

Small Wonders: Ursa Major

A sky guide for the beginning to intermediate amateur astronomer

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29-Mar-2006

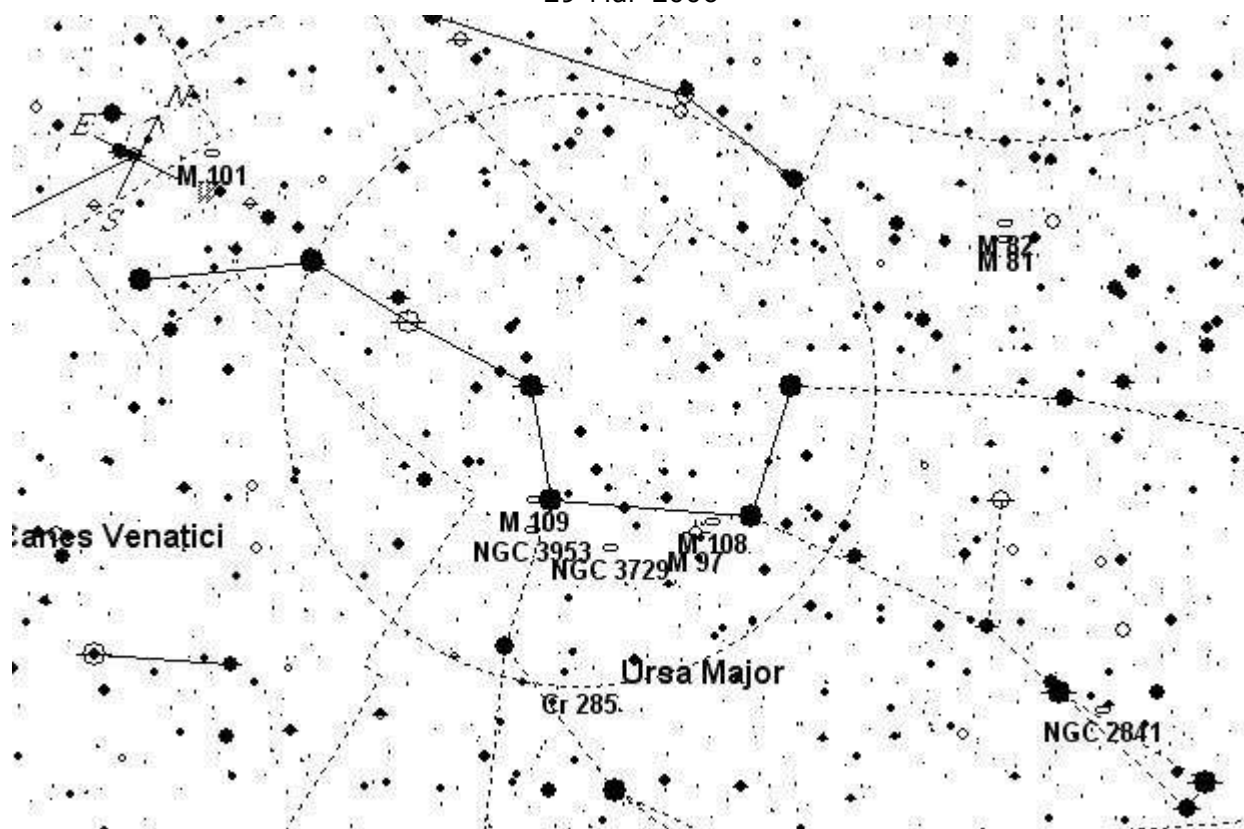


Figure 1. Widefield map

Target List

Object	Type	Size	Mag	RA	DEC
NGC 2841	Galaxy	8.1'x3.5'	9.3	09 ^h 22 ^m 30.0 ^s	+50°57' 09"
NGC 2976	Galaxy	5.9'x2.7'	10.1	09 ^h 47 ^m 49.0 ^s	+67°53' 30"
M 81	Galaxy	24.9'x11.5'	7	09 ^h 56 ^m 08.2 ^s	+69°02' 26"
M 82	Galaxy	11.2'x4.3'	8.6	09 ^h 56 ^m 29.1 ^s	+69°39' 23"
NGC 3077	Galaxy	5.2'x4.7'	10	10 ^h 03 ^m 54.2 ^s	+68°42' 27"
IC 2574	Galaxy	13.2'x5.4'	10.2	10 ^h 28 ^m 54.2 ^s	+68°23' 13"
M 108	Galaxy	8.6'x2.4'	9.9	11 ^h 11 ^m 54.1 ^s	+55°38' 21"
M 97	Planetary Nebula	2.8'	9.9	11 ^h 15 ^m 12.1 ^s	+54°59' 08"
NGC 3718	Galaxy	8.1'x4.0'	10.6	11 ^h 32 ^m 57.9 ^s	+53°01' 56"
NGC 3729	Galaxy	2.9'x1.9'	11	11 ^h 34 ^m 12.4 ^s	+53°05' 29"
NGC 3953	Galaxy	6.9'x3.6'	9.8	11 ^h 54 ^m 10.6 ^s	+52°17' 21"
M 109	Galaxy	7.5'x4.4'	9.8	11 ^h 57 ^m 57.5 ^s	+53°20' 16"
Cr 285	Open Cluster	1400.0'	0.4	12 ^h 03 ^m 22.2 ^s	+57°57' 51"
M 101	Galaxy	28.8'x26.9'	7.5	14 ^h 03 ^m 28.1 ^s	+54°18' 54"
NGC 5474	Galaxy	4.7'x4.7'	10.6	14 ^h 05 ^m 17.1 ^s	+53°37' 42"

Challenge Objects

Name	Type	Size	Mag	RA	DEC
HCG56	Galaxy Cluster		14.5	11 ^h 33 ^m 11.2 ^s	+52°51' 54"
HCG41	Galaxy Cluster		13.9	09 ^h 58 ^m 07.4 ^s	+45°10' 19"

Ursa Major

Our constellation for this edition of Small Wonders is familiar to any denizen of the northern hemisphere. Throughout history, Ursa Major has been a recognizable figure in the night sky. It's alternately been seen as a bear, three hunters and a bear, a plough, a bear and a wagon. (Did I mention that it's been seen as a bear?) The asterism it contains — the Big Dipper — is probably the most commonly recognized figure in the night sky. The Dipper serves as a guide post to many of the northern hemisphere constellations, and is itself an open cluster. Designated Collinder 285, or the Ursa Major Moving Group, it contains the five central stars of the Dipper and is centered a mere 70 light years from earth. Cr285 is best viewed with the naked eye.

Many of the targets this month are visible in binoculars.

The Dipper is a cornucopia of deep sky delights. Lying well off the Milky Way and covering over 1280 degrees of sky, this is a very large patch of space looking far out into intergalactic reaches. Ursa Major is therefore, unsurprisingly, rich in galaxies and galactic clusters. But it's home to a number of other interesting targets as well: some 32767 galaxies brighter than mag 20 (on a more realistic limit, there are 812 at mag 15 or brighter, and 56 brighter than mag 12), 7 Hickson groups, 327 Abell Galaxy Clusters, 641 quasars (MKN 421 @ 11^h05^m, +38° 11' and mag 13.5 is the brightest), two planetary nebula, 9 diffuse nebula, and one globular cluster (Palomar 4) — to list a few.

There are several stars of note in Ursa Major — outside of the stars of the dipper, UMa also contains Lalande 21185 — a mag 7.49 red dwarf — which is the 4th closest star to the solar system and located a mere 8.1 light years away. Lalande 21185 is the brightest red dwarf visible from the northern hemisphere. UMa is also home to Groombridge 1830 — at mag 6.45, it lies 28 light years away and has the third fastest proper motion of any other known stars. Groombridge 1830 is a population II object and as old as the galaxy's globulars. Another star of note in Ursa Major is 47 Ursae Majoris — which is one of the (many) extrasolar systems to have a (suspected) planetary inhabitant.

Ursa Major houses a total of 7 Messier Objects – 6 that are of interest visually. (We'll toss out M40, although double star observers might want to take a gander at it.)

Hubble Deep Field

The Great Bear is also home to the first Hubble Deep Field at $12^{\text{h}} 36^{\text{m}} 49.4000^{\text{s}} +62^{\circ} 12' 58.000''$, this tiny window (about the size of a grain of rice held at arms length) let the HST look outside our galaxy and capture at least 1500 galaxies in a 10 day long exposure. Nearly everything you can see in the image below is a galaxy. (If you have a high bandwidth connection, be sure to see "Zooming In to the Hubble deep field" in the links at the end of this article.)

