DEMO PRINT VERSION of BOOK

Stargazing for EVERYONE with Binoculars

By Greg Babcock

Home Page

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Stargaze Tonight

Star gazing is as simple as aiming your binoculars at the sky and scanning for objects. With their light gathering power and wide field of view, binoculars are ideal for observing large star clusters and other "Deep Sky Objects."

For the darkest skies…

What you need…

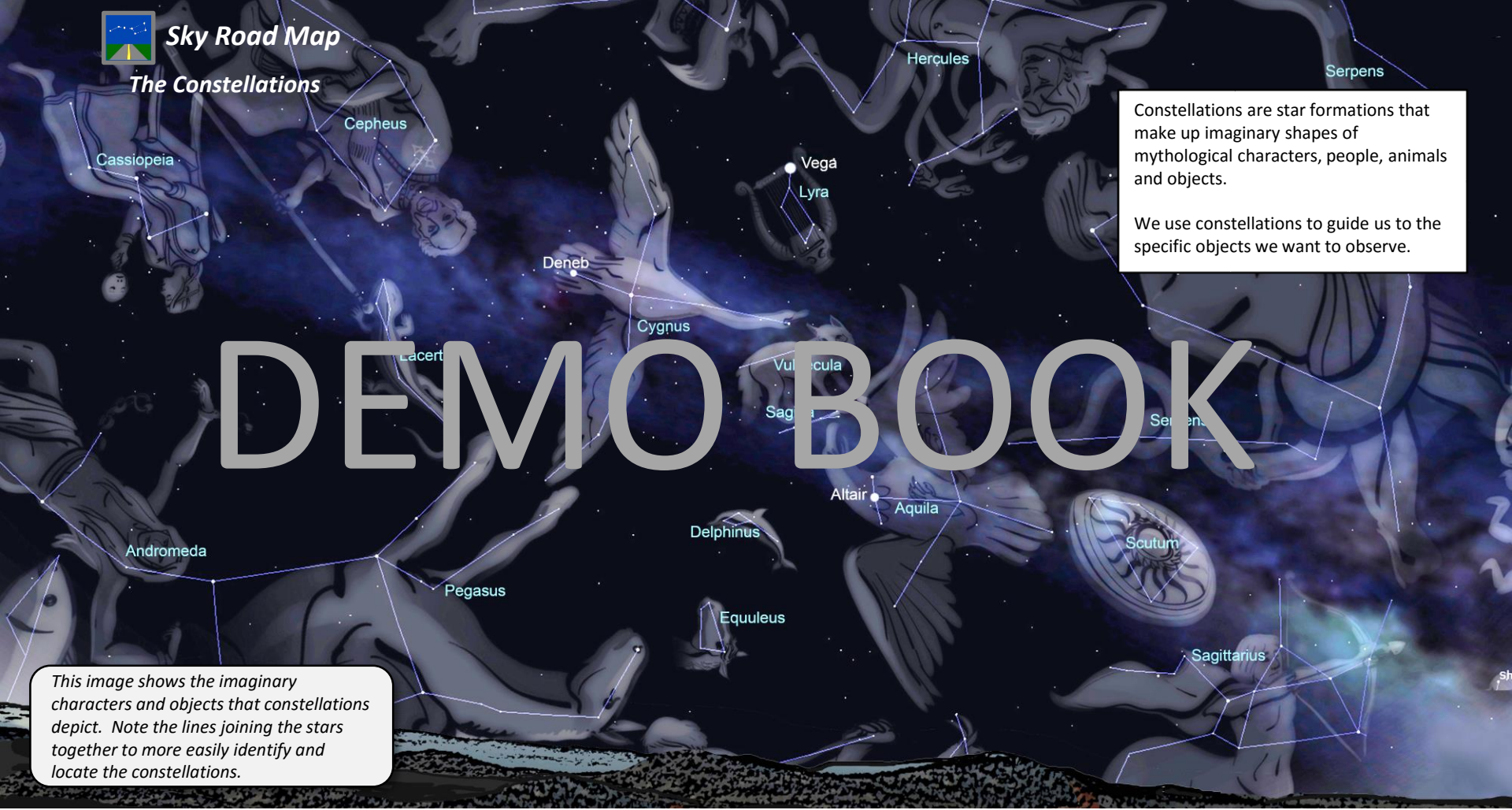
What you don't want…

Even if conditions are not perfect, go out tonight and scan the sky for objects. You might be surprised by how much your binoculars will show you.

As you scan the sky with your binoculars, you will notice that the stars seem brighter and are more numerous. You will also notice fuzzy patches of light. This is your binocular's "light gathering power" at work. You are looking at objects located outside of our solar system. These are known as "deep sky" objects. These are star clusters, gaseous nebulas and even galaxies. Individual objects are identified by their catalog numbers. The brighter objects have been given nicknames for their shapes or for the constellations they are located in. This book will help you find and identify many of these objects.

This image shows objects (yellow symbols) and their locations in the sky.

The Constellations



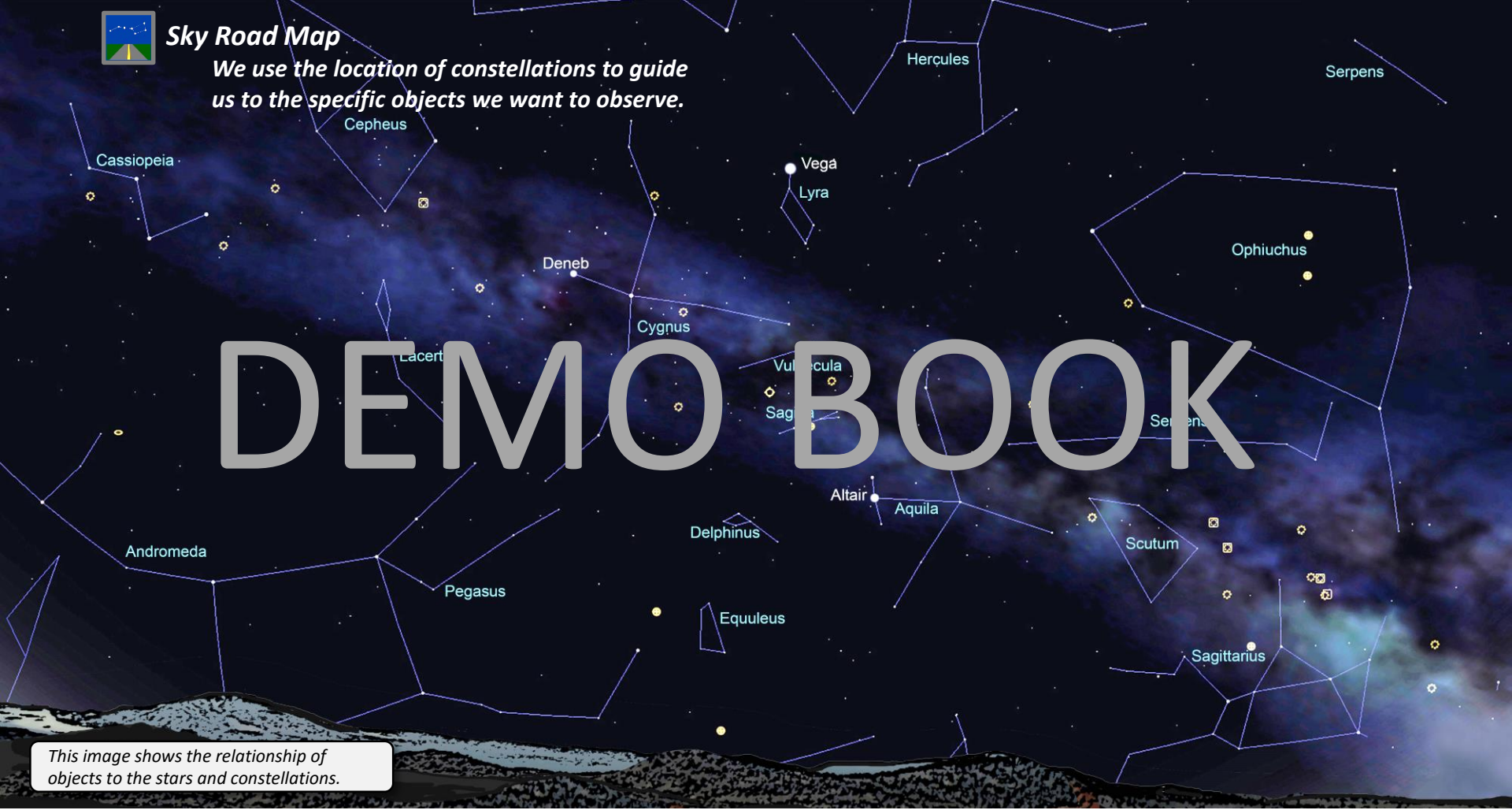
Constellations are star formations that make up imaginary shapes of mythological characters, people, animals and objects.

We use constellations to guide us to the specific objects we want to observe.

This image shows the imaginary characters and objects that constellations depict. Note the lines joining the stars together to more easily identify and locate the constellations.

Sky Road Map

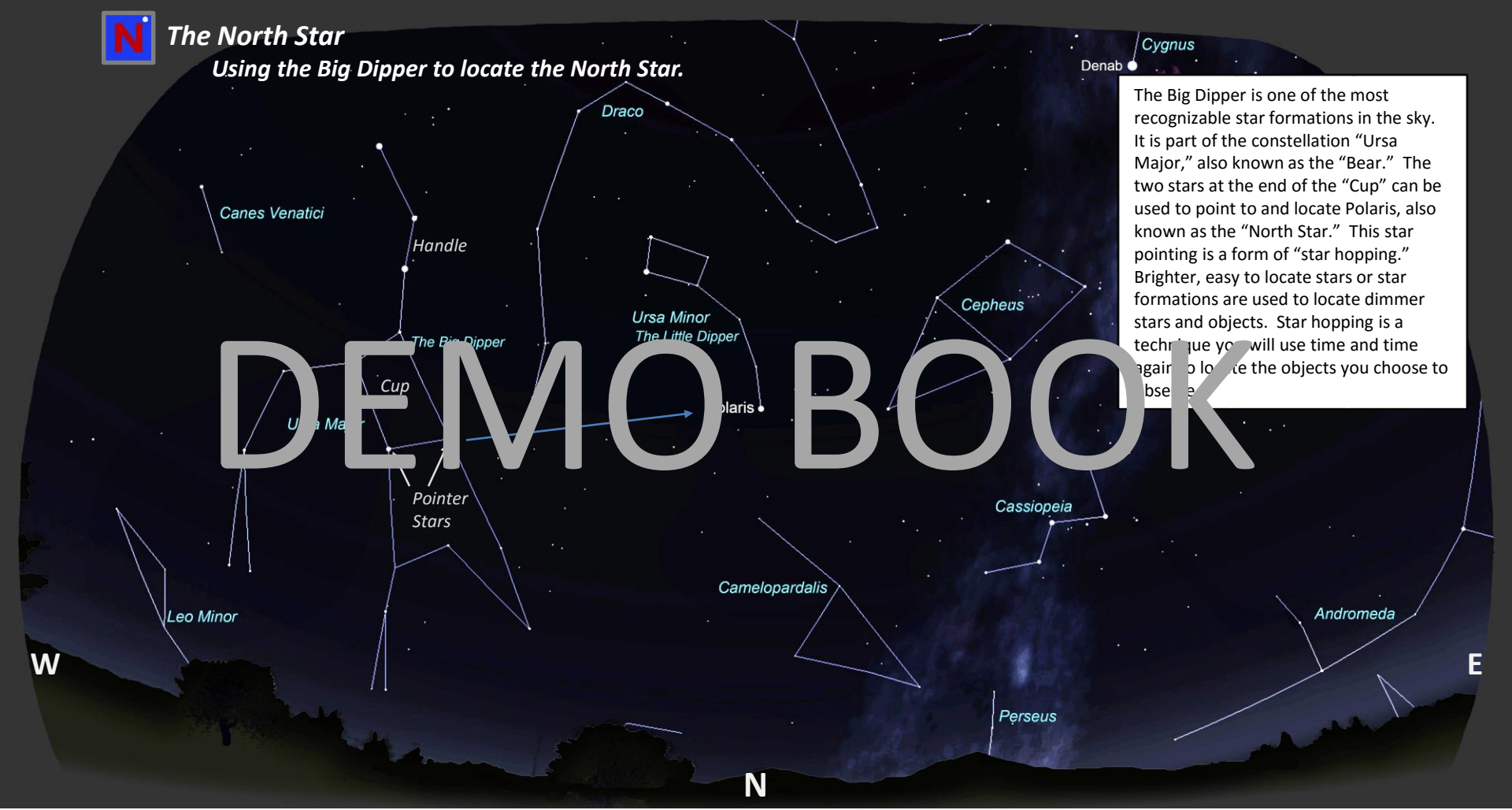
We use the location of constellations to guide us to the specific objects we want to observe.



This image shows the relationship of objects to the stars and constellations.

The North Star

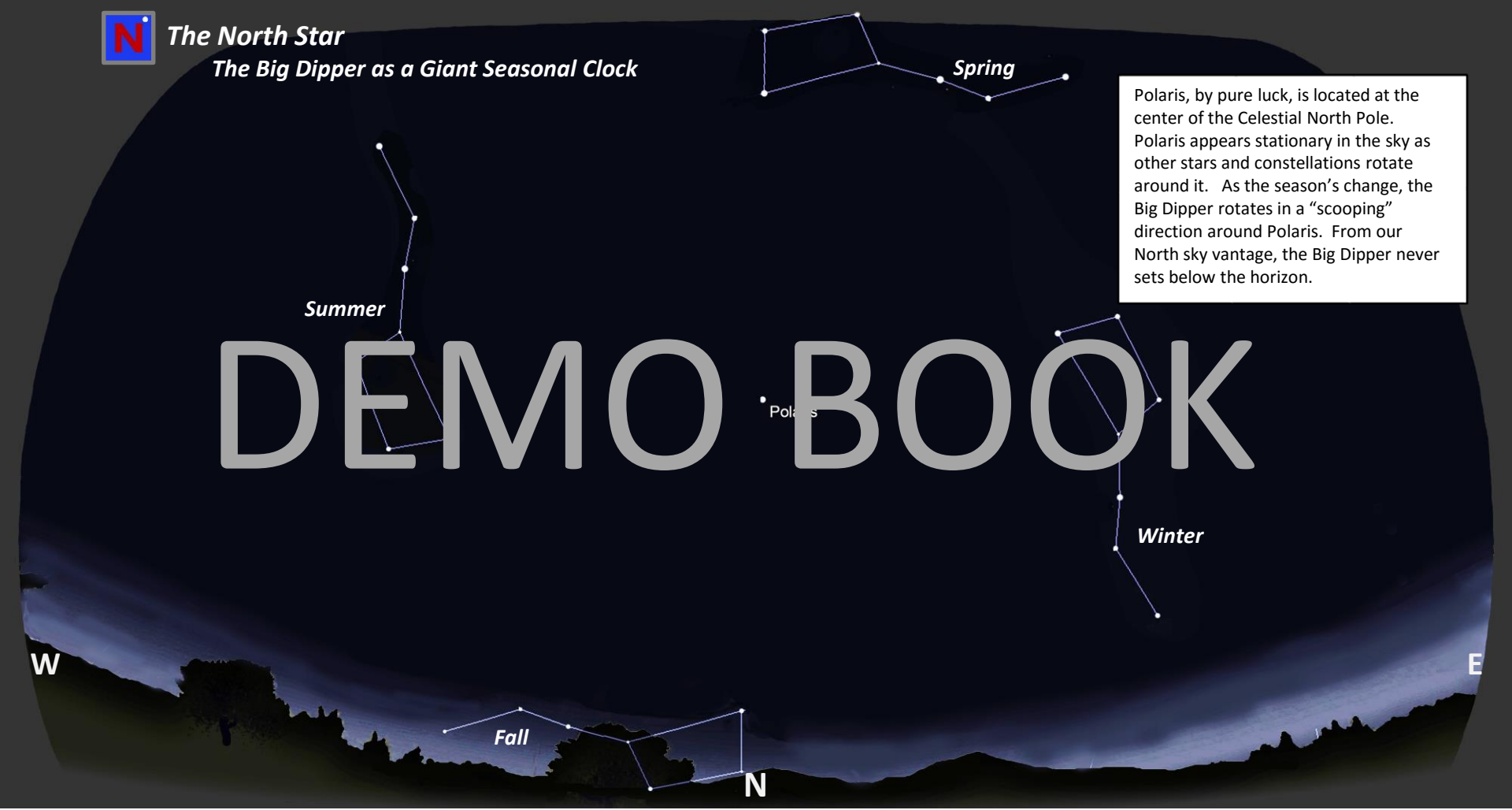
Using the Big Dipper to locate the North Star.



