Cloudy Nights Telescope Reviews
Your astronomical community

Small Wonders: Cepheus

A monthly sky guide for the beginning to intermediate amateur astronomer

Tom Trusock

11-Sep-2005

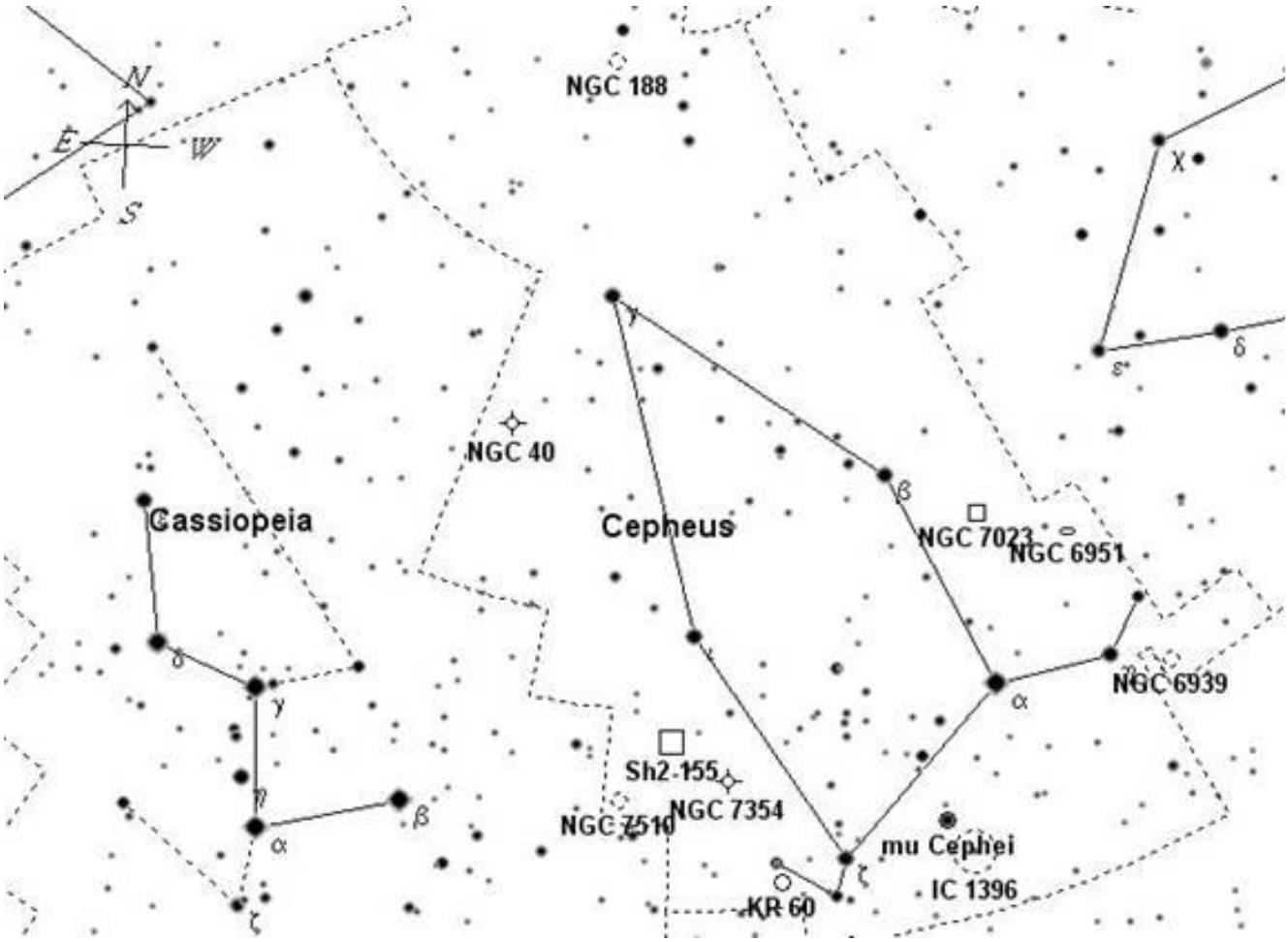

Figure 1. Widefield map

Target List

Object	Type	Size	Mag	RA	Dec
μ (mu) Cephei (Garnet star)	Star		4.2	21h 43m 42.2s	+58° 48' 27"
KR 60	Star		9.6	22h 28m 14.4s	+57° 43' 37"
IC 1396	Reflection Nebula	90.0'		21h 39m 17.8s	+57° 31' 38"
NGC 40	Planetary Nebula	1.2'	12.3	00h 13m 21.7s	+72° 33' 12"
NGC 188	Open Cluster	15.0'	8.1	00h 48m 10.8s	+85° 17' 04"
NGC 6939	Open Cluster	10.0'	7.8	20h 31m 38.0s	+60° 41' 00"
NGC 6951	Galaxy	3.9'x3.2'	11	20h 37m 19.6s	+66° 07' 39"
NGC 7023	Bright Nebula	10.0'x8.0'	7.1	21h 01m 41.3s	+68° 11' 36"
NGC 7354	Planetary Nebula	36"	12.2	22h 40m 34.1s	+61° 18' 59"
NGC 7510	Open Cluster	7.0'	7.9	23h 11m 19.7s	+60° 36' 07"

Challenge Objects

Object	Type	Size	Mag	RA	Dec
Sh2-155	Bright Nebula	50.0'x30.0'		22^{h} 57^{m} 02.9^{s}	+62° 38' 51"

Cepheus

Our celestial personality for the month — Cepheus — is the son of Belus, King of Eqypt. Cepheus became King of Ethiopia and entered celestial mythology as both the husband of Cassiopiea and the father of Andromeda. According to one legend, both Cepheus and Cassiopiea are killed at Andromeda's wedding to Peresus. Poseidon then places both in the night sky to immortalize them.

