

A Brief Binocular Tour of the Summer Sky

by Lisa Wieland

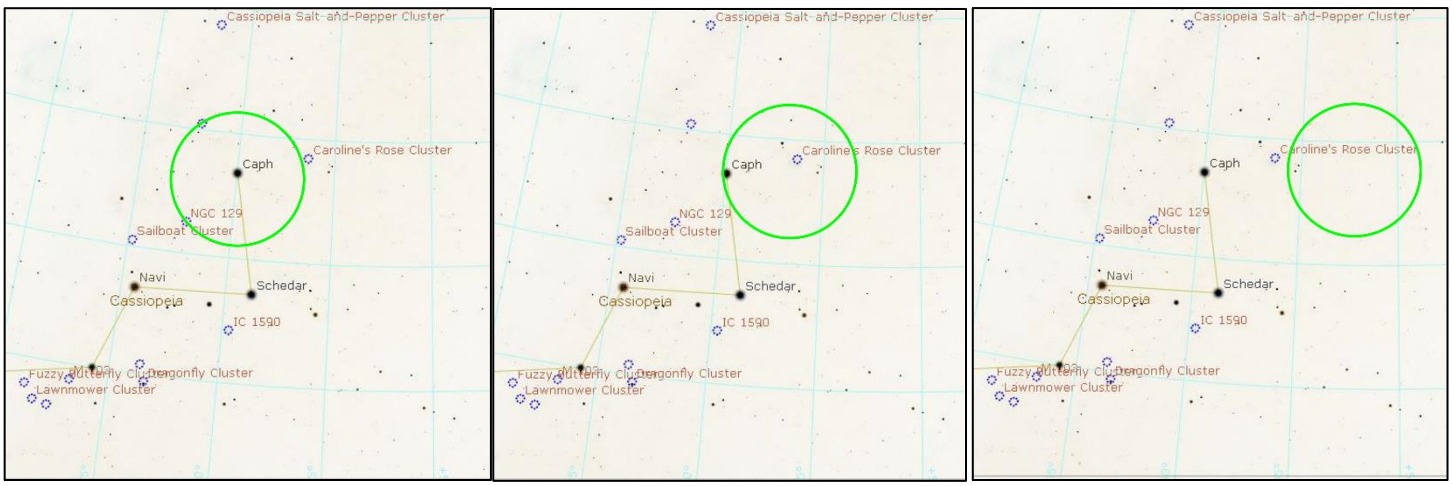
Understanding Your Binoculars: Binoculars are characterized by two numbers: their magnification and the diameter of their two front lenses (aka *objective lenses*). Most binoculars have this information printed on them somewhere, usually near the eyepieces, e.g., 10×50. In this example, 10× = 10 times magnifying power and 50 = the diameter of the objective lenses in millimeters.

Most binoculars are also marked with a second set of numbers describing the width of their field of view, e.g.: 367 ft/1000 yds. This means that, if you were looking at a building 1,000 yds away, you'd see 367 ft of its height and 367 ft of its width.

When it comes to astronomy, where the distance of everything is in billions or trillions of miles, this information has to be converted into degrees to be meaningful because astronomers measure sky distances in degrees. For example, the distance from the horizon to the point directly over your head (aka the "zenith") is 90°, the width of your fist on your outstretched arm is about 10°, and the Moon is about 1/2° across.

To convert ft/1000 yds to degrees, divide the ft number by 52.4. Example: Binoculars that show 367 ft/1000 yds have a field of view of about 7°: 367/52.4 = 7.0038. If your binoculars use metric units, such as 112 meters/1000 meters, then divide the first number by 16, so in this example: 112/16 = 7, so your binoculars would have a 7° field of view.

Using Your Binoculars on the Sky: When you think of using binoculars to find objects, start by centering on a star or other object and then panning your binoculars in full binocular fields across the sky. To do this, you'll center on a star and then move your binoculars slowly in a direction of choice, setting the original centered star at the edge of your field. As you do this, other stars will come into view and become the new objects you center on and then place at the field's edge.