The Big Dipper is one of the most recognizable star formations in the sky. It is part of the constellation "Ursa Major," also known as the "Bear." The two stars at the end of the "Cup" can be used to point to and locate Polaris, also known as the "North Star." This star pointing is a form of "star hopping." Brighter, easy to locate stars or star formations are used to locate dimmer stars and objects. Star hopping is a technique you will use time and time again to locate the objects you choose to observe.

The North Star

The Big Dipper as a Giant Seasonal Clock

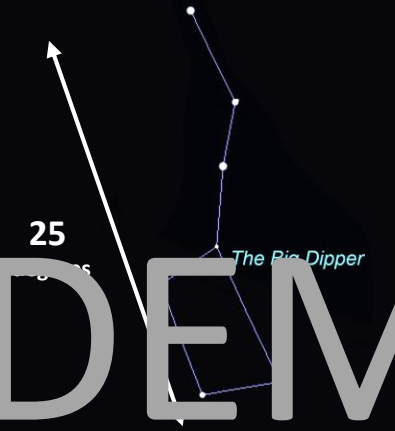


Polaris, by pure luck, is located at the center of the Celestial North Pole. Polaris appears stationary in the sky as other stars and constellations rotate around it. As the season's change, the Big Dipper rotates in a "scooping" direction around Polaris. From our North sky vantage, the Big Dipper never sets below the horizon.

Hand Sky Ruler

Use your hand, as shown, as a "Sky Ruler." It is ideal for finding objects near a reference star or star formation.

A measurement of note is that the altitude of Polaris will equal the latitude of your location on Earth. The mid United States is about 40 degrees latitude. The further North you are, the higher your latitude on Earth and thus the higher in the sky Polaris is. As you go South, Polaris drops lower in the sky. You can roughly determine your altitude on Earth by holding your fist at arms length and counting the fist heights from horizon to Polaris.



Typical 10x50 binoculars will give a 6 degree field of view. That is about 1/4 the length of the Big Dipper.

The Moon is 1/2 degree in diameter. It would take 50 Moons to span the length of the Big Dipper.

1/2 degree

One fist at arms length = 10 degrees.

40
degrees *

*** Polaris is 40 degrees if your location on Earth = 40 degrees Latitude.**

W

E

Hand Sky Ruler

Holding your hand at arms length makes your hand a Sky Ruler.

What are we going to look at?

We are going to look at Deep Sky Objects, those objects outside our Solar System.

Double Stars

These are two or more stars held together by each other's gravity. The smaller star orbits the larger. There are many colorful examples. Binoculars can see the separation between many doubles. Higher power telescopes are required for the closest doubles.

Open Star Clusters

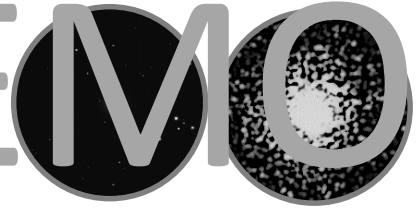
These are groups of sta[illegible]gether by each other's gravity. The larg[illegible]t hav[illegible] been named by Swedis[illegible] Astronom[illegible]er, **Per Collinder (Cr)** and [illegible] British Astronomer **Philibert J[illegible]ques M[illegible]otte (Mel)**. Large Open Clus[illegible] are ideal binocular objects.

Nebulas

Planetary nebula are the result of an exploding star, or nova. They are circular in shape. Other forms are large wispy gases and large dark nebulas. Many of the dark nebula are named after the American Astronomer, **Edward Barnard**. These are listed as "B" objects.

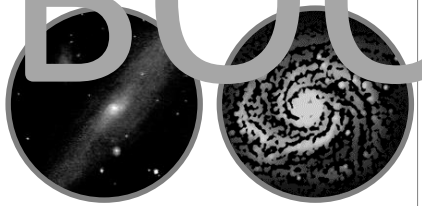
Globular Star Clusters

Globulars are tight "globs" of thousands of stars or more. They reside in a "halo" formation around the outside of our galaxy. In binoculars, they appear as small cotton balls. See image of M22 (below left). Resolving individual stars is a task for large, high powered telescopes, see (right image of M13). Clusters listed in this book are the best for binoculars to view.



Galaxies

Galaxies are the furthest objects from us. They are a place where stars, solar systems, star clusters and nebulas reside. Galaxies come in two basic forms, spiral & elliptical. Spiral galaxies are relatively flat in thickness with a brighter bulging center nucleus. Some are viewed from the side or "edge on," (see left image). It requires a large telescope to reveal the spiral arms. Elliptical galaxies appear as larg[illegible] balls, si[illegible] appearan[illegible] to g[illegible]obular [illegible]uste[illegible] when vie[illegible]ed w[illegible]n bin[illegible]ular.

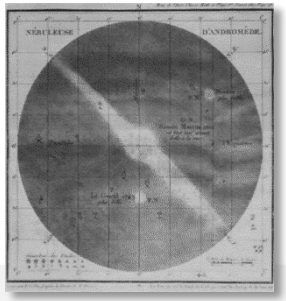


What else are going to look at?

This book will also cover observing the Moon and planets in a later section.

Charles Messier

The M in M31 stands for Messier 31, named by French Astronomer, **Charles Messier**. With a small telescope, Messier sought fame by searching for comets. Since deep sky objects can resem[illegible]le c[illegible]mets, he cataloged them to eliminate them as comets. He recorded 10[illegible] o[illegible]jects and, ironically, became famous for his list, not for discovering comets. An "M" listed object in this book is a Messier object.



Andromeda Galaxy Group
Sketch by Charles Messier

Using the Sky Maps to locate Objects.

The Sky Maps will show you the location of objects among the Stars and Constellations. To use the Sky Maps, follow these 3 steps.

1.) Browse the Sky Maps and corresponding object information pages that match your seasonal time of year, and choose the objects you want to look at.

2.) Use the Sky Maps to locate the region of the sky your object is located in. Be sure to use the "North" and "South" directions on the maps to help orient you with the sky.

3.) Use your binoculars to scan the area of the sky your selected object or objects are located in.

TIP: The printable Sky Maps at the end of this book may be easier to see at night.

More about the guides…

Each chapter is by season and divides the sky into 3 sections, South, Overhead & North Maps. There is a corresponding object information page for each map.

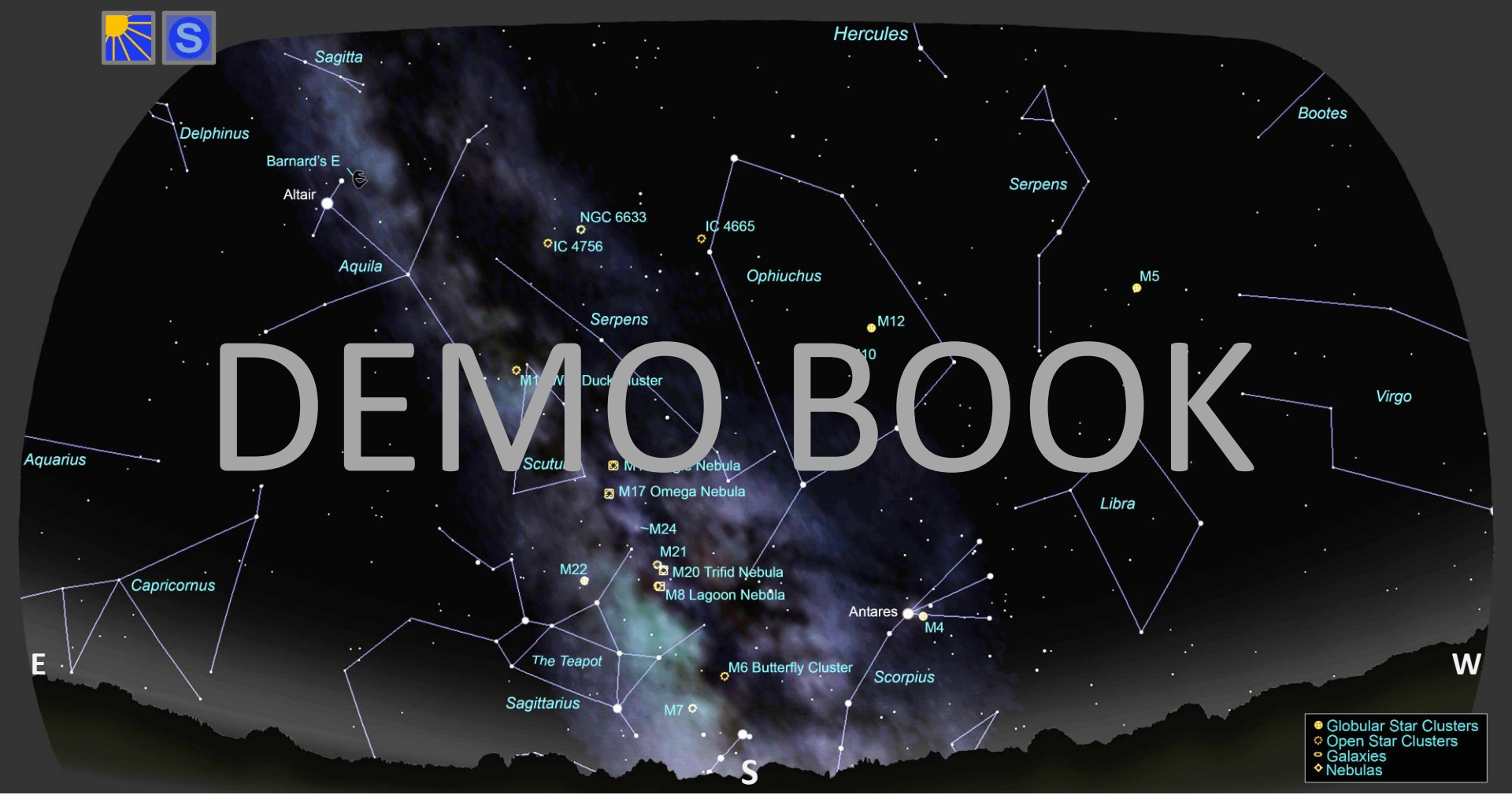
Each chapter shows the South sky first because we are looking more into our Galaxy and see the most objects here.

Summer is the first chapter because it is often the time when we get the first and best opportunities to observe.

Some objects, because of map over-lapping, will appear on multiple maps in multiple chapters. The object information will appear on multiple object information pages as well.

Object descriptions will often reference what is viewable in a 6 degree field. This is a field typical for 10x50 binoculars. Field of view will vary with different binoculars.

Chapter 1 Summer Stargazing


Hercules
Sagitta
Delphinus
Barnard's E
Altair
Aquila
Bootes
Serpens
NGC 6633
IC 4756
IC 4665
Ophiuchus
M5
M12
Serpens
Virgo
Aquarius
Scutu
M17 Omega Nebula
Libra
M24
M21
M22
M20 Trifid Nebula
M8 Lagoon Nebula
Capricornus
Antares
M4
The Teapot
M6 Butterfly Cluster
Scorpius
Sagittarius
M7
E
W
S
Globular Star Clusters
Open Star Clusters
Galaxies
Nebulas

Serpens to Aquila

M5 Globular Star Cluster, in Serpens, is a large, bright globular found between Virgo and Serpens (see map).

M10 & M12 Globular Star Clusters are nice "twin" clusters in the center of Ophiuchus.

IC 4665 Open Star Cluster is in Ophiuchus and is easy to find being near a bright star (see map). It is 1/4 of degree in size with 30 stars.

NGC 6633 & IC 4756 Open Star Cluster Ophiuchus and Serpens can be viewed together. NGC 6633 is 1/4 degree in size with 30 stars. IC 4756 is 3/4 degree in size with 80 stars.

M11 Wild Duck Open Cluster in the Northeast corner of Scutum. It is bright, 1/4 degree in size and rich with 100 stars.

Barnard's E Dark Nebula, in Aquila, cuts a black "E" shape in a star rich back-ground of the Milky Way. Use the bright star **Altair** to help locate it.

North of the Teapot

M16 Eagle Nebula in Serpens is a glowing nebula with a star cluster inside of it. **M17 Omega Nebula,** a bright patch in Sagittarius. It is also known as the Swan Nebula for its shape as a floating swan. In the same field, you might see the small open cluster M18.

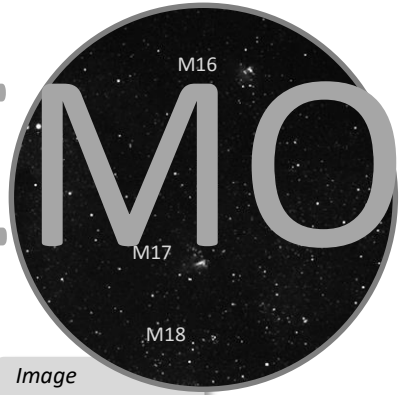


Image
by Gary Seronik

North of the Teapot

M24 Star Cloud in Sagittarius is 1.5 degrees in size and visible as a soft glow to the unaided eye.

M22 Globular Star Cluster, in Scorpios, Northwest of the top of the Teapot.

Sketch
by Ronny De Laet
using 8x56mm binoculars.

The rich Teapot Region

Scanning this dense region of the Milky Way will reveal additional fuzzy patches of star clusters and other objects.

Northwest of the Teapot

Sagittarius Grouping – MUST SEE
These Objects make up one of the best views in the sky. All can be viewed in a 6 degree binocular field.