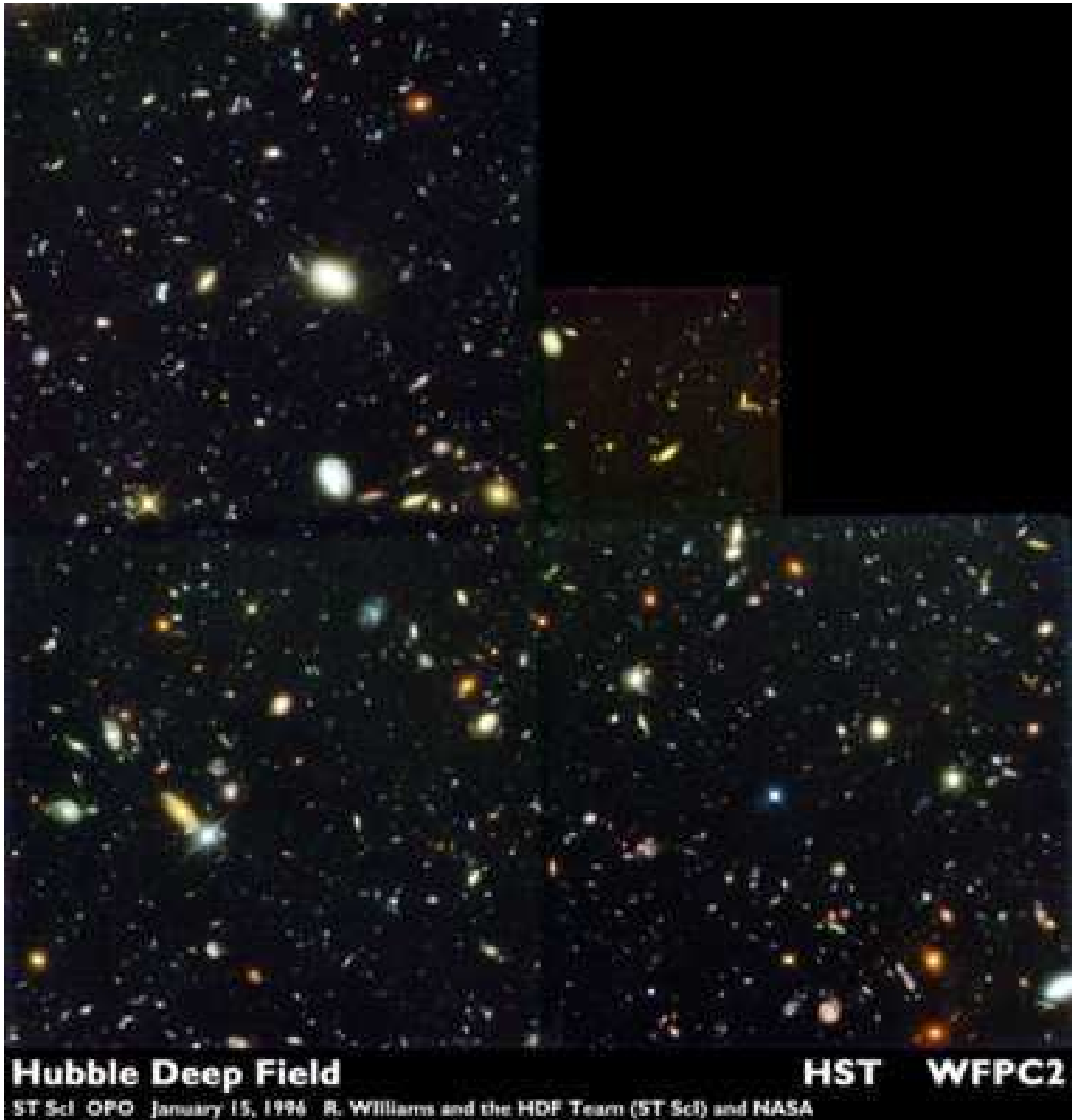


Figure 2: Hubble Deep Field (HST)

Star names

Before we go further, let's be on a first name basis with the stars that make up the Dipper proper. Starting at the handle, we have Alkaid, then the naked eye double Alcor and Mizar is found at the handles bend. Moving on down the ladle we come to Alioth, and a little further leads us to the first of the stars that mark the bowl of the Dipper – Megrez. Down the first side we hit Phecda, then Merak and Dubhe. One of the first things any novice learns is to line up Merak and Dubhe and use them as pointers to find Polaris, the North Star in Ursa Minor.

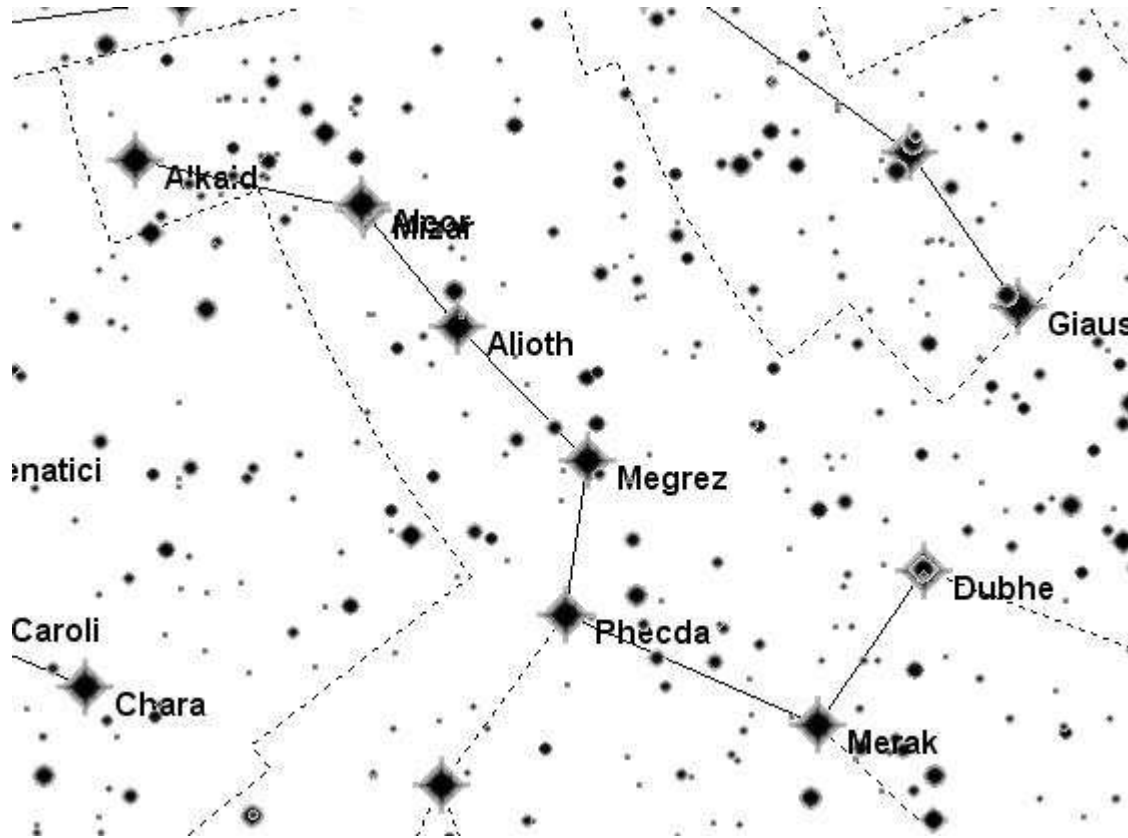
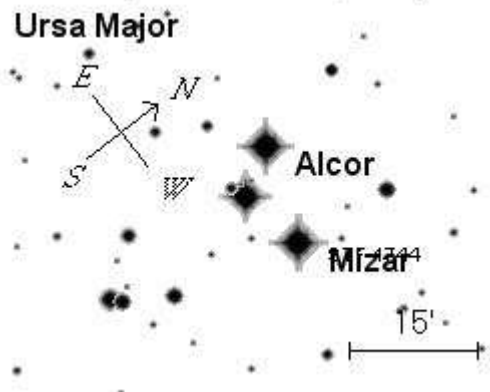


Figure 3: Star names in The Dipper

Various sources I've read have said that many civilizations and cultures used Alcor and Mizar as tests of visual acuity, but this has often puzzled me a bit, as I've never found them all that difficult to separate.



