nebulosity was detectable and the shape of the cluster was elongated connecting M20 with M21.
M21	Sgr	Opn CL	28x	M21 was a condensed group of stars on one extremity of M20. M8, M20 and M21 are really spectacular targets.
M23	Sgr	Opn CL	28x	This cluster was a little bit at North-West from M21. It was a bit dim, but if the sky were more transparent and darker it would be a lovely target, I think.

M25	Sgr	Opn CL	28x	This cluster showed a mix of bright and dim stars. The size is sufficient for the Nag13 and the details are quite rich.
M16	Ser	CL+Neb	28x	Eagle Nebula. After seeing M25, I moved North-West towards M16. This appeared quite bright with some stars at the centre.
M17	Sgr	CL+Neb	28x	Omega Nebula. From the Eagle Nebula, I simply moved South and saw this target. It is a bit smaller than the Eagle, but still bright.
M18	Sgr	Opn CL	28x	A small open cluster at South of Omega Nebula.
M24	Sgr	Opn CL	28x	Sagittarius Star Cloud. Impressive and large group of stars. Really spectacular. It covered a field of almost 2 degrees populated by stars. The surrounding stars were quite bright. Globally this appeared as a bright area with a few faint stars.

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**Date:** 11/06/2015      **Telescopes:** Tele Vue 60 F6  
**Time:** 22:00-0:00      **Eyepieces:** TV Panoptic 24mm, Nagler 13mm, Nagler 3.5mm, Bresser SA 2x  
**Location:** Cambridge, UK      **Power, EP, FOV:** 15x, 4mm, 4.30deg; 28x, 2.2mm, 2.80deg; 103x, 0.6mm, 0.77deg; 206x, 0.3mm, 0.38deg  
**Altitude:** 12m      **Filters:**  
**Temperature:** 15C (wind: 2km/h)  
**Seeing:** 3 - Moderate seeing  
**Transparency:** 3 - Somewhat clear

Target	Cons	Type	Power	Notes
Saturn	Lib	Planet	103x, 206x	Very nice view of Saturn tonight. At both 103x and 206x, the Cassini division was detectable when the sky appeared steady for few seconds. It appeared as a soft grey shade on the lateral parts of the rings. Possibly what I was seeing was the shade between the A and B rings. This was not always visible, but just for few seconds when the seeing was steady and no wind blew, the difference in colour intensity was noticeable. Titan was also visible on the South of the planet. It seemed a grey dot. The North Equatorial Belt on the planet appeared as a soft darker gradient compared to the planet equatorial zone. The North Polar Region was not clearly detectable.
Venus	Com	Planet	103x, 206x	Phase about 50%. No detail visible, but the image was sufficiently stable. A SPF would have helped, but I forgot it at home.
Jupiter	Leo	Planet	103x, 206x	206x was too much for Jupiter tonight. Mostly seen it at 103x. Three moons visible, whereas the fourth seemed behind the planet. North and South Hemisphere bands visible. On the North Hemisphere another band was also detectable. No GRS visible.
C33 / 34 - NGC6992 / 6960	Cyg	SN Rem	15x +/- OIII, 28x +/- OIII	Veil Nebula. No visible or detectable. I carefully searched the stars and positioned at 52 Cygni. 28x +OIII seemed to show a soft transparent cloud, but I cannot say that that was the Veil Nebula. The sky was not fully transparent and dark. This might be the reason.
Epsilon	Lyr	Dbl star	103x	The Double Double. Just managed to see the two pairs, although the separation was not clear. They appeared just a tiny more than elongated stars. I am not sure, but I suspect this was more due to the Nagler 3.5mm. I will try with the Vixen 5mm next time, as generally this eyepiece delivers better views than the Naglers, on planets at least.
Beta	Sco	Mlt star	103x	Acrab or Graffias. It was clearly split, but the seeing was not very nice near the horizon and the stars light was not puntiform. The small star is blue. This double star is the top of the three stars of Scorpius.

**Date:** 10/06/2015      **Telescopes:** Tele Vue 60 F6  
**Time:** 22:00-0:00      **Eyepieces:** TV Panoptic 24mm, Nagler 7mm, Nagler 3.5mm  
**Location:** Cambridge, UK      **Power, EP, FOV:** 15x, 4mm, 4.30deg; 51x, 1.2mm, 1.54deg; 103x, 0.6mm, 0.77deg  
**Altitude:** 12m      **Filters:**  
**Temperature:** 14C (wind: 5km/h)  
**Seeing:** 3 - Moderate seeing  
**Transparency:** 5 - Clear

Target	Cons	Type	Power	Notes
Saturn	Lib	Planet	103x	Seen during civil twilight and later in the nautical twilight. Although the seeing was not great, Saturn appeared very crisp. The rings had a very nice inclination. The Cassini division was generally not detectable. For few seconds when the seeing stabilised, a hint of dimmer colour was visible on the external part of the rings. A nice belt was visible all the time on the North hemisphere (North Equatorial Belt) of the planet. Titan was visible too. The view was really nice generally. Possibly due to the seeing, but I preferred the view when the sky was darker.
Alpha	Sco	Star	15x	Antares. Lovely red star. I could see the Airy disc and diffraction rings very nicely. Antares is one of my favourite stars.
M107	Ser	Glob CL	15x, 51x	From Han, Zeta Oph, go slightly South and see a triangle. M103 is on the outside of one of the verteces. It was barely visible at 15x, also due to the bright sky. At 51x was detectable but still with difficulty. Not much to see. Just a grey smudge visible with averted vision.
M10	Oph	Glob CL	15x, 51x	Nice globular cluster. It does not have nearby stars, but is relatively large. Stars are not really visible, but the cluster appear with some hint of granulation particularly detectable on the outside.
M12	Oph	Glob CL	15x, 51x	Like M10, this is another nice globular cluster. Somehow I preferred it to M10 because of the presence of surrounding close stars at east. I believe this cluster is slightly bigger than M10, or at least it seemed so. Like M10, a hint of granulation was detectable.
IC4665 Cr349	- Oph	Opn CL	15x	Summer Beehive Cluster. Amazing open cluster of large size above the star Cebalrai. A pleasure to see with a low power eyepiece. Stars have similar colours and magnitude, but the shape is nice.
NGC6633	Set	Opn CL	15x	From 71-72 Oph to East, NGC6633 and Cr386 appear in succession. Both are sufficiently large to be appreciable with a low power eyepiece. They are quite rich in stars.
IC4756 Cr386	- Set	Opn CL	15x	Graff's cluster. See above
Epsilon	Lyr	Dbl star	51x	The Double Double. I could not split the two. The image suggested a possible elongation of the two stars, but this was not obvious. I would not have detected it if I had not known that they are doubles. I carefully focused inward and outward to reach the optimum, but this was not sufficient.

Beta	Sco	Mlt star	51x	Acraab or Graffias. Very fine multiple star system at 51x. The two stars have different colour and brightness. If I remember correctly the small one was blue. They were split but still quite tight. At 70x they should be split clearer.
M57	Lyr	Pln Neb	51x	It was lovely to see this planetary nebulae at 1.2mm exit pupil. The ring was clearly visible and the size was acceptable. No colour of course, but averted vision showed this object pretty well, although it was visible also via direct observation. As expected, the Nalger 7mm is perfect for this target and I expect that is more than adequate for many other planetary nebulae.

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**Date:** 06/06/2015      **Telescopes:** Tele Vue 60 F6  
**Time:** 15:00-18:00      **Eyepieces:** Nagler 7mm, Vixen 5mm, Nagler 3.5mm  
**Location:** Cambridge, UK      **Power, EP, FOV:** 51x, 1.2mm, 1.54deg; 72x, 0.8mm, 0.69deg; 103x, 0.6mm, 0.77deg  
**Altitude:** 12m      **Filters:** Variable Polarising Filter (VPF), Single Polarising Filter (SPF)  
**Temperature:** 23C (wind: 5-32km/h)  
**Seeing:** 3 - Moderate seeing  
**Transparency:** 5 - Clear

Target	Cons	Type	Power	Notes
Sun	Tau	Star	51x +/- VPF or SPF, 72x +/- VPF, 103x +/- VPF	<p>I enjoyed observing the Sun a lot today. There were more than 30 sunspots and also a hint of granulation when the wind became calm for short moments. Very nice day. The wind did not allow to see Sun granulation most of the time. The seeing improved after 5pm when the wind became more moderate. Many sunspots were visible. Three larger umbrae were surrounded by nice areas of penumbra. One of this had an irregular shape and the South part vanished gradually. This at all powers. It was very attractive. A central area contain 4 well defined sunspots and many little grey spots. Around the larger sunspots, there were brighter and extended areas on the Sun surface. 51x gave the best view most of the time. 72x and 103x were interesting powers but only suitable when the wind was calm, which was rare! A VPF increased the detail noticeably. Apart from reducing image brightness, I appreciate this filter because it stabilises the image, particularly under average seeing. Surprisingly I found that I prefer the view through a SPF rather than VPF. A VPF reduces image brightness, whereas a SPF improves contrast to me. Through a SPF I could see a hint of granulation at 51x even when there was moderate wind. This did not happen with a VPF. I am considering whether separate the two filters. Having them separate would also be quite comfortable when watching planets in the twilight. SPF also improved contrast for all the sunspots. This works as follows: 0 (or 180) degrees shows the brightest image, 90 (or 270) degrees shows the darkest image. For observing both planets and the Sun, I found that I prefer the view when the SPF is positioned at 45 (or 135 or 225 or 315) degrees. The image was still bright, contrast was highest than all other options and the number of details was maximised. Nagler 7mm, Vixen 5mm, and Nagler 3.5mm form my best eyepiece combination for watching the Sun with the TV-60. All of them are really useful, although the first two achieve best results almost every time. The Nagler 3.5mm can show some very nice close-up of umbrae and penumbrae.</p>

**Date:** 03/06/2015      **Telescopes:** Tele Vue 60 F6  
**Time:** 21:40-23:30      **Eyepieces:** TV Panoptic 24mm, Nagler 3.5mm, Bresser SA 2x  
**Location:** Cambridge, UK      **Power, EP, FOV:** 15x, 4mm, 4.30deg; 103x, 0.6mm, 0.77deg; 206x, 0.3mm, 0.38deg  
**Altitude:** 12m      **Filters:** Single Polarising Filter  
**Temperature:** 12C (wind: 0km/h)  
**Seeing:** 1 - Perfect seeing  
**Transparency:** 5 - Clear

Target	Cons	Type	Power	Notes
Jupiter	Cnc	Planet	103x +/- SPF, 206x + SPF	Just a quick look until the sky became darker. No particular event tonight. It was very nice to see it. The two main bands revealed some subtle detail appearing like tiny shades. In particular these were more detectable for the main band in the North Hemisphere.
Moon	Sgr	Satellite	103x +/- SPF	Phase 96%. No many detail were revealed. The moon is not really interesting when full. Craters and seas were detectable but not immersive.
M57	Lyr	Pln Neb	103x	Ring nebula. The ring was visible with averted vision, but no other detail really. The contrast between the ring and the internal area is much more visible with an OIII filter. Still nice planetary nebula.
Zeta	Lyr	Dbl star	15x, 103x	Already split at 15x, but much nicer at 103x.
Delta	Lyr	Dbl star	15x, 103x	This is a very nice system of stars already visible at 15x. A larger triangle with a little internal triangle. Just beautiful.
Epsilon	Lyr	Dbl star	15x, 103x, 206x	The Double Double. Epsilon 1 and 2 were easily split at 15x. At 103x it was possible to detect that both Epsilon 1 and 2 are double stars themselves. At 206x this pair of tight double stars was visible although these double stars remained very close. Same colour.
Beta	Lyr	Dbl star	15x, 103x	Sheliak. Splendid double already split at 15x. This was very nice at 103x.
Beta	Cyg	Dbl star	15x, 103x	Albireo. Wonderful double. A bit tight at 15x, but very nice at 103x. One orange, the other one blue.