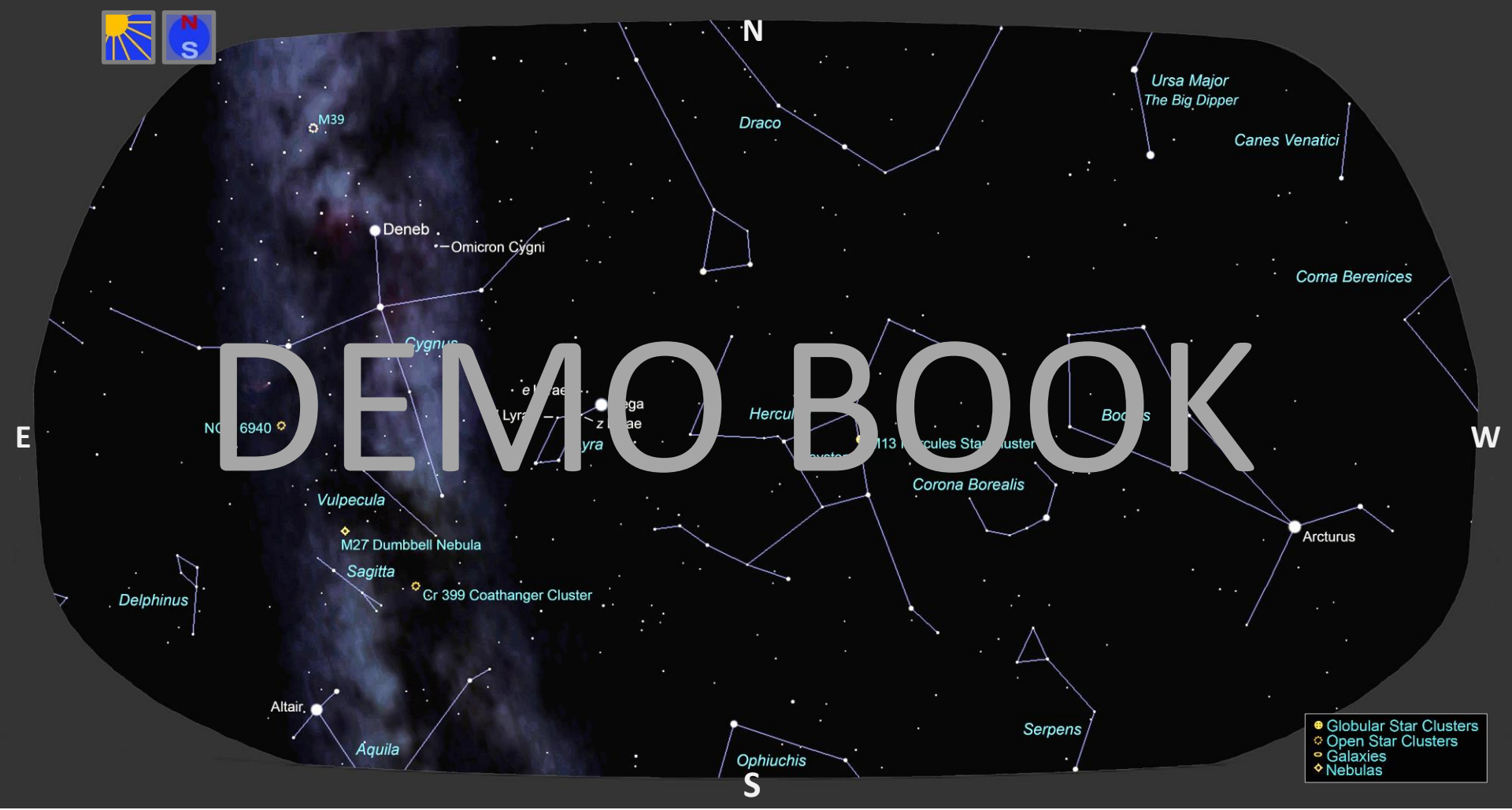
M8 Lagoon Nebula is bright and large. It is 1.5 degrees in size.
M20 Trifid Nebula is bright and named for its 3 fragments of nebulosity.
M21 Open Star Cluster is 1/4 degree in size with 70 stars.

Cluster in Scorpios

M4 Globular Star Cluster in Scorpios is easy to find being next to the super red giant star **Antares.**

M6 Butterfly Open Star Cluster is a bright beautiful cluster, 1/3 degree in size with 50 stars. It appears almost as a double cluster as groups of stars form the two wings.

M7 Open Star Cluster is a nice cluster just 4 degrees Southeast of M6. It is 1.2 degrees in size with 80 stars. It is low on the horizon and may be hard to see.


N
E
W
S
Ursa Major
The Big Dipper
Draco
Canes Venatici
M39
Deneb
Omicron Cygni
Coma Berenices
Cygnus
Vulpecula
M27 Dumbbell Nebula
Sagitta
Cr 399 Coathanger Cluster
Delphinus
Corona Borealis
Arcturus
Altair
Aquila
Ophiuchis
Serpens
Globular Star Clusters
Open Star Clusters
Galaxies
Nebulas

Hercules

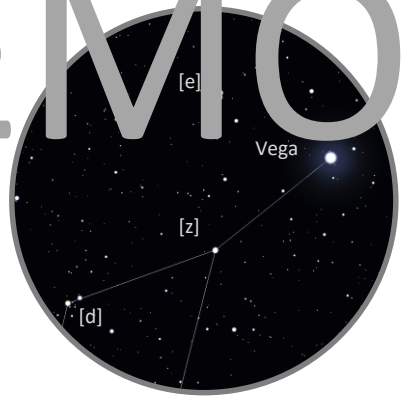
M13 Hercules Globular Star Cluster is considered the best globular star cluster in the Northern sky. It is located in line with the two stars on the West side of the Keystone in Hercules (see map).

Sagitta

This is an arrow shaped constellation, with four equal brightness stars and fifth dimmer star against th Milky Way background. Sag a almos fits inside a 6 degree binoc ar field. the center, you might see t faint lo e globular star cluster M .

Near the bright star Vega

Lyra Double Stars, are easily located using **Vega** as a guide star. Vega is the 5th brightest star in the sky. **Epsilon Lyrae [*e*]** is a "double/double," but appears as a double only in binoculars. **Zeta Lyrae [z]** Double is a bright/ dim star combination and somewhat challenging to split. **Delta Lyrae [d] 1 & 2** is a red giant and blue dwarf double star. This group will fit inside a 6 degree bino ar field of vi



Vulpecula

Cr 399 Coathanger Open Star Cluster is a large bright cluster, 1 degree in length and named for its shape.

M27 Dumbbell Nebula is a large, bright planetary nebula.

NGC 6940 Open Star Cluster is 1/2 degree in size and bright with 60 stars.

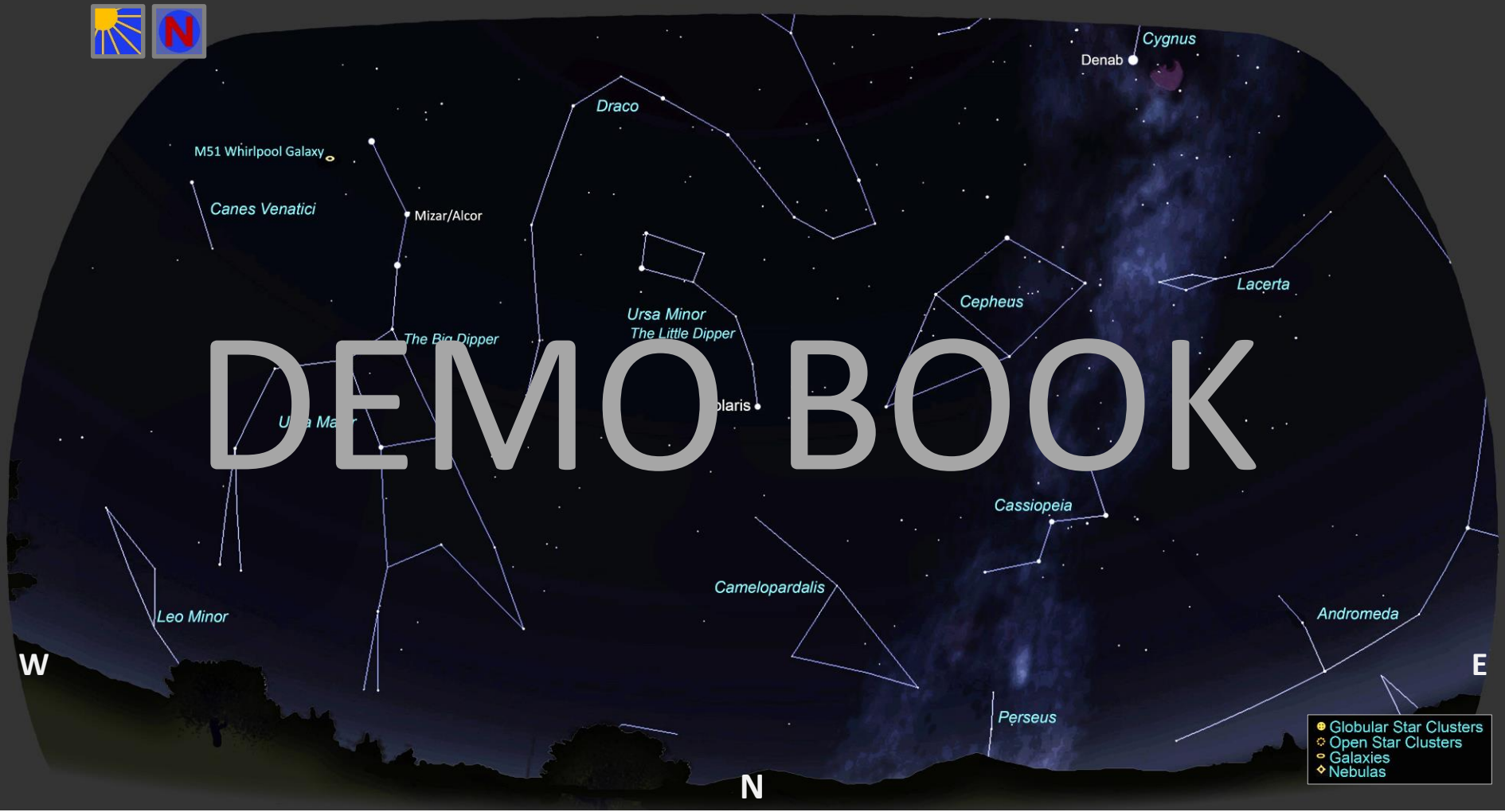
Northern Cygnus

Omicron Cygni Triple Star is a colorful triple star system.

M39 Open Star Cluster is a nice, bright, cluster, 1/2 degree in size and contains 30 stars.

More in Cygnus

The Milky Way runs though the c ter of ygnus. Scanning C nu will reveal additional small st usters.


Cygnus
Denab
Draco
M51 Whirlpool Galaxy
Canes Venatici
Mizar/Alcor
Ursa Minor
The Little Dipper
Cepheus
Lacerta
The Big Dipper
Cassiopeia
Camelopardalis
Leo Minor
Andromeda
Perseus
W
E
N
Globular Star Clusters
Open Star Clusters
Galaxies
Nebulas

Carried over from Spring viewing…

Ursa Major Region

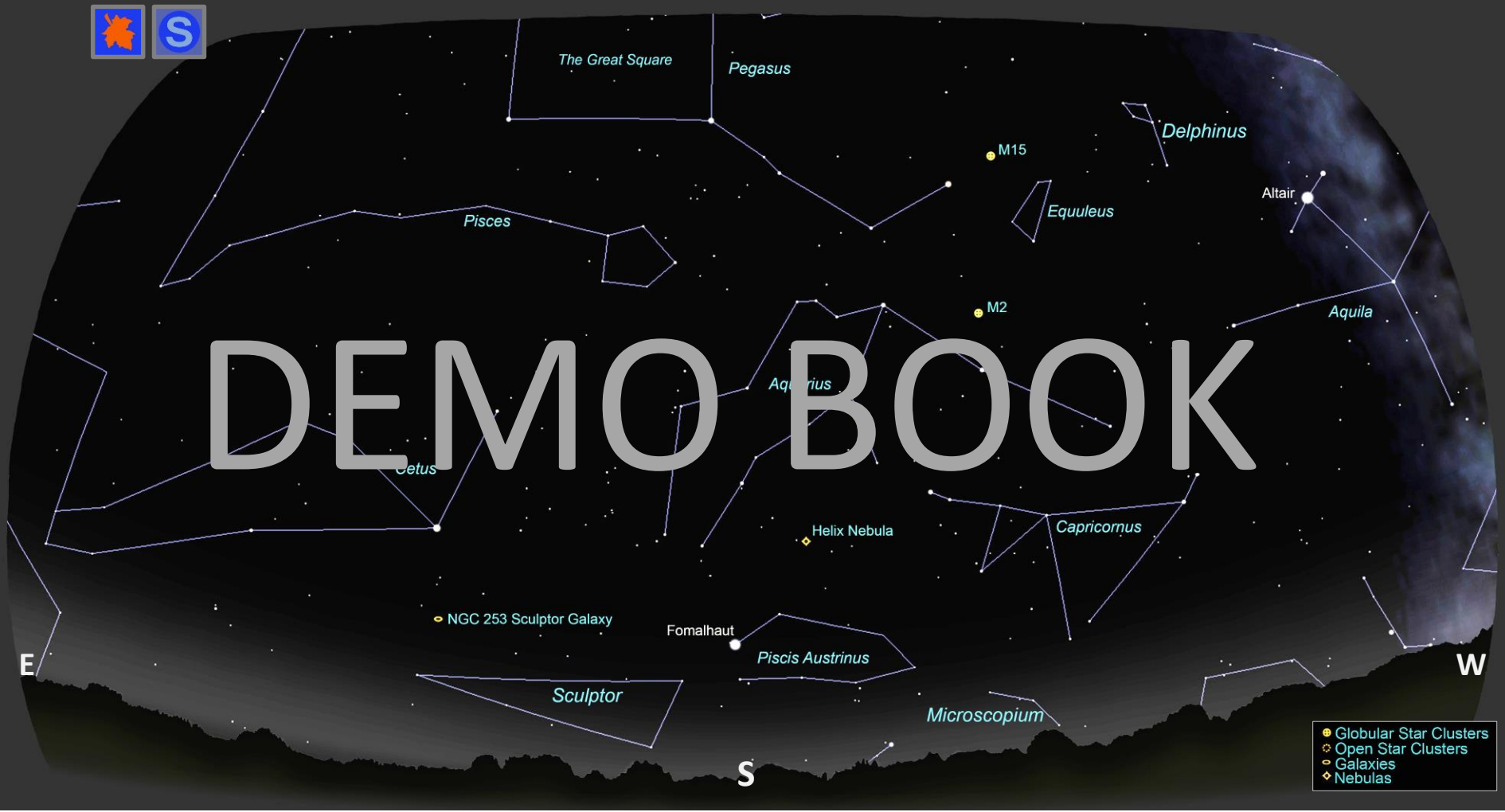
Mizar/Alcor Double Star is located in Ursa Major and is the second star from the end of the handle of the Big Dipper. It is actually a "Double/Double." Your eyes can separate Mizar from Alcor, but even binoculars will have trouble separating the rest of the stars. Still it makes for a nice view.

M51 Whirlpool Galaxy [illegible] Venati… It is 3 degrees South of [illegible]e end o[illegible]the B… Dipper handle. It has a [illegible]mall gala[illegible] at the end of a spiral arm [illegible]n binocu[illegible]rs, M51 has an oval shape. This obj[illegible]t is best seen in Spring. Ea[illegible]/Summer may be the last time it can be viewed before it is too low to the horizon to see well. ***See M51 best from late Winter to early Summer.***

FUN FACT

*Your small 10x25mm hiking binoculars has **13x** the light [illegible]gather[illegible]g power of the [illegible]um[illegible] eyes.*

Stargazing
for EVERYONE with
Binoculars


The Great Square
Pegasus
Delphinus
M15
Altair
Equuleus
Pisces
M2
Aquila
DEMO BOOK
Aquarius
Cetus
Helix Nebula
Capricornus
NGC 253 Sculptor Galaxy
Fomalhaut
Piscis Austrinus
E
W
Sculptor
Microscopium
S
Globular Star Clusters
Open Star Clusters
Galaxies
Nebulas

Pegasus

M15 Globular Star Cluster in Pegasus, is a nice globular that can be seen with the un-aided eyes under dark skies.
Also see on the Fall Overhead Map.