Frankly, Ursa Major is a daunting constellation to write a sky tour for: it's absolutely massive, and home to dozens of targets for an observer with even the most modest of telescopes. Because of this, I've concentrated on what I consider to be the brightest and most spectacular objects, but one area I've neglected is what Walter Scott Houston called "The Bowl Of Night" – the bowl of the Big Dipper itself. Once you've finished this month's tour, I'd encourage you to spend some time scanning in the bowl itself – you'll find several targets worthy of a moderate telescope, and I provide a map and listing of some of the brighter galaxies in and around the bowl at the end of this article.

The bottom of the Bowl

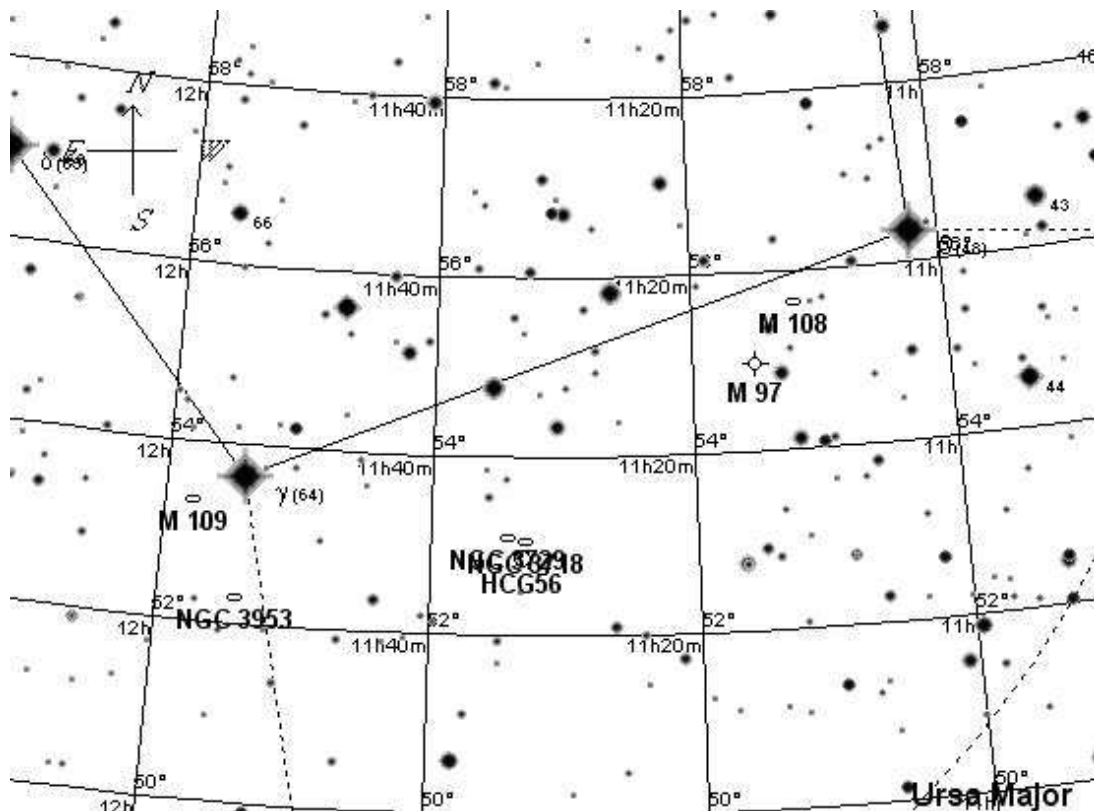


Figure 4: Bottom of the Bowl finder chart

M109



Figure 5: M109 Image courtesy Jason Blaschka

We'll start off tonight's tour at the bottom of the bowl on a line connecting Phecda and Merak. Just to the south east of Merak, (the star at the bottom of the bowl closest to the handle), we'll find our first Messier target for the evening: M109.

Discovered by Méchain, M109 was known by Messier but didn't appear on "his" list until the middle of the 20th century. Messier's original list consisted of 103 targets with some of them questionable (M40 – a double star, and the "missing" messier – M102).

Jason Blaschka's photo of M109 is astounding, but bears little resemblance to what I see even in the largest telescopes. Some of the features are there – the galaxy bears a marked resemblance to a tie fighter even in my 4" apos — under good skies — the central bar is often visible, but it's a rare night on which I catch hints of the spiral arms in small apertures.



Figure 6: M109 — Sketch Courtesy Jay Michaels

Jay Michaels excellent drawing is a good example of what can be seen in an 8-10 inch scope on a good night.

While you are in the area, take a moment to look for NGC 3953 about a degree south of M109.

NGC 3718, NGC 3729 and Hickson 56

Afterwards move up towards the middle of the bottom then drop a bit south to find a nice cluster of objects – NGC3718, NGC 3729 and one of our challenge objects for the month – Hickson 56.

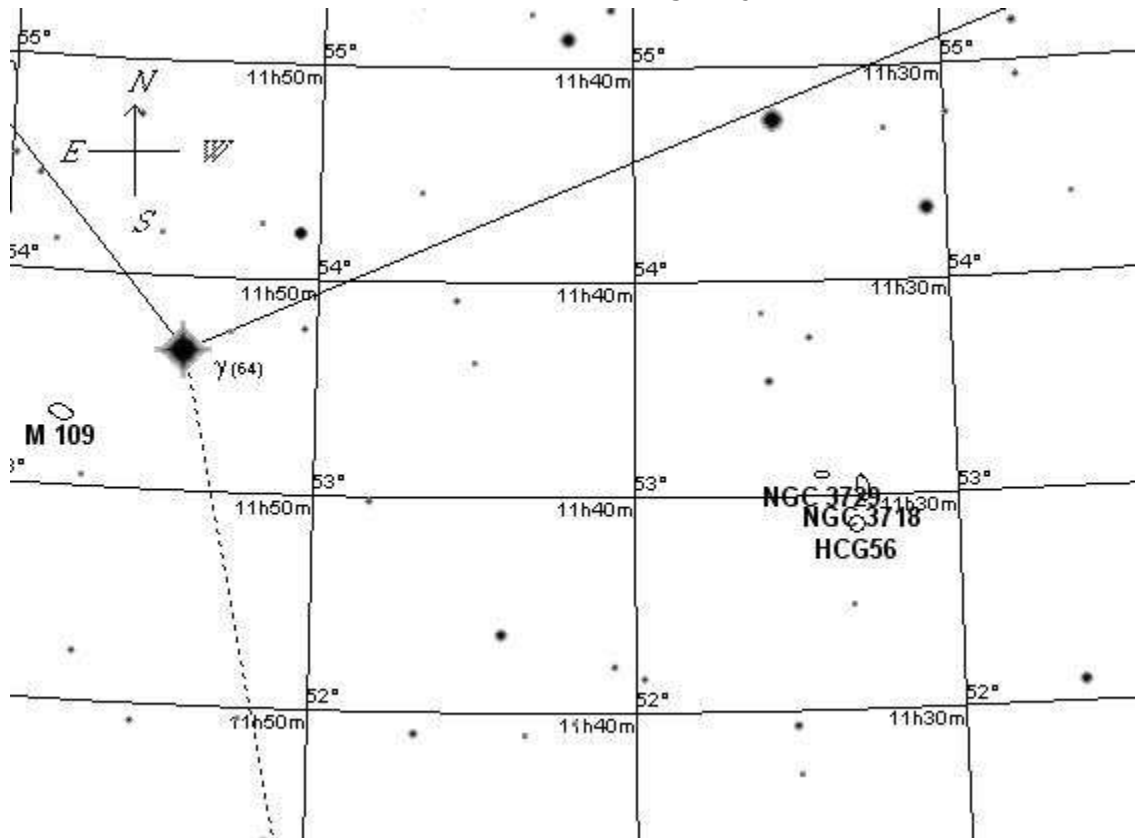


Figure 7: Area map of NGC 3718, NGC 3729 & Hickson 56

Visually you'll find both 3718 and 3729 lie within the same moderate power field of view – I find 3718 to be about three times larger than 3729, but to my eye both galaxies are fairly similar. In larger telescopes, I find that both have visible (if faint) cores, and a dispersed outer halo. Just a bit to the south, you'll find Hickson 56 – but we'll come back to that one in a bit.



M97 (Owl Nebula) and M108

Move back up towards the bottom pointer star (Merak) with a low power wide field eyepiece, and you'll run across a celestial odd couple. First into view should be M97 – the Owl Nebula. A planetary nebula discovered by Méchain in 1781, I've found that this is one of those few objects which actually resembles its nickname. Even in small scopes (under good conditions) I can catch a glimpse of the dark spots which form the owl's eyes. It's fairly large, and as such the surface brightness is quite low. Some observers have claimed to see blue or green across the face of the disk – on excellent nights, I've caught hints of green in large telescopes, but it usually appears simply grey.