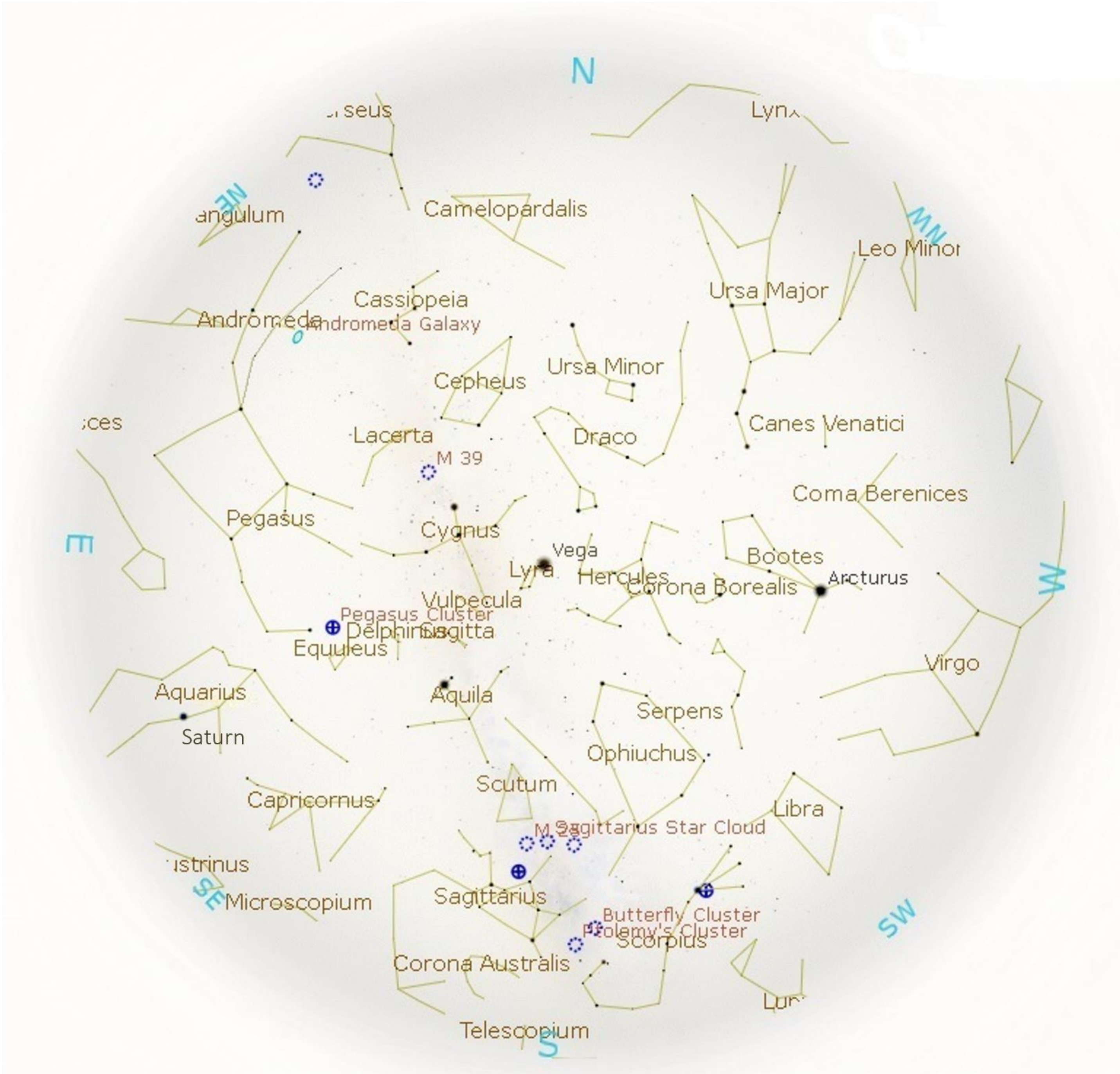


In the above 3 pictures, consider the green circle to be your binocular field of view. In this example, at the far left we start by centering our field on Beta (β) Cassiopeia. In the middle picture, we slide our binoculars to the right, placing β Cass at the edge of the field. In the third photo, we put the farthest 2 stars in the middle picture's field at the edge of photo 3's field. In this way, we can move binoculars in a careful and measured way across the sky to help us find objects. (Hint: If you start by following the moves in this example, one more FOV to the right and then you can slide up to the Measuring Cup Asterism in Andromeda.)

Abbreviations In This Handout:	
Aka = also known as	LY = light years
Binox = binoculars	Mag = magnitude (see appendix)
Diam = diameter	MW = Milky Way
Dist = distance	Neb = nebula
FOV = Field of View	Symbols: × = times, # = number, > = more than; ~ = about
Glob = globular cluster (see appendix)	Symbols: ° = degrees; ' = arc minutes; " = arc seconds

Constellation Abbreviations			
Andromeda :And	Cepheus: Cep	Leo: Leo	Scorpius: Sco
Aries: Ari	Corona Borealis: CBr	Libra: Lib	Scutum: Sct
Aquarius: Aqr	Corvus: Cor	Lyra: Lyr	Serpens: Ser (Ser cap = S. caput)
Aquila: Aql	Cygnus: Cyg	Ophiuchus: Oph	Ursa Major: UMa
Boδtes: Boo	Draco: Dra	Pegasus: Peg	Ursa Minor: UMi
Cassiopeia: Cas	Delphinus: Del	Perseus: Per	Virgo: Vir
Canes Venatici: CVn	Equuleus: Equ	Sagitta: Sge	Vulpecula: Vul
Capricornus: Cap	Hercules: Her	Sagittarius: Sgr	

This map shows the constellations visible in midsummer here at Prairie Grass Observatory/Camp Cullom around midnight.

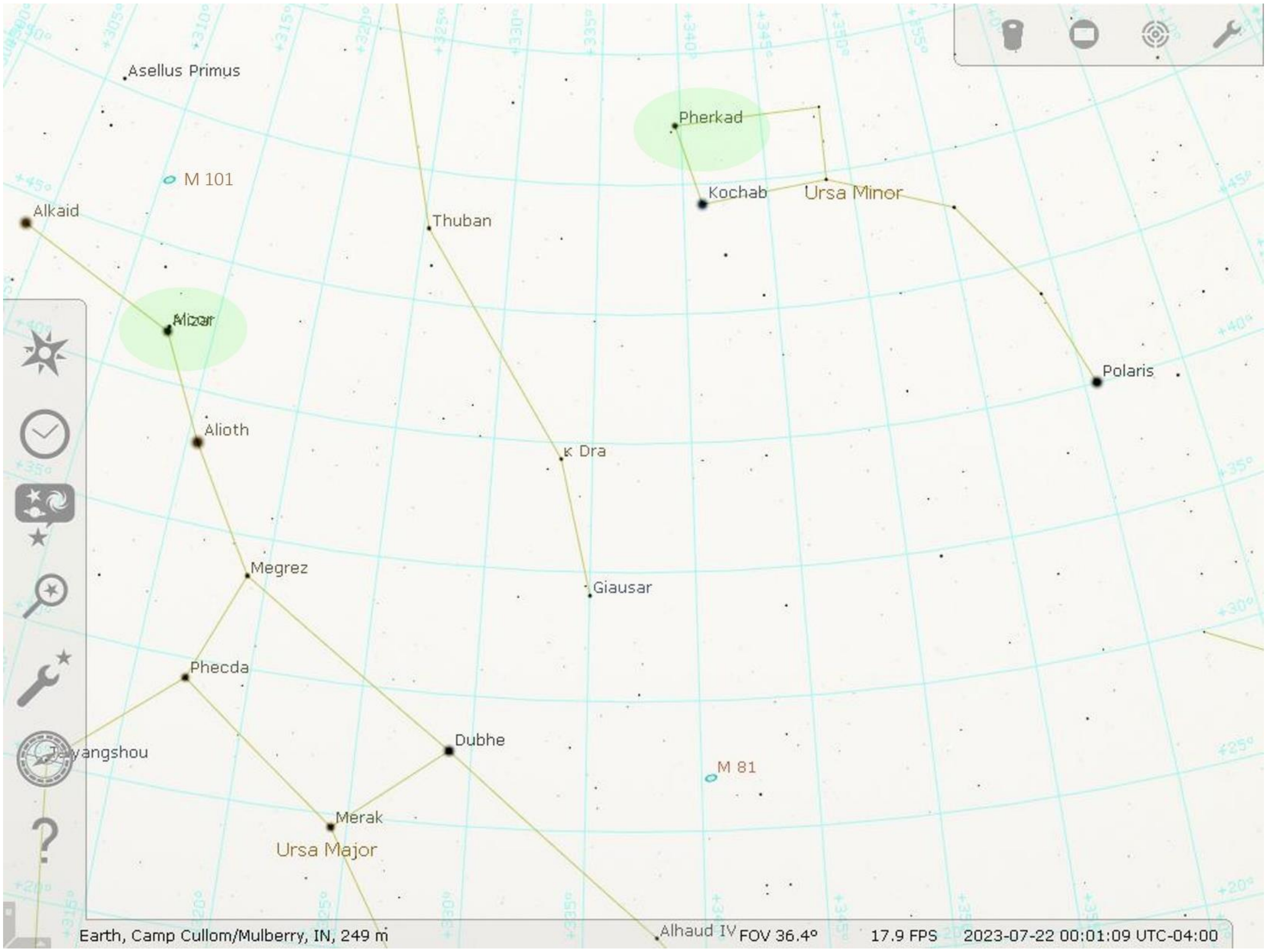


Objects to Look for Include:

Star Clusters: Globular & Open (see Appendix for definitions)
Nebulae (See Appendix for definitions)
Double & Multiple Stars: In true double & multi-star systems, the stars are gravitationally bound; in apparent doubles & multis, they're not, but merely fall along the same line of sight.
Asterisms (Groupings of stars that form a recognizable pattern.)
1 Galaxy (Galaxies are enormous objects containing thousands of millions – trillions of stars) & **1 Planet** (2 if you can stay up super late, planets are non-stellar objects having attained a size making them spherical (& meeting some other criteria) that orbit a star).

To begin to look for an object, you must first find the constellation it lives in. We will begin in the North, then look Northeast, East, Southeast, and South. Only a few objects are highlighted in green on every map; these are visible in binox; other objects listed but not highlighted may also be, but some require telescopes to see. Don't let that deter you from trying!

Northern Sky



Areas of interest are highlighted in green.