Aquarius

M2 Globular Star Cluster in Aquarius, is a nice globular.

Helix Nebula in Aquarius is a large planetary nebula appearing as a faint oval smoke ring.

Sculptor

NGC 253 Sculptor Galaxy is one of the largest and brightest galaxies in the sky. It is 1/2 degree in size and appears as a smaller version of the Andromeda galaxy. Being low to the horizon makes viewing opportunities fewer.

Sketch
by Sue French
Sculptor Galaxy at 17x

FUN FACT
*Your 10x50mm binoculars has **51x** the light gathering power of the human eyes.*


N
S
E
W
Stock 2
Double Cluster
Cassiopeia
Cepheus
Perseus
NGC 457
M52
M34
NGC 7789
Vega
Lyra
Omicron Cgni
Deneb
M39
M110
M32
Cygnus
DEMO BOOK
Aries
M33 Triangulum Galaxy
NGC 6940
Cr 399 Coathanger Cluster
M27 Dumbbell Nebula
Sagitta
The Great Square
Pegasus
Pisces
Delphinus
Altair
Aquila
M15
Equuleus
Globular Star Clusters
Open Star Clusters
Galaxies
Nebulas

Carried over from Summer viewing…

Vulpecula

Cr 399 Coathanger Open Star Cluster is a large bright cluster, 1 degree in length and named for its shape.

M27 Dumbbell Nebula is a large, bright planetary nebula. It is between the end stars of Sagitta and Vulpecula.

NGC 6940 Open Star Cluster is 1/2 degree in size and bright with 60 stars.

Carried over from Summer viewing…

Northern Cygnus

Omicron Cygni Triple Star is a colorful triple star system.

M39 Open Star Cluster is a nice bright cluster, 1/2 degree in size and contains 30 stars.

The Milky Way Region

The Milky Way runs though the center of Cygnus and Cassiopeia. Scanning this region will reveal additional small star clusters and other objects.

Carried over from Summer viewing…

Sagitta

This is an arrow shaped constellation, with four equal brightness stars and fifth dimmer star against the dense Milky Way background. In the center, you might see the faint loose globular star cluster M71.

Pegasus

M15 Globular Cluster in Pegasus is a nice cluster and the last good globular or globular viewing season.

Also see on the Fall South Map.

Cassiopeia

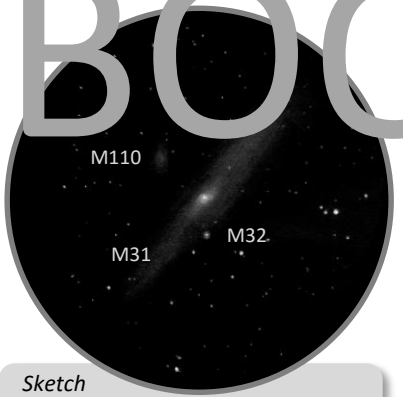
NGC 7789 Open Star Clusters and **M52 Open Star Clusters** are rich clusters dense with stars. NGC 7789 is 1/2 degree in size and has 300 stars. M52 is 1/4 degree in size and contains 100 stars.

NGC 457 The Owl Cluster looks like ET with its bright eyes (stars) and out stretched arms. It is 1/4 degree in size with 80 stars.

Also see these objects on the Fall North Map.

Andromeda

M31 Andromeda Galaxy is a **MUST SEE** fall showpiece. It is the largest, brightest and best binocular spiral galaxy in the sky. It is visible to the un-aided eye. At 3 degrees in size, it is 6 times larger than the Moon in apparent size. About 2 degrees are visible in binoculars. The haze surrounding the bright core are spiral arms. It is flanked by its much smaller and fainter elliptical galaxy companions **M32** and [illegible].



Sketch
by Sue French
Andromeda Galaxy Group at 17x

Triangulum

M33 Triangulum Galaxy, is a large galaxy, over 1 degree in diameter. It is located between bright stars in Aires and Andromeda (see map). It is about 2/3rds up from the bright Aires star.

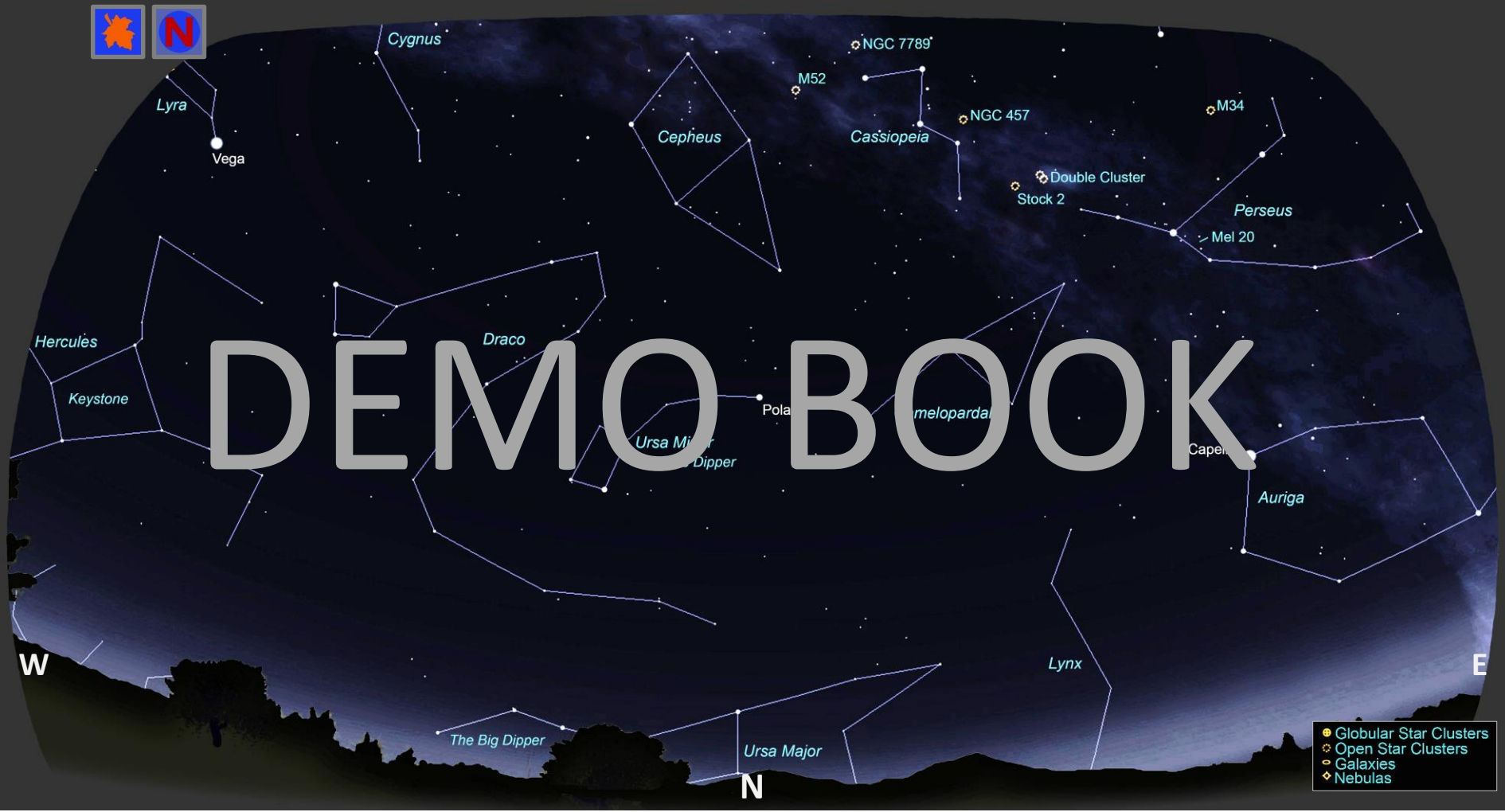
Perseus Star Clusters

Double Open Star Cluster is a **MUST SEE** beautiful dual cluster. In the same field is **Stock 2 Open Star Cluster**, located in Cassiopeia. The view of these clusters are enhanced by the background of a pretty sparkling star pattern. This is an excellent view in binoculars.

Mel 20 Perseus Star Cluster is a beautiful, very large open star cluster, 5 degrees in size. It is ideal for binocular viewing.

M34 Open Star Cluster is further West in Perseus. It is a large and loose cluster, 2/3 degree in size, and contains 60 stars.

These Objects are best seen on the Fall North Map.


Cygnus
NGC 7789
M52
Lyra
Vega
Cepheus
Cassiopeia
NGC 457
M34
Double Cluster
Stock 2
Perseus
Mel 20
Hercules
Keystone
Draco
Pola
Ursa Mi
Dipper
melopardal
Capel
Auriga
W
Lynx
E
The Big Dipper
Ursa Major
N
Globular Star Clusters
Open Star Clusters
Galaxies
Nebulas

Perseus Star Clusters

Double Open Star Cluster is a **MUST SEE** beautiful dual cluster. In the same field is **Stock 2 Open Star Cluster**, located in Cassiopeia. The view of these clusters are enhanced by the background of a pretty swirling star pattern. This is an excellent view in binoculars.

Mel 20 Perseus Star Cluster is a beautiful, very large open star cluster, 5 degrees in size. It is ide[illegible] binocular viewing.

Also see these Objects on the Fall Overhead Map.

Foot of Perseus

M34 Open Star Cluster is further West in Perseus. It is a large and loose cluster, 2/3 degree in size, and contains 60 stars. ***Also see on the Fall Overhead Map.***

Open Clusters in Cassiopeia

NGC 7789 Open Star Clusters and **M52 Open Star Clusters** are rich clusters dense with stars. NGC 7789 is 1/2 degree in size and has 300 stars. M52 is 1/4 [illegible]ee in size [illegible] cont[illegible]s 100 st[illegible]s. ***Also [illegible]ee these C[illegible]je[illegible]s on [illegible]e Fall Over[illegible]ead Map.***

A Cassiopeia favorite

NGC 457 The Owl Cluster has many names. It is also known as the ET Cluster, Kachina Doll Cluster or the Skiing Cluster. It looks like ET with its bright eyes (stars) and out stretched arms. Named for its resemblance to the ET alien character in the movie ET. It is 1/4 degree in size with 80 stars. The brightest stars form the shape of ET. Use the two bright eye stars to locate and ide[illegible]. ***Als[illegible]see o[illegible]he F[illegible] Overhe[illegible] Map.***

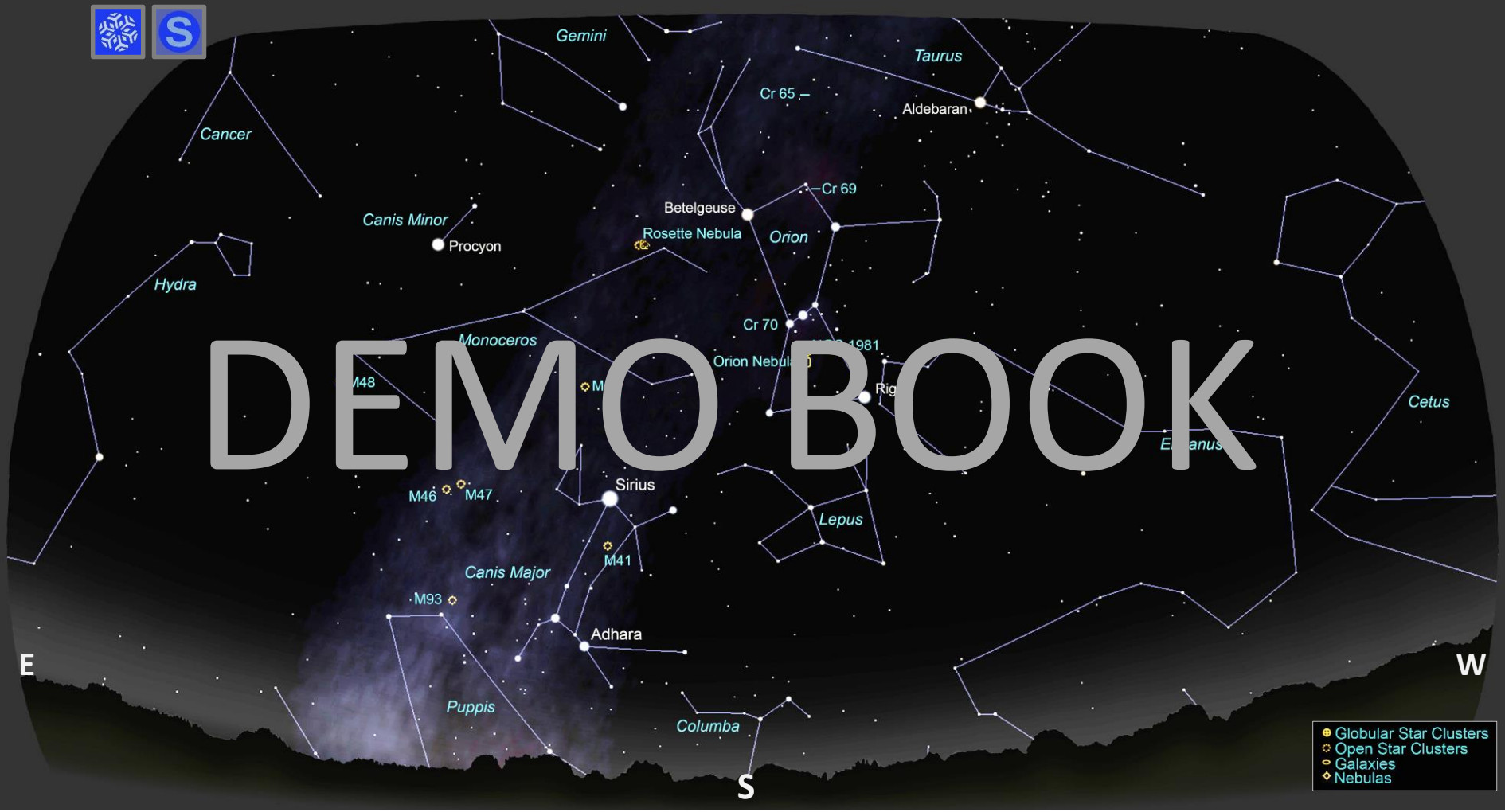
More in Cassiopeia

The Milky Way runs through Cassiopeia. Scanning this area will reveal many more faint, small open star clusters.

More on Open Star Clusters

Smaller star clusters that are rich with stars, such as NGC 7789, M52 or other similar clusters, will [illegible]en a[illegible]ear as hazy glows in b[illegible]oculars. Individual stars are [illegible]hanging to resolve. With l[illegible]ser star clusters, individual s[illegible]rs are more easily resolved.