Figure 8: M97 – Image Courtesy Rick Krejecki

Rick Krejecki's shot of M97 is amazing. Take a gander at the full resolution version on his web site (http://www.ricksastro.com/DSOs/owl_XT_xscoop.html) – you can spend a fair amount of time just counting the tiny background galaxies. I wonder if any of these have been spotted visually by observers with giant telescopes?

If we want to look at extragalactic targets we don't have to look far away – just a little closer to Merak you'll find the edge on barred spiral M108. Spend some time experimenting with different magnifications on this target – see what, if any mottling you can make out, and if you can detect any presence of an outer halo.



Figure 9: M108 and M97 – Image Courtesy Tom Nicolades

Tom Nicolades' excellent shot shows a bruised and battered M108 and an electric blue M97 in the same frame, and in low power wide field views (anything providing more than 1 degree TFOV), both can easily be caught in the same field of view.

NGC 2841

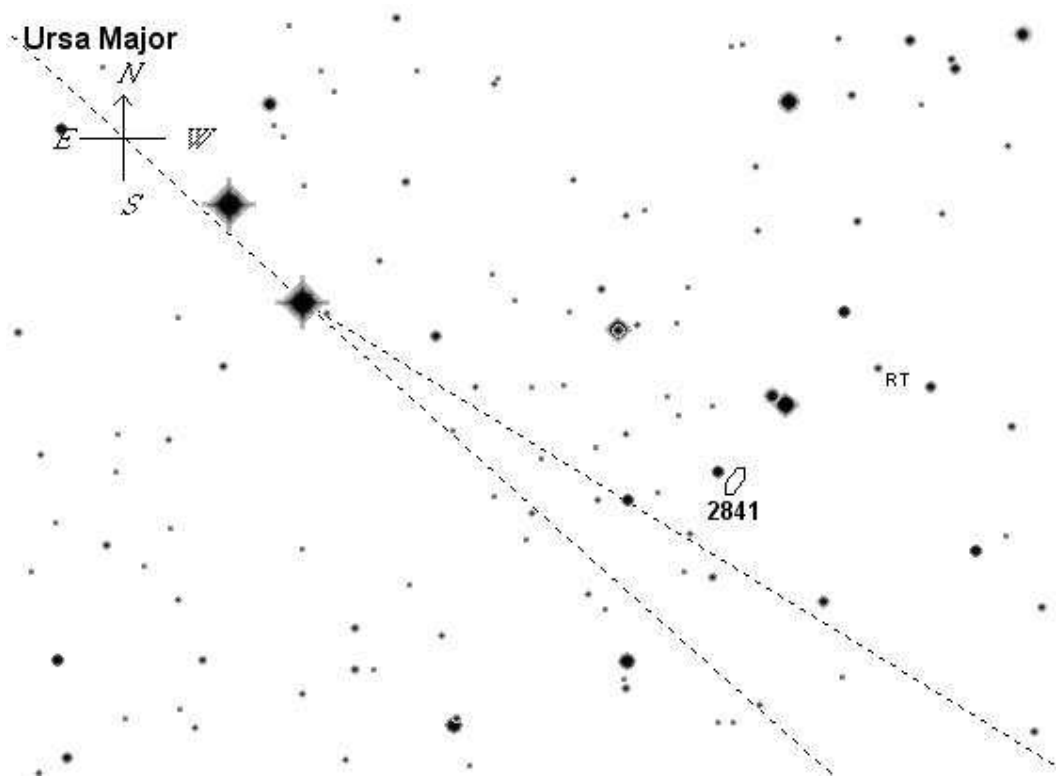
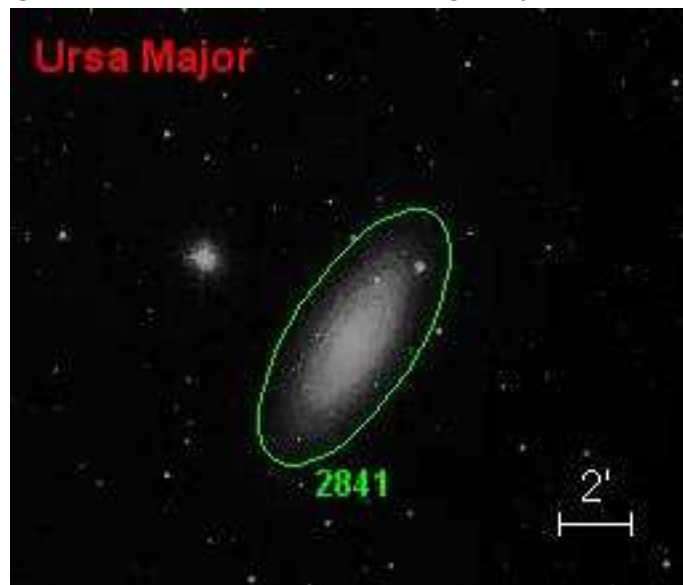


Figure 10: NGC 2841 Area

While we're here, let's hop down the front legs of the bowl and take a quick gander at 2841. This mag 9.2 galaxy will present a nice sliver of light for moderately sized telescopes. A bright core region is surrounded by a slightly dimmer halo. If you have a larger telescope, look for a dust lane marked by a sharp fading of the halo on one side of the galaxy.



M81 & M82

When you've finished with 2841, let's move on to two of the real showpieces in the Great Bear: M81 and M82.

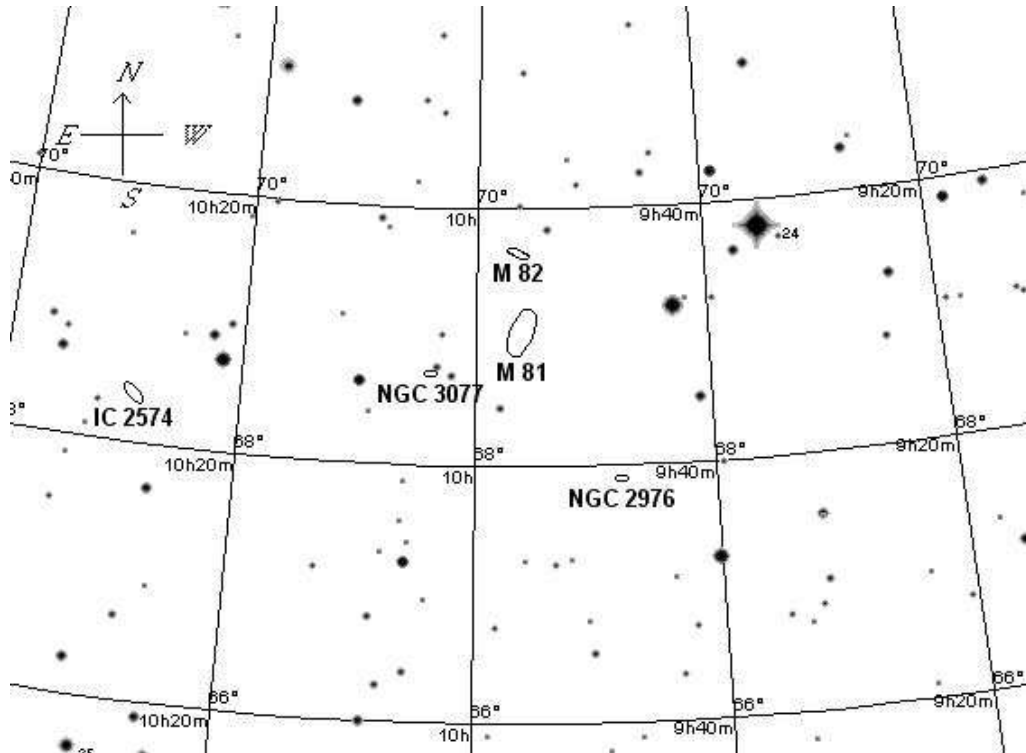


Figure 11: Area map of M81 & M82



Figure 12: M81 & M82 — Image Courtesy John Moody

M81 and 82 are a spectacular pairing of galaxies visible even through small binoculars. Separated by a mere $\frac{3}{4}$ degree both are visible in wide field telescopes and present a wonderful pairing. Dis-

covered by Bode in 1774, they are examples of galactic morphology which couldn't appear to be more different from one another. Both are members of a small cluster of galaxies called the M81 group (which lies a neighborly 10 million light years away), so I suppose it would be appropriate to discuss M81 first. In smaller telescopes, M81 is a bright oval, but large scopes begin to show its spiral structure. M81 is by far the larger and brighter of the two, and in long exposure photographs is a classic spiral. M82, by contrast, is a tortured irregular that looks like it's been the loser in some vast celestial conflict. In my 18", I see it bent at one end while the mottling is clearly apparent, along with a nearly clean division around 1/3 of the way from one edge. While it's slightly fainter than M81, visually I find it far more impressive.