Photometrically, Cepheus isn't one of the brighter constellations. It's brightest star, α (Alpha) (Alderamin) is only mag 2.4. Although it's not a standout, he is distinctive and stands out between his daughter (Andromeda) and wife (Cassiopeia) as he has a very a distinctive shape, much like a child's drawing of a house. If you prefer to see a king here, think of Cepheus as a bust — the 4 stars that make up the body of the house describe his face, while the house's pointed roof becomes the crown.

While not nearly rich as last month's constellation, Cygnus, this region still has a number of targets to offer the dedicated observer. Galaxies, colored stars, multiple stars, planetary nebula, variables, open clusters and reflection nebula are all on the list this month.

Stars

Delta Cephei (whose variations were discovered by John Goodricke in 1784) is the prototypical Cepheid — a short term pulsating variable whose light changes are actually due to a pulsation of the star rather than the eclipsing variations like those in an eclipsing binary. Their most interesting property was documented in a paper published by Henrietta Leavitt in 1912 while she was working for Harvard. Leavitt realized that there was a link between a Cepheid's variable period and the absolute magnitude of the star itself. Her 1912 paper documented 25 Cepheid periods and their brightness. Since apparent magnitude varies with distance, she figured out that you could interrelate the two and thus measure a Cepheid's distance if you knew the period. This standard candle helped measure the boundaries of the universe to 10 million light years, and was instrumental in establishing modern cosmology.

This constellation is also home to an interesting double named Kruger 60. This pair of red dwarf stars is extremely nearby, lying a mere 13 light years away. They form a rapid binary system with an orbital period of around 44 years. The two stars are magnitudes 11.8 and 13.4 and are separated by a distance of around 9.2 AUs. Kruger 60 is of interest to the telescopic observer not only because it's a rapid binary whose position angle will be obvious to the observer over a number of years, but also because of the fact that B is a flare star. One of 60b's flares (while having no more output than a standard solar flare) can double the total radiation of the star, and might be picked up by an amateur astronomer. In fact, Burnham's Celestial Handbook shows

actual images of 60b while it's undergoing a flare, and one can actually see the flare itself — something very unique for any star other than Sol.

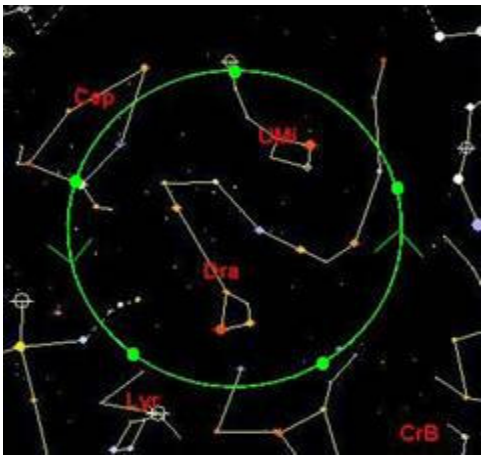

Figure 2: Path of the North Celestial Pole in time

Cepheus has another claim to fame in that it will (in several thousand years) play host to not one, but multiple pole stars. Because of procession both Gamma (Errai) and Beta (Alfirk) will share the honor for a few thousand years till the title is handed off to Alpha (Alderamin) some 4100 years from now. The tic marks on the picture represent about 5200 years a piece.

The last star we'll discuss in Cepheus this month is Mu Cephei – otherwise known as Herschel's Garnet star. Mu varies from a minimum of around 5 to a maximum of 3.4, but it's not it's variability we're interested in tonight. Mu is probably the reddest star in the northern sky, and one of the few objects that you can see color in. According to the article "***Mu Cephei — A Most Beautiful Object***" by Kate Davis at the AAVSO web site (see resources at the bottom of this article), Mu was observed by Herschel (most likely in the early 1780's) and dubbed it the garnet star in the published work; "***Philosophical transactions of the Royal Astronomical Society of London (1783)***":

A very considerable star, not marked by Flamstead, will be found near the head of Cepheus. Its right ascension in time, is about 2'19" preceding Flamstead's 10th Cephei, and it is about 2°20'3" more south than the same star. It is of a very fine deep garnet colour, such as the periodical star o ceti was formerly, and a most beautiful object, especially if we look for some time at a white star before we turn our telescope to it, such as α cephei, which is near at hand.