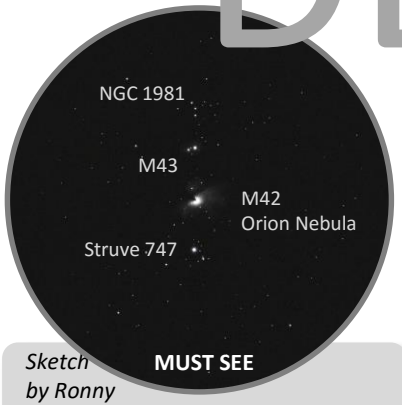
Stargazing
for EVERYONE with
Binoculars


Gemini
Taurus
Cr 65
Aldebaran
Cancer
Cr 69
Betelgeuse
Canis Minor
Rosette Nebula
Orion
Procyon
Hydra
Cr 70
Monoceros
Orion Nebula
M48
Cetus
Sirius
M46
M47
Lepus
M41
Canis Major
M93
Adhara
Puppis
Columba
E
W
S
Globular Star Clusters
Open Star Clusters
Galaxies
Nebulas

Sword & Belt of Orion

Orion is one of the most recognizable constellations in the sky. Its 3 bright belt stars are part of **Cr 70 0pen Star Cluster**. 100 stars swirl around the 3 main stars. This is a **MUST SEE** object.

South of the belt, is the Sword. In it is **M42 The Orion Nebula**. It is a place where stars are created. It is the best Nebula in the Northern Sky. M43 is the small detached Nebula. **NGC 1981 Open Star Cluster**, is a pretty cluster, 1/2 degree in size with 20 stars. Also in the view is Struve 747, a nice double star.



Sketch by Ronny De Laet using 15x70mm binoculars.

MUST SEE

Northern Orion

Cr 65 Open Star Cluster is located at the top of Orion (arms). It is almost 4 degrees in diameter with 15 stars, but many more stars in the background enhance the view.

More Southeast of Orion

You can see additional smaller star clusters in this rich region of the Milky Way.

Northern Orion

Cr 69 Open Star Cluster is near the head of Orion. A trail of 3 faint stars between brighter ones identifies this cluster. It is 1.1 degree in length containing 20 stars.

To the East in Orion is **Betelgeuse,** a bright super red giant star that appears distinctly pink in binoculars.

East of Sirius

M46 & M47 Open Star Clusters in Puppis, are a nice pair, one degree apart. M47 is brighter and larger, 1/2 degree with 30 stars. M46 is 1/3 degree in size and is rich with 100 stars.

Monoceros Region

NGC 2244 Rosette Nebula & Open Star Cluster is a large nebula, 1/2 degree in diameter, with a star cluster inside it. The nebula is faint, but the cluster is bright and has 100 stars.

M50 Open Star Cluster is a nice cluster, 1/4 degree in size with about 80 stars.

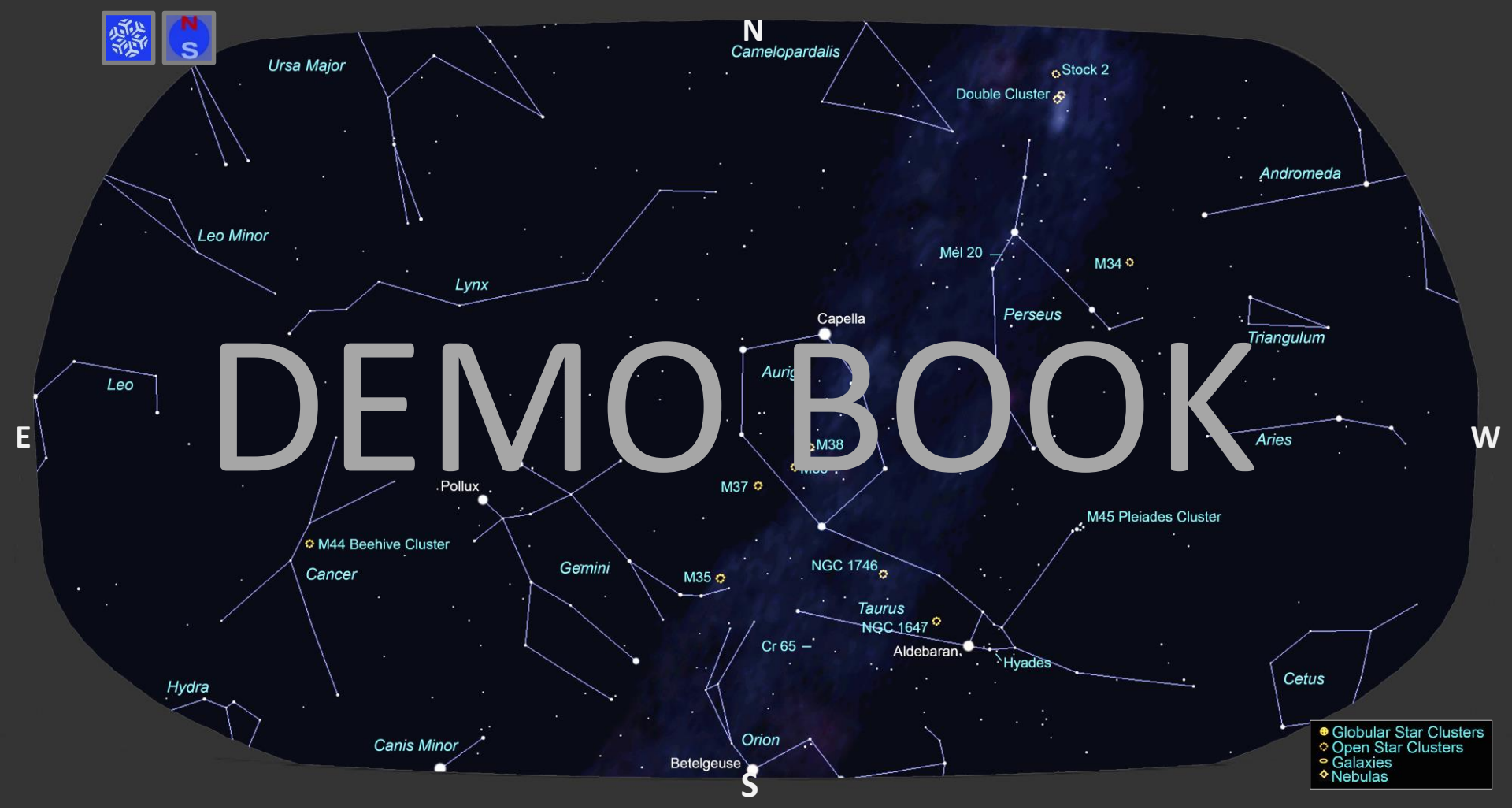
M48 Open Star Cluster is on the Southeast side of Monoceros, but is located in Hydra. It is a nice cluster about 1/2 degree in size with 80 stars.

Canis Major & Puppis Region

M93 Open Star Cluster, in Canis Major is 1/3 degree in size with 80 stars.

M41 Open Star Cluster, in Canis Major is one of the best open clusters in the sky. It is bright, 2/3 degree in size and consists of 80 stars.

Sirius in Canis Major is the brightest star in the sky.


N
E
W
S
Ursa Major
Camelopardalis
Stock 2
Double Cluster
Andromeda
Leo Minor
Lynx
Mél 20
M34
Perseus
Capella
Triangulum
Leo
Aries
M38
M37
Pollux
M45 Pleiades Cluster
M44 Beehive Cluster
Cancer
Gemini
M35
NGC 1746
Taurus
NGC 1647
Cr 65
Aldebaran
Hyades
Cetus
Hydra
Canis Minor
Orion
Betelgeuse
Globular Star Clusters
Open Star Clusters
Galaxies
Nebulas

Carried over from Fall viewing…

Perseus Star Clusters

Double Open Star Cluster is a **MUST SEE** beautiful dual cluster. In the same field is **Stock 2 Open Star Cluster**, located in Cassiopeia. The view of these clusters are enhanced by the background of a pretty swirling star pattern. This is an excellent view for binoculars.

Mel 20 Perseus Star Cluster is a beautiful, very large op[illegible]ster, [illegible] degrees in size, ideal fo[illegible]binocula[illegible] viewing.

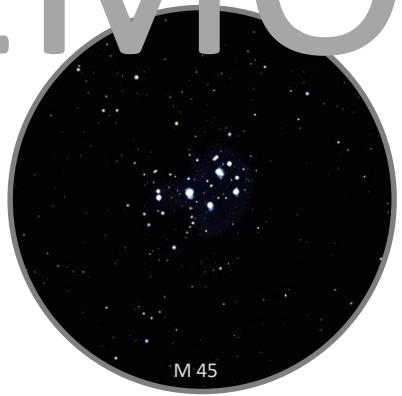
Also see these Objects [illegible]n the W[illegible]ter North Map.

Foot of Perseus

M34 Open Star Cluster is further West in Perseus. It is a large cluster, 2/3 degree in size, and contains 60 stars.
Also see on the Winter North Map.

The Pleiades in Taurus

M45 The Pleiades or The Seven Sisters is a **MUST SEE** cluster located in Taurus**.** It has the appearance of a micro dipper or a measuring cup. It is 2 degrees in size and can easily be seen with the un-aided eyes. Though the few brightest stars are dominant to the cluster's appearance, there are actually 100 stars in this cluster. Binoculars will show many of these other stars. There are strands of faint [illegible]bulosity in [illegible] cluster[illegible]ay be se[illegible]nder ver[illegible]ark sk[illegible]s. This is [illegible]y favo[illegible]e [illegible]uster t[illegible]ob[illegible]erve[illegible]ith bino[illegible]lars



Star Clusters in Taurus

Mel 125 The Hyades, in Taurus is a large cluster that forms the head of the Taurus. The bright Orange Star Aldebaran, enhances the view. This cluster is 5.5 degrees in size with 40 stars. Ideal for binoculars.

Between the Horns of Taurus is **NGC 1647, The Crab Cluster**, named for its shape. It is a bright, rich and 2/3 degree in size with 200 stars. A short distance to the East is **NGC 1746**. It is bright and large, 2/3 degree in size and contains 20 stars.

Star Clusters-Cancer to Auriga

M38 & M36 Open Star Clusters in Auriga are a nice rich pair viewed in the same field. M38 is the larger, 1/3 of a degree in size with 100 stars. M36 is actually brighter, but only 1/6th of a degree in size with 60 stars.

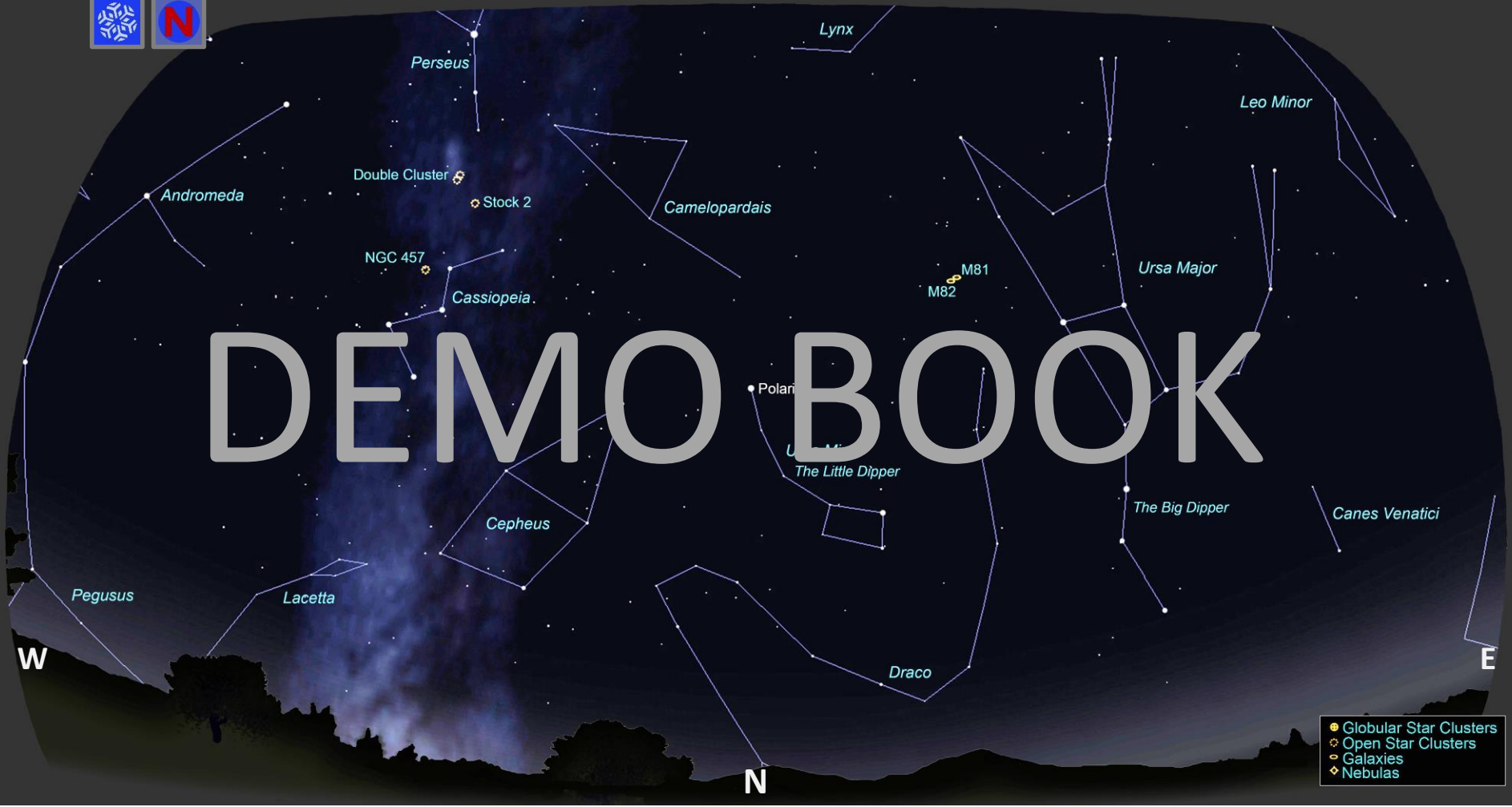
To the East is **M37 Open Star Cluster** bright, rich with about 150 stars and 1/4 of degree in diameter.

M35 [illegible]per [illegible]tar Cluster is located just [illegible]bov[illegible] foot of the West Twin of [illegible]em[illegible]. [illegible] is nearly 1/2 degree in size and [illegible]ry ri[illegible] with 200 stars. This is a very [illegible]ce clus[illegible]r.

M44 Beehive Open Star Cluster in Cancer is a **MUST SEE** cluster that is very large and loose. It is 1.2 degrees in size with 50 stars. M44 is one of the best clusters for binoculars.

South of Taurus

Cr 65 Open Star Cluster is almost 4 degrees in diameter with only 15 stars, but has a nice star background.
Also see on the Winter South Map.


Lynx
Perseus
Leo Minor
Double Cluster
Andromeda
Stock 2
Camelopardais
NGC 457
M81
M82
Ursa Major
Cassiopeia
DEMO BOOK
Polari
The Little Dipper
The Big Dipper
Canes Venatici
Cepheus
Pegusus
Lacetta
Draco
W
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Globular Star Clusters
Open Star Clusters
Galaxies
Nebulas

Carried over from Fall viewing…

Perseus Star Clusters

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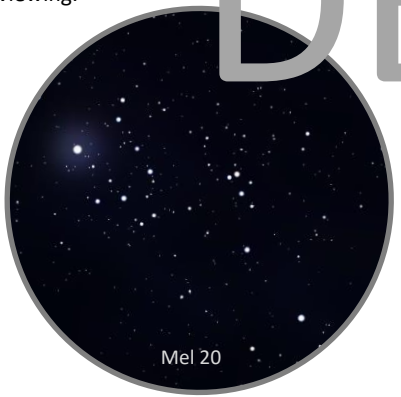
Mel 20 Perseus Star Cluster is a beautiful, very large op[illegible]ster, 5 degrees in size, ideal [illegible]r binocu[illegible]r viewing.