It's worth noting that this is one of the few DSO's visual observers have reported color in, but don't grab those 80mm scopes in anticipation yet. While a friend of mine in Arizona with access to a 30 inch telescope describes seeing red or pink, I've yet to see it even tho I've gazed at this object with telescopes up to 25" in size. I suspect it takes an excellent night, good optics, and as much aperture as you can throw at it.

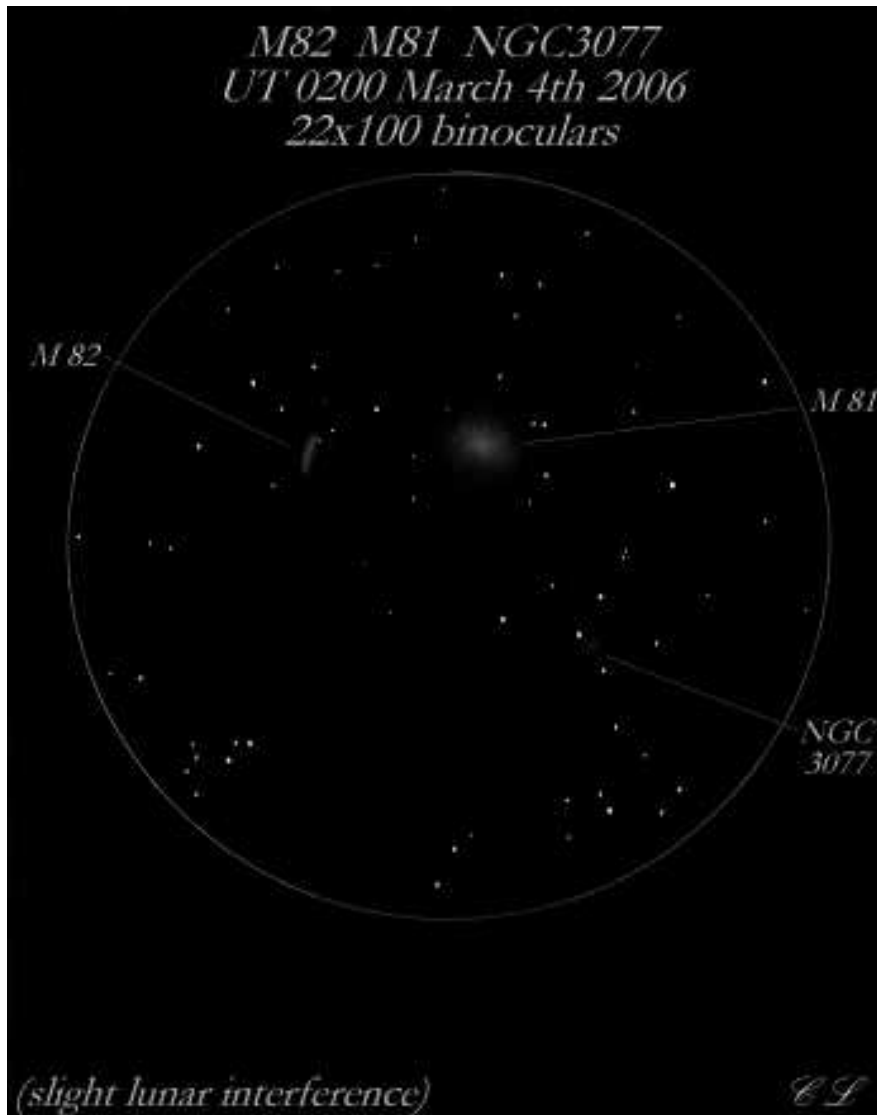


Figure 13: M81 & M82 — Image Courtesy Carol Lakomiak

Don't despair however – in my opinion, M82 is one of the finest targets in the night sky – color or not. Even in small scopes, these two are stunning, and can be picked out from dark skies with the slightest optical aid.

Carol Lakomiak's sketch of the area provides an excellent example of what can be seen in large binoculars or a small telescope.

As you'll note in the area chart, there are a number of other targets in this region as well – take the time to scout around a little bit - keep an eye out for NGC 3077, 2976 and IC 2574. In large scopes, I find that NGC 3077 and 2976 bear a resemblance to glimpses I've had of M81 in smaller apertures. When I'm star hopping and stumble on one of these one first, it can get quite confusing trying to find M81. Always keep your expectations in line with your aperture.

We haven't even really begun to cover the possibilities in Ursa Major, but we'll make one more basic pit stop for the night and then introduce two challenge objects.

M101 (Pinwheel Galaxy)

Head over around the top of the dipper and back the handle for M101 – the Pinwheel Galaxy. Discovered by Méchain in 1781, it's truly a spectacular object in a large telescope showing obvious spiral structure and mottling across the arms.

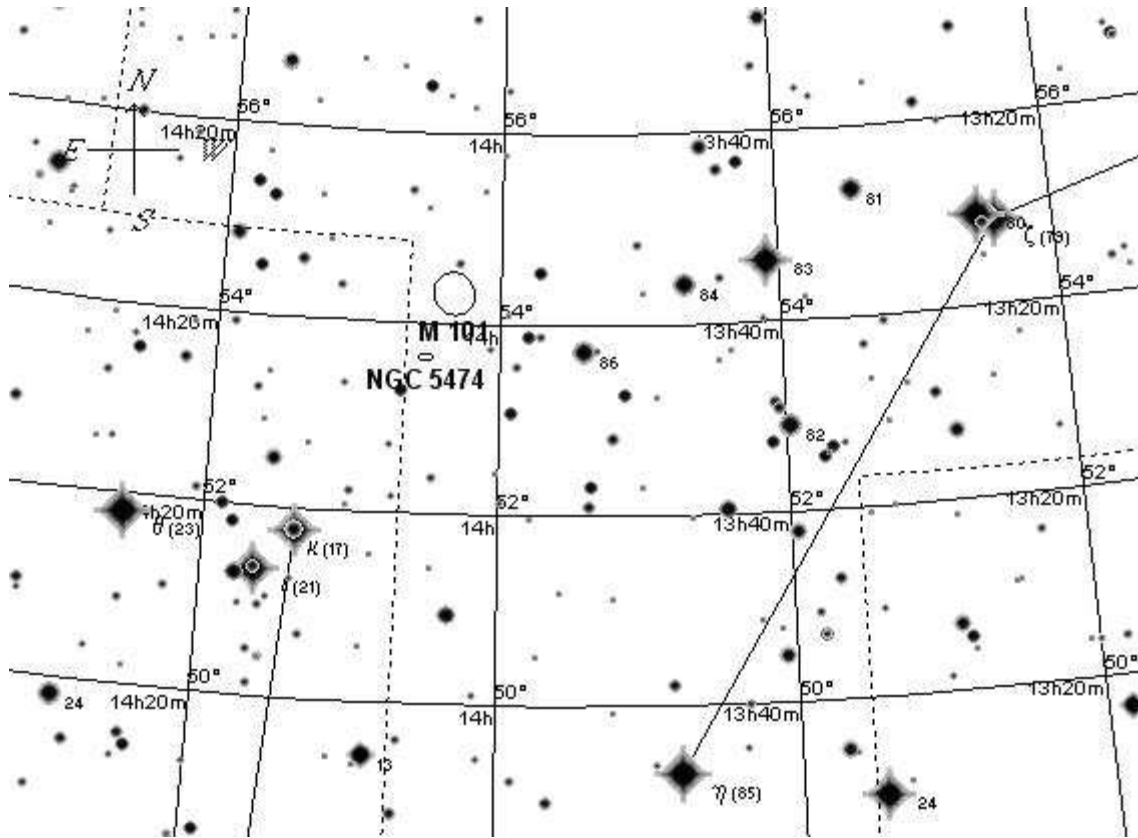


Figure 14: Area map of M101

M101 is a large, loose face-on object that can be deceptively difficult in small telescopes. Keep in mind when searching you are looking for a large object - around 2/3 the size of the full moon, but the surface brightness is very faint so keep your eyes peeled for a gradual brightening of the background brightness.