Double Star: Pherkad (the dimmer one **in the bowl of Little Dipper, UMi**):. Pherkad is a white giant, A2 III 4.8 solar mass star with radius 15× that of the Sun. It is a variable star (Delta Scuti type, i.e. a pulsating variable whose brightness varies as it contracts and expands), but the brightness only varies by a few tenths of magnitude over a period of 3.43 hours. Pherkad is about 487 LY from Earth.

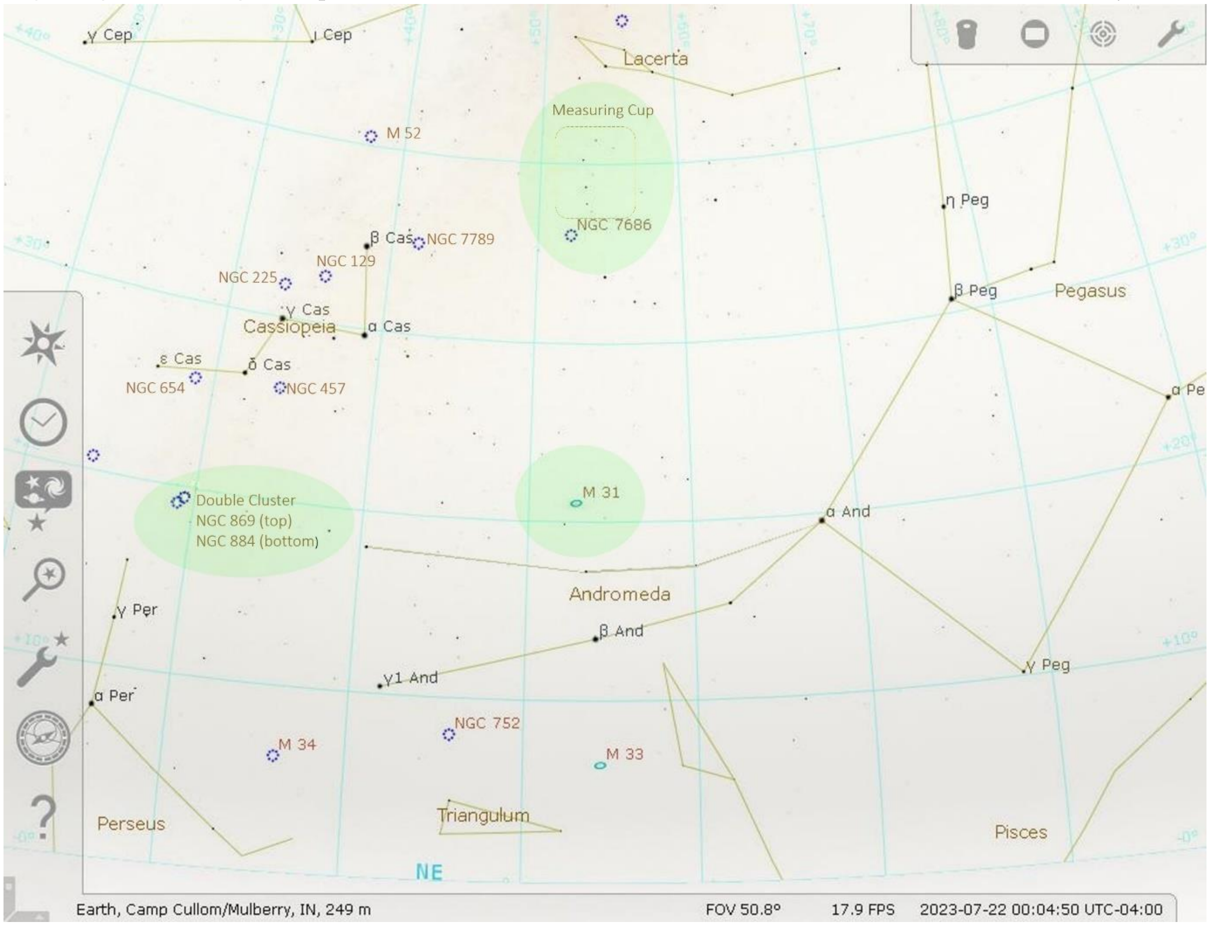
Pherkad Minor (aka 11 Umi) is an orange giant star that looks like a companion to Pherkad, but is actually much closer to us at just 410 LY away. It makes an apparent double star with Pherkad, but the 2 stars aren't really associated.

Double Star: Mizar/Alcor (in Big Dipper, UMa): Mizar is actually a 4-star system & Alcor is actually a binary. Alcor & Mizar share proper motion, i.e., they're moving through space together, along with other members of the UMa Group. It is thought that Alcor may actually be gravitationally bound to Mizar. If it is, then the "two" stars actually constitute a sextuple (i.e., 6-star) system.

Greek Alphabet		
α Alpha	ι Iota	ρ Rho
β Beta	κ Kappa	σ Sigma
γ Gamma	λ Lambda	τ Tau
δ Delta	μ Mu	υ Upsilon
ε Epsilon	ν Nu	φ Phi
ζ Zeta	ξ Xi	χ Chi
η Eta	ο Omicron	ψ Psi
θ Theta	π Pi	ω Omega

Northeastern Sky

Asterism: The Measuring Cup (In And & Lac): Comprised of Stars 3, 5, 7, 8, & 11 And & stars EW & V424 Lac. Covers nearly 5°of sky. Brightest star is mag 4.50, so under very dark skies it's naked eye and dead obvious. Is near Open Cluster NGC 7686.
Find it: Start at Beta Cass and go right (due SE). You'll go past a pair of bright stars right away, keep going to the right. After placing that pair at the edge of your field, keep going another FOV's worth and a bit past. When you see a FOV with a bright star or 2, go up. The cup should be right there.



"Open Cluster" NGC 7686 (in And):
Dist from Earth: 900 – 3000 LY
# of stars: Looks like ~40 in small scopes; ~80 in actuality
Is not a true cluster as the stars in the "group" show no evidence of a cluster main sequence.
Find it: In Andromeda at the end of the handle of the Measuring Cup asterism.

Open Clusters: The Double Cluster: NGC 869 & 884 (in Per):
Dist from Earth: NGC 869 is 7,460 LY away; NGC 884 is 7,640 LY away.
# of stars: Between the 2 there are 400 blue-white supergiants; there are also some more red giant type stars.
Ages: NGC 869 & 884: Both are ~14 million years old
Diams: 869: 66.30 LY; 884: ~76 LY
NGC 869 is the western-most of the 2; 884 is the easternmost of the 2. Both clusters are physically close to each other, only a few hundred LY apart.
Find Them: Take an imaginary line from Gamma (γ) Cass to Delta (δ) Cass. The double cluster is about 1 FOV down from δ along this line.

Galaxy: M31 (in And): Dist From Earth: 2.54 million LY away
Age: 10 billion years old
Size: 220,000 LY (MW is ~100,000 LY in diam)
# of Stars: > 1 trillon stars (Milky Way contains 200 – 400 billion stars).
Aka, "The Andromeda Galaxy." Is large spiral galaxy. Has bright companion galaxies: M32 (smaller, rounder one) and M 110 (Other spiral) which can also be seen in binox. It's approaching us at about 68 mi/s & will collide with Milky Way in ~ 3.75 billion years. Binox & small scopes reveal only bright galactic core.
Find It: Center on Beta (b) And and go straight up, toward Mu (u) And, which will look bright in your FOV. Keep going up, placing Mu at the bottom of your FOV, and possibly passing out of it, depending on your binox. A bright patch of sky should come into view, that's M31.