**Date:** 26/05/2015      **Telescopes:** Tele Vue 60 F6  
**Time:** 21:15-0:00      **Eyepieces:** TV Panoptic 24mm, Nagler 13mm, Nagler 3.5mm, Bresser SA 2x  
**Location:** Cambridge, UK      **Power, EP, FOV:** 15x, 4mm, 4.30deg; 28x, 2.2mm, 2.80deg; 103x, 0.6mm, 0.77deg; 206x, 0.3mm, 0.38deg  
**Altitude:** 12m      **Filters:** Astronomik UHC, OIII, Single Polarising Filter  
**Temperature:** 9-14C (wind: 15km/h)  
**Seeing:** 2 - Slight undulations  
**Transparency:** 5 - Clear

Target	Cons	Type	Power	Notes
Jupiter	Cnc	Planet	103x +/- SPF	Observed in civil twilight. The seeing was not enough good for pushing magnification beyond 103x. At 103x, two major bands and two moons were visible. I did not spend much on this target tonight because it was too windy when I observed it.
Moon	Leo	Satellite	103x +/- SPF, 206x + SPF	Observed in the twilight. Visible almost 60% of its phase. The SPF seems to stabilise the image if the seeing is not good. This is a lovely target with the TV60, and keeps magnification pretty well. At 206x the moon surface appeared like a bubble at the poles due to the seeing, but there were moments in which it was possible to see a quasi stable image. Subtle details on the surface were observable as well as minute craters and shades on the ground. Interestingly, on the terminator mounts tips were illuminated whereas their bases were obscured. There is so much to see at 206x that one could spend the entire night observing our satellite! Montes Apenninus, Caucasus, and Alpes were incredible targets and appeared just beautiful. The crater Cassini and all the small nearby craters were spectacular. While I am not sure the SPF increased image contrast, I prefer the view with SPF as it seems that the image is just stabler at both 103x and 106x.
M57	Lyr	Pln Neb	28x +/- UHC, 103x +/- UHC or OIII	Ring Nebula. The UHC filter increases a little bit the visibility of this target at 28x, but does not improve the contrast. The object appears as a grey blob without a shape. At 103x the ring was detectable using an UHC filter using averted vision, but this was not easy too see. The ring shape was more noticeable with a OIII filter despite the severe loss in image brightness. Without filter the nebula appeared just as a grey blob and no ring was detectable. Generally, I think an exit pupil of 0.6mm is just too small for nebula filters. It seems to me that 1.0mm is the maximum usable effectively. As this is the exit pupil typically used when observing planetary nebulae, I would say that an OIII filter is a better choice for these targets as it allows to increase contrast which is needed on these targets. Conversely, for bright extended nebulae to watch with low power eyepieces (or exit pupils larger than 3mm), a UHC filter can be beneficial for targeting and maximizing nebulae extension.
M97	UMa	Pln Neb	28x +/- UHC	Owl Nebula. Invisible at 28x with or without UHC filter. This target requires an OIII filter for being detectable with small aperture telescopes. Consistently with what said for M57, the OIII filter is a better choice for planetary nebulae (and for extended nebulae where we want to maximise nebulae contrast).

M81	UMa	Galaxy	15x, 28x	Bode's nebulae. Not easy to find it at 15x with half moon, but M81 and M82 were detectable via star hopping from Dubhe. At 28x this large galaxy shows its core and a bit of brightness on the body. I was very impressed at seeing these two targets and I believe M31, M32, M101, M81, and M82 are the most appreciable galaxies for small telescopes. Averted vision improved the visibility of this target significantly.
M82	UMa	Galaxy	15x, 28x	Cigar galaxy. Its elongated shape was visible. It was amazing to see this galaxy and its neighbour M81 in the same field. These two targets are going to become one of my favourite objects.
M3	CVn	Glob CL	28x	As all the globular cluster seen with a small telescope, M3 also appears like a little grey cloud. This is a bright globular cluster and a hint of 'granulation' is perceptible although no star can be resolved. Not very easy to find due to the lack of bright stars to star hop from Arcturus.
M5	Ser	Glob CL	28x	It appears like a grey cloud. From the star Unukalhai (Alpha Ser), go South and you find it. It is a relatively easy target.
M13	Her	Glob CL	28x	Same as M3. Very bright and large globular cluster. Some granulation is perceptible but no star could be resolved.

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<b>Date:</b>	20/05/2015	<b>Telescopes:</b>	Tele Vue 60 F6
<b>Time:</b>	21:30-0:00	<b>Eyepieces:</b>	TV Panoptic 24mm, Nagler 13mm, Nagler 3.5mm, Bresser SA 2x
<b>Location:</b>	Cambridge, UK	<b>Power, EP, FOV:</b>	15x, 4mm, 4.30deg; 28x, 2.2mm, 2.80deg; 103x, 0.6mm, 0.77deg; 206x, 0.3mm, 0.38deg
<b>Altitude:</b>	12m	<b>Filters:</b>	Astronomik OIII, Single Polarising Filter
<b>Temperature:</b>	9C (no wind)		
<b>Seeing:</b>	3 - Moderate seeing		
<b>Transparency:</b>	5 - Clear		

Target	Cons	Type	Power	Notes
Jupiter	Cnc	Planet	103x +/- SPF, 206x + SPF	Observed in the twilight. The SPF noticeably improved the view. Four bands and the transit of Callisto were easily visible at both 103x and 206x. The use of a SPF seemed to stabilise the image and improved contrast. A fair amount of shades were also perceptible on the main two bands. The transit appeared as a crisp black dot on the planet atmosphere. Without the SPF it was only possible to see the two main bands and no shade on them. They simply appeared as two thick lines across the planet. Interestingly the transit shadow appeared a tiny bit better without the filter. To me, using the SPF requires a bit of experience in order to rotate the eyepiece to gain the best contrast. However this is feasible.
Venus	Gem	Planet	103x +/- SPF, 206x + SPF	Observed in the twilight. Visible 60% of its phase. No cloud detail was detectable even with the SPF. Planet glare was reduced but it was very difficult to focus, likely due to the average seeing and high magnification.
C14 NGC869 / 884	- Per	Opn CL	15x, 28x	Double Cluster. This target is superb with the Nagler 13. Although low on the horizon, it still offers nice contrast with the background sky and the 2.8deg of fov show the object with all its context.
M56	Lyr	Glob CL	15x, 28x	This is the first time I detect this target. It is quite challenging to find with a 60mm but not impossible. I used the Sheliak (Beta Lyrae) and Sulafat (Gamma Lyrae) as pointers to target M56 along the line passing through these two stars on the side of Sulafat. M56 was detectable with a 15x using an atlas but was very faint and averted vision was almost required to find it. At 28x the object was more visible, but did not show much detail as it only appeared as a soft grey patch. This target required larger aperture and / or darker skies.
M57	Lyr	Pln Neb	28x +/- OIII	Ring Nebula. I tried the OIII filter with the Nagler 3.5 (103x). Although the ring shape was noticeable, it was just too much magnification and the overall image was largely degraded. At 28x + OIII the Ring Nebula emerged from the background sky and appeared as a colourless bubble. I believe that an exit pupil of 1-1.5mm can improve the view for this target.
M97	UMa	Pln Neb	28x +/- OIII	Owl Nebula. Interesting target. Completely invisible without OIII filter. With the OIII, it emerges from the sky and the nearby stars. It is a quite large planetary nebula. No colour or shape was detectable, but it simply appeared as a grey bubble. At 15x + OIII was detectable, but was too small to see any major detail.

M108	UMa	Galaxy	15x, 28x	Surfboard Galaxy. Invisible at both 15x and 28x. This object as well as most of the other galaxies require larger aperture and / or a darker sky.
C33 / 34 - NGC6992 / 6960	Cyg	Glob CL	15x + OIII	Veil Nebula. Again, no visible although it is too low on the horizon.
Saturn	Sco	Planet	103x, 206x	It is still fairly low on the horizon. Titan was visible. The Cassini division was not detectable, but it was possible to see a shade in the middle of the ring. At 206x the image was just degraded and difficult to focus. I have to wait for a higher position of the planet.

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<b>Date:</b>	13/05/2015	<b>Telescopes:</b>	Tele Vue 60 F6
<b>Time:</b>	21:00-0:00	<b>Eyepieces:</b>	TV Panoptic 24mm, Nagler 13mm, Nagler 3.5mm, Bresser SA 2x
<b>Location:</b>	Cambridge, UK	<b>Power, EP, FOV:</b>	15x, 4mm, 4.30deg; 28x, 2.2mm, 2.80deg; 103x, 0.6mm, 0.77deg; 206x, 0.3mm, 0.38deg
<b>Altitude:</b>	12m	<b>Filters:</b>	Astronomik OIII
<b>Temperature:</b>	8C (no wind)		
<b>Seeing:</b>	1 - Perfect seeing		
<b>Transparency:</b>	5 - Clear		

Target	Cons	Type	Power	Notes
Jupiter	Cnc	Planet	103x, 206x	Observed in the twilight. The idea started as a joke because I thought the image would have been too dark for discerning any detail. Instead, it was possible to perceive a little amount of shades on the two major bands of the planet. The boundaries of the other two less visible bands (North and South hemisphere, respectively) were also there. At 103x I was able to see the boundaries of these two bands on the 'equator side', but not on the 'pole side'. At 206x these were noticeable. 4 moons were detectable and one was just about to get closer to Jupiter. I agree with Gerry (sgl: jetstream) that watching Jupiter in twilight shows more contrast. I was also able to see some red-ish colour on the major two bands, which instead is less noticeable when watching Jupiter in the dark. Looking at a bright source before watching the planet did not help me instead. I found I had more difficulty to notice details. Although the exit pupil was only 0.3mm, floaters did not cause me serious problems. Interestingly, I found floaters to be a problem when watching the Sun at 103x. Could these be related to overall image brightness?
Venus	Gem	Planet	103x, 206x	Observed in the twilight. Visible 60% of its phase. No cloud detail was detectable. At 206x, on one side of the focus, Venus appeared violet, on the other side green/yellow. When in focus, there was no colour aberration. Curiously, at this magnification it was still very bright suggesting that a variable polarising filter might be beneficial.
C1	-	UMi	Opn CL	28x
NGC188				The detail of this target seemed accessible, but I did not manage to see anything in the position suggested by Stellarium. Unfortunately, I did not have a star atlas with me.
Alpha		UMi	Dbl Star	28x, 103x
				Polaris. A nice target because of the large difference in brightness between the two stars. Polaris' companion was dim grey and detectable at 28x with some difficulty. 103x easily split the two stars.
M60	Vir	Galaxy	28x	It was detectable with averted vision at 28x. It appeared as a grey patch without a structure. I tried M58, but it was not visible. I believe that to see these targets with this small telescope, very dark skies are required.
C33 / 34 - NGC6992 / 6960	Cyg	Glob CL	15x + OIII	Veil Nebula. No visible, although it is not the best time of the year to see this target.