Also see these Objects on the Winter Overhead Map.

Carried over from Fall viewing…

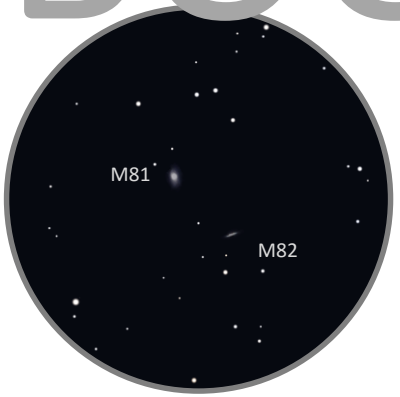
Cassiopeia

NGC 457 The Owl Cluster has many names. It is also known as the ET Cluster, Kachina Doll Cluster or the Skiing Cluster. It looks like ET with its bright eyes (stars) and out stretched arms. Named for its resemblance to the ET alien character in the movie ET. It is 1/4 degree in size with 80 stars. The brightest stars form the shape of ET. Use the t[illegible]bright eye[illegible]rs to lo[illegible]ate an[illegible] iden[illegible]y

Ursa Major

M81 & M82 Galaxies. These galaxies are best viewed in Spring when they are higher in the sky, but they can also be viewed in the Winter. Both are bright and only 1 degree apart. M81 is the larger and brighter spiral galaxy. M82, the Cigar Galaxy, is named for its shape. It gives an "edge on" view. Both galaxies will appear as small patches. Use the second and third stars of Draco to point 10 [illegible] West to l[illegible]hem. Also ma[illegible]e an im[illegible]ginar[illegible] star poin[illegible]ng lin[illegible] by goi[illegible]r fro[illegible]the "[illegible]p" stars, c[illegible]s to [illegible]here tha[illegible]ine in[illegible]sec[illegible] the Draco[illegible]ne.

Als[illegible] see or[illegible]he S[illegible]ring Nort[illegible] Map.



Stargazing
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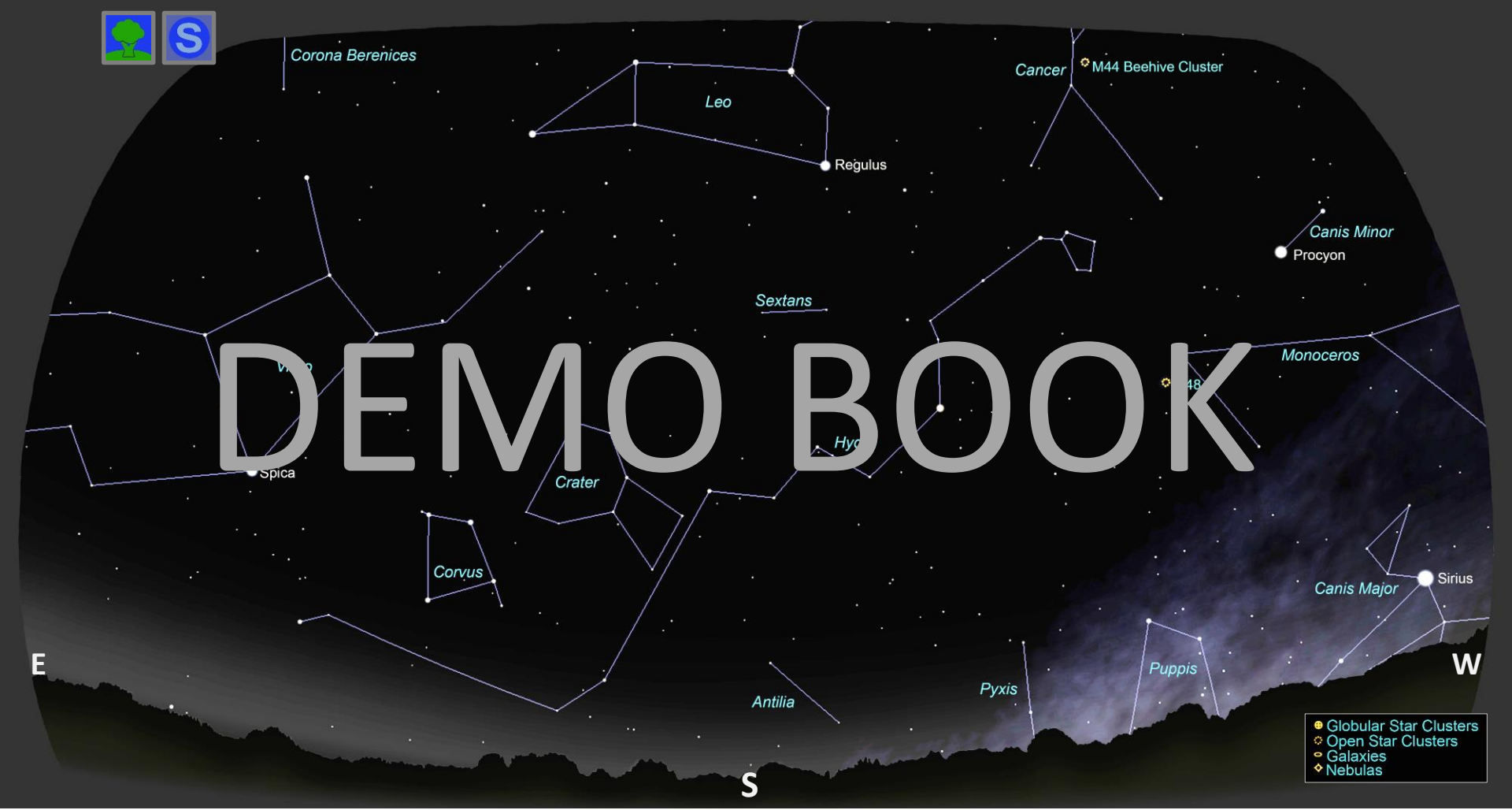
Corona Berenices
Leo
Regulus
Cancer
M44 Beehive Cluster
Canis Minor
Procyon
Sextans
Monoceros
DEMO BOOK
Spica
Crater
Corvus
Canis Major
Sirius
Puppis
Pyxis
Antilia
E
W
S
Globular Star Clusters
Open Star Clusters
Galaxies
Nebulas

Carried over from Winter viewing…

Monoceros

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Carried over from Winter viewing…

Cancer

M44 Beehive Open Star Cluster in Cancer is a **MUST SEE** o[illegible]t is ver[illegible] large and loose. It is 1.[illegible] degrees [illegible] size with 50 stars. M44 is o[illegible]e of the b[illegible]st clusters for binoculars.

Also see on the Spring [illegible]verhea[illegible]Map.

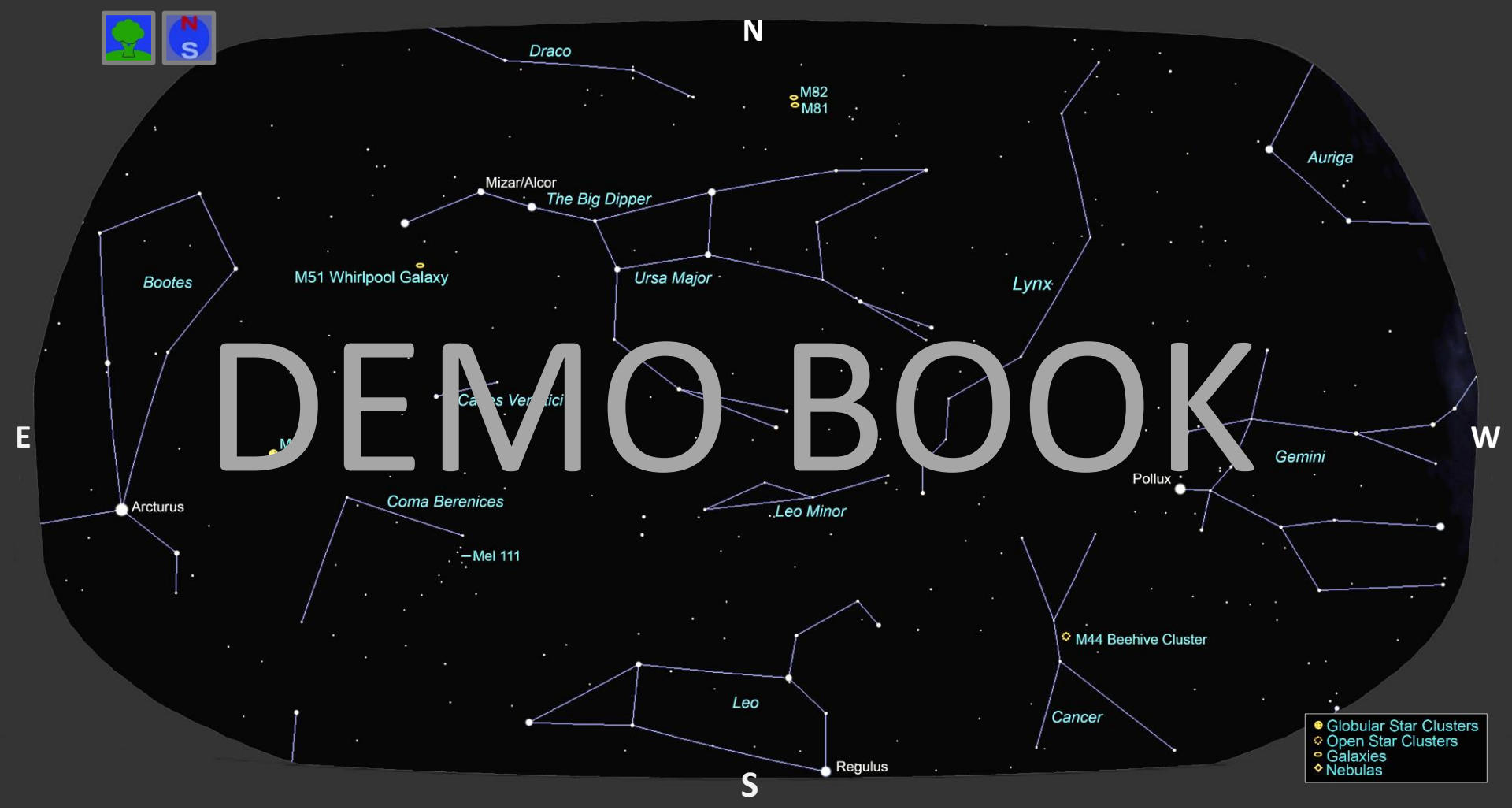
Leo

Regulus Double Star in Leo, is a very bright star with a seemly distant and much dimmer companion. It almost has the appearance of being a planet with a moon.

Also see on the Spring Overhead Map.

Messier Marathon

The last weekend of March, is the time of year when many Astronomy clubs host their annual Messier Marathon. Observers around the world attempt to view all or most of the Messier or "M" objects from dusk to dawn. The Winter objects set in the West early so [illegible]ey m[illegible]be the first viewed [illegible]d l[illegible]ged. The Spring objects [illegible]already up and rising. The [illegible]m[illegible]ning Summer and Fall [illegible]ject[illegible]rise late at night and [illegible]arly in t[illegible]e morning. Use this book to help with your own viewing marathon.


N
E
W
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Draco
M82
M81
Auriga
Mizar/Alcor
The Big Dipper
Bootes
M51 Whirlpool Galaxy
Ursa Major
Lynx
DEMO BOOK
Gemini
Pollux
Arcturus
Coma Berenices
Leo Minor
Mel 111
M44 Beehive Cluster
Leo
Cancer
Regulus
Globular Star Clusters
Open Star Clusters
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Nebulas

Carried over from Winter viewing…

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Also see on the Spring South Map

Leo

Regulus Double Star in [illegible] very bright star with a seem[illegible] distant and much dimmer compan[illegible]n. It alm[illegible]t ha[illegible] the appearance of bein[illegible]a planet [illegible]ith a moon.

Also see on the Spring [illegible]ad Map.

Coma & Canes Venatici

Mel 111 Open Star Cluster in Coma Berenice. It is a very large open star cluster and is also known as the Hair of Coma.

M3 Globular Cluster is one of the brightest and best globular in the sky. I think of it as the introduction to the coming Summer globulars.

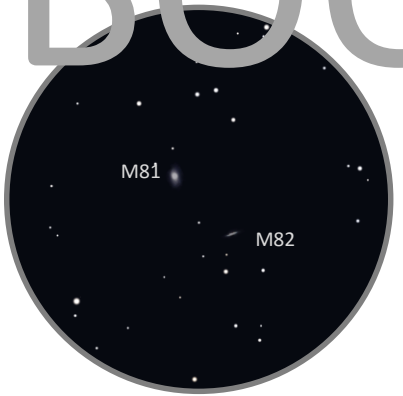
M51 [illegible]hirlpool Ga[illegible]y in Can[illegible]tici is loc[illegible]te[illegible] 3 degre[illegible]outh [illegible] the end the B[illegible]g D[illegible]per h[illegible]dl[illegible] It h[illegible]s a small galax[illegible]at t[illegible]e en[illegible] of a spira[illegible]arm. In bino[illegible]lars, [illegible] app[illegible]rs as [illegible]n oval shap[illegible]

Carried over from Winter viewing…

Ursa Major

M81 & M82 Galaxies. Both galaxies are bright and only 1 degree apart. M81 is the larger and brighter spiral galaxy. M82, the Cigar Galaxy, is named for its shape. It gives an "edge on" view. Both galaxies will appear as small patches. Use the second and third stars of Draco to point 10 degrees West to locate them. Also make an imaginary star pointing line by [illegible]m the "[illegible]s, out to wh[illegible]e that [illegible]ne in[illegible]ersects th[illegible]Drac[illegible]ine.