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δ Delta	μ Mu	υ Upsilon
ε Epsilon	ν Nu	φ Phi
ζ Zeta	ξ Xi	χ Chi
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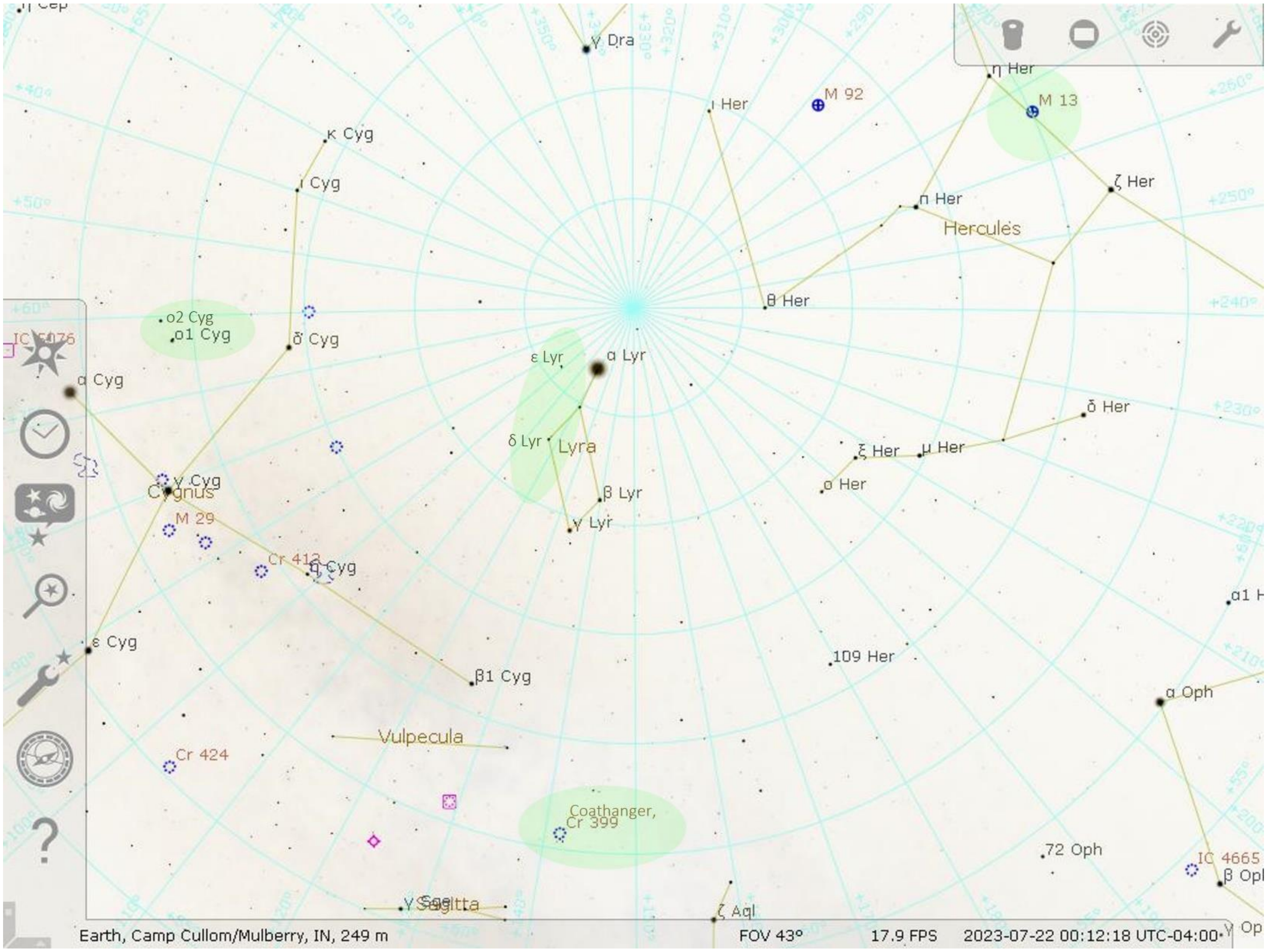
Eastern Sky



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Asterism: The Coathanger. (Cr 399, Cr = Collinder; aka "Brocchi's Cluster): Not a real star cluster since none of the stars are gravitationally bound together, but a fun grouping of stars. Looks like a little upside down coathanger in the sky.
Find it: Method 1: Start at Albireo in Cygnus and roll down the right side of the triangle of stars that it (Albireo) sits at the top of and then continue past the double star Alpha Vul to arrive at the coathanger. This route involves a tad over 8°
Method 2: Start at Altair in Aquila and sweep upward toward bright Vega. The coathanger sits ~1/3 of the way up along this line. This route involves around 12° of sky.

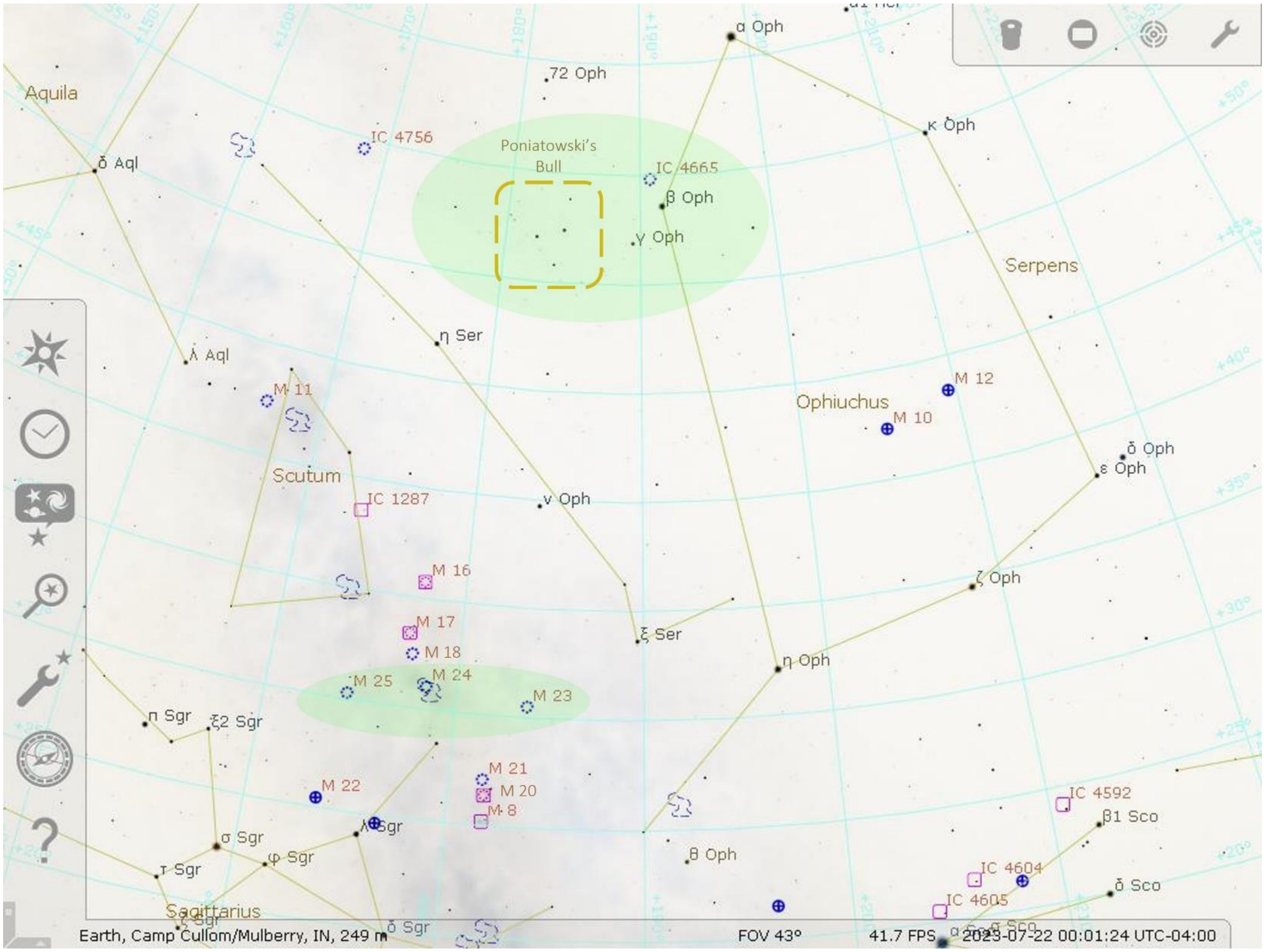
Globular Cluster M13 (in Her): Dist from Earth: 22,180 LY
Age: 11.66 billion years old
\# of Stars: 300-500K
Diameter of cluster: ~145 LY
Find it: Center your binox on mag 3.45 Eta (η) Herculis. Look for the dusty smudge below it in the binoc field.