--William Herschel

Figure 3: William Herschel's Garnet Star: Mu Cephei - Alan Clitherow

Kruger 60, Mu Cephei, NGC 7354 and IC 1396

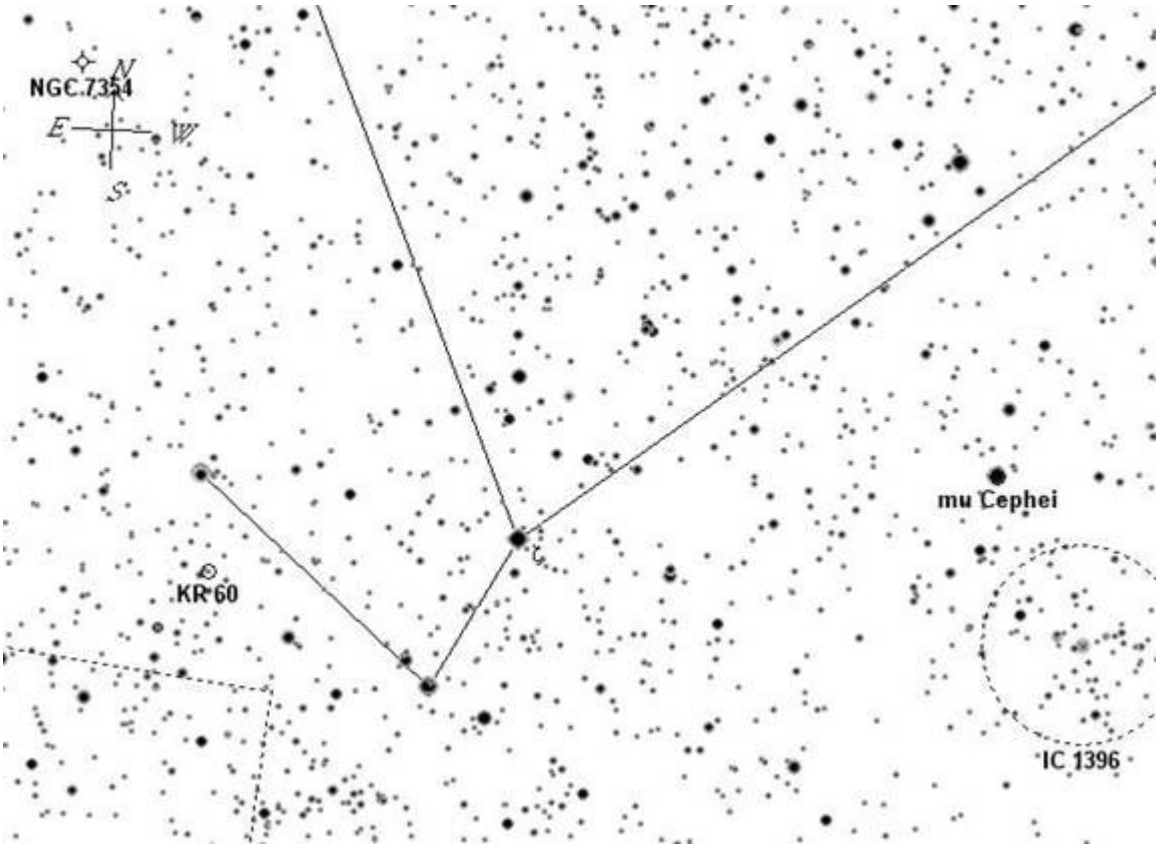

Figure 4: Area map of Kruger 60, Mu Cephei, NGC 7354 and IC 1396

Mu Cephei is one of the largest stars known, and in just a few million years is expected to explode in a huge supernova, leaving behind a SNR and either a pulsar or black hole. Observers seem to see different hues to this star – I've heard people claim every thing from a deep red to an orange to a yellowish red. Since color perception is to some extent dependent on individual biology, it's not all that surprising that different observers view it different ways. Take some time to look at Mu and taking William Herschel's advice - contrast it to the pure white of alpha. What color does Mu appear to you?

While you're in the area, drop slightly south west of Mu and take a look for the reflection nebula IC 1396. Keep in mind it's large, over 3 degrees in size, so you'll need an instrument like a wide field refractor or a set of big binoculars. Deep in the heart of 1396 lies the open cluster Trumpler 37 so keep an eye out for that as well. Don't get discouraged if you don't pick it out, but rather try again as NGC 1396 requires both dark and transparent skies. You may find a nebula filter helps to raise the contrast and assists you in spotting this elusive target.