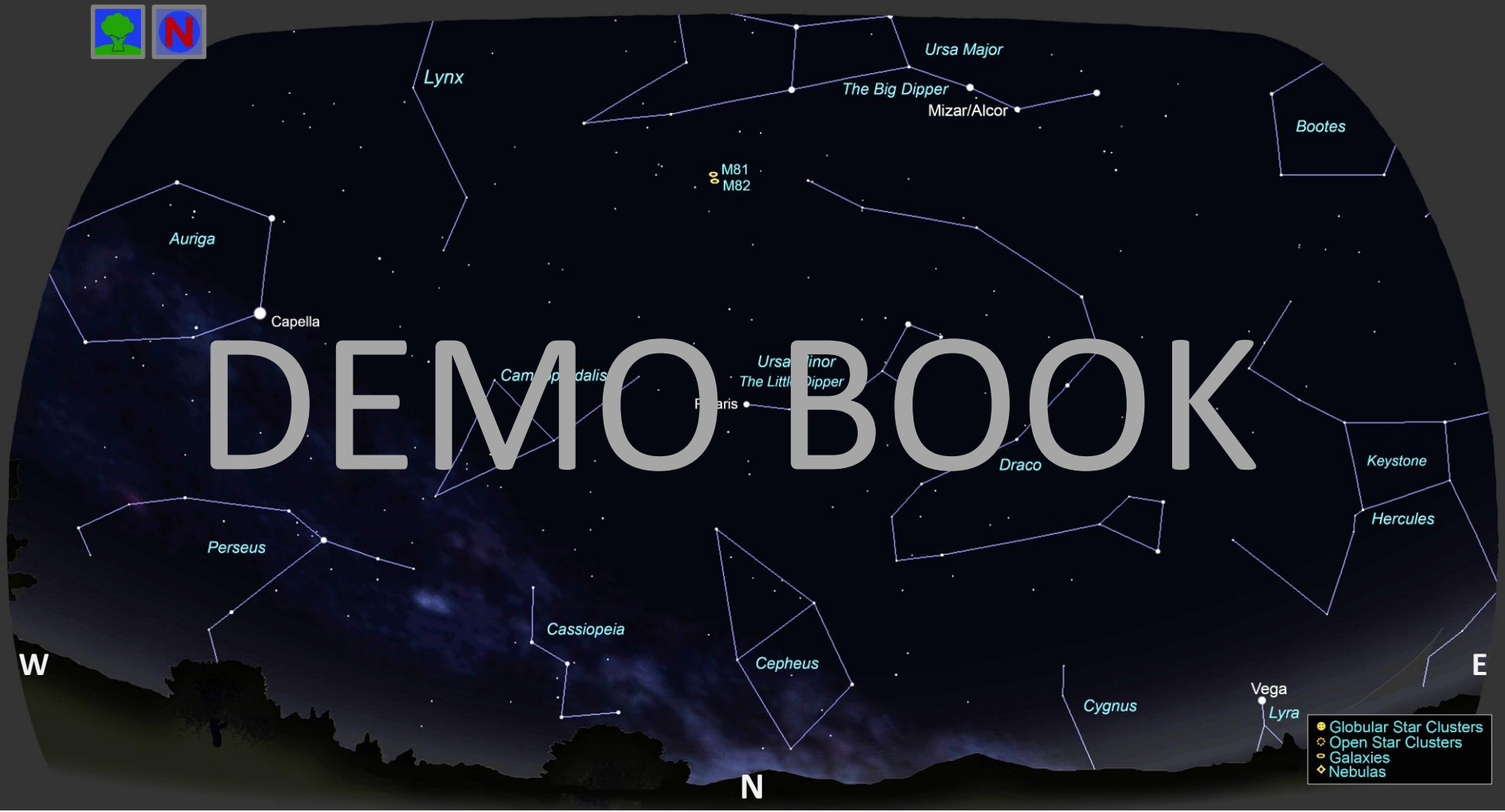
Als[illegible]see [illegible] the S[illegible]ring North [illegible]Map



Ursa Major

Mizar/Alcor Double Star In Ursa Major, is the second star on the "Handle" of the Big Dipper. This is actually a "double/double" star. Your eyes can separate Mizar from Alcor, but even binoculars will have trouble separating the rest of the stars. It is still a nice view.

Also see on the Spring North Map


Lynx
Ursa Major
The Big Dipper
Mizar/Alcor
Bootes
M81
M82
Auriga
Capella
Ursa Minor
The Little Dipper
Polaris
Draco
Keystone
Hercules
Perseus
Cassiopeia
Cepheus
Cygnus
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Globular Star Clusters
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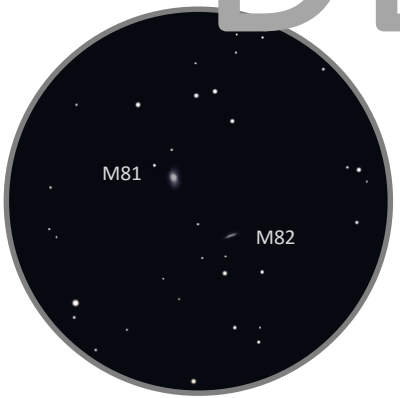
Also see on the Spring Overhead Map



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Also see on the Spring Overhead Map

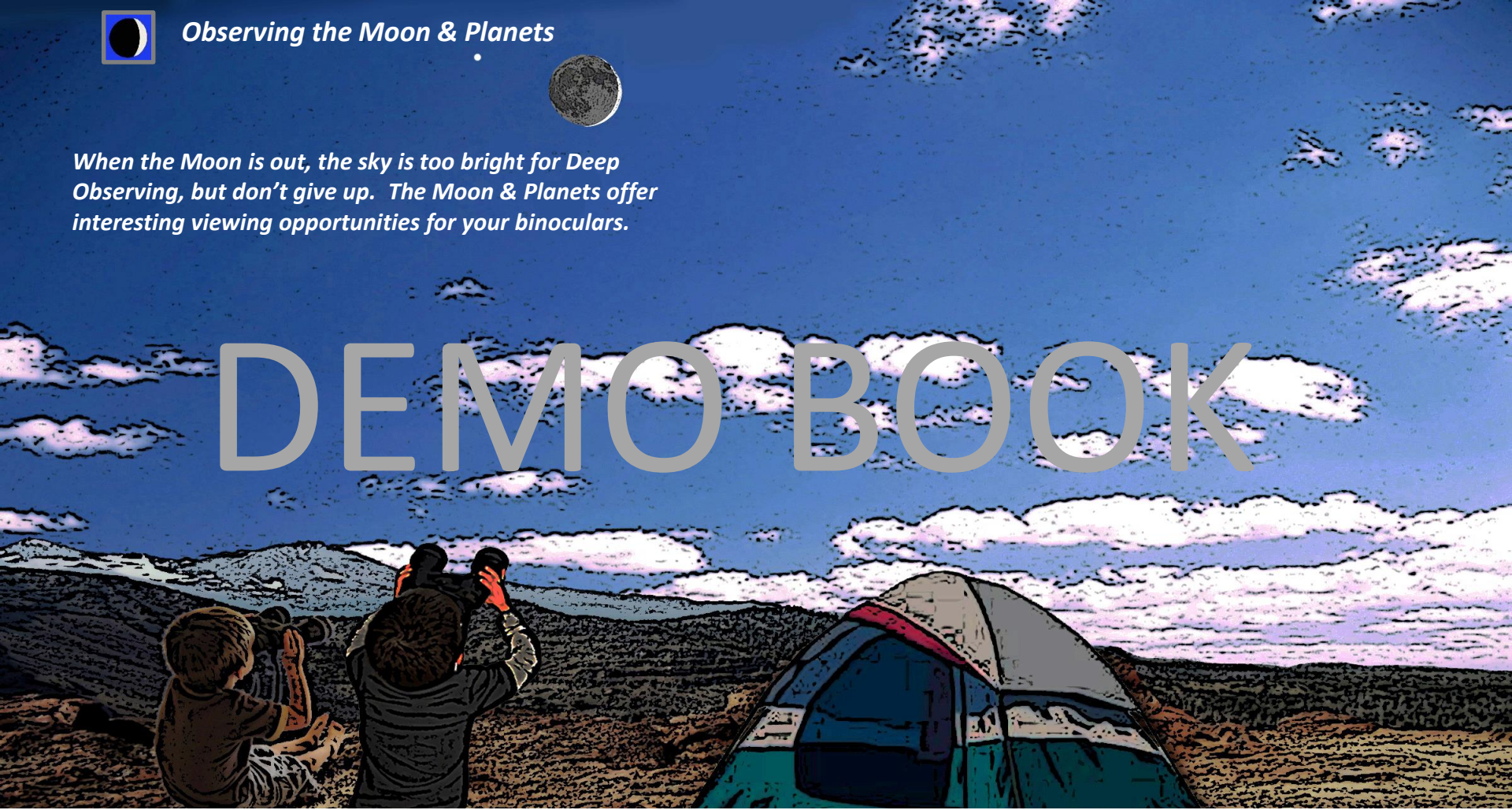
FUN FACT

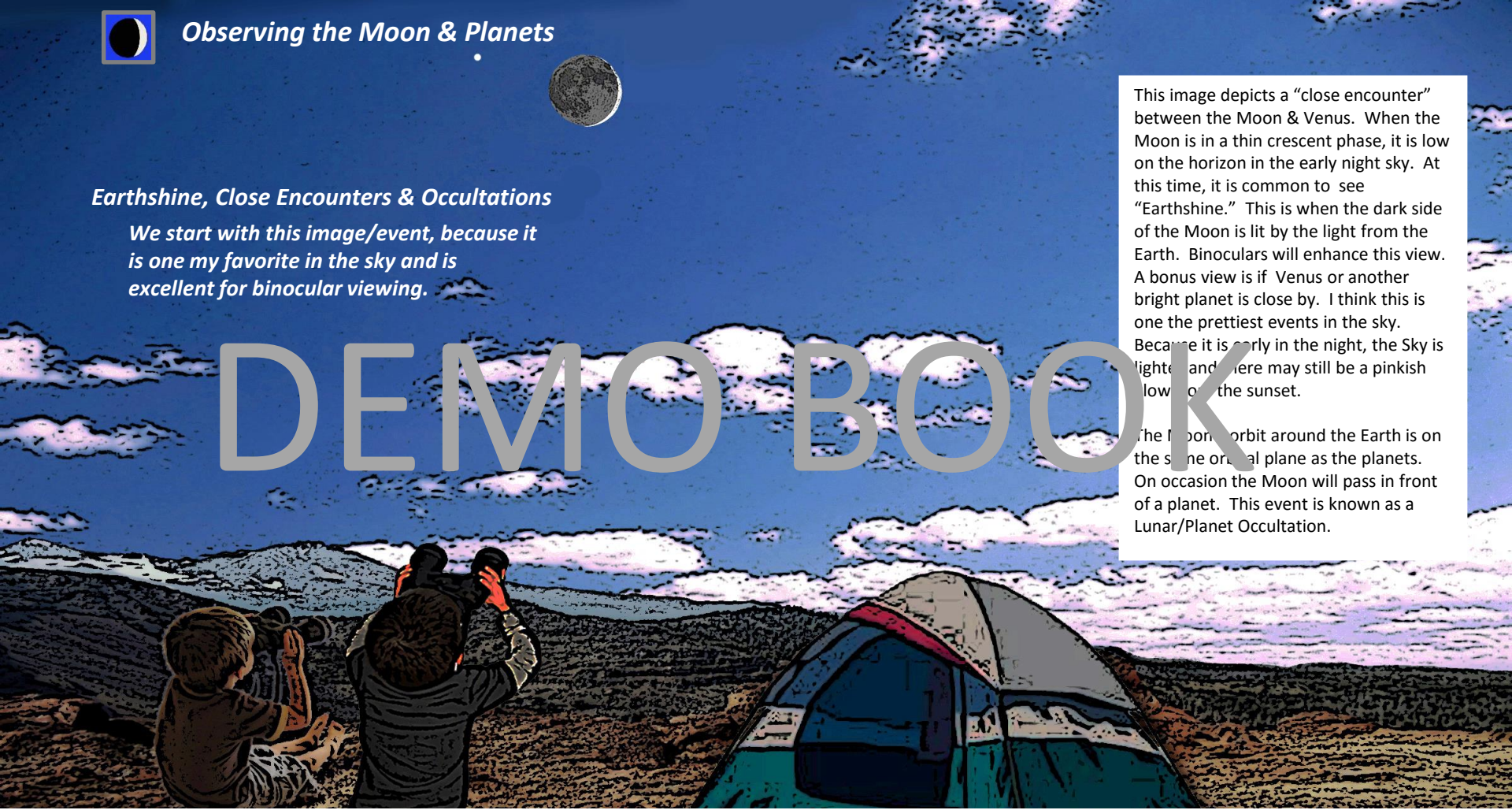
Our sample 10x50mm binoculars have a 6 degree field of view diameter. That is a large enough field to fit the equivalent of 12 Moons side by side.

Stargazing
for EVERYONE with
Binoculars

Observing the Moon & Planets

When the Moon is out, the sky is too bright for Deep Observing, but don't give up. The Moon & Planets offer interesting viewing opportunities for your binoculars.



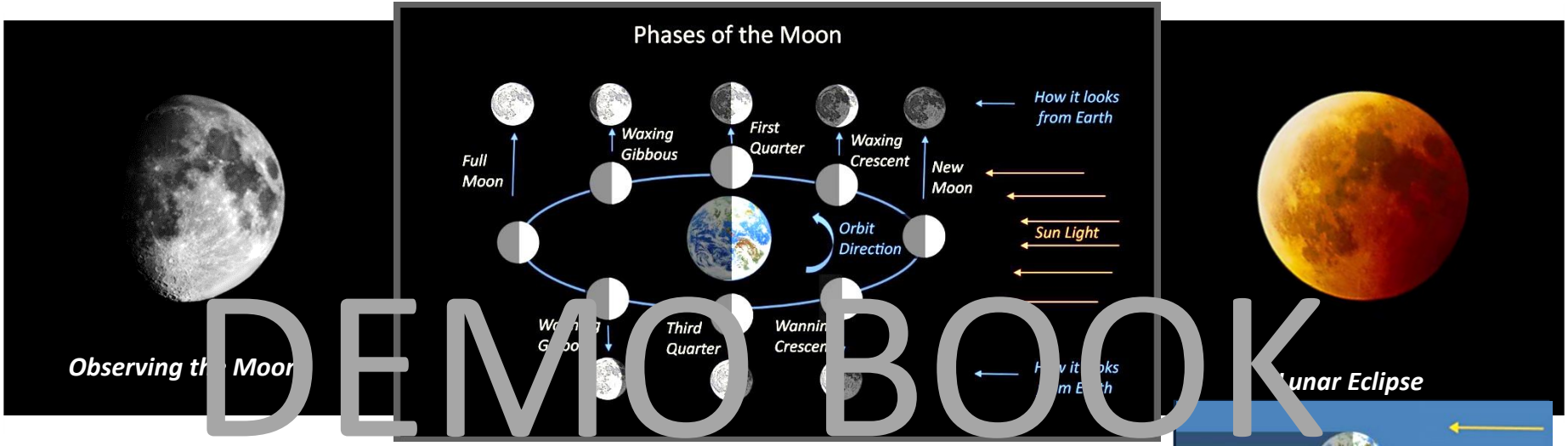


Earthshine, Close Encounters & Occultations

We start with this image/event, because it is one my favorite in the sky and is excellent for binocular viewing.

This image depicts a “close encounter” between the Moon & Venus. When the Moon is in a thin crescent phase, it is low on the horizon in the early night sky. At this time, it is common to see “Earthshine.” This is when the dark side of the Moon is lit by the light from the Earth. Binoculars will enhance this view. A bonus view is if Venus or another bright planet is close by. I think this is one the prettiest events in the sky. Because it is early in the night, the Sky is lighter and there may still be a pinkish glow from the sunset.

The Moon’s orbit around the Earth is on the same orbital plane as the planets. On occasion the Moon will pass in front of a planet. This event is known as a Lunar/Planet Occultation.



Best time to observe the Moon

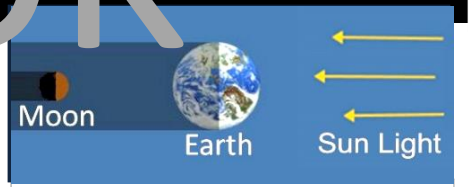
The Moon is best observed when it is in a "phase" state, as shown above. The shadow enhances the view of the craters and mountain ranges located on the shadow's edge. The image (above) is a typical view in 10x50 binoculars. The dark patches are flat planes called mares, meaning seas. They are easily seen at any phase.