Double Star Epsilon (ε) Lyra (in Lyr): AKA: The double double, a multiple star system of at least 5 stars ~ 162 LY away. Both "stars" that you'll see in binoculars are actually double stars themselves, but you'll need a telescope for that. The northern component is ε^1 and the southern is ε^2. ε^1 & ε^2 orbit each other over hundreds of thousands of years. These two are separated by 208"—about 100× farther apart than their subcomponents. The component stars of ε^1 have magnitudes of 4.7 & 6.2, separated by 2.6" with a 1200 year orbital period. The main components of ε^2 have magnitudes of 5.1 and 5.5 and are separated by 2.3" and orbit in perhaps 600 years. A 5th component of the system was found to be orbiting one of the ε^2 pair; this was detected in 1985. Orbital data for this hasn't yet been computed, but it has a rapid motion suggestive of an orbital period of a few tens of years Its maximum observed separation is 0.2", precluding direct visual observation. It was detected by speckle interferometry, which is a high-resolution astrophotographic technique.
Find it: Center on bright Vega in Lyra; it makes a bright triangle with 2 other stars below it, Zeta (ζ) and Epsilon, which is below and more to the left (NE). Epsilon shows up as 2 stars.

Double Star Delta (δ) Lyra (in Lyr): AKA: The other double-double or the Delta Twins of Lyra. This is an optical (or apparent) double, but the two stars are not gravitationally linked, in fact, they are actually moving in opposite directions. Delta1 is a double star. Its member stars are of magnitudes 5.6 & 9.9; they are 1080 LY away.
Delta2 is the brighter one, and it's a multiple star. Its member stars are of magnitudes 4.3, 11.2, and 11.6—but it's the mag 4.3 one you notice: it's a red giant star, take note of its subtle orangey color. The Delta2 system is 889 LY away.
Find it: Center on bright Vega in Lyra, which makes a triangle with double star Epsilon Lyr and Zeta Lyr. Delta is the double star down and to the right (NE) of Zeta.

Multi-Star Omicron (o) Cyg (in Cyg): This is a multistar system. Omicron1, aka 31 & 30 Cyg actually consists of 3 stars: 31 Cyg A & B, and 30 Cyg. 31 Cyg is actually a multistar system comprised of 31 Cyg A, a magnitude 3.7, class K, orangey star that's actually a spectroscopically detected (i.e., not a visually detected, so you can't see it) eclipsing binary on its own, & 31 Cyg B, a magnitude 7, class B, whitish companion that's hard to see with binoculars unless you can steady your arms and have a good, dark viewing site. Next to 31 Cyg A, through binox, you'll see 30 Cyg, a magnitude 4.80, class A, bluish-white star.
Across from the pair you'll see Omicron2, aka 32 Cyg, which is actually another spectroscopic eclipsing binary comprised of 32 Cyg A, a magnitude 3.95, class K, orangey star and 32 Cyg B, a class B blue-white companion that can't be directly or actually seen.
Find it: Center on bright Deneb in Cygnus. The Omicron Cygni group sits a tad over 5° above & a bit right (SW) of this star. Of the entire Omicron Cyg system, you'll surely see the little triangle of stars (31 Cyg A, 30 Cyg, and 32 Cyg A), I'm not sure if you'll see 31 CygB. This multistar system is 1100-1200 LY away.

Southeastern & Upper Southern Sky



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Open Cluster IC 4665 (In Oph): Dist from Earth: 1,400 LY
# of stars: About 12 or so in binox, ~ 30 in actuality
Age: 35 million years
Diam: ~30 LY
AKA "The Summer Beehive Cluster" and also the "HI Cluster" because the stars in it form the word, "Hi"—but it looks backwards in refractor telescopes & binox. I can discern the greeting, sort of from the camp—need steadier FOV.
Find it: It sits immediately above (~ 1° NNE of) mag 2.75 Beta Oph.