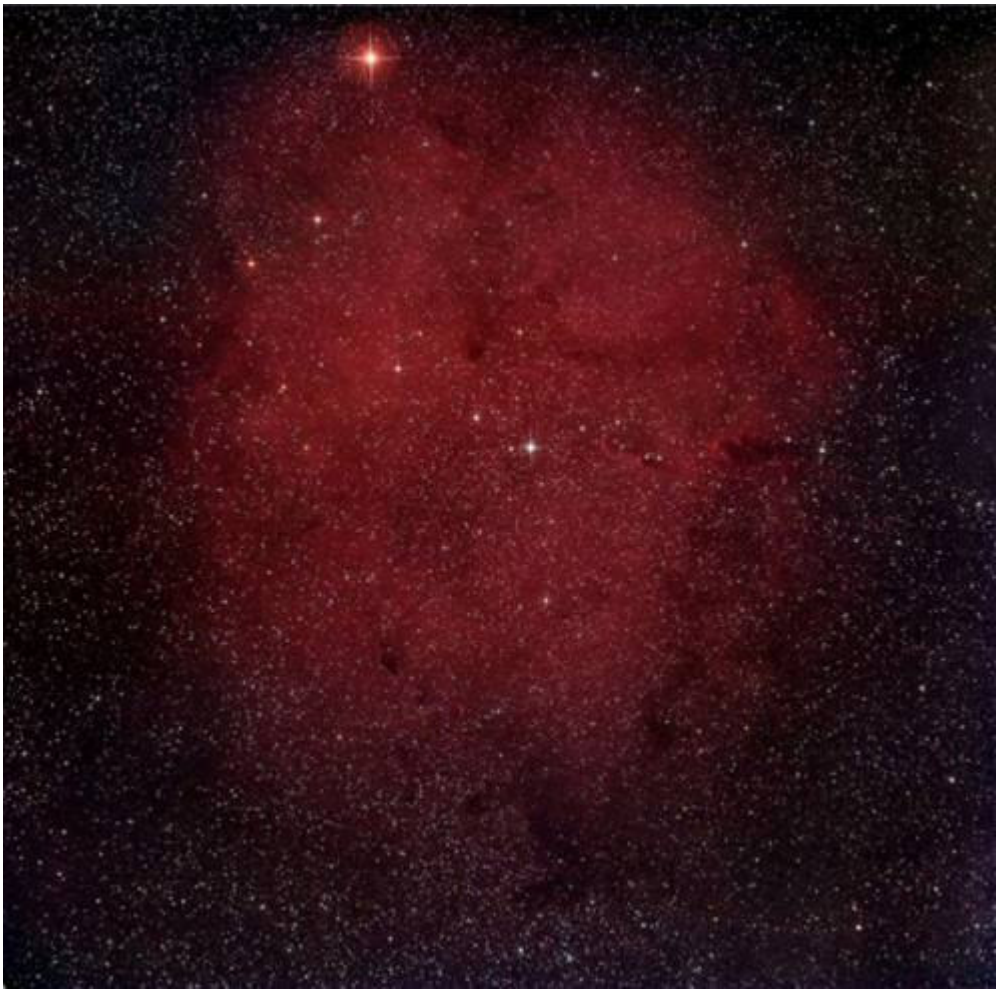

Figure 5: Nick King - IC 1396

Our last stop in this general region is the small, bright planetary nebula NGC 7354. A moderate sized telescope (8”-10”) should allow you to spot its small faint disk. Once you’ve found it spend some time with various magnifications and try to pull out its central star. I have yet to see it myself, but have heard reports of observations of the mag 16.5 central star with 16”+ telescopes at high power.