M57	Lyr	Pln Neb	15x + OIII	Ring Nebula. The OIII filter largely improves the detection of this nebula at 15x. Without a filter, its detection is not easy. It emerges in the sky as a grey little ball. I believe the Nagler 7mm or even the Vixen 5mm can give great views when combined with an OIII filter.
Saturn	Sco	Planet	103x	It was a bit higher than yesterday, but unfortunately, my telescope and eyepieces were soaked with humidity and could not really see this target after the first 5 min. Rings were clearly defined, and I believe the Cassini division could have been detectable.

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**Date:** 12/05/2015      **Telescopes:** Tele Vue 60 F6  
**Time:** 21:00-23:45      **Eyepieces:** TV Panoptic 24mm, Nagler 13mm, Nagler 7mm, Nagler 3.5mm, Bresser SA 2x  
**Location:** Cambridge, UK      **Power, EP, FOV:** 15x, 4mm, 4.30deg; 28x, 2.2mm, 2.80deg; 51x, 1.2mm, 1.54deg; 103x, 0.6mm, 0.77deg; 206x, 0.3mm, 0.38deg  
  
**Altitude:** 12m      **Filters:**  
**Temperature:** 6C (wind: 20km/h)  
**Seeing:** 2 - Slight undulations  
**Transparency:** 5 - Clear

Target	Cons	Type	Power	Notes
Jupiter	Cnc	Planet	103x, 206x	Observed in the twilight. Still visible at 206x with some detail but the new tripod is not up to this sort of magnifications. To be fair, the new tripod was fine at 103x but only when there was no wind. 3 bands and 4 moons visible. It would be interesting to try 206x with my solid tripod.
Venus	Gem	Planet	103x	Observed in the twilight. Visible 60% of its phase. No cloud detail was detectable. A polarised filter might help on this target.
M44	Cnc	Opn CL	15x, 28x	The Nagler 13mm offers the best view. Its fov covers the whole object nicely. Image not degraded at all and the background sky was darkened just the right amount for maximising contrast. Exit pupil of about 2.0mm shows a really nice brightness / contrast for point source DSO.
C14 NGC869 / 884	- Per	Opn CL	15x, 28x	Double Cluster. Again, the Nagler 13 offering almost 3 degrees of fov shows the full object with great detail but conserving an adequate image brightness.
Stock2	Cas	Opn CL	15x, 28x	As above.
M103 C13 - NGC457	or Cas -	Opn CL	28x	Not sure whether I saw M103 or C13 (the Owl Cluster) though. A clear double star was well visible and there were a few dim stars in the background were also detectable. This object starts being visible at 28x. It is relatively small, but a lovely target. I think it was M103 as my memory seems more similar to the images.
M60	Vir	Galaxy	15x, 28x	Turn West to Vindemiatrix. A little crown of star is visible slightly South. Continue and you see a little arrow of stars and a single star in the North. M60 is between these two objects. Not detectable at 15x. Detectable via averted vision at 28x. A patch of grey. The sky was not fully dark though and my eye was not dark adapted. I believe this object can show more detail.
27 Hya	Hya	Dbl Star	15x, 28x	Easily split. Colours detectable.
M13	Her	Glob CL	15x, 28x	Detectable at 15x, but nicer at 28x. No star was resolved. It would be interesting to try 51x although I guess this might be too much.
M57	Lyr	Pln Neb	15x, 28x, 51x	Ring Nebula. For the first time, I managed to see this object with the TV-60. I find extremely difficult to detect it at 15x unless I map the nearby stars with Stellarium. At 28x M57 is clearly visible and appears as a grey blob. At 51x the ring is detectable. I did not try to use an OIII filter because I was freezing due to lack of cloths and about to leave. I believe this target will show much more detail at 51x with OIII filter.

Saturn	Sco	Planet	103x	Very low on the horizon and therefore not the best moment for viewing this target. Despite this, rings and titan were visible. Cassini division and bands were not detectable.
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<b>Date:</b>	30/04/2015	<b>Telescopes:</b>	Tele Vue 60 F6
<b>Time:</b>	22:00-23:00	<b>Eyepieces:</b>	TV Panoptic 24mm, Nagler 7mm, Nagler 3.5mm
<b>Location:</b>	Cambridge, UK	<b>Power, EP, FOV:</b>	15x, 4mm, 4.30deg; 51x, 1.2mm, 1.54deg; 103x, 0.6mm, 0.77deg
<b>Altitude:</b>	12m	<b>Filters:</b>	
<b>Temperature:</b>	6C (no wind)		
<b>Seeing:</b>	2 - Slight undulations		
<b>Transparency:</b>	5 - Clear		

Target	Cons	Type	Power	Notes
Moon	Vir	Satellite	51x, 103x	Moon phase 91%. The moon at 103x did not need a filter. It was very crisp and showed details in the south hemisphere despite it was almost full. At 51x, the moon is simply scaled of a factor of 1/2, indicating that the Nagler 3.5mm behaves as a perfect 2x Nagler 7mm. It would be useful to have a Moon map to check the crater's names.
Jupiter	Cnc	Planet	103x	At 103x Jupiter showed 4 moons and 4 bands. No specific events were visible this evening.
M44	Cnc	Opn CL	15x	Beehive cluster. One of the best wide open cluster. Not many faint stars were visible because of almost full moon. However, the cluster still emerged in the sky.
C14 NGC869 / 884	- Per	Opn CL	15x, 51x	Double cluster. Superb cluster. Even if low in the sky, it was a pleasure to see it. At 51x, the cluster emerged from the background and showed more faint stars.
Stock2	Cas	Opn CL	15x	This cluster next to the double cluster is very nice and needs a wide field telescope. Its stars are not so bright and generally of similar magnitude and colour.
Mel20	Per	Opn CL	15x	Alpha Per moving cluster. Wide field telescopes or binoculars are the best for this superb cluster. Even if low in the sky, it was very beautiful to see. ¿70 stars detectable.
C39 NGC2392	- Gem	Pln Neb	15x, 51x	Eskimo nebula. At 15x it was detectable with averted vision. It was easily visible at 51x and appeared like a fuzzy blue/grey small patch next to the star.

**Date:** 14/04/2015b      **Telescopes:** Tele Vue 60 F6  
**Time:** 21:30-23:20      **Eyepieces:** TV Panoptic 24mm, Plossl 20mm, Nagler 7mm, Vixen SLV 5mm, Nagler 3.5mm  
**Location:** Cambridge, UK      **Power, EP, FOV:** 15x, 4mm, 4.30deg; 18x, 3.3mm, 2.7deg; 51x, 1.2mm, 1.54deg; 72x, 0.8mm, 0.69deg; 103x, 0.6mm, 0.77deg  
  
**Altitude:** 12m      **Filters:**  
**Temperature:** 9C (no wind)  
**Seeing:** 2 - Slight undulations  
**Transparency:** 5 - Clear

Target	Cons	Type	Power	Notes
M35	Gem	Opn CL	15x	Under dark sky this object emerges clearly. A few bright stars with many little faint stars in background. Averted vision helps, but this object is not too demanding if the sky is sufficiently transparent.
M65	Leo	Galaxy	15x, 18x	This object requires aperture and dark sky to be detected and viewed properly. Just very faint object visible through averted vision. An exit pupil of 3.3mm is better than 4.0mm. I wonder whether something between 2.5 and 2.0mm can improve this view even more.
M66	Leo	Galaxy	15x, 18x	See above
Mel111	Com	Opn CL	15x	Coma Berenices star cluster. Located just south of Gamma Com, this large object is as spectacular as M44. Very rich of stars, some bright some small and fainting. Some are doubles. As this is a large object, 15x is the adequate magnification. As Coma Berenices does not have bright stars, you can find this object knowing that is between Denebola (Leo) and Cor Caroli (Alpha CVn).
M53	Com	Glob CL	15x, 18x, 51x	This object is not easy to find. It is just 1-2 degrees east of Diadem (Alpha Com), but this star is very dim to be seen, unless the sky is enough dark. Instead use the Virgo trapezium and point to north following the star Vindemiatrix (Virgo). You can find Diadem just going some degree north from Vindemiatrix. M53 appears as a little grey cloud at 15x. No detail of this globular cluster is visible. At 18x, the contrast is a bit improved, but the image is the same. At 51x this objects is larger and well detectable, but still appears like a grey cloud.
NGC5053	Com	Glob CL	15x, 18x, 51x	Invisible. This is a bit smaller and dimmer than M53. I could not find it.
M3	CVn	Glob CL	15x, 51x	Again, not easy to find. I used the axis from Gamma to Beta Com. This cluster is brighter than M54 and at 51x seems a large white/grey blob.
Jupiter	Cnc	Planet	103x, 72x	Transit of Ganymede on Jupiter. Little black dot on the Equatorial zone. All the other three main satellites were well distinct on right.

**Date:** 14/04/2015a      **Telescopes:** Tele Vue 60 F6  
**Time:** 18:00-19:00      **Eyepieces:** Nagler 7mm, Vixen SLV 5mm, Nagler 3.5mm  
**Location:** Cambridge, UK      **Power, EP, FOV:** 51x, 1.2mm, 1.54deg; 72x, 0.8mm, 0.69deg; 103x, 0.6mm, 0.77deg  
**Altitude:** 12m      **Filters:** Variable Polarizing Filter  
**Temperature:** 21C (no wind)  
**Seeing:** 2 - Slight undulations  
**Transparency:** 5 - Clear

Target	Cons	Type	Power	Notes
Sun	Psc	Star	51x +/- VPF; 72x, 103x	Today at 4pm there was a gigantic flare (CME) about 1 sun radius long. Unfortunately I was not at home. I looked at the Sun, but the flare was gone by the time I set up the telescope. A large group of black spots was visible in the North hemisphere. Around them granulation was clearly visible. Granulation was also detectable, although with some difficulty, on the Sun surface at 51x using a VPF. At 72x the Sun revealed a nice image where Sun spot details were visible as well as surface granulation. 103x was just too much for this seeing. Although it can be used for magnifying the solar spots, granulation is completely lost. In addition, floaters become a real issue when watching the sun using 0.6mm exit pupil. I think the best magnification is between 51x and 72x. The Vixen 5mm works very well with the Sun. This was used without VPF filter.

**Date:** 11/04/2015      **Telescopes:** Tele Vue 60 F6  
**Time:** 18:00-19:00      **Eyepieces:** Nagler 7mm, Vixen SLV 5mm  
**Location:** Cambridge, UK      **Power, EP, FOV:** 51x, 1.2mm, 1.54deg; 72x, 0.8mm, 0.69deg  
**Altitude:** 12m      **Filters:** Variable Polarizing Filter  
**Temperature:** 12C (wind)  
**Seeing:** 2 - Slight undulations  
**Transparency:** 2 - Poor

Target	Cons	Type	Power	Notes
Sun	Psc	Star	51x +/- VPF; 72x	Two spot areas: one in the north, the other one in the south. 5 small spots where visible in the north, 4-5 in the south spot area. 2 small spots in the centre of the sun. Best view 51x, using variable polarising filter. No granularity was visible due to the bad seeing.

