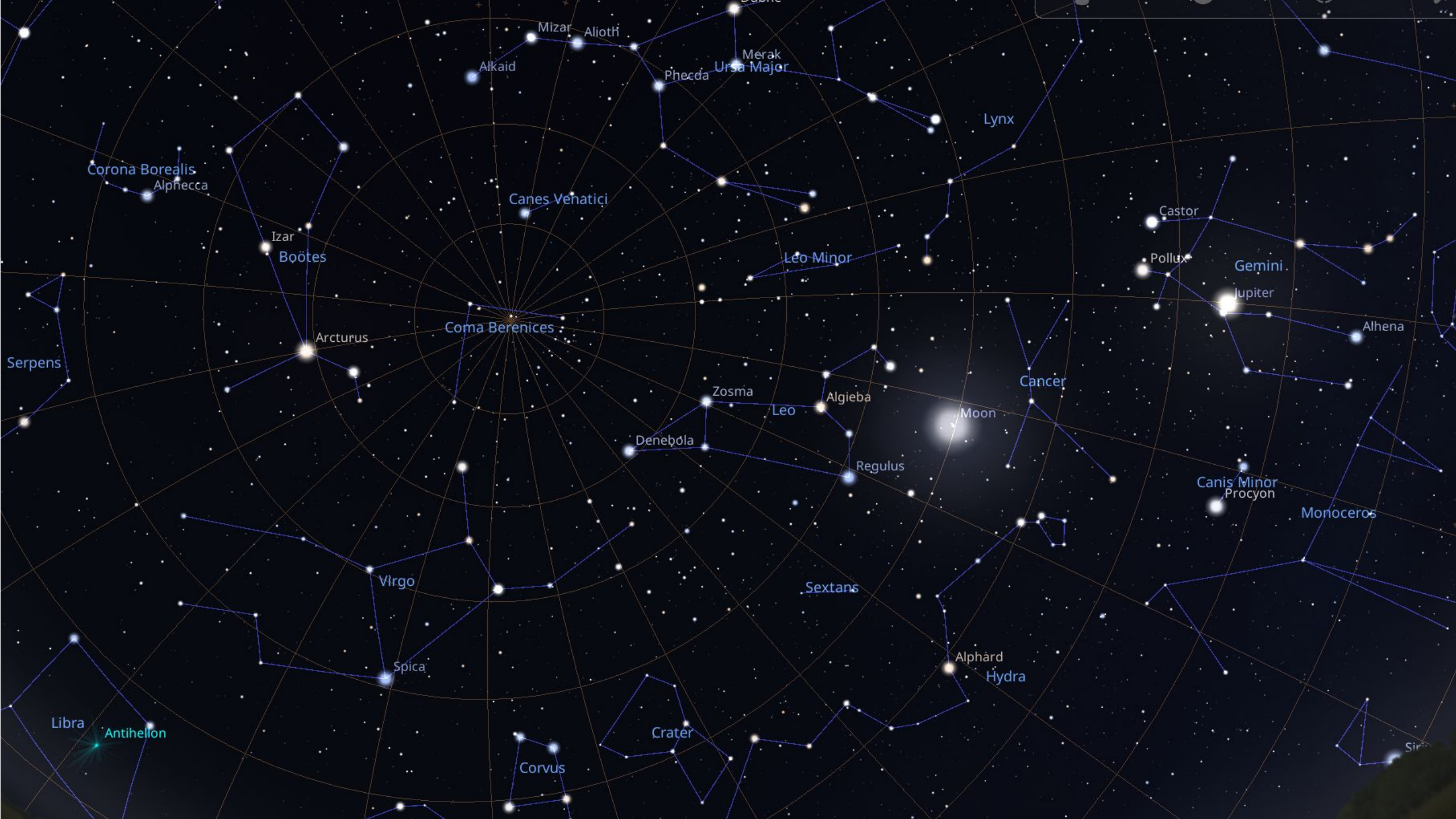
Mizar
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Merak
Phecda
Ursa Major
Lynx
Corona Borealis
Alphecca
Canes Venatici
Izar
Boötes
Leo Minor
Castor
Pollux
Gemini
Jupiter
Alhena
Arcturus
Coma Berenices
Serpens
Zosma
Algieba
Leo
Cancer
Moon
Denebola
Regulus
Canis Minor
Procyon
Monoceros
Virgo
Sextans
Spica
Alphard
Hydra
Libra
Antihelion
Crater
Corvus

# Introduction

- Clear Spring skies offer breathtaking celestial wonders. Constellations like Leo, with its bright star Regulus and lion-like appearance, and Bootes with brilliant Arcturus draws our attention.
- Although the brilliant stars of Winter are setting in the West, and the glow of the Milky Way is absent, Spring skies features Ursa Major (with it's Big Dipper asterism) useful for finding other stars and constellations such as Leo, Virgo and Bootes each possessing beautiful double stars.
- Observers with small and moderate size telescopes delight in the bright deep sky objects such as M3 globular cluster and the galaxy clusters in Coma Berenices and Virgo.  Tonight, the Moon and planet Jupiter are well placed for observation as is Castor a bright double star in Gemini. (although the bright moon will make finding deep sky objects (galaxies) difficult.)
- Familiarizing oneself with the Spring constellations using star charts, planispheres and/or interactive apps ***before*** heading outside will greatly enhance the observing experience on any clear night during April and May.

# Outline of presentation