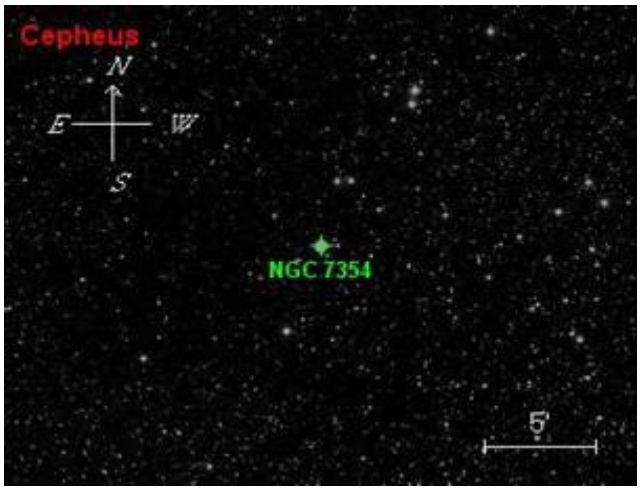

Figure 6: NGC 7354

NGC 6939, NGC 6951 and NGC 7023

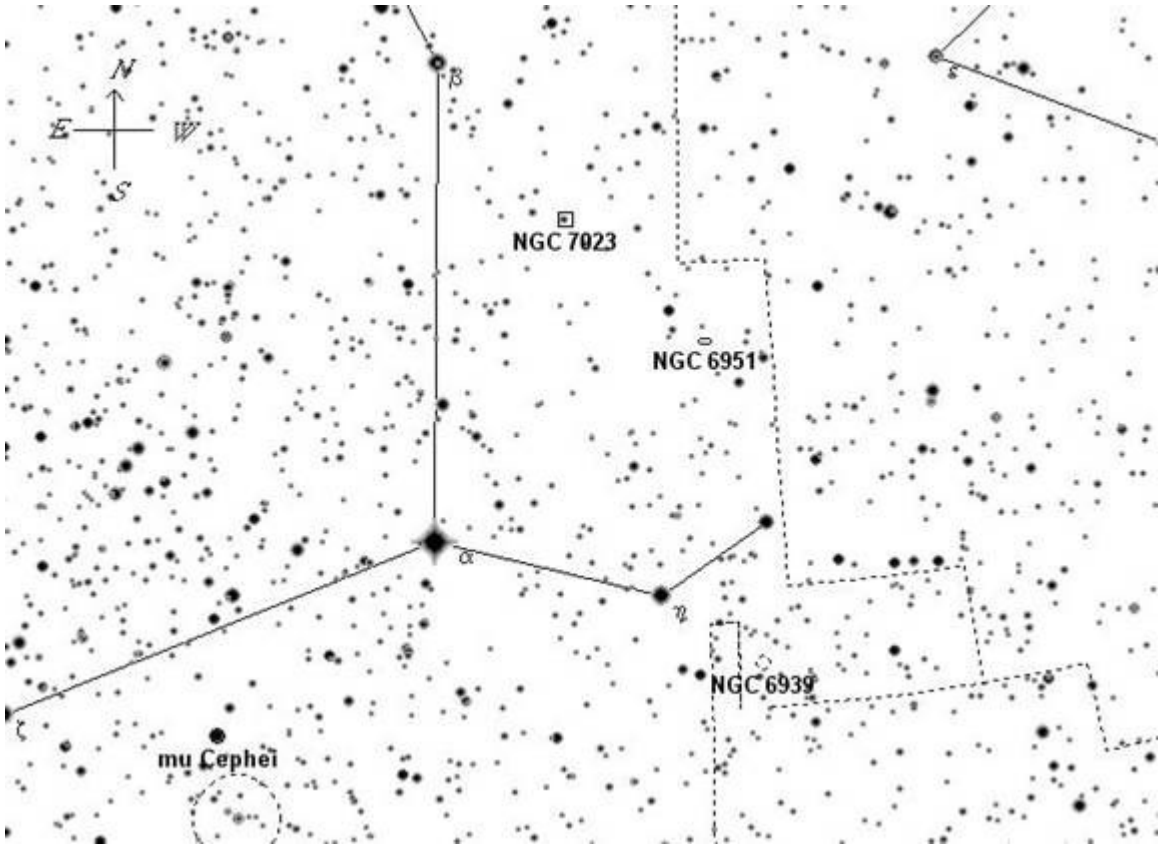

Figure 7: Area map of NGC 6939, NGC 6951 and NGC 7023

Let's move onto the other side of Cepheus and stop at NGC 6939. It is one of my favorite targets in any size scope. It's a moderately bright open cluster which I typically see as a non-stellar haze on the verge of resolution in my 4" apo. In a small scope like this – by itself – the views aren't really all that striking. What DOES make it striking is it's proximity to face on galaxy 6946 which straddles the Cygnus / Cepheus border (and thus isn't on the "official" list of targets for the month). One galactic, one extragalactic, this dissimilar pair makes an interesting view in any scope capable of showing them both at once. You'll need something that provides about a full degree of field to catch them at their best. I find the galaxy to be a bit brighter and smoother in a 4" apo, while the cluster itself shows hints of resolution. Not much, but there is a definite graininess there. Larger telescopes resolve 6939 into dozens of pinpoint stars.

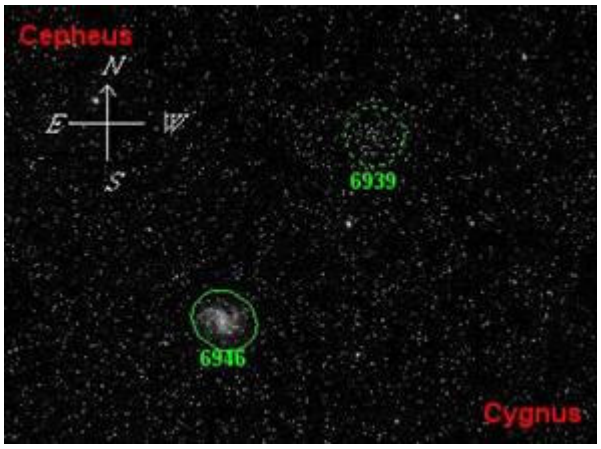

Figure 8: NGC 6939 and NGC 6946

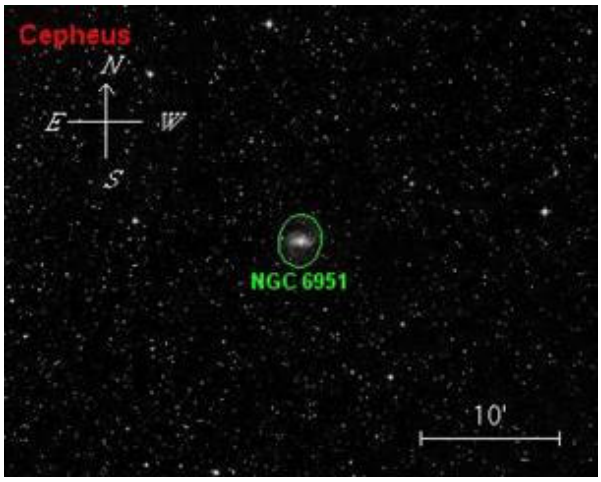

Figure 9: NGC 6951

If you've got a larger telescope then take a few moments and look for the piece of extragalactic fuzz that is NGC 6951. I've viewed this galaxy in my 18", but can't definitively say that I've caught it in my 4" telescope. That's a little odd, because while it's small, it's cataloged magnitude definitely puts it in the acceptable range for a small scope – at least from a dark site. In the 18", it's a fine sight with a bright halo and nearly stellar core.

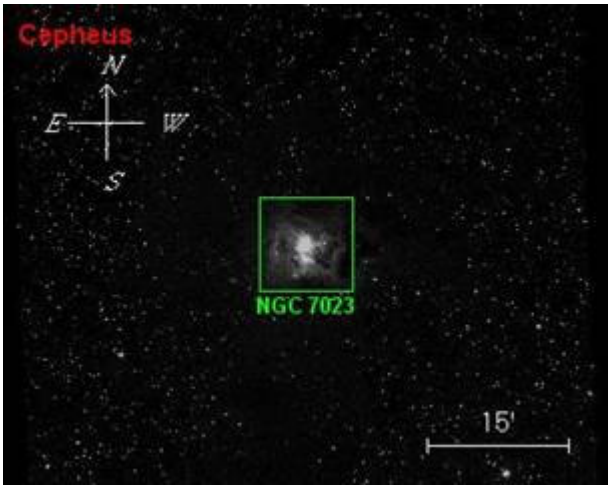

Figure 10: NGC 7023

Last but not least on this side of Cygnus, let's stop at NGC 7023. This is a rather bright reflection nebula centered on a mag 7 star, which at first glance, particularly with smaller apertures shows little to no structure. What it reminds me most of, in fact, is dew on the eyepiece! The longer you look, the more interesting it becomes. You'll soon notice that the "dew" is confined to one bright star in particular, and if you're using a low powered eyepiece, there are several other stars in the field that are completely unaffected. After viewing this for a while it began to dawn on me that the bright star, central to the nebulosity, was actually illuminating the nebula. This is a prototypical reflection nebula, and I'm not sure I've seen one that better gets the mechanics of these beasties across. While you are viewing it, it's extremely obvious that if that star went out, the nebula itself would go dark. Move back to a little wider field and inspect the area around it. It seems to be a light patch in a darker area of space.