**Date:** 09/04/2015      **Telescopes:** Tele Vue 60 F6  
**Time:** 21:20-22:45      **Eyepieces:** TV Panoptic 24mm, Nagler 3.5mm  
**Location:** Cambridge, UK      **Power, EP, FOV:** 15x, 4mm, 4.30deg; 103x, 0.6mm, 0.77deg  
**Altitude:** 12m      **Filters:** Variable Polarizing Filter  
**Temperature:** 9C (no wind)  
**Seeing:** 2 - Slight undulations  
**Transparency:** 2 - Poor

Target	Cons	Type	Power	Notes
Jupiter	Cnc	Planet	15x; 103x +/- VPF	At the eyepiece from right to left: Callisto, Io, Jupiter, Europa and Ganymede. This evening I decided to test my new eyepiece (Nagler 3.5mm). Due to the lack of transparency, I only tested this on Jupiter. This was the first time I observed at 103x without using a Bresser 2x SA. The difference was quite substantial. I had the impression that the Nagler 7mm with Bresser 2x SA was more colour corrected than the Nagler 3.5mm only at the edge (last 10% before the field stop). This might have been caused by the presence of light fog though, instead of the eyepiece. I will test this again. On the other hand, the lack of the Bresser 2x SA (4 lens less) improved transparency, and this was detectable. With a Nagler 7mm and Bresser 2x SA, I am able to see a bit more than the two main bands only when the seeing is quite good. Tonight, although the seeing was acceptable, but the sky was quite foggy. The main two bands (North and South Equatorial Belts) were visible and other two bands at the poles were easily detectable (North Polar Region, S.S. Temperate Belt). In the North and South Equatorial Belts, some shades were also detectable. No direction was visible but it was possible to see that the borders and belt colours were rough and not homogeneous. This was particularly true for the North Equatorial Band. No GRS was detectable. The use of a single or double polarizing filter did not improve image quality. The whole image only appeared too dark and the minute details previously described were lost. Possibly, the VPF is more appropriate for brighter objects (e.g. the Sun and the Moon) or Jupiter during sunset or dawn.

**Date:** 06/04/2015      **Telescopes:** Tele Vue 60 F6  
**Time:** 21:00-22:45      **Eyepieces:** TV Panoptic 24mm, Nagler 7mm, Vixen SLV 5mm, Bresser 2x SA  
**Location:** Cambridge, UK      **Power, EP, FOV:** 15x, 4mm, 4.30deg; 30x, 2mm, 2.15deg; 51x, 1.2mm, 1.54deg; 72x, 0.8mm, 0.69deg; 103x, 0.6mm, 0.77deg  
**Altitude:** 12m      **Filters:** Astronomik UHC, OIII  
**Temperature:** 8C (no wind)  
**Seeing:** 2 - Slight undulations  
**Transparency:** 3 - Somewhat clear

Target	Cons	Type	Power	Notes
NGC1647	Tau	Opn CL	15x, 51x	In this period of the year, Taurus is quite low on the horizon. This object did not show many stars due to the light pollution and atmosphere. You will need darker skies or look at it when it is higher on the horizon. From Aldebaran, go east for 4 degrees. It is near a couple of stars and i Tauri (mag 5), which is the brightest star in the area. 51x did not help tonight, as the object became too dim. I suspect a 30x, exit pupil 2.0mm would be the best for these targets.
NGC1746	Tau	Opn CL	15x, 51x	After finding NGC1647, from i Tauri, go east for other 4-5deg until you see iota(?) Tauri (102 Tau, mag 4.6). NGC1746 is a medium size cluster at 15x at west of 102 Tau. It also appears very nice at 51x.
NGC1817	Tau	Opn CL	15x, 51x	After finding NGC1647, from i Tauri, go south-east for 5 deg until you see m Tauri (mag 4.9). NGC1817 and 1807 appear on the same field of view at both 15x and 51x. 15x is not sufficient for seeing details of these two clusters. These are accessible at 51x. NGC1817 seems less visible than NGC1807
NGC1807	Tau	Opn CL	15x, 51x	See NGC1817. NGC1807 is more spectacular than NGC1817 at 51x possibly because it has brighter stars.
NGC1662	Ori	Opn CL	15x, 51x	A little open cluster near the top of Orion's shield. It is also reachable from Aldebaran (Alpha Tauris) moving towards south for about 8deg. At 15x it only shows its compactness. At 51x it shows some stars. This is a compact open cluster formed by relatively visible stars.
M1	Tau	SN Rem	15x; 51x +/- OIII, UHC	Invisible after trying with different magnifications and averted vision. Filters did not help either. You need dark skies for this target. Possibly you need to use an eyepiece at 2.0mm exit pupil.
M65	Leo	Galaxy	30x	Leo triplet. Elongated grey patch visible with averted vision. Shape of a cigar. At 30x, the patch is visible more easily than at 15x. The Leo triplet is more easily detectable when the telescope is slightly moved. The patches will move accordingly.
M66	Leo	Galaxy	30x	Leo triplet. As for M65.
M51	CVn	Galaxy	30x	Whirlpool Galaxy. Grey patch without a structure visible with averted vision. A darker sky will make the difference on this target.
Jupiter	Cnc	Planet	103x	Two bands clearly visible and a faint one on the south hemisphere was detectable. All four satellites were visible. Io and Europa were very tight at East of the planet.



C59	-	Hya	Pln Neb	15x; 51x +/-	Ghost of Jupiter. By naked eye, from Alphard (Alpha Hydrae, mag 1.95), move east and detect
NGC3242				OIII, UHC; 72x	the Lambda Hydrae (mag 3.6). This star appears like a star system extending north and south from Lambda Hydrae. Continue moving east following Hydrae body. The next star is slightly south of Lambda. This is Mu Hydra (mag 3.6). Then next one is Nu Hydra (mag 3.10). Mu Hydra will appear Yellow/Orange and almost isolated. It has a little star on the north. Slightly south, you see two bright couples of stars: two more distant at east (HIP50693, HIP50764), two closer at west (HIP51170, HIP51193). Consider the tight couple at west. There is a little star (near this couple in the direction of the other couple. If you use the tight couple and the little star as pointer and you move for another segment in the direction of the little star, the planetary nebula will appear. This appears as a faint tiny and diffuse light. No structure. At 51x it appears like a little full circle. An OIII seems more effective than an UHC filter here possibly because the planetary nebula is low on the horizon. The OIII filter makes it appear from the sky, whereas really few nearby stars are visible. 72x does not show more detail. UHC filter works fine but does not boost the object at the same level as the OIII does.

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**Date:** 25/03/2015      **Telescopes:** Tele Vue 60 F6  
**Time:** 21:00-22:45      **Eyepieces:** TV Panoptic 24mm, Plossl 20mm, Nagler 7mm, Vixen SLV 5mm, Bresser 2x SA  
**Location:** Cambridge, UK      **Power, EP, FOV:** 15x, 4mm, 4.30deg; 18x, 3.3mm, 2.73deg; 30x, 2mm, 2.15deg; 51x, 1.2mm, 1.54deg; 72x, 0.8mm, 0.69deg  
**Altitude:** 12m      **Filters:** Astronomik UHC, OIII  
**Temperature:** 6C (no wind)  
**Seeing:** 2 - Slight undulations  
**Transparency:** 3 - Somewhat clear

Target	Cons	Type	Power	Notes
M47	Pup	Opn CL	15x	Rich of stars. These are quite spread, making this cluster easy to detect and study.
M46	Pup	Opn CL	15x	This is a compact cluster. It is detectable.
M48	Hya	Opn CL	15x	Dim open cluster. It requires transparent skies to shine properly.
M65	Leo	Galaxy	15x, 18x, 30x	Invisible. Sky not transparent enough. I think an exit pupil of 3.3mm is a good compromise between 4mm and 2mm. 2mm is too much for the TV60 on this targets.
M66	Leo	Galaxy	15x, 18x, 30x	Invisible. Sky not transparent enough.
C50	- Mon	Opn CL	15x	Satellite cluster. Six stars in two columns
NGC2244				
NGC2264	Mon	CL+Neb	15x	Christmas tree.
C39	- Gem	Pln Neb	15x, 51x +/-	Eskimo nebula. From Wasat (Delta Gem) move east to 63 Gem. 63 Gem is the brightest star of a 'half moon' of 7 stars. The Eskimo nebula is next to the star HIP36370 (mag8.2), which is a bit isolated but very close to 63 on the opposite direction of Wasat. You can spot it at 15x without filters, but you see it only with averted vision. It appears as a very small patch next to the star. At 51x the nebula is visible as a grey little ball. The boundaries are obfuscated. An UHC filter helps increasing the contrast between the sky and the nebula. An OIII filter shows even more contrast, although I think an UHC filter is better at this exit pupil (1.2mm). Using these filters, the boundaries of the nebula appear much clearer although no structure is visible at this magnification. At 72x (and no filter) is still visible as a grey little ball. Boundaries are obfuscated.
NGC2392			OIII, UHC, 72x	
Jupiter	Cnc	Planet	72x	Quick observation. Two bands and four satellite were visible.
Alpha	Hya	Star	72x	Alphard. Yellow star
Alpha	Vir	Star	72x	Spica. Blue star
Alpha	Leo	Dbl Star	15x, 72x	Regulus. Blue-white double star visible at 15x. Clearly split at 72x although not all this magnification is actually required for split it.

**Date:** 24/03/2015      **Telescopes:** Tele Vue 60 F6  
**Time:** 19:00-21:30      **Eyepieces:** TV Panoptic 24mm, Nagler 7mm, Vixen SLV 5mm, Bresser 2x SA  
**Location:** Cambridge, UK      **Power, EP, FOV:** 15x, 4mm, 4.30deg; 51x, 1.2mm, 1.54deg; 72x, 0.8, 0.69deg; 144x, 0.4mm, 0.35deg  
**Altitude:** 12m      **Filters:**  
**Temperature:** 5C (no wind)  
**Seeing:** 3 - Moderate seeing  
**Transparency:** 3 - Somewhat clear

Target	Cons	Type	Power	Notes
M47	Pup	Opn CL	15x, 51x	Superb anchor shape. 51x reveals many more details. Quite tight double star near the centre. From Alpha Mon, go 5 degrees South.
M46	Pup	Opn CL	15x, 51x	Missed as I confused it with the aggregation of stars at North-West of 2 Pup A and 4 Pup.
M48	Hya	Opn CL	15x	Not easy to see if the sky is not very dark. Fortunately it is quite large. It is the third vertex of the triangle formed by the trio of stars "1Hya C Hya 2Hya (CHya mag 3.8 is the brightest in the middle of the trio) and 29 Mon (mag 4.35).
Moon	Tau	Satellite	72x	Waxing crescent 25%. Very crisp details.
Venus	Cet	Planet	72x, 144x	144x was too much. Possibly because the planet was too low, or because the eyepiece did not cool down properly. In any case, even at 72x, no planet atmosphere detail.
Delta	Ori	Dbl Star	72x	Mintaka. Easily split.
Zeta	Ori	Dbl Star	72x	Alnitak. Separated components A and C. Cannot remember if B was detectable.
Sigma	Ori	Dbl Star	72x	Visible 5 stars, although only able to split Sigma Orionis into two stars.
Iota	Ori	Dbl Star	72x	Hatsya. Very nice double star. The companion is quite dim and small compared to Hatsya. Companion is grey.
Alpha	CMa	Dbl Star	72x	Sirius. Not able to split Sirius. Too much bright.
Alpha	Gem	Dbl Star	72x	Castor. The companion Castor B is also bright and the two stars are quite close to each other. Same colour. Castor C is very dim and more distant from the other two.
Zeta	Gem	Dbl Star	72x	Mekbuda. Easily split double star.
M35	Gem	Opn CL	72x	Many other stars are visible.