The galaxy is immense in size – sources put it from 170,000 to 190,000 light years across, some 25 million light years away and home to some of the most spectacular and immense star forming areas known.

Many of these giant starbirth areas are bright enough to merit their own NGC numbers - NGC 5441, 5447, 5450, 5449, 5451, 5453, 5458, 5461, 5462, and 5471. NGC 5471 is the largest and brightest H-II region in M101 – far larger than anything comparable in the Milky Way (and has been proposed to contain a hypernova in 5471B). These are visible in larger telescopes, and while often I'd recommend a power to view the galaxy at (my favorite galaxy buster is my 13T6 Nagler in my 18" Obsession, it provides a magnification of around 180x, and a nice wide field), because of its detailed structure, I'd rather recommend that you spend a while examining it at high and low powers to find what works best for you. Be sure to take a gander for some of the brighter HII regions. Note that 5450 and 5447 are overlapped in the image below - 5447 is the region directly to the south of 5450.

Like M81, M101 is the dominant member of its own cluster of galaxies, so while you are in the area keep an eye out for other interlopers. Brighter neighbors include NGC 5474 and NGC 5473 but numerous other galaxies reside in the area.

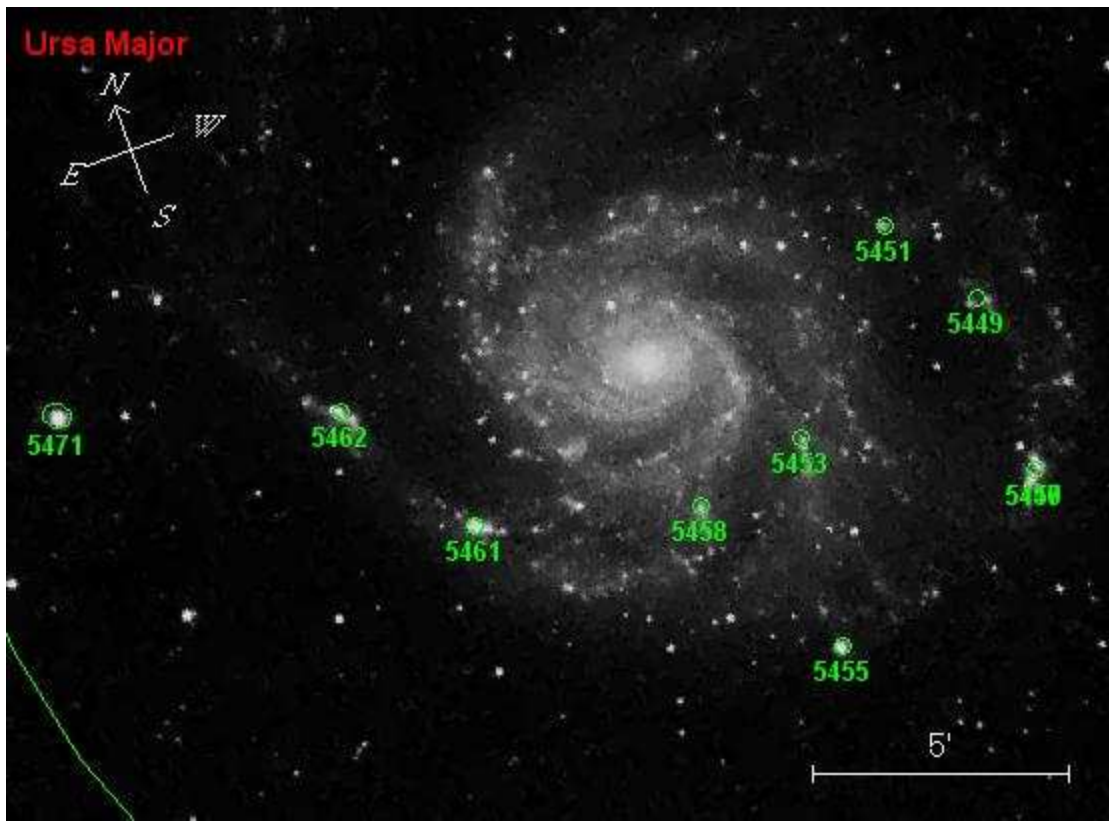


Figure 15: H-II Regions in M101



Figure 16: M101 — Image courtesy James Jacobson

Challenge Objects

There are several objects worthy of the challenge tag in Ursa Major – 6 Hickson groups, Palomar 4 (a globular cluster), and a fairly bright quasar were the first that came to mind. Quasars are interesting for what they are – not what you see, and Palomar 4 is certainly doable with a large scope from a dark site, but on the whole I tend to prefer galaxy groupings. With that in mind, I present as challenge objects two of the “brightest” Hickson’s in Ursa Major – Hickson 56 and Hickson 41.

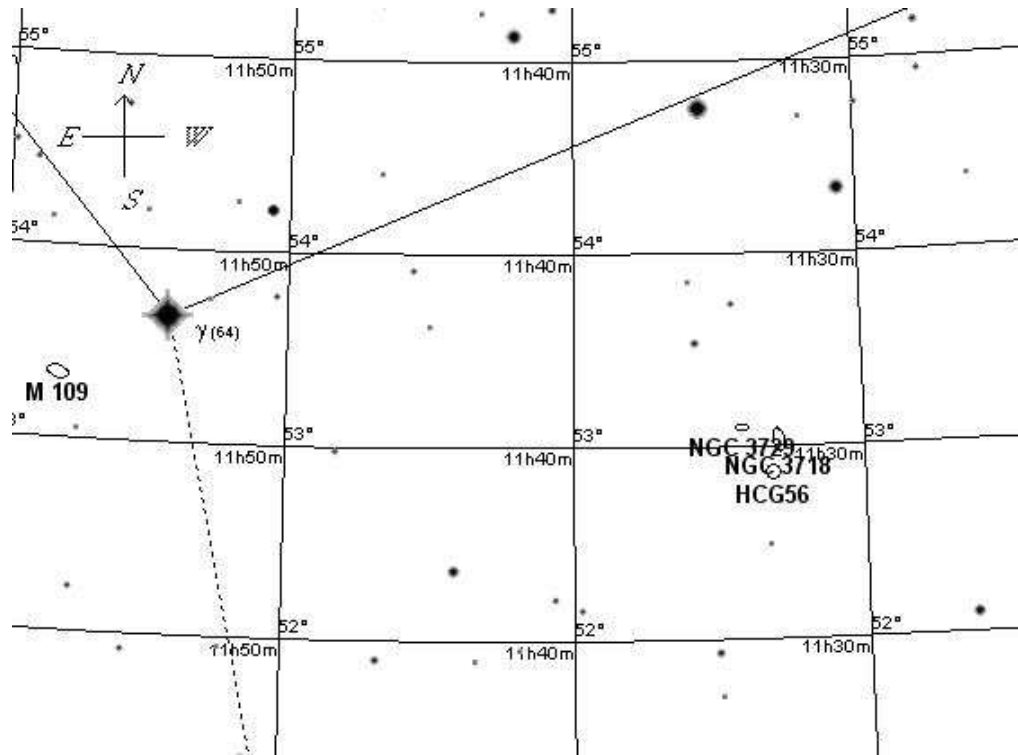


Figure 17: Hickson 56 Finder Chart

Hickson 56 lies just to the south of a galaxy pair we visited earlier – NGC 3729 and 3718.

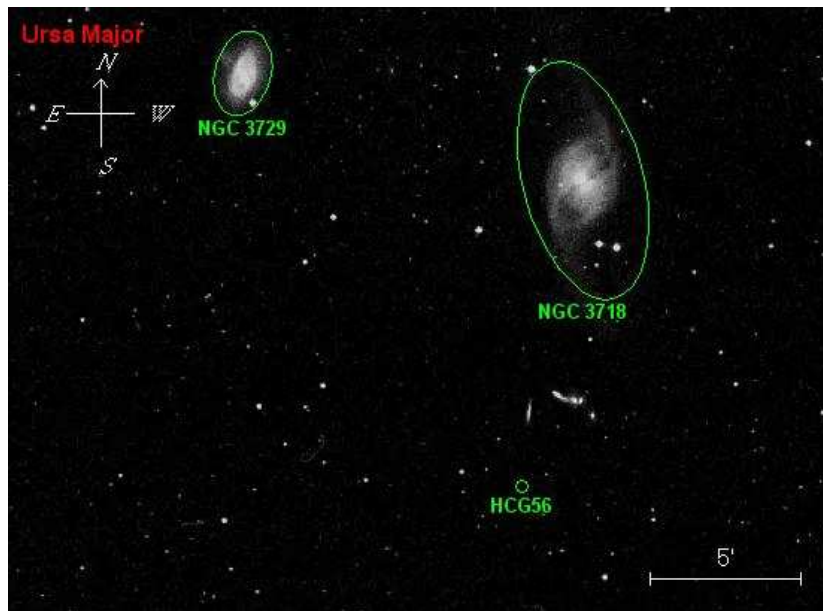


Figure 18: Hickson 56 finder chart

Note that the position of Hickson 56 is slightly off in the image above.