Figure 11: Nejc Ucman – NGC 7023

One wonders if the dust cloud here is much larger than simply what's illuminated, and the unlit portion is blocking the view beyond. If you look closely, you will probably notice 3-4 lobes of darkness surrounding 7023. Are they real? Or is it simply an optical illusion generated by the brain over processing the scene? What do you think? If you do manage to see them, try varying your magnifications along with various filters. Do they affect the size of the illuminated portion of the nebula? Do you see any streaks or streamers in the nebula? This is a target that's worthy of some time. It's also worth noting that most catalogs have this reflection nebula misclassified as an open cluster. One of the few that seems to have noted it correctly is the oft maligned Caldwell catalog, in which it makes it's entry as Caldwell 4.

NGC 40 and NGC 188

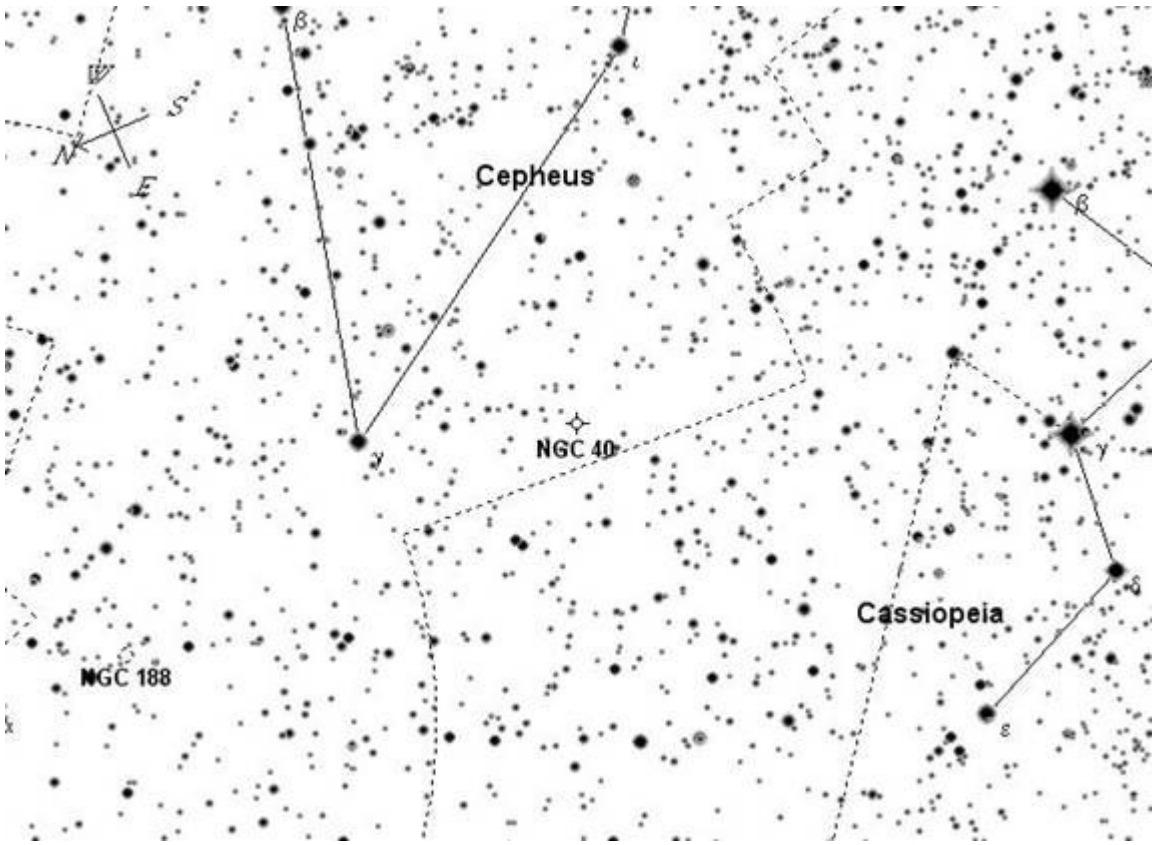

Figure 12: Area map of NGC 40 and NGC 189

Now pop up off the peak of the house, near the northern celestial pole for a look at one of the oldest stellar clusters known. A mere 4 degrees from Polaris lies NGC 188 – a fairly unusual open cluster. While it lies within the plane of the galaxy, it's remarkably long lived (galactic tidal forces tend to rip apart open clusters). Astronomers estimate it's age at over 7 billion years. It's detectable in a 4" telescope as a gentle background brightening, but frankly, it's not really worth the effort. If you have an 8" or larger telescope however, it really begins to come into it's own. With 18" the cluster is truly an impressive sight – easily showing dozens of stars. Tom Polakis in his excellent ***Celestial Portraits*** series for ***Astronomy Magazine*** informed us that it lies 30,000 light years from the center of the galaxy – a point which lies in it's favor when considering it's longevity.