**Date:** 22/03/2015      **Telescopes:** Tele Vue 60 F6  
**Time:** 19:00-22:00      **Eyepieces:** TV Panoptic 24mm, Nagler 7mm, Vixen SLV 5mm, Bresser 2x SA  
**Location:** Cambridge, UK      **Power, EP, FOV:** 15x, 4mm, 4.30deg; 51x, 1.2mm, 1.54deg; 144x, 0.4mm, 0.35deg  
**Altitude:** 12m      **Filters:** Astronomik OIII  
**Temperature:** 3C (no wind)  
**Seeing:** 2 - Slight undulations  
**Transparency:** 3 - Somewhat clear

Target	Cons	Type	Power	Notes
M45	Tau	Opn CL	15x, 51x	Very clear and defined. 15x offers the best fov.
M42	Ori	CL+Neb	15x + OIII, 51x	4mm exit pupil + OIII shows nebula extension. 51x shows trapezium
Sigma	Ori	Mlt star	51x	Sufficient for seeing 5 stars
NGC1980	Ori	Neb	15x + OIII	4mm exit pupil + OIII shows a bit of nebula around the star Hatsya
M78	Ori	Neb	15x	Unsuccess
C50	- Mon	Opn CL	15x	Satellite cluster. Six stars in two columns
NGC2244				
C49	- Mon	Neb	15x + OIII	Rosette nebula. Detectable with OIII filter. A grey patch 2 degree large. No structure visible
NGC2237				
NGC2264	Mon	CL+Neb	15x + OIII	Christmas tree + Cone nebula. Christmas tree is easily visible. Cone nebula is detectable with an OIII filter near and south of 15mon.
M35	Gem	Opn CL	15x	Under transparent night, many stars are visible inside.
M36	Aur	Opn CL	15x	Easy to find after finding M38. A bit difficult to see inside as it is quite dim.
M37	Aur	Opn CL	15x	Easy to find after finding M36. Still difficult to see inside.
M38	Aur	Opn CL	15x	Quite clear under transparent skies.
M44	Cnc	Opn CL	15x	Praesepe. Spectacular at 15x.
M67	Cnc	Opn CL	15x, 51x	King cobra. Not to easy to detect. Nicer at 51x.
M65	Leo	Galaxy	15x	Leo triplet. From Chertan (theta Leo), use the star pointers HIP54688 and HIP54711 to reach eta Leo. Eta Leo forms a 90Deg triangle with HIP55033 and HIP55262. From the latter look at south slightly. Galaxy detectable as patches. M56 is elongated. Averted vision for 10min is required. Cover the other eye to relax the observing eye nerve.
M66	Leo	Galaxy	15x	Leo triplet. As for M65. Maybe using an exit pupil of 2.7-2.0mm is better.
M95	Leo	Galaxy	15x	Unsuccess
M96	Leo	Galaxy	15x	Unsuccess
Gamma	UMi	Dbl Star	15x	Pherkad. Blue 3mag. It has a neighbour star 10.30mag. Pherkad Minor orange 5mag.
19-20	Dra	Dbl Star	15x	4.5mag and 7mag.
Eta-	Dra	Dbl Star	15x	2.7mag and 6.05mag
HIP80309A				

M51	CVn	Galaxy	15x	Whirlpool Galaxy. From UMA-Alkaid, move south to 24CVn. Continue on that direction until HIP65768. This forms a triangle with HIP66004 and HIP66116. They are all 7mag stars. HIP65768 is the brightest in the area. M51 lies externally of the line between HIP65768 and HIP66004. Averted vision for 10min is required. You will see a grey patch. No structure.
M101	UMa	Galaxy	15x	Unsuccess
Jupiter	Cnc	Planet	144x	Order: Europa, Callisto, Jupiter, Io, Ganymede. Two bands very visible. The lower one was visible on the left (refractor). On the right the great red spot was detectable. Very minor bands north and south.

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**Date:** 23/02/2015      **Telescopes:** Tele Vue 60 F6  
**Time:** 19:00-21:00      **Eyepieces:** TV Panoptic 24mm, Plossl 20mm, Nagler 7mm, Vixen SLV 5mm, Bresser 2x SA  
**Location:** Cambridge, UK      **Power, EP, FOV:** 15x, 4mm, 4.30deg; 18x, 3.3mm, 2.73deg; 103x, 0.6mm, 0.77deg; 144x, 0.4mm, 0.35deg  
**Altitude:** 12m      **Filters:** Astronomik OIII, UHC  
**Temperature:** 1C (no wind)  
**Seeing:** 2 - Slight undulations  
**Transparency:** 3 - Somewhat clear

Target	Cons	Type	Power	Notes
M42	Ori	CL+Neb	15x, 18x	4mm exit pupil + UHC shows nebula extension. OIII shows more contrast.
C50	-	Mon	Opn CL	Satellite cluster. Six stars in two columns
NGC2244				
C49	-	Mon	Neb	15x, 18x
NGC2237				Rosette nebula. Detectable with OIII filter. Very soft grey patch. No structure. Invisible with UHC filter.
M35	Gem	Opn CL	15x	Detectable but not much detailed.
M36	Aur	Opn CL	15x	Very poor detail, but detectable.
M37	Aur	Opn CL	15x	Very poor detail, but detectable.
M38	Aur	Opn CL	15x	The first of the group to find. Poor detail.
M44	Cnc	Opn CL	15x	Praesepe. Spectacular at 15x.
M67	Cnc	Opn CL	15x	King cobra. Not too easy to detect. Looks like a grey patch, more visible using averted vision.
Jupiter	Cnc	Planet	103x, 144x	A bit of wind, but the image stays crisp at high magnifications. No aberration.
NGC1662	Ori	Opn CL	15x, 51x	Found casually while scanning from Aldebaran to Betelgeuse. Very small little open cluster at 15x. Much better at 51x. Not easily detectable, because of its small size
NGC1647	Tau	Opn CL	15x	Beautiful open cluster easily detectable from Aldebaran
NGC1746	Tau	Opn CL	15x	Not sure I found it. It appeared smaller than NGC1647. Possibly a darker sky reveals more interesting features.
Cr65	Tau	Opn CL	15x	Nice aggregation of stars, although none of them really emerges. Wide field is required. North of Orion-Meissa.
Cr70	Ori	Opn CL	15x	Gorgeous Orion's belt. The chain of stars surrounding Alnilam is superb. Wide field telescope.

**Date:** xx/xx/1998      **Telescopes:** Celestron Newton 114mm F8; Binoculars 15x70; Tele Vue 60 F6  
**Time:** Mar 1998 to Jan 2015      **Eyepieces:** Kellner 25mm, Orion Sirius 10mm, Orion Shorty 2x Barlow. TV Panoptic 24mm, Plossl 20mm, Nagler 7mm, Vixen SLV 5mm, Bresser 2x SA  
**Location:** Venice, Lorenzago (IT). Newcastle, Luton Devon, Cambridge, (UK)      **Power, EP, FOV:** 36.4x, 3.1mm, 1.4deg; 72.8x, 1.6mm, 0.7deg; 91x, 1.3mm, 0.57deg; 182x, 0.6mm, 0.3deg. 15x, 4mm, 4.30deg; 18x, 3.3mm, 2.73deg; 103x, 0.6mm, 0.77deg; 144x, 0.4mm, 0.35deg  
**Altitude:** 10m - 880m      **Filters:**  
**Temperature:** -5 to +30C (wind: 0 to 40km/h)  
**Seeing:** 1 to 3  
**Transparency:** 3 to 5

Target	Cons	Type	Power	Notes
M1	Tau	SN Rem	36x	Crab Nebula. C114F8, Venice (IT).
M2	Aqr	Glob CL	15x	B15x70, Newcastle (UK).
M7	Sco	Opn CL	36x	Ptolemy Cluster. C114F8, Venice (IT). Large and beautiful open cluster. It was just above the horizon and the last cluster visible if moving towards East.
M10	Oph	Glob CL	36x; 15x	C114F8, Venice (IT); B15x70, Newcastle (UK).
M11	Sct	Opn CL	15x	Wild duck cluster. B15x70, Newcastle (UK).
M12	Oph	Glob CL	15x	B15x70, Newcastle (UK).
M13	Her	Glob CL	36x; 15x, 51x	Hercules Globular Cluster. C114F8, Venice (IT); B15x70, TV60F6, Newcastle (UK).
M15	Peg	Glob CL	15x	B15x70, Newcastle (UK).
M20	Sgr	CL+Neb	36x	Trifid nebula. C114F8, Venice (IT).
M27	Vul	Pln Neb	15x	Dumbbell nebula. B15x70, Newcastle (UK).
M29	Cyg	Opn CL	15x	B15x70, Newcastle (UK).
M31	And	Galaxy	36x; 15x	Andromeda Galaxy. C114F8, Venice (IT); B15x70, Luton, Devon (UK); TV60F6, Newcastle (UK).
M32	And	Galaxy	15x	Companion to M31. B15x70, Luton, Devon (UK).
M34	Per	Opn CL	15x	B15x70, TV60F6, Newcastle (UK).
M35	Gem	Opn CL	15x, 72x	B15x70, Newcastle (UK).
M36	Aur	Opn CL	15x, 30x	TV60F6, Newcastle, Cambridge (UK).
M37	Aur	Opn CL	15x, 30x	TV60F6, Newcastle, Cambridge (UK).
M38	Aur	Opn CL	15x, 30x	TV60F6, Newcastle, Cambridge (UK).
M41	CMa	Opn CL	15x	TV60F6, Cambridge (UK).
M42	Ori	CL+Neb	36x; 15x, 18x, 30x, 36x, 51x, 72x	Orion nebula. C114F8, Venice (IT); TV60F6, Newcastle, Cambridge (UK).