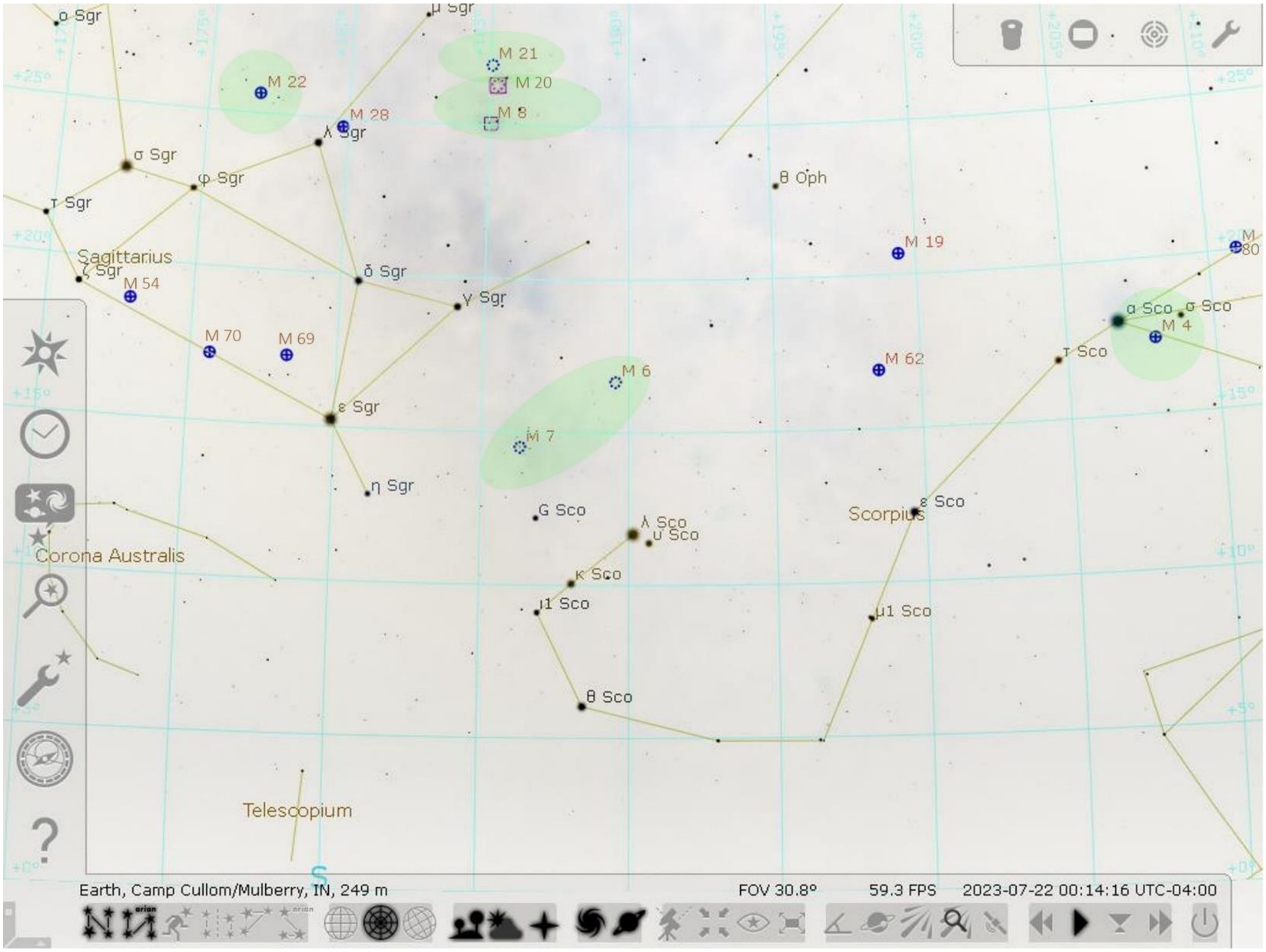
Asterism Poniatowski's Bull (AKA: Taurus Poniatovii): This group of stars used to be a constellation made to honor Stanislaus Poniatowski, King of Poland from 1764 to 1795. It consists of stars: 66, 67, 68, 70, and 73 Oph and looks similar in shape to the Hyades star cluster which makes up the head of the bull in the constellation Taurus (which is seen in the fall and winter).
Find it: Center on Beta (β) Oph. Below that star is Gamma (ϒ) Oph. Once you have Beta and Gamma in your field of view, just slide to the left (E); the bull comes right into view.

Open Cluster M23: Dist from Earth: 2,050 LY
# of stars: 169—414.
Age: ~330 ± 100 million years old
Diam: 16 LY
Find it: First find M8, the Lagoon neb. From there, move about ~1 binoc field above and to the right (a bit over 5.5° NNE). M23 appears as a faint, dusty patch of sky.

Star Cloud M24, the Small Sagittarius Star Cloud (in Sgr): Dist from Earth: 10,000 LY
# of Stars: About 1000 are visible in a single field of view.
Age: NA since it contains both stars and other star clusters.
Diam: 600 LY
M24 is not really a cluster at all, but a collection of millions of stars found along the plane of the Milky Way seen through a gap in our galaxy's dust lanes, so basically, it's just a hole in the dust that allows you to look towards the bright galactic core.
Find it: First find M23, then swing a tad less than 4.5° left & slightly up (ENE) until you reach a bright, starry patch. That's M24.

Open Cluster M25: Dist from Earth: 2,000 LY
# of stars: Can see 30-60 in small scopes. Has 601 known member stars in actuality.
Age: 90 million years.
Diam: 19 LY
Is larger and brighter than M23.
Find it: Method 1: First find M24, then swing just under 4° (3° 50') to the left (E) to arrive at M25.
Method 2: First find M22, then swing a tad under 5° (4° 54') up and a bit to the right (NW) to arrive at M25.

Far Southern Sky



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Globular Cluster M4 (in Sco): Dist from Earth: 7,200 LY
# of stars: >20,000
Age: 12.2 billion years old
Diam: 75 LY
Find it: Center on Antares (Alpha [α] Sco) in Scorpius and then just look to the star's right (W) for a faint dusty smudge.

Open Cluster M7 (in Sco): Dist from Earth: 980 LY
# of stars: ~80 (some are in the shape of a square—look for this!)
Age: 20 million years
Diameter: 50 LY
Find it: Use the stinger stars in Scorpius, **Lesath** (Upsilon [υ] Sco) and **Shaula** (Lambda [λ] Sco) as pointer stars to M7. M7 sits nearly 5°(which is less than 1 binocular field) from Shaula along a line drawn from Lesath through Shaula (NE). Then, if you center on M7, M6 should show up in the same binoc field to it's upper R (NW).

Open Cluster M6 (in Sco): Dist from Earth: 1600 LY
# of stars: >300, but binocs show only a few dozen and small scopes ~80.
Age: 100 million years old
Diameter: ~ 12 LY
Messier-objects.com says you can see the butterfly shape in 7X50s or 10X50s, but I couldn't see it from the camp.
Find it: First find M7. M6 sits about 1 binoc field to M7's upper right (NW) when you're looking S.