Next head down the other side of the house to the magnitude 12.3 planetary nebula NGC 40 – sometimes referred to as the Bow Tie nebula. This is a wonderful target for nearly any size telescope. In the midst of a zig/zag line of stars, you may – at first glance – miss the planetary completely. This planetary is one of those unusual few whose central star is brighter than the planetary itself. At low powers in smaller apertures, I found that the nebulosity tends to disappear when you are just scanning the area. So, scan slowly and use averted vision. Look

for a small star that sprouts wings as your eyes move across it. The star itself seems nearly twice as bright as the nebula. Once you've found the planetary use averted vision, and study the planetary itself. In the 4", I see two brighter notches on opposite sides near the outside of the nebula, and a faint haze across the center. If I had to pick, I'd say that the SE side of the planetary has the brighter clumping. Take your time and try UHC and OIII filters to see what detail you can make out. If you have access to different telescopes, you might even want to visit this in different apertures. I find that different scopes can provide completely different views of the same object, and like to spend as much time revisiting old friends as I can.

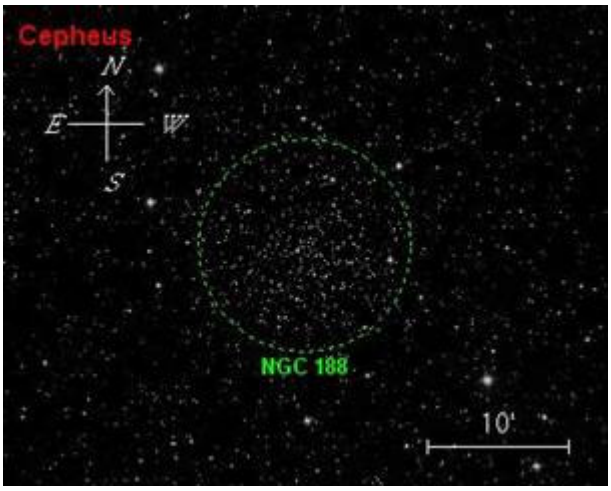

Figure 13: NGC 188

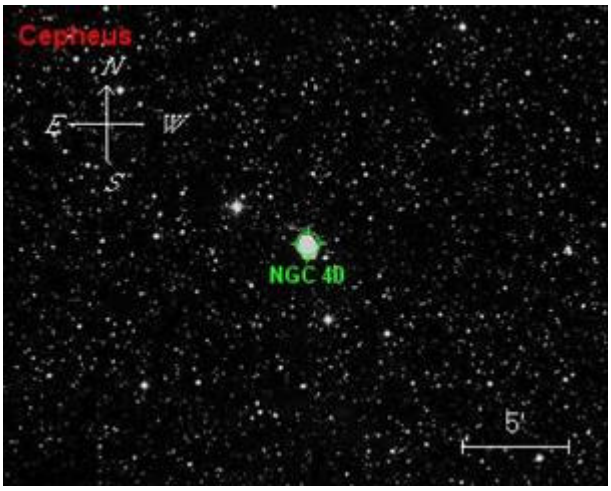

Figure 14: NGC 40

NGC 7510, SH2 155 and NGC 7354

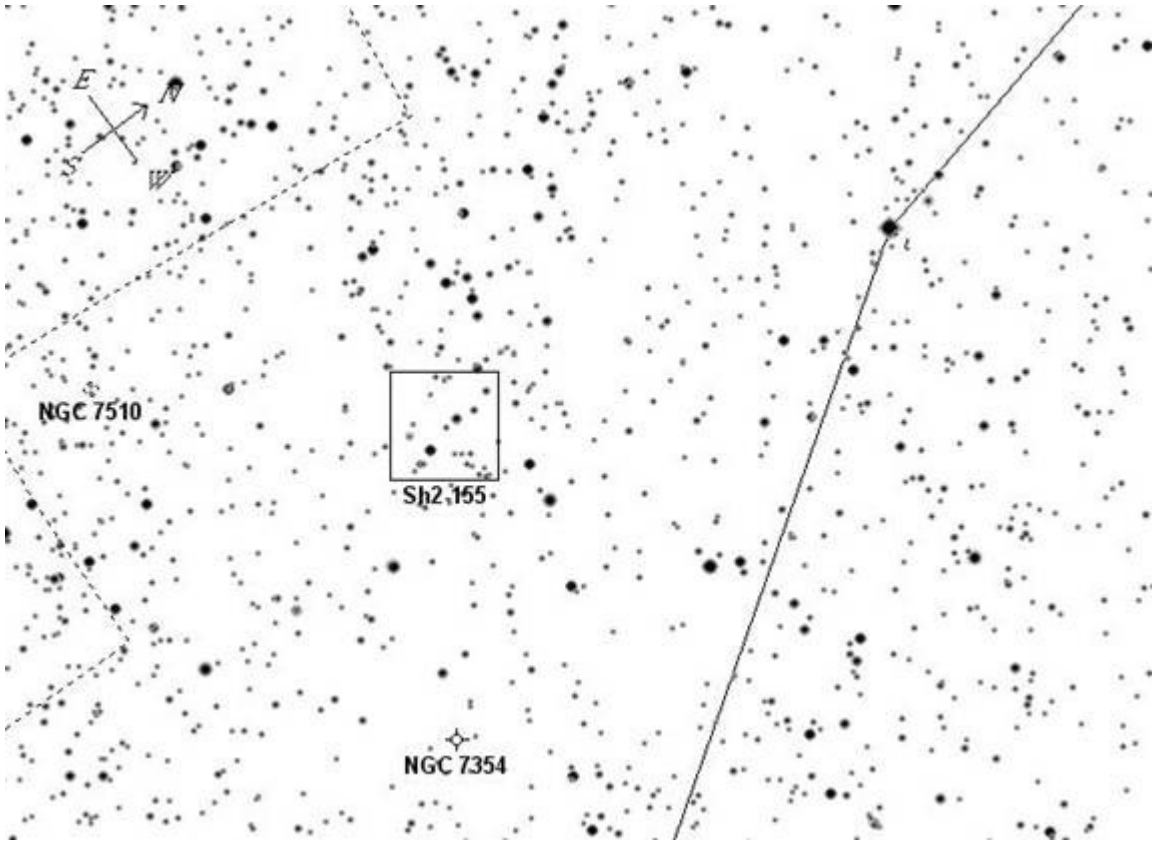

Figure 15: Area map of NGC 7510, SH2 155 and NGC 7354

Our final "non-challenge" stop tonight is the open cluster NGC 7510. This diamond shaped cluster is a delight in nearly any size telescope. It's brightness and regular form help it to stand out very well from the background even in a 4" telescope. What's the smallest aperture you can spot this cluster in?

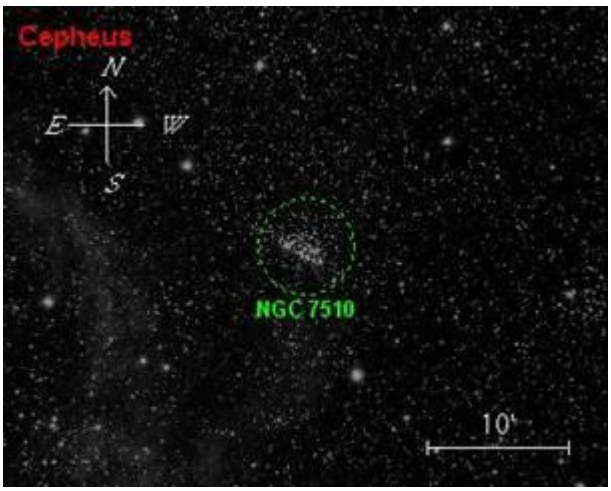

Figure 16: NGC 7510

Challenge object: Sh2-155

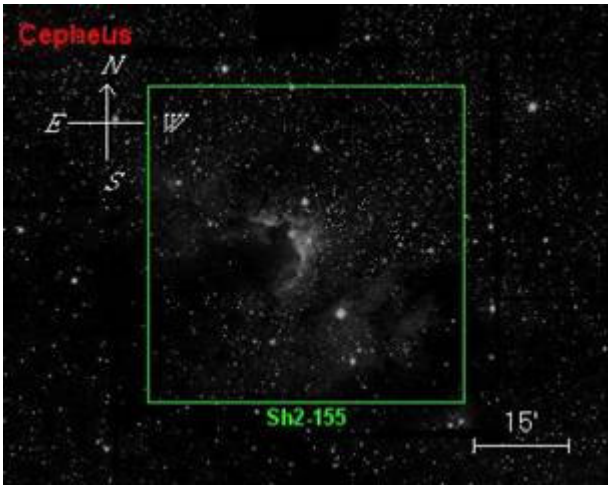

Figure 17: Sh2-155