The Phases of the Moon

New Moon" is the time when the Moon is aligned between the Earth and the Sun. The Moon is un-seen as only the back side is lit. As its orbit moves it visually further from the Sun, its lit portion grows larger until it becomes a "Full Moon" when the Earth is between it and the Sun. As the Moon continues its orbit visually toward the Sun, its phases grow smaller until it becomes a new Moon again.

The Moon's Orbit & Rotation

The Moon Orbits the Earth once every 29 days. The Moon also rotates around its axis once every 29 days. Because of this, we only see one side of the Moon.



A Lunar Eclipse Occurs when the light of the Sun is blocked by the Earth, giving the Moon a burnt orange appearance. (See the illustration). The orbital planes of the Earth and Moon are not perfectly flat, making a Lunar Eclipse a relatively rare event. There are websites to give you times when they occur.

Observing the Planets

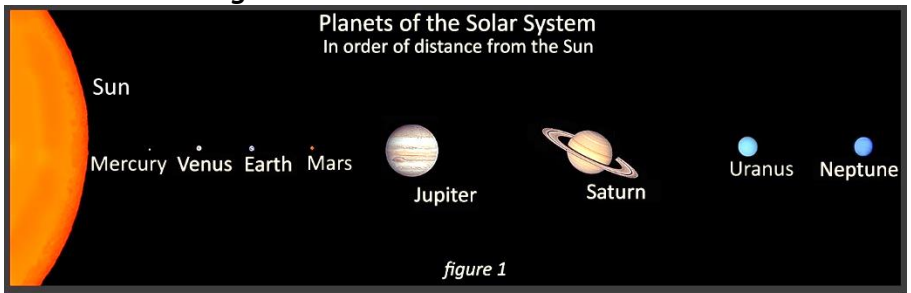


figure 1

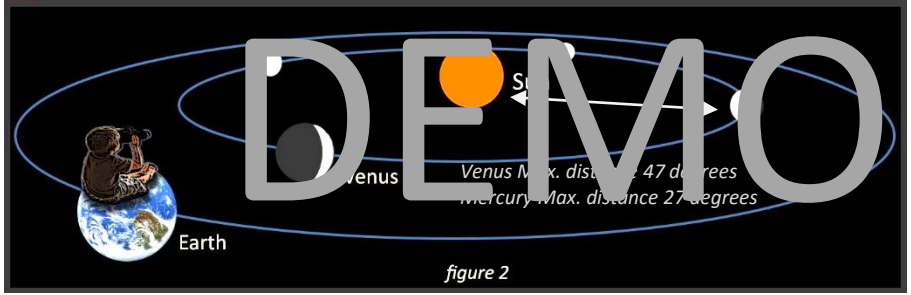


figure 2

There are eight major planets in the Solar System. All but the planet Neptune are visible to the un-aided eyes. Planets do not twinkle like stars do. Also, as planets orbit the Sun, their positions change relative to the stars location. This change is gradual. There are useful websites to help you track their positions. The planets, Moon and Sun travel along the same orbital plane or "ecliptic line." This line is where the constellations of the Zodiac reside. In binoculars planets will appear as colorful bright stars.

Mercury & **Venus** orbit's are inside that of the Earth's therefore, they never appear far from the Sun and both are best seen just before sunrise or just after sunset. Both planets have phases similar to the Moon. (see figure 2)

Venus is unmistakably bright. It is often referred to as the morning star when it is rising in the East. It is also known as the evening star when it is setting in the West. As Venus gets closer to the Earth, its disk appears larger, but its crescent phase is thinner since it is visually closer to the Sun. This will make it more challenging to see.

Mercury can only be seen when it is at its greatest visual distance from the Sun, whether that be in the morning or evening. Binoculars will improve your chances to see it.

Mars, the "red planet," appears yellow/orange and bright. Mars is small, even in telescopes.

Jupiter is very bright. It is the largest planet in the Solar System. Binoculars will show 4 of orbiting Galilean Moons change position each night (see example illustration lower left). On some nights some of the Moons may be unseen as they orbit near, behind or in front of the planet. 15x to 20x will show Jupiter's disk and its larger bands.

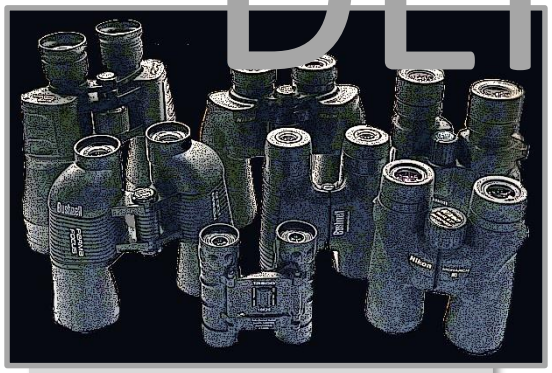
Saturn is sometimes referred to as the jewel of the Solar System with its beautiful rings. In typical binoculars, it will appear as a bright yellow star. It will take 25x to show the rings.

Uranus is visible to the un-aided eye on a good dark night. With binoculars, you can see its turquoise color among the stars.

Jupiter's Galilean Moons

Italian Astronomer Galileo is credited with developing the first usable telescope. He discovered the four bright Moons of Jupiter in the 1600's.

About Your Binoculars



Binoculars are available in countless shapes, sizes & price.

Why Binoculars for Astronomy?

While they may not have the magnification or light gathering power of a larger telescope, binoculars still provide a significant improvement to your eye's ability to see faint objects in the sky. Even small, 21mm binoculars have 9 times the light gathering power of the human eyes.

Binoculars offer a far wider field of view than a telescope. This permits the viewing of the largest objects or the viewing of a cluster of objects in the same field. This is why almost every amateur astronomer owns binoculars as a companion to their larger telescope.

Unlike with telescopes, binoculars allow you to use both eyes and they display images right side up.

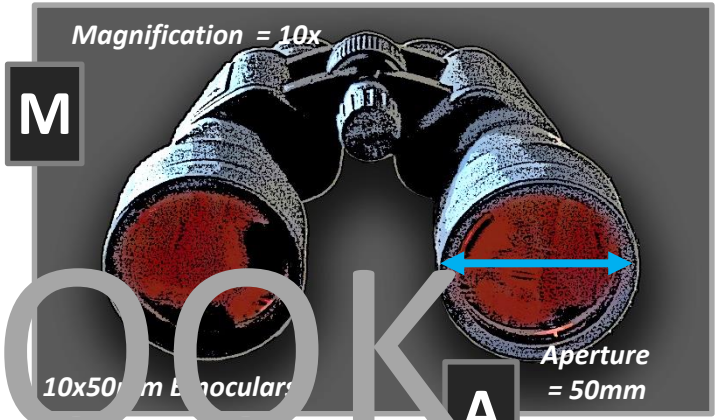
Grab and go star gazing is where binoculars excel. No lengthy equipment set-up is required to stargaze.

Their portability feature is very important as astronomers often need to travel long distances away from the influence of city lights to find dark skies.

		
Features	***Binoculars***	***Telescopes***
Light Gathering Power		
Magnification Options		
Stable Mount on Tripod		
Super Wide Field of View		
Use of both Eyes		
Image- Right Side up		
Grab & Go Impulse		
Portability & Size		

Binocular Specifications

What do the numbers mean?
The specification of binoculars are usually found next to the Eyepiece as shown. (10x50 binoculars will be our example)



The Exit Pupil can be seen by aiming the Binoculars at a bright area and holding them a foot away. The image will be fully illuminated when holding the binoculars to your eyes.

About Your Binoculars

Binocular Specifications

Exit Pupil & Magnification

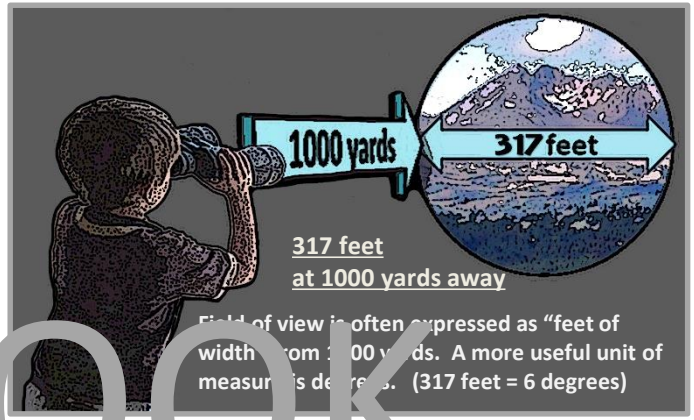
The exit pupil is the amount of light that binoculars sends to the eyes. To calculate the exit pupil, use the formula below.

Aperture(A) divided by Magnification(M) = Exit Pupil

The lower the magnification, the larger the exit pupil and the more light produced. 7mm is considered the maximum usable exit pupil because human eye pupils are considered to be 7mm. However, as we age, our pupils reduce in size. If the exit pupil is larger than our pupils, light is wasted. 10x50mm binoculars are considered ideal for their 5mm exit pupil and higher power. 10x doesn't create a "hold them steady challenge" or over tax the binoculars aperture. In the world of star gazing **aperture is king**. The larger the aperture, the more light, p[illegible]d resolu[illegible]can [illegible]ain.

Magnifi[illegible]tion Ad[illegible]nta[illegible]es / Disad[illegible]ar[illegible]ges	
[illegible]we[illegible] Power	[illegible]Hig[illegible]r P[illegible]we[illegible]
Object Detail	
Contrast	
Usable Incoming Light	
Image Sharpness	
Largest Field of View	
Least Motion from holding binoculars	

Field of View



To conv[illegible]t fee[illegible]of width a[illegible]1000 [illegible]ard[illegible]to [illegible]egree[illegible]se th[illegible]ormul[illegible]

Feet of width x 0.019 = Field in Degrees

If Field is expressed in Metric,

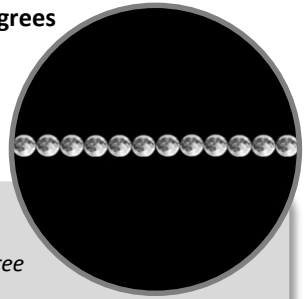
Meters of Width x .0625 = Field in Degrees

How large is 1 degree?

The Moon's diameter = ½ degree.

1 degree = 2 Moons side by side.

1 degree



Our example binoculars yields a 6 degree field of view, enough to place 12 moons side by side.

Choosing Binoculars

Binoculars are available in countless brands, models, sizes and prices. The group shown below is a small example of what is available.

The larger the binoculars, the more you can see, but the greater the need for a tripod, taking away the spontaneity to use them. However, they are still popular for serious observers. While small b[illegible]culars [illegible]ow less, t[illegible] still impro[illegible] you[illegible] eyes[illegible]bility to see [illegible]n offer th[illegible] adde[illegible] fea[illegible] of being eas[illegible] to h[illegible]d a[illegible]d take[illegible]iking

The 10x50mm standard design binoculars are very popular for astronomy for their large aperture, 5mm exit pupil and wide field. They are also easy to hand hold. I like the 10x42mm compact design for their light weight and good 4.2mm exit pupil.

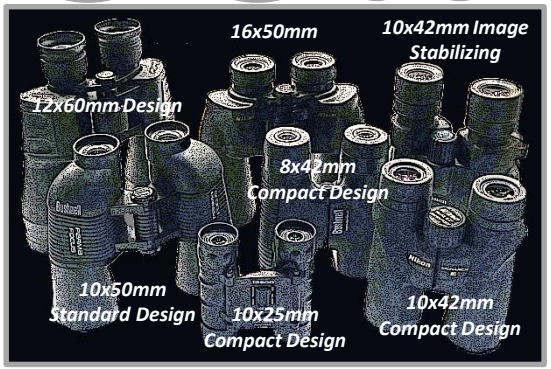
While higher power can offer more detail, lower power offers a wider field of v[illegible]w, ma[illegible]g it easier t[illegible] locat[illegible] objects[illegible] higher pow[illegible]r magnifie[illegible] any m[illegible]vem[illegible]t you may ha[illegible]e from try[illegible]old th[illegible]n steady.

The image stabilizing (IS) binoculars are in a class by themselves including price. There is no need for a tripod, but they are heavier than non IS binoculars. They too come in a variety of brands and models. Using them will spoil you.

Finally, it is important to note, that optical quality is important. Cheap binoculars will give poor views.

Note about the Stable Platform

If the image stabilizing binoculars are too pricey, there are other solutions. Bracing yourself against a large object or laying on your back in a lawn chair are ways to hold binoculars steady. But this will limit scanning. I have seen numerous products ranging from complex tripods with counterweights, to binocular holders attached to swiveling/reclining chairs. They have their pluses, but they can be expensive and cumbersome. I recommend keeping it simple. Use a camera tripod or mono-pod with a loosely tightened head for free movement. Set it to a height that is comfortable for sitting or standing.



Resources:

Greg Babcock's Astronomy Website http://www.synrgistic.com/astro/
for companion information to this book.

Ronny De Laent's Website http://rodelaet.xtreemhost.com/index1.html

Binocular Highlights by Gary Seronik

Gary Seronik's Website http://www.garyseronik.com/?q=taxonomy/term/2

Sky Atlas for Small Telescopes and Binoculars by David S. & Billie E. Chandler

Viewing the Night Sky through Binoculars by Michael E. Bakich

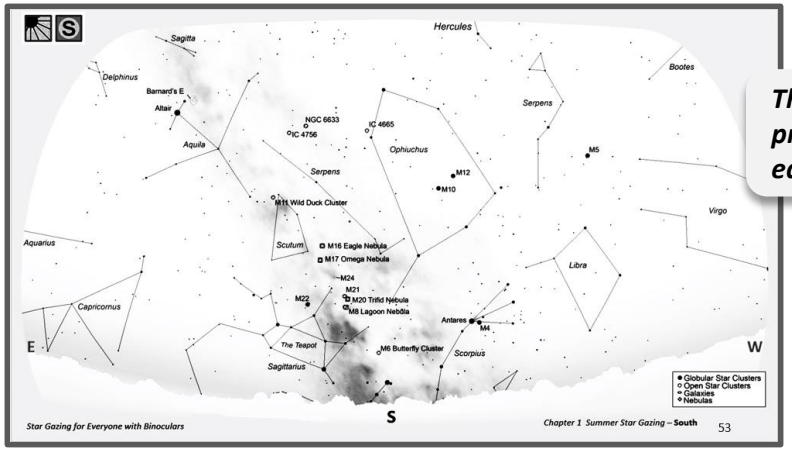
Sunriver Nature Center http://www.oregonobservatory.org/

Special Thanks for their contributions…
Gary Seronik
Larry Cerullo of the Oregon Observatory
Leonardo Cavagnaro
Ronny De Laent
Sue French

A little bit about me the author,
Greg Babcock

I have had a interest in observational astronomy since I was 12 years old. Pictured is my 20 inch Dobsonian telescope built by Nate Currier of Aurora Precision. Casual star gazing has always remained one of my favorite forms of astronomy. Binoculars facilitates that well.

Stargazing for Everyone with Binoculars
Version 1.4
Print Version



These Maps are Black printed on white for easier night use.

Field Sky Maps	
Summer Sky Maps	**Maps 1 - 3**
Fall Sky Maps	**Maps 4 - 6**
Winter Sky Maps	**Maps 7 - 9**
Spring Sky Maps	**Maps 10 - 12**