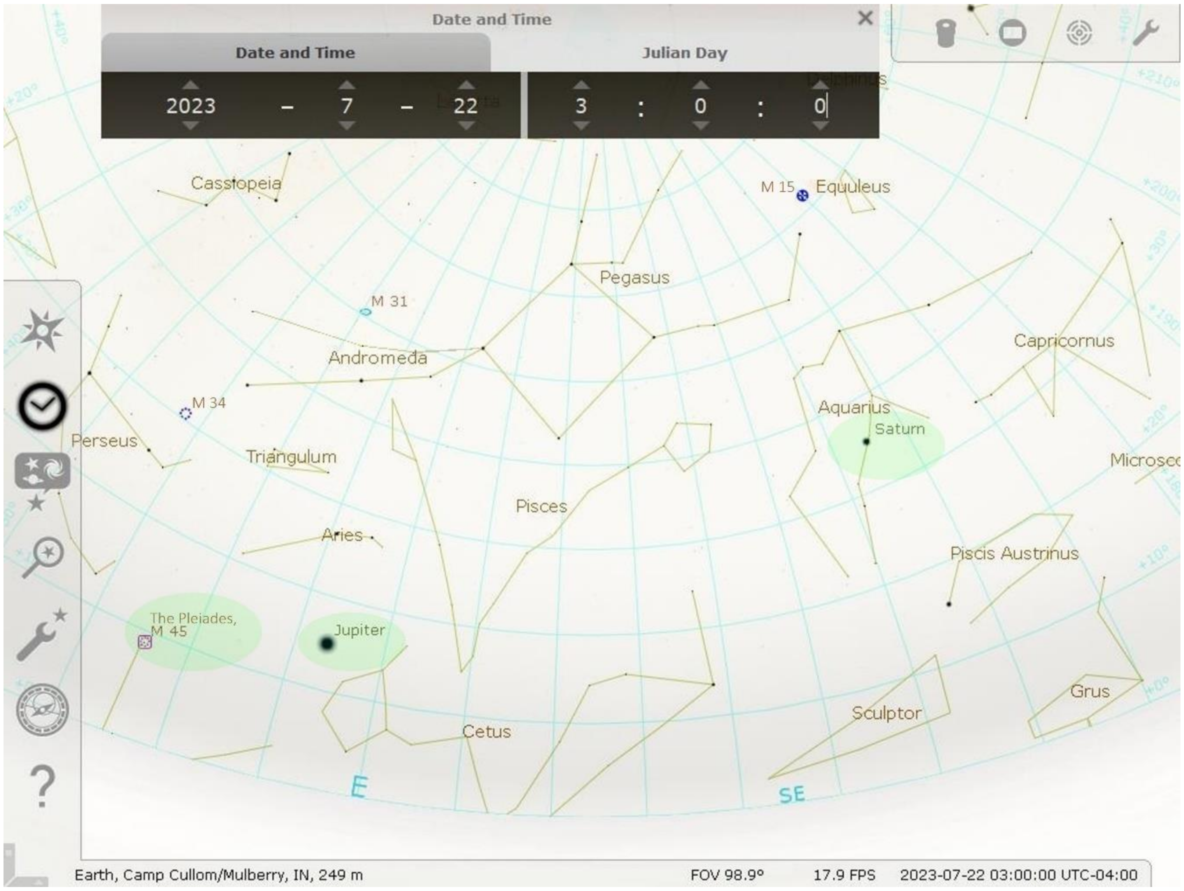
Nebula M8 (Lagoon, in Sgr): Dist From Earth: 4,310 LY
Size: 110 X 50 LY
Age: 2.3 million years
Type: Emission neb/star-forming neb
Contains open cluster NGC 6530 whose stars are made of material from M8. It contains 50 – 100 stars and is only about 2 million years old. M8 glows because of these hot young stars.
Find it: M8 sits about 1 binoc field (5° W, R) of the top of the teapot, Lambda (λ) Sgr.

Nebula M20 (aka The Trifid, in Sgr): Dist from Earth: 5,200 LY
Size: 42 LY
Age: 300,200 YO
Type: Consists of an emission neb, a reflection neb, a dark neb (Barnard 85), and an open cluster (C 1759-230).
B85 is responsible for the apparent gaps in the larger emission neb. The cluster is surrounded by the red emission neb which is, in turn, surrounded by the blue reflection neb, which is particularly prominent in the northern part of M20.
Find it: First find M8. It sits just 2° NW of M8 (the Lagoon Neb). Open cluster M21 is in same field of view as M8 & M20.

Open Cluster M21 (in Sgr): Dist from Earth: 4,250 LY
# of stars: 57 seen, about 100 in actuality
Age: 4,6 million years old
Diam: 16 LY
Find it: It’s in the same FOV as M20, the Trifid Nebula.

Globular Cluster M22 (in Sgr): Dist from Earth: 10,600 LY
Age: 12 billion years old
# of stars: 83,000
Diameter of Cluster: 99 ± 9 LY (90-109 LY: I saw just 99 on messier-objects.com).
Find it: Center your binox on mag 2.80 Lambda (λ) Sagittari, aka Kaus Borealis, the top of the teapot asterism. Look for the dusty smudge to its upper left (NE).

3:00 A.M. Eastern Sky on 7/22/23 & Late Summer earlier



By 3:00 a.m., Jupiter is 14.5° high and golden Saturn sits over 30° above the horizon. Bright Capella (not appearing on this map), the brightest star in Auriga, a Fall/Winter constellation, sparkles some 10° high to the NE.

All of these objects lie below the constellation Andromeda amid the very dim stars that make up the constellations of Aquarius, Pisces, Cetus, and Aries—what I call "the realm of the dim." Because Jupiter and Saturn are in the realm of the dim, they show UP and draw a lot of attention to themselves. There is little else out there, there's no mistaking them!

To Jupiter's left (N), you may notice a bright smudgey object at nearly the samel altitude, this is Open Cluster M45, the Pleiades, in Taurus, a Fall/Winter constellation. By 8/22, Saturn will be 14.5° by shortly after 10:00 p.m. By 9/22, the eastern sky will look like this map by around 11:00 p.m.

Saturn (currently in Aqr): By midnight Saturn is about 10° high.
Distance from Earth: 843,270,00 miles.
Distance from Sun: ~ 909,654,000 miles.
It takes light 81.39 minutes to reach Saturn from the Sun.
1 Saturn year = 29 Earth years
Diameter: 72,368 miles without rings; 175,000 miles with rings
1 Saturn day = ~10.5 Earth hours, so it's spinning FAST.
Looking At It: You need at least 25× magnification to see the rings of Saturn, so 10×50 binox won't show you these.

Jupiter (currently in Aries): Jupiter isn't 10° high until about 03:00 in the morning.
Distance from Earth: 488.75 million miles
Distance from Sun: 461,017,000 million miles
It takes light about 41.25 minutes to reach Jupiter from the Sun.
1 Jupiter year = 12 Earth years.
Diameter: 86,881 miles. (Earth diameter = 7,917.5 miles)
1 Jupiter day = ~ 10 Earth hours, so it's spinning FAST.
Looking At It: Binox won't show you details on Jupiter's surface, but you might be able to see its 4 Galilean moons. You'll need to steady your arms or use a tripod to see them though.

Open Cluster M45 (in Tau): Dist From Earth: 444 LY
# of Stars: 37 – 59 counted; up to 14 of which can be seen without binox. In actuality: >1000, ~3000
Age: ~115 million years
Diam: 16 LY
The faint reflection nebula surrounding it isn't related to the cluster's formation, but is merely a dust cloud through which it is currently passing. The Maia Neb (i.e., the reflection neb) has a different radial velocity than the cluster itself, that's how they know this. There are other reflection nebs in the vicinity .

APPENDIX:

Globular Cluster: Globular Clusters are spherical groupings of stars whose members number from 10,000 to several million. Some of them are only a few tens of light-years across and some of them are up to 200 light-years across! All of them are old made up of mostly yellow and red stars weighing a bit less than 2 solar masses. They are not only spherical themselves, but tend to be distributed about the galaxy in a spherical shape. (Examples: M 13 in Her & M22 in Sgr)

IC = Index Catalogue, another catalogue of astronomical object additional to and discovered after Messier's list (see M, below).

M = Messier objects, objects that Charles Messier identified as verified non-comets back in the 1700s.

Magnitude: A seemingly backward scheme of measuring star brightness: the larger the number, the dimmer the star (so, in some sense, magnitude could be considered to be a measure of dimness). Example: a magnitude 3 star is far dimmer than a magnitude 0 star.

Nebulae: Nebulae come in several types: Emission, Reflection, Planetary (which have nothing to do with planets), Supernova Remnants, and Dark/Absorption nebulae.

Emission Nebulae: Born from the influence of young stars, Emission Nebula glow because of the heat and radiation energy of young stars exciting the atoms (tiny particles of a single element, like hydrogen) in the gas of the nebula, causing the gas to "emit" or put out its own light. Note that in this case, the gas makes its own light, it doesn't just reflect light back. (Example: M8, the Lagoon neb.)