Our challenge object is SH2-155.

We have a total of four Caldwell objects on the list this month. So many at one time brings to mind the controversy that some amateurs view the Caldwell list with, and to my mind nothing better emphasizes that than SH2-155. While I see the Caldwell list as mainly a collection of interesting objects for amateurs to hit alongside or after the Messiers, I do find my self surprised at some of Patrick Moores choices. For example, NGC 40, NGC 188 and NGC 7023 are all nice objects that deserve a look – and they are well within the range of most typical backyards, telescopes and observers.

But - He has a few doozies in his list, and possibly topping the charts is Sh2-155.

Sh2-155 is a fairly well known photographic target, but it's a bear visually. It's known as the Cave Nebula - one of many to have that particular moniker, and looks wonderful on the DSS plates. In order to attempt this, you'll need the largest aperture you can get your hands on (at least 10-12 inches, preferably more), a good UHC filter, excellent sky conditions and a very dark site. Even then, it will bear little if any resemblance to the photos. Look for hints of nebulosity around the brighter stars in the area.

Bonus challenge object: NGC 7139

If that's a little too much for you but you're not quite ready to head in yet, you can try for another planetary in Cepheus if you like: NGC 7139. I won't prep you too much for this one. You'll have to look it up - but it's worth a peek.

Additional Reading/Resources:

- Mu Cephei – a Most Beautiful Object: http://www.aavso.org/vstar/vsots/1002.shtml
- Finder Guides to the Caldwell Objects: http://www.solarius.com/msas/findercharts/caldwell_objects.html

I'd love to hear of your experiences under the night sky - please feel free to e-mail me or send any observing reports to: tomt@cloudynights.com
Please indicate if I can cite your observations in future columns.

Special Thanks to Collin Smith for his editorial assistance.

PDF formatting by Olivier Biot.