M43	Ori	Brt Neb	36x; 15x, 18x, 30x, 36x, 51x, 72x	Detached part of Orion Nebula. C114F8, Venice (IT); TV60F6, Newcastle, Cambridge (UK).
M44	Cnc	Opn CL	15x	Beehive Cluster. B15x70, TV60F6, Newcastle (UK).
M45	Tau	CL+Neb	36x; 15x, 51x	Pleiades. C114F8, Venice (IT); TV60F6, Newcastle, Cambridge (UK).
M57	Lyr	Pln Neb	37x; 15x	Ring Nebula. C114F8, Venice, Lorenzago (IT); B15x70, Newcastle (UK).
M67	Cnc	Opn CL	15x	The King Cobra Cluster. TV60F6, Cambridge (UK).
M81	UMa	Galaxy	15x	Bode's Galaxy. B15x70, Newcastle (UK).
M82	UMa	Galaxy	15x	Cigar Galaxy. B15x70, Newcastle (UK).
M92	Her	Glob CL	15x	B15x70, Newcastle (UK).
M110	And	Galaxy	15x	M31 Companion. B15x70, Luton, Devon (UK).
C14	-	Per	Opn CL	Double Cluster. B15x70, Exeter, Newcastle (UK); TV60F6, Newcastle (UK).
NGC869 / 884				
C28	-	And	Opn CL	15x
NGC752				B15x70, Newcastle (UK).
C37	-	Vul	Opn CL	15x
NGC6885				B15x70, Newcastle (UK).
C39	-	Gem	Pln Neb	15x, 51x, 72x
NGC2392				Eskimo Nebula. TV60F6, Cambridge (UK).
C41		Tau	Opn CL	36x; 15x, 18x, 51x
				Hyades. C114F8, Venice (IT); B15x70, TV60F6, Newcastle (UK).
C49	-	Mon	Neb	15x
NGC2237				Rosette Nebula. TV60F6, Cambridge (UK).
C50	-	Mon	Opn CL	15x
NGC2244				Satellite cluster. TV60F6, Newcastle, Cambridge (UK).
Stock1	Vul	Opn CL	15x	B15x70, Newcastle (UK).
Stock2	Cas	Opn CL	15x	B15x70, TV60F6, Newcastle (UK).
Mel20	Per	Opn CL	15x	B15x70, TV60F6, Newcastle (UK).
Mel25	Tau	Opn CL	36x; 15x, 51x	Hydes. C114F8, Venice (IT); TV60F6, Newcastle, Cambridge (UK).
Mel111	CmB	Opn CL	15x	Coma Berenices Star Cluster. B15x70, Newcastle (UK).
Cr39	Ori	Opn CL	36x; 15x, 51x	TV60F6, Cambridge (UK).
Cr65	Tau	Opn CL	15x	TV60F6, Cambridge (UK).
Cr68	Ori	Opn CL	15x, 30x	TV60F6. Newcastle, Cambridge (UK).
Cr89	Gem	Opn CL	15x	TV60F6. Newcastle, Cambridge (UK).
Cr97	Mon	Opn CL	15x, 30x	TV60F6, Cambridge (UK).
Cr106	Mon	Opn CL	15x, 30x	TV60F6, Cambridge (UK).



Cr107	Mon	Opn CL	15x, 30x	TV60F6, Cambridge (UK).
Cr399	Vul	Opn CL	15x	Brocchi's Cluster, the Coathanger. B15x70, Newcastle (UK).
NGC1750	Tau	Opn CL	15x, 51x	TV60F6, Cambridge (UK).
NGC1980	Ori	Neb	15x	TV60F6, Cambridge (UK).
NGC1981	Ori	Opn CL	15x, 51x	TV60F6, Cambridge (UK).
NGC2264	Mon	Opn CL	36x; 15x, 51x	C114F8, Venice (IT); TV60F6, Cambridge (UK).
NGC6633	Oph	Opn CL	36x; 15x	C114F8, Venice (IT); B15x70, Newcastle (UK). A beautiful chain of stars.
IC4756	Ser	Opn CL	36x; 15x	Graff's Cluster. C114F8, Venice (IT); B15x70, Newcastle (UK).
27 Hydra	Hya	Dbl Star	51x	TV60F6, Cambridge (UK).
Gamma	UMi	Dbl Star	51x	Pherkad. TV60F6, Cambridge (UK).
Beta	And	Dbl Star	15x	Mirach. B15x70, Newcastle (UK).
Alpha	Her	Dbl Star	15x	Rasalgethi. B15x70, Newcastle (UK).
71-72	Oph	Dbl Star	15x	B15x70, Newcastle (UK).
Alpha	Leo	Dbl Star	37x, 74x	Regulus. C114F8, Italy (IT).
Beta	Ori	Dbl Star	37x, 74x; 15x	Rigel. C114F8, Italy (IT), B15x70, Newcastle (UK).
Alpha	UMa	Dbl Star	15x; 30x	Dubhe. B15x70, TV60F6, Newcastle (UK).
Zeta	UMa	Dbl Star	15x; 15x, 51x	Mizar and Alcor. B15x70, TV60F6, Newcastle, Cambridge (UK).
19-20	Dra	Dbl Star	51x	TV60F6, Cambridge (UK).
Eta-	Dra	Dbl Star	51x	TV60F6, Cambridge (UK).
HIP80309A				
Beta	Cyg	Dbl Star	72x	Albireo. C114F8, Venice (IT); TV60F6, Newcastle (UK).
Sun		Star	50x; 15x, 51x	TV60F6, Cambridge (UK).
Moon		Satellite	36x, 90x, 180x; 15x, 51x, 72x, 103x, 144x	C114F8, Italy (IT); B15x70, TV60F6, Newcastle, Cambridge (UK).
Mercury		Planet	15x	B15x70, Newcastle (UK).
Venus		Planet	36x; 72x, 144x	C114F8, Venice (IT); TV60F6, Cambridge (UK).
Mars		Planet	36x, 90x, 180x	C114F8, Venice (IT).
Jupiter		Planet	36x, 90x, 180x; 72x, 103x, 144x	C114F8, Italy (IT); B15x70, TV60F6, Newcastle, Cambridge (UK).
Saturn		Planet	36x, 90x, 180x	C114F8, Venice (IT).
Uranus		Planet	10x; 15x; 15x	B10x50, Lorenzago (IT); B15x70, TV60F6, Newcastle (UK).

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# Messier Catalogue

Name	Other	Type	Cons	RA	Dec	Mag	Size (arc min)	SB	Distance (ly)	Common Name
M1	NGC1952	SN Rem	Tau	00:40:22	+22° 01'	8.4	8'	11	4.9-8.1	Crab Nebula
M2	NGC7089	Glob CL	Aqr	00:42:42	-0° 49'	6.3	11.7'	11	33	
M3	NGC5272	Glob CL	CVn	00:42:44	+28° 23'	6.2	18.6'	11	33.9	
M4	NGC6121	Glob CL	Sco	01:33:12	-26° 32'	5.9	26.3'	12	7.2	Butterfly Cluster
M5	NGC5904	Glob CL	Ser	01:33:51	+2° 05'	6.7	19.9'	11	24.5	
M6	NGC6405	Opn CL	Sco	01:36:42	-32° 13'	4.2	20'	10	1.6	
M7	NGC6475	Opn CL	Sco	01:42:20	-34° 49'	3.3	80'	12	0.65-1.31	Ptolemy Cluster
M8	NGC6523	CL+Neb	Sgr	02:42:00	-24° 23'	6	45'	13	4.1	Lagoon Nebula
M9	NGC6333	Glob CL	Oph	02:42:41	-18° 31'	8.4	5.5'	11	25.8	Wild Duck Cluster
M10	NGC6254	Glob CL	Oph	03:47:00	- 4° 06'	6.4	12.2'	12	14.3	
M11	NGC6705	Opn CL	Sct	05:24:11	- 6° 16'	6.3	14'	9	6.2	
M12	NGC6218	Glob CL	Oph	05:28:43	-1° 57'	7.7	14.5'	12	15.7	Great Globular Cluster in Hercules
M13	NGC6205	Glob CL	Her	05:34:32	+36° 28'	5.8	23.2'	12	22.2	
M14	NGC6402	Glob CL	Oph	05:35:31	- 3° 15'	8.3	6.7'	12	30.3	
M15	NGC7078	Glob CL	Peg	05:36:12	+12° 10'	6.2	12.3'	11	33	Eagle Nebula
M16	NGC6611	CL+Neb	Ser	05:37:17	-13° 47'	6	7'	12	7	
M17	NGC6618	CL+Neb	Sgr	05:46:47	-16° 11'	6	11'	13	5,000-6,000	
M18	NGC6613	Opn CL	Sgr	05:52:19	-17° 08'	7.5	9'	12	4.9	Omega, Swan, Horseshoe, or Lobster Nebula
M19	NGC6273	Glob CL	Oph	06:08:54	-26° 16'	7.5	5.3'	11	28.7	
M20	NGC6514	CL+Neb	Sgr	06:46:54	-23° 02'	6.3	28'	13	5.2	
M21	NGC6531	Opn CL	Sgr	07:02:48	-22° 30'	6.5	13'	11	4.25	Trifid Nebula
M22	NGC6656	Glob CL	Sgr	07:36:36	-23° 54'	5.1	24'	11	9.6-11.6	
M23	NGC6494	Opn CL	Sgr	07:41:48	-19° 01'	6.9	27'	13	2.15	
M24	IC4715	Opn CL	Sgr	07:44:36	-18° 29'	4.6	95'	4.3	10	Sagittarius Star Cloud
M25	IC4725	Opn CL	Sgr	08:13:48	-19° 15'	4.6	29'	12	2	
M26	NGC6694	Opn CL	Sct	08:40:24	- 9° 24'	8	15'	12	5	
M27	NGC6853	Pln Neb	Vul	08:51:18	+22° 43'	7.5	480"	11.2	1.148-1.52	Dumbbell Nebula
M28	NGC6626	Glob CL	Sgr	09:55:33	-24° 52'	7.7	15'	11	17.9	
M29	NGC6913	Opn CL	Cyg	09:55:52	+38° 32'	7.1	7'	11	7.2	
M30	NGC7099	Glob CL	Cap	10:43:58	- 23° 11'	7.7	8.9'	11	27.8-31	Andromeda Galaxy
M31	NGC224	Galaxy	And	10:46:46	+41° 16'	3.4	189'	13.5	2,430-2,650	
M32	NGC221	Galaxy	And	10:47:50	+40° 52'	8.1	8.5'	12.4	2,410-2,570	
M33	NGC598	Galaxy	Tri	11:11:31	+30° 39'	5.7	68.7'	14.2	2,380-3,070	Triangulum Galaxy
M34	NGC1039	Opn CL	Per	11:14:48	+42° 47'	5.5	35'	-	1.5	
M35	NGC2168	Opn CL	Gem	11:18:56	+24° 20'	5.3	28'	12	2.8	
M36	NGC1960	Opn CL	Aur	11:20:15	+34° 08'	6.3	12'	12	4.1	
M37	NGC2099	Opn CL	Aur	11:57:36	+32° 33'	6.2	24'	11	4.511	
M38	NGC1912	Opn CL	Aur	12:13:48	+35° 50'	7.4	21'	12	4.2	