Hickson 56 has 5 components (although not all may be visible) that range from magnitude 16.2 to 15.8, and all the components are tiny (the largest is 1.3x.2 arc seconds) – so make sure you try for this one under good skies with plenty of aperture.

Iiro Sairanen from Härskiänsaari, Ruoholahti, Finland observed Hickson 56 with his 16 inch Newtonian at 292x and provided the following sketch:

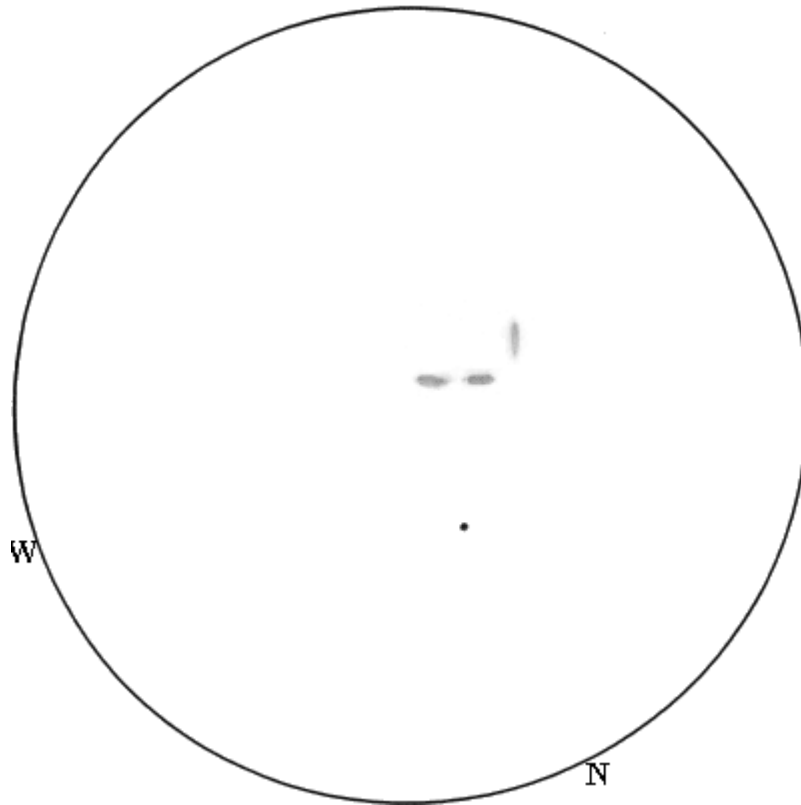


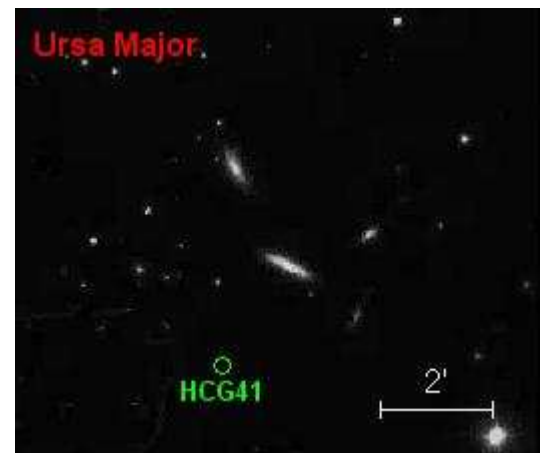
Figure 19: Sketch of Hickson 56 – Courtesy Iiro Sairanen

The other challenge object this month is Hickson 41.

Hickson 41 is a little more difficult to get to, but it's a little brighter. Again, note that it does not perfectly match up with the charts provided. Use the DSS images for reference. There are 4 listed components ranging in magnitude from 14.6 to 18.1, with the largest being a mere 1.5x.2 arcseconds in size. Alvin Huey, in his excellent Hickson Group Observer's Guide observing at 377 and 528x, was unable to catch the 4th member of the group with his 22" f4.1 dobsonian.

I was able to catch three of the four galaxies in my 18" f4.5 from my driveway, but it necessitated some extreme measures; I used a towel to cover my head and shield all extraneous light, I needed a good evening (for my driveway), and I used extremely high powers (600x) in order to darken the sky background sufficiently. Finally, I had to resort to rapping the side of the telescope in order to ensure that I had spotted all three of the members.

The Hicksons, for the most part, are not casual observation or quick look targets. Use every trick in the book including high magnification and perseverance to glimpse these tiny groups of interacting galaxies.