Reflection Nebulae: Sometimes, the light of new stars gets reflected off the gas and dust around them so we can see it. This type of nebula is called a "Reflection Nebula". (Example: M45, the Pleiades.)

Planetary Nebulae: These are formed when old stars of a size similar to our Sun's have used up most of their hydrogen fuel after burning for billions of years. Their hydrogen gets converted to helium and as the star's gravity and nuclear forces (big explosions in the very center of the star) wobble and war, it throws off shells of gas and expands to become a Red Giant. At the Giant phase, the star does not so much explode as much as it ejects (or throws off) gases at much lower speeds and at different times. As the star continues to evolve (change over time), its central core becomes a very hot White Dwarf, whose high temperature radiation causes the thrown off shells of gas to become "ionized" (changed in the number of electrons in the outer shell of the gas such that the gas becomes negatively or positively charged) and glow. A very long time after this, those glowing shells can drift away altogether leaving nothing but the very hot, very small (some are Earth-sized—which is TINY for a star) White Dwarf Star. (Example: M27, in Vul.)

Supernova Remnants: A Supernova happens when a high-mass star reaches the end of its life and nuclear forces stop in its core. Without the nuclear forces to prop up the star's mass, it all comes collapsing in toward the center where it all then either bounces rapidly back or gets so strongly heated (or both) that it expands rapidly back outward in a violent explosion. A shell of glowing gas expands away from the blast, putting out its own light. (Example: M1, the Crab neb, in Tau, a fall/winter constellation.)

Dark/Absorption Nebulae: Dark nebulae are clouds of gas and dust that absorb some light from behind them. This absorbed light heats up the gas and dust particles, causing them to re-radiate or emit some of the absorbed energy as infrared light, which can't be seen with our eyes. What we *do* see, when we *can* see dark nebulae, are dark clouds in front of more distant stars or in front of emission nebulae. Sometimes they look like big dark holes in an otherwise well-dotted, rich, field of stars—they're the big blank spots, where it looks like there's nothing there. It can sometimes be tough to determine dark nebulae from actual blank spots in space. (Example: Barnard 85, the dark nebula causing the apparent gaps in the Trifid neb, M20.)

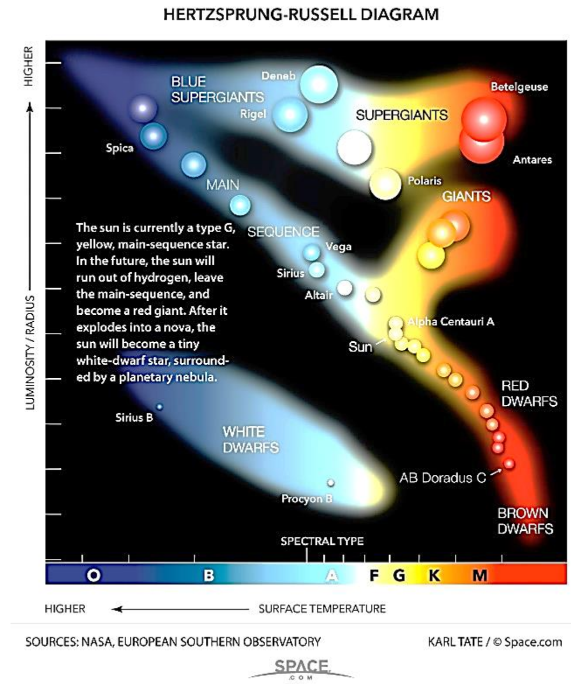
NGC = New General Catalogue (A catalogue of astronomical objects)

Open Cluster: Unlike Globular Clusters (see above), which are distributed about a galaxy in a basically spherical (ball) shape, Open Clusters are found in the galactic plane and are just about always found within a galaxy's spiral arms. In general, they contain less than a few hundred member stars—which are often hot, young, and blue—within a region that's up to about 30 light-years across. Being less crowded and more loosely populated than globular clusters, the gravity holding the stars together is not as tight so, over time, open clusters can be disrupted by the gravitational influence of giant gas or dust clouds, or other clusters as they move through the galaxy. Some cluster members can also be lost by a process known as "evaporation": when the close passing of two stars in the cluster results in a change of direction of one of them, setting it on a path that makes it eventually wander out of the cluster. Even if this happens, cluster stars will still continue to move in the same basic direction through space even if they are no longer held together by gravity. If it happens that all of the cluster's stars are no longer held together by gravity, but are just all moving in a similar direction, the stars are then called a "stellar association", or a "moving group". (Example: (IC 4665 in Oph.)

Red Giant: See planetary nebula, above. (Examples: Antares in Sco & Arcturus in Boo.)

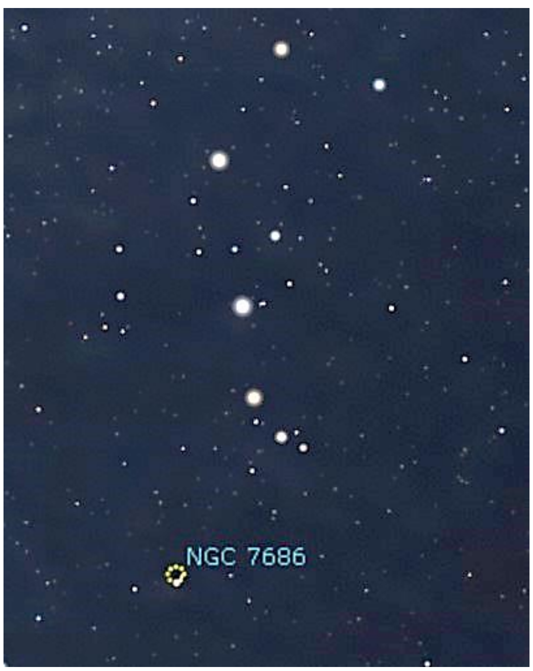
Star Class: There are 7 main classes of stars which are based on surface temperature: O,B,A,F,G,K,M. Class O, B,& A stars tend to run hot and appear blue-white to white in color. Class F & G stars tend to be yellow and have cooler surface temps than the O,B,A class stars. Our Sun is a G class star. Class K&M stars have the coolest surface temps. These stars tend to be nearing the end of their lives.

A star's initial mass (the amount of material that makes it up) determines what course its life will take. Some stars are born supergiant, others become giant in size when their outer shells get pushed outward by changes within the star toward the end of its life. A Hertzsprung-Russell diagram (right) depicts the various types of stars and where they fall along class lines and evolutionary lines.



White Dwarf: See Planetary Nebula, above. (Example: Sirius B, the companion to Sirius, aka Alpha Canis Majoris. These objects are in the realm of telescopes.)

Pictures of the Asterisms:



The Measuring Cup Asterism (up on its handle). Note Open Cluster NGC 7686 nearby.


The coathanger


Poniatowski's Bull

Recommendations for steadying your view: Tripods, reclining lawn chairs, learning your arms on a car, picnic table or post, bean bag chairs.
Recommended book: *Binocular Highlights, 109 Celestial Sights for Binocular Users* (2d Edition) by Gary Seronik; published by *Sky & Telescope*

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Wabash Valley Astronomical Society
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