M39	NGC7092	Opn CL	Cyg	12:18:50	+48° 26'	5.5	32'	11	0.8244	
M40	Winnecke 4	2 Stars	UMa	12:18:58	+58° 05'	9.7	12	-	0.51	Winnecke 4
M41	NGC2287	Opn CL	CMa	12:21:55	- 20° 44'	4.5	38'	12	2.3	
M42	NGC1976	CL+Neb	Ori	12:22:24	- 5° 27'	4	90'	11	1.324-1.364	Orion Nebula
M43	NGC1982	Brn Neb	Ori	12:22:55	- 5° 16'	9	20'	13	1.6	De Mairan's Nebula
M44	NGC2632	Opn CL	Cnc	12:25:04	+19° 59'	3.7	95'	13	0.577	Beehive Cluster
M45	Mel 22	CL+Neb	Tau	12:25:24	+24° 07'	1.6	100'	11	0.39-0.46	Pleiades
M46	NGC2437	Opn CL	Pup	12:26:12	-14° 49'	6.1	27'	13	5.4	
M47	NGC2422	Opn CL	Pup	12:29:47	-14° 30'	4.2	30'	11	1.6	
M48	NGC2548	Opn CL	Hya	12:30:49	- 5° 48'	5.5	54'	13	1.5	
M49	NGC4472	Galaxy	Vir	12:31:59	+8° 00'	9.4	9.8'	13.2	53,600-58,200	
M50	NGC2323	Opn CL	Mon	12:35:26	- 8° 23'	5.9	16'	12	3.2	
M51	NGC5194	Galaxy	CVn	12:35:40	+47° 12'	8.4	10.8'	12.9	19,000-27,000	Whirlpool Galaxy
M52	NGC7654	Opn CL	Cas	12:36:50	+61° 35'	5	13'	12	5	
M53	NGC5024	Glob CL	Com	12:37:44	+18° 10'	8.3	14.4'	12	58	
M54	NGC6715	Glob CL	Sgr	12:39:28	- 30° 29'	8.4	9.1'	11	87.4	
M55	NGC6809	Glob CL	Sgr	12:39:59	- 30° 58'	7.4	19'	13	17.6	
M56	NGC6779	Glob CL	Lyr	12:42:02	+30° 11'	8.3	5'	12	32.9	
M57	NGC6720	Pln Neb	Lyr	12:43:40	+33° 02'	8.8	86"	9.3	1.6-3.8	Ring Nebula
M58	NGC4579	Galaxy	Vir	12:50:53	+11° 49'	10.5	6'	13.1	63,000	
M59	NGC4621	Galaxy	Vir	12:56:44	+11° 39'	10.6	5.3'	12.9	55,000-65,000	
M60	NGC4649	Galaxy	Vir	13:12:55	+11° 33'	9.8	7.6'	12.9	51,000-59,000	
M61	NGC4303	Galaxy	Vir	13:15:49	+4° 28'	10.2	6.5'	13.4	50.2-54.6	
M62	NGC6266	Glob CL	Oph	13:29:52	- 30° 07'	7.4	14.1'	11	22.2	
M63	NGC5055	Galaxy	CVn	13:37:01	+42° 02'	9.3	12.6'	13	37000	Sunflower Galaxy
M64	NGC4826	Galaxy	Com	13:42:11	+21° 41'	9.4	10.3'	12.7	22,000-26,000	Black Eye Galaxy
M65	NGC3623	Galaxy	Leo	14:03:12	+13° 05'	10.3	9'	12.8	41,000-42,000	Leo Triplet
M66	NGC3627	Galaxy	Leo	15:06:29	+12° 59'	8.9	9.1'	12.7	31,000-41,000	Leo Triplet
M67	NGC2682	Opn CL	Cnc	15:18:34	+11° 49'	6.1	30'	13	2.61-2.93	
M68	NGC4590	Glob CL	Hya	16:17:03	-26° 45'	9.7	9.8'	13	33.6	
M69	NGC6637	Glob CL	Sgr	16:23:35	- 32° 21'	8.3	7.1'	11	29.7	
M70	NGC6681	Glob CL	Sgr	16:32:32	- 32° 18'	9.1	7.8'	11	29.4	
M71	NGC6838	Glob CL	Sge	16:41:41	+18° 47'	6.1	6.1'	12	13	
M72	NGC6981	Glob CL	Aqr	16:47:15	-12° 32'	9.4	5.9'	12	53.40-55.74	
M73	NGC6994	Opn CL	Aqr	16:57:09	-12° 38'	9	2.8'	-	2.5	
M74	NGC628	Galaxy	Psc	17:01:13	+15° 47'	10	10'	14.2	24,000-36,000	
M75	NGC6864	Glob CL	Sgr	17:02:38	-21° 55'	9.2	6'	11	67.5	
M76	NGC650/1	Pln Neb	Per	17:17:07	+51° 34'	10.1	163"	10.4	2.5	Little Dumbbell Nebula
M77	NGC1068	Galaxy	Cet	17:19:12	- 0° 01'	9.6	7.3'	13	47000	Cetus A
M78	NGC2068	Brn Neb	Ori	17:37:36	+0° 03'	8.3	8'	12	1.6	
M79	NGC1904	Glob CL	Lep	17:40:06	-24° 33'	8.6	7.8'	12	41	

M80	NGC6093	Glob CL	Sco	17:53:54	-22° 59'	7.9	5.1'	11	32.6	
M81	NGC3031	Galaxy	UMa	17:56:48	+69° 04'	6.9	24.9'	13.2	11,400-12,200	Bode's Galaxy
M82	NGC3034	Galaxy	UMa	18:02:23	+69° 41'	8.4	10.5'	12.5	10,700-12,300	Cigar Galaxy
M83	NGC5236	Galaxy	Hya	18:03:37	-29° 52'	7.5	13.1'	13	14700	Southern Pinwheel Galaxy
M84	NGC4374	Galaxy	Vir	18:04:36	+12° 53'	10.1	6.7'	13	57,000-63,000	
M85	NGC4382	Galaxy	Com	18:18:24	+18° 11'	10	7.4'	12.9	56,000-64,000	
M86	NGC4406	Galaxy	Vir	18:18:48	+12° 57'	9.8	9.8'	13.2	49,000-55,000	
M87	NGC4486	Galaxy	Vir	18:19:54	+12° 24'	9.6	8.7'	13	51,870-55,130	Virgo A
M88	NGC4501	Galaxy	Com	18:20:26	+14° 25'	10.4	6.8'	13	39,000-56,000	
M89	NGC4552	Galaxy	Vir	18:24:33	+12° 33'	10.7	5.3'	13.2	47,000-53,000	
M90	NGC4569	Galaxy	Vir	18:31:23	+13° 10'	10.3	9.9'	13.4	55,900-61,500	
M91	NGC4548	Galaxy	Com	18:31:36	+14° 30'	11	5.2'	13.4	47,000-79,000	
M92	NGC6341	Glob CL	Her	18:36:24	+43° 08'	6.3	11.2'	11	26.7	
M93	NGC2447	Opn CL	Pup	18:43:13	-23° 52'	6	22'	12	3.6	
M94	NGC4736	Galaxy	CVn	18:45:12	+41° 07'	9	12.3'	13.1	14,700-17,300	
M95	NGC3351	Galaxy	Leo	18:51:06	+11° 42'	11.4	7.3'	13.5	31,200-34,000	
M96	NGC3368	Galaxy	Leo	18:53:35	+11° 49'	10.1	7.8'	13.1	28,000-34,000	
M97	NGC3587	Pln Neb	UMa	18:55:03	+55° 01'	9.9	202"	12.1	2.03	Owl Nebula
M98	NGC4192	Galaxy	Com	19:16:36	+14° 54'	11	9.4'	14	44400	
M99	NGC4254	Galaxy	Com	19:39:59	+14° 25'	10.4	5.3'	13.2	44,700-55,700	
M100	NGC4321	Galaxy	Com	19:53:46	+15° 49'	10.1	7.5'	13	55000	
M101	NGC5457	Galaxy	UMa	19:59:36	+54° 21'	7.9	28.5'	14.9	19,100-22,400	Pinwheel Galaxy
M102	NGC5866	Galaxy	Dra	20:06:05	+55° 46'	9.9	6.5'	12.2		
M103	NGC581	Opn CL	Cas	20:23:56	+60° 42'	7.4	6'	11	10	
M104	NGC4594	Galaxy	Vir	20:53:28	-11° 37'	9	8.6'	11.6	28,700-30,900	Sombrero Galaxy
M105	NGC3379	Galaxy	Leo	20:59:00	+12° 35'	10.2	5.3'	12.8	30,400-33,600	
M106	NGC4258	Galaxy	CVn	21:29:58	+47° 18'	9.1	17.4'	13.6	22,200-25,200	
M107	NGC6171	Glob CL	Oph	21:32:12	-13° 03'	8.9	3.3'	12	20.9	
M108	NGC3556	Galaxy	UMa	21:33:27	+55° 40'	10.7	8.6'	13	46000	
M109	NGC3992	Galaxy	UMa	21:40:22	+53° 23'	10.6	7.5'	13.6	59,500-107,500	
M110	NGC205	Galaxy	And	23:24:12	+41° 41'	9	19.5'	14	2,600-2,780	

# Caldwell Catalogue

Name	Other	Type	Cons	RA	Dec	Mag	Size (arc min)	SB	Distance (ly)	Common Name
C1	NGC188	Opn CL	Cep	00h 44.4m	+85° 20m	8.1	14	13.9	4800	
C2	NGC40	Pln Neb	Cep	00h 13.0m	+72° 32m	11.6	0.6	10.9	3500	Bow Tie Nebula
C3	NGC4236	Galaxy	Dra	12h 16.7m	+69° 28m	9.7	21x7	15	7 million	
C4	NGC7023	Neb	Cep	21h 01.8m	+68° 12m	6.8	18x18	13.3	1400	Iris Nebula
C5	IC342	Galaxy	Cam	03h 46.8m	+68° 06m	9.2	18x17	15.4	13 million	
C6	NGC6543	Pln Neb	Dra	17h 58.6m	+66° 38m	8.8	0.3/5.8	11.9	3000	Cat's Eye Nebula
C7	NGC2403	Galaxy	Cam	07h 36.9m	+65° 36m	8.9	18x10	14.1	14 million	
C8	NGC559	Opn CL	Cas	01h 29.5m	+63° 18m	9.5	4	12.5	3700	
C9	Sh2-155	Neb	Cep	22h 56.8m	+62° 37m	7.7	50x10	6.8	2800	Cave Nebula
C10	NGC663	Opn CL	Cas	01h 46.0m	+61° 15m	7.1	16	13.1	7200	
C11	NGC7635	Neb	Cas	23h 20.7m	+61° 12m	7	15x8	16.2	7100	Bubble nebula
C12	NGC6946	Galaxy	Cep	20h 34.8m	+60° 09m	9.7	11x9	14	18 million	
C13	NGC457	Opn CL	Cas	01h 19.1m	+58° 20m	6.4	13	12	-	Owl or E.T. Cluster
C14	NGC869/884	Opn CL	Per	02h 20.0m	+57° 08m	4.3	30 & 30	11.7	7300	Double Cluster, h & chi Persei
C15	NGC6826	Pln Neb	Cyg	19h 44.8m	+50° 31m	9.8	0.5/2.3	10.6	2200	Blinking Planetary
C16	NGC7243	Opn CL	Lac	22h 15.3m	+49° 53m	6.4	21	13	2500	
C17	NGC147	Galaxy	Cas	00h 33.2m	+48° 30m	9.3	13x8	14.4	2300000	
C18	NGC185	Galaxy	Cas	00h 39.0m	+48° 20m	9.2	12x9	14.4	2300000	
C19	IC5146	Neb	Cyg	21h 53.5m	+47° 16m	10	12x12	12.6	3300	Cocoon Nebula
C20	NGC7000	Neb	Cyg	20h 58.8m	+44° 20m	6	120x100	10.2	1800	North America Nebula
C21	NGC4449	Galaxy	CVn	12h 28.2m	+44° 06m	9.4	5x3	12.7	10 million	
C22	NGC7662	Pln Neb	And	23h 25.9m	+42° 33m	9.2	0.3/2.2	10	3200	Blue Snowball
C23	NGC891	Galaxy	And	02h 22.6m	+42° 21m	9.9	14x2	14	31 million	
C24	NGC1275	Galaxy	Per	03h 19.8m	+41° 31m	11.6	2.6x1	13.4	230 mil.	Perseus A
C25	NGC2419	Glob CL	Lyn	07h 38.1m	+38° 53m	10.4	4.1	13.5	275000	
C26	NGC4244	Galaxy	CVn	12h 17.5m	+37° 49m	10.6	16x2.5	14.2	10 million	
C27	NGC6888	Neb	Cyg	20h 12.0m	+38° 21m	7.5	20x10	5.8	4700	Crescent Nebula
C28	NGC752	Opn CL	And	01h 57.8m	+37° 41m	5.7	50	14.2	1200	
C29	NGC5005	Galaxy	CVn	13h 10.9m	+37° 03m	9.8	5.4x2	12.4	69 million	
C30	NGC7331	Galaxy	Peg	22h 37.1m	+34° 25m	9.5	11x4	13.6	47 million	
C31	IC405	Neb	Aur	05h 16.2m	+34° 16m	6	30x19	6.9	1600	Flaming Star Nebula
C32	NGC4631	Galaxy	CVn	12h 42.1m	+32° 32m	9.3	15x3	13.5	22 million	Whale Galaxy
C33	NGC6992	SN Rem	Cyg	20h 56.4m	+31° 43m	-	60x8	13.4	2500	East Veil Nebula
C34	NGC6960	SN Rem	Cyg	20h 45.7m	+30° 43m	-	70x6	13.6	2500	West Veil Nebula
C35	NGC4889	Galaxy	Com	13h 00.1m	+27° 59m	11.4	3x2	13.4	300 mil.	
C36	NGC4559	Galaxy	Com	12h 36.0m	+27° 58m	9.8	10x4	14.1	32 million	
C37	NGC6885	Opn CL	Vul	20h 12.0m	+26° 29m	5.7	7	10.1	1950	
C38	NGC4565	Galaxy	Com	12h 36.3m	+25° 59m	9.6	16x3	13.8	32 million	Needle Galaxy