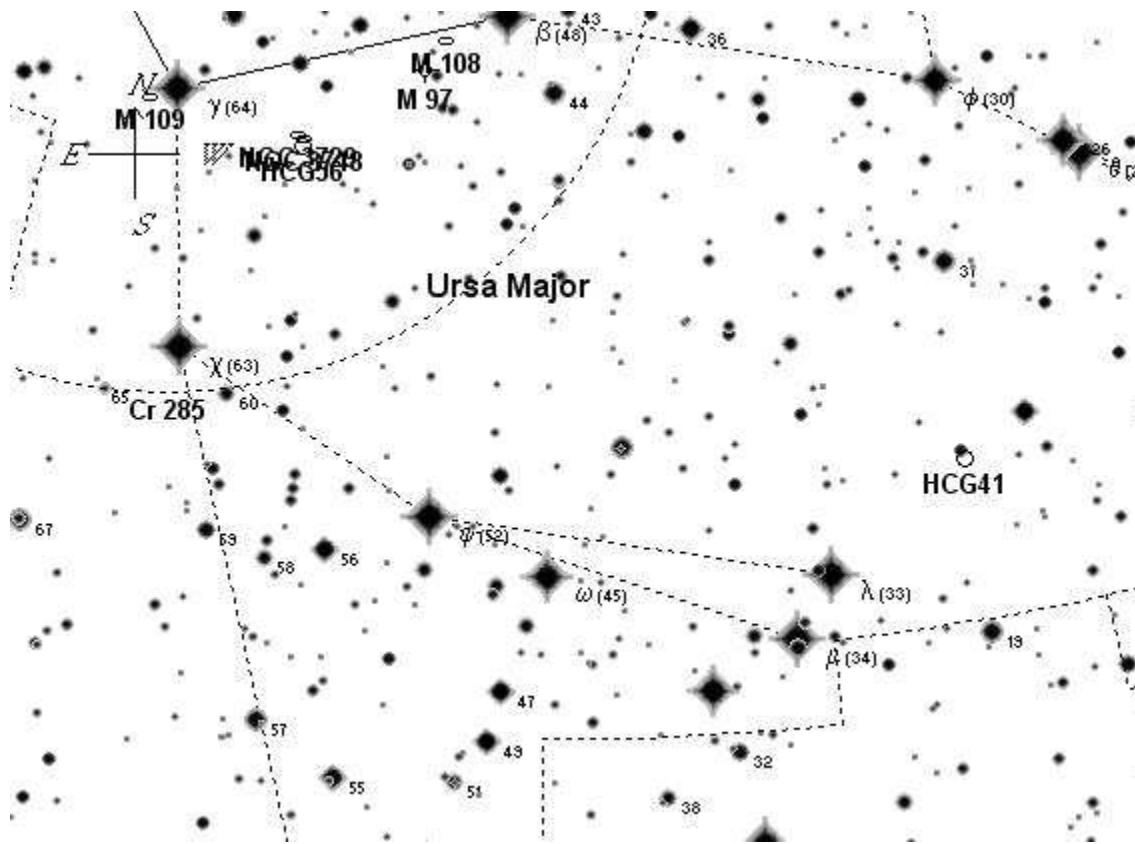


Figure 20: Hickson 41 Wide Field Chart

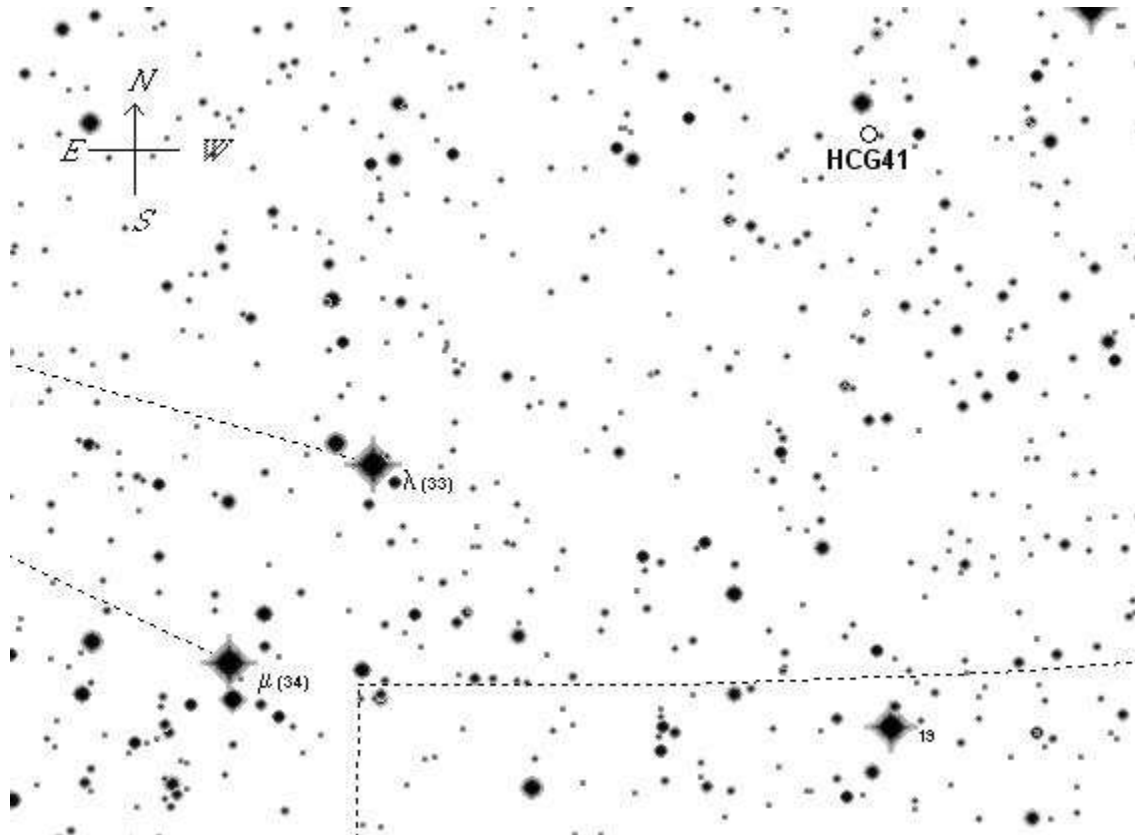


Figure 21: Hickson 41 Area Finder Chart

Additional Targets

As I alluded above, Walter Scott Houston called this area the "Bowl of Night" - with that in mind, here's a map to some other suggestions for the Dipper's bowl.

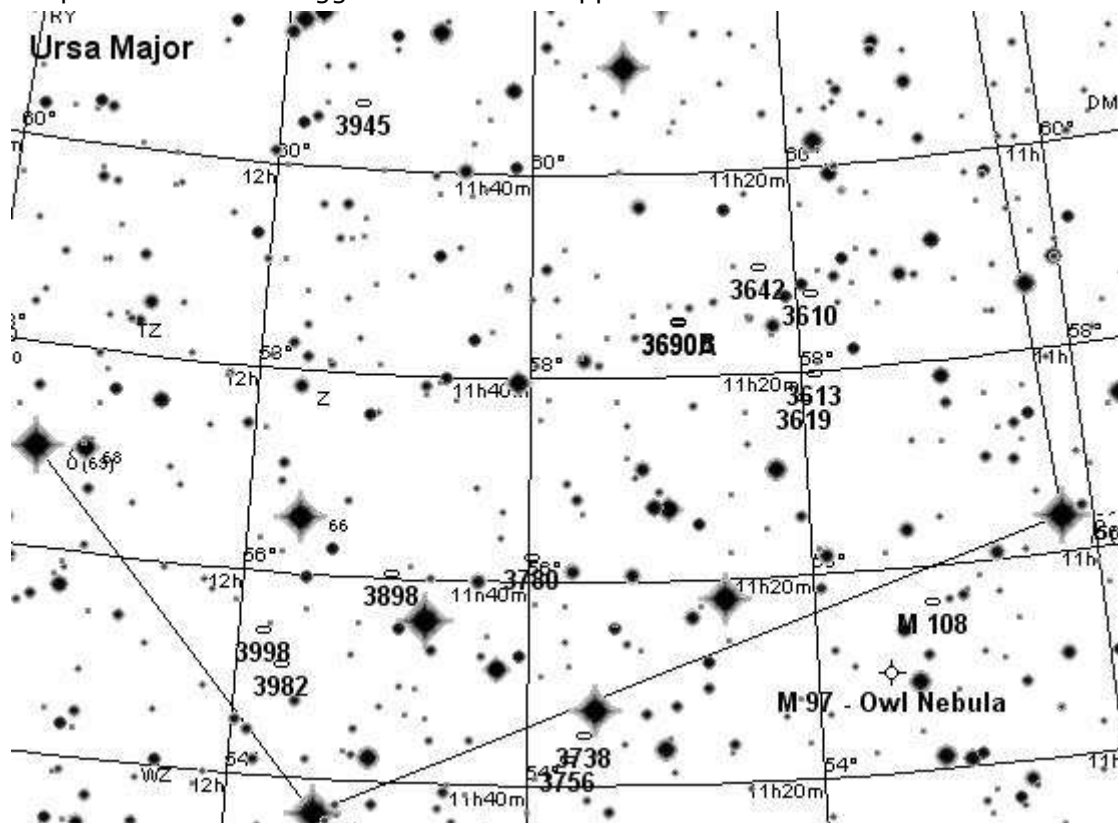


Figure 22: More targets in the "Bowl of Night"

And here's the necessary info on the additional targets:

Object	Type	Size	Mag	RA	DEC
NGC 3610	Galaxy	2.7'x2.3'	10.7	11 ^h 18 ^m 49.8 ^s	+58° 45' 13"
NGC 3613	Galaxy	3.9'x1.9'	10.8	11 ^h 19 ^m 00.6 ^s	+57° 58' 02"
NGC 3619	Galaxy	2.7'x2.3'	11.5	11 ^h 19 ^m 46.1 ^s	+57° 43' 30"
NGC 3642	Galaxy	5.5'x4.7'	10.8	11 ^h 22 ^m 42.2 ^s	+59° 02' 30"
NGC 3690B	Galaxy	2.0'x1.4'	10.9	11 ^h 28 ^m 56.9 ^s	+58° 31' 50"
NGC 3690A	Galaxy	1.6'x1.4'	11.2	11 ^h 28 ^m 54.6 ^s	+58° 31' 39"
NGC 3738	Galaxy	2.5'x1.9'	11.5	11 ^h 36 ^m 11.5 ^s	+54° 29' 23"
NGC 3756	Galaxy	4.2'x2.1'	11.2	11 ^h 37 ^m 11.0 ^s	+54° 15' 35"
NGC 3780	Galaxy	3.0'x2.4'	11.5	11 ^h 39 ^m 45.3 ^s	+56° 14' 10"
NGC 3898	Galaxy	4.4'x2.6'	10.8	11 ^h 49 ^m 38.1 ^s	+56° 03' 00"
NGC 3945	Galaxy	5.2'x3.5'	10.5	11 ^h 53 ^m 36.6 ^s	+60° 38' 26"
NGC 3982	Galaxy	2.3'x2.0'	11.1	11 ^h 56 ^m 50.4 ^s	+55° 05' 24"
NGC 3998	Galaxy	2.7'x2.3'	10.6	11 ^h 58 ^m 18.2 ^s	+55° 25' 08"

Till next time -

Tom T.

Additional Links

- The Hubble Deep Field:
<http://www.stsci.edu/ftp/science/hdf/hdf.html>
- Zooming in to the Hubble Deep Field:
<http://hubblesite.org/newscenter/newsdesk/archive/releases/1996/01/video/a>
- A critical examination of hypernova remnant candidates in M101. II. NGC 5471B:
<http://www.journals.uchicago.edu>

If you liked this article, you may want to check out the [rest of the series](#).

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.

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Special Thanks to Collin Smith for his editorial assistance, Olivier Biot for assistance with the PDF's and all those who take the time to read and contribute to this series.