C39	NGC2392	Pln Neb	Gem	07h 29.2m	+20° 55m	9.9	0.2/0.7	8.4	4000	Eskimo or Clown Nebula
C40	NGC3626	Galaxy	Leo	11h 20.1m	+18° 21m	10.9	3x2	12.9	86 million	
C41	-	Opn CL	Tau	04h 27m	+16° 00m	1	330	13.2	151	Hyades
C42	NGC7006	Glob CL	Del	21h 01.5m	+16° 11m	10.6	2.8	12.8	135000	
C43	NGC7814	Galaxy	Peg	00h 03.3m	+16° 09m	10.5	6x2	13.2	49 million	
C44	NGC7479	Galaxy	Peg	23h 04.9m	+12° 19m	11	4x3	13.7	106 mil.	
C45	NGC5248	Galaxy	Boo	13h 37.5m	+08° 53m	10.2	6x4	13.7	74 million	
C46	NGC2261	Neb	Mon	06h 39.2m	+08° 44m	10	2x1	9.8	2500	Hubble's Variable Nebula
C47	NGC6934	Glob CL	Del	20h 34.2m	+07° 24m	8.9	5.9	12.7	57000	
C48	NGC2775	Galaxy	Can	09h 10.3m	+07° 02m	10.3	4.5x3	13.1	55 million	
C49	NGC2237	Neb	Mon	06h 32.3m	+05° 03m	-	80x60	17.5	4900	Rosette Nebula
C50	NGC2244	Opn CL	Mon	06h 32.4m	+04° 52m	4.8	24	11.7	4900	Satellite Cluster
C51	IC1613	Galaxy	Cet	01h 04.8m	+02° 07m	9	12x11	14.5	2300000	
C52	NGC4697	Galaxy	Vir	12h 48.6m	-05° 48m	9.3	6x3	12.8	76 million	
C53	NGC3115	Galaxy	Sex	10h 05.2m	-07° 43m	9.1	8x3	12.3	22 million	Spindle Galaxy
C54	NGC2506	Opn CL	Mon	08h 00.2m	-10° 47m	7.6	7	11.8	10000	
C55	NGC7009	Pln Neb	Aqr	21h 04.2m	-11° 22m	8.3	2.5/1	9	1400	Saturn Nebula
C56	NGC246	Pln Neb	Cet	00h 47.0m	-11° 53m	8	3.8	14.7	1600	
C57	NGC6822	Galaxy	Sgr	19h 44.9m	-14° 48m	9.3	10x9	13.7	2300000	Barnard's Galaxy
C58	NGC2360	Opn CL	CMa	07h 17.8m	-15° 37m	7.2	13	12.8	3700	
C59	NGC3242	Pln Neb	Hya	10h 24.8m	-18° 38m	8.6	0.3/21	10.6	1400	Ghost of Jupiter
C60	NGC4038	Galaxy	Crv	12h 01.9m	-18° 52m	11.3	2.6x1.8	12.6	83 million	Antennae Galaxies
C61	NGC4039	Galaxy	Crv	12h 01.9m	-18° 53m	11.8	3.2x2.2	13.8	83 million	Antennae Galaxies
C62	NGC247	Galaxy	Cet	00h 47.1m	-20° 46m	8.9	20x7	14.5	6800000	
C63	NGC7293	Pln Neb	Aqr	22h 29.6m	-20° 48m	7.3	13	12.9	522	Helix Nebula
C64	NGC2362	Opn CL	CMa	07h 18.8m	-24° 57m	4.1	6	8	5100	
C65	NGC253	Galaxy	Scl	00h 47.6m	-25° 17m	7.1	25x7	12.7	9800000	Sculptor Galaxy
C66	NGC5694	Glob CL	Hya	14h 39.6m	-26° 32m	10.2	3.6	13	113000	
C67	NGC1097	Galaxy	For	02h 46.3m	-30° 17m	9.2	9x6	13.7	47 million	
C68	NGC6729	Neb	CrA	19h 01.9m	-36° 57m	9.7	1	9.5	424	
C69	NGC6302	Pln Neb	Sco	17h 13.7m	-37° 06m	9.6	0.8	9.1	5200	Bug Nebula
C70	NGC300	Galaxy	Scl	00h 54.9m	-37° 41m	8.7	20x13	14.8	3900000	
C71	NGC2477	Opn CL	Pup	07h 44.6m	-23° 52m	5.8	27	13	3700	
C72	NGC55	Galaxy	Scl	07h 44.6m	-23° 52m	7.9	32x6	13.6	4200000	
C73	NGC1851	Glob CL	Col	00h 14.9m	-39° 11m	7.3	11	12.5	39400	
C74	NGC3132	Pln Neb	Vel	05h 14.1m	-40° 03m	9.4	0.8	8.9	2000	Eight Burst Nebula
C75	NGC6124	Opn CL	Sco	10h 07.7m	-40° 26m	5.8	29	13.1	1500	
C76	NGC6231	Opn CL	Sco	16h 25.6m	-40° 40m	2.6	15	8.5	6000	
C77	NGC5128	Galaxy	Cen	16h 54.0m	-41° 48m	7	18x14	13	16 million	Centaurus A
C78	NGC6541	Glob CL	CrA	13h 25.5m	-43° 01m	6.6	13	12.2	22300	
C79	NGC3201	Glob CL	Vel	18h 08.0m	-43° 42m	6.7	18	13	17000	

C80	NGC5139	Glob CL	Cen	10h 17.6m	-46° 25m	3.6	36	11.6	17300	Omega Centauri
C81	NGC6352	Glob CL	Ara	13h 26.8m	-47° 29m	6.1	7	10.3	18600	
C82	NGC6193	Opn CL	Ara	17h 25.5m	-48° 25m	5.2	15	11.1	4300	
C83	NGC4945	Galaxy	Cen	16h 41.3m	-48° 46m	8.7	20x4	13.5	17 million	
C84	NGC5286	Glob CL	Cen	13h 05.4m	-49° 28m	7.6	9	12.4	36000	
C85	IC2391	Opn CL	Vel	13h 46.4m	-51° 22m	2.5	50	11	500	Omicron Vel Cluster
C86	NGC6397	Glob CL	Ara	08h 40.2m	-53° 04m	5.6	26	12.7	7500	
C87	NGC1261	Glob CL	Hor	17h 40.7m	-53° 40m	8.4	7	12.6	55500	
C88	NGC5823	Opn CL	Cir	03h 12.3m	-55° 13m	7.9	10	12.9	3400	
C89	NGC6087	Opn CL	Nor	15h 05.7m	-55° 36m	5.4	12	10.8	3300	S Norma Cluster
C90	NGC2867	Pln Neb	Car	16h 18.9m	-57° 54m	9.7	0.2	6.5	5500	
C91	NGC3532	Opn CL	Car	09h 21.4m	-58° 19m	3	55	11.7	1600	
C92	NGC3372	Neb	Car	11h 06.4m	-58° 40m	6.2	120x120	11.4	7500	Eta Carinae Nebula
C93	NGC6752	Glob CL	Pav	10h 43.8m	-59° 52m	5.4	20	11.9	13000	
C94	NGC4755	Opn CL	Cru	19h 10.9m	-59° 59m	4.2	10	9.2	4900	Jewel Box
C95	NGC6025	Opn CL	TrA	12h 53.6m	-60° 20m	5.1	12	10.5	2500	
C96	NGC2516	Opn CL	Car	16h 03.7m	-60° 30m	3.8	30	11.2	1300	
C97	NGC3766	Opn CL	Cen	07h 58.3m	-60° 52m	5.3	12	10.7	5800	
C98	NGC4609	Opn CL	Cru	11h 36.1m	-61° 37m	6.9	5	10.4	4200	
C99	-	Dk Neb	Cru	12h 42.3m	-62° 58m	-	400x300	12.8	610	Coalsack Nebula
C100	IC2944	CL+Neb	Cen	12h 53m	-63° 00m	4.5	15	10.4	6000	Lambda Centauri Nebula
C101	NGC6744	Galaxy	Pav	11h 36.6m	-63° 02m	9	16x10	13.8	34 million	
C102	IC2602	Opn CL	Car	19h 09.8m	-63° 51m	1.9	50	10.4	492	Theta Car Cluster
C103	NGC2070	Neb	Dor	10h 43.2m	-64° 24m	1	40x25	15.7	170000	Tarantula Nebula
C104	NGC362	Glob CL	Tuc	05h 38.7m	-69° 06m	6.6	13	12.2	27700	
C105	NGC4833	Glob CL	Mus	01h 03.2m	-70° 51m	7.3	14	13.1	19600	
C106	NGC104	Glob CL	Tuc	12h 59.6m	-70° 53m	4	31	11.5	14700	47 Tucanae
C107	NGC6101	Glob CL	Aps	00h 24.1m	-72° 05m	9.3	11	14.5	49900	
C108	NGC4372	Glob CL	Mus	16h 25.8m	-72° 12m	7.8	19	14.2	18900	
C109	NGC3195	Pln Neb	Cha	12h 25.8m	-72° 40m	11.6	40_35	10.5	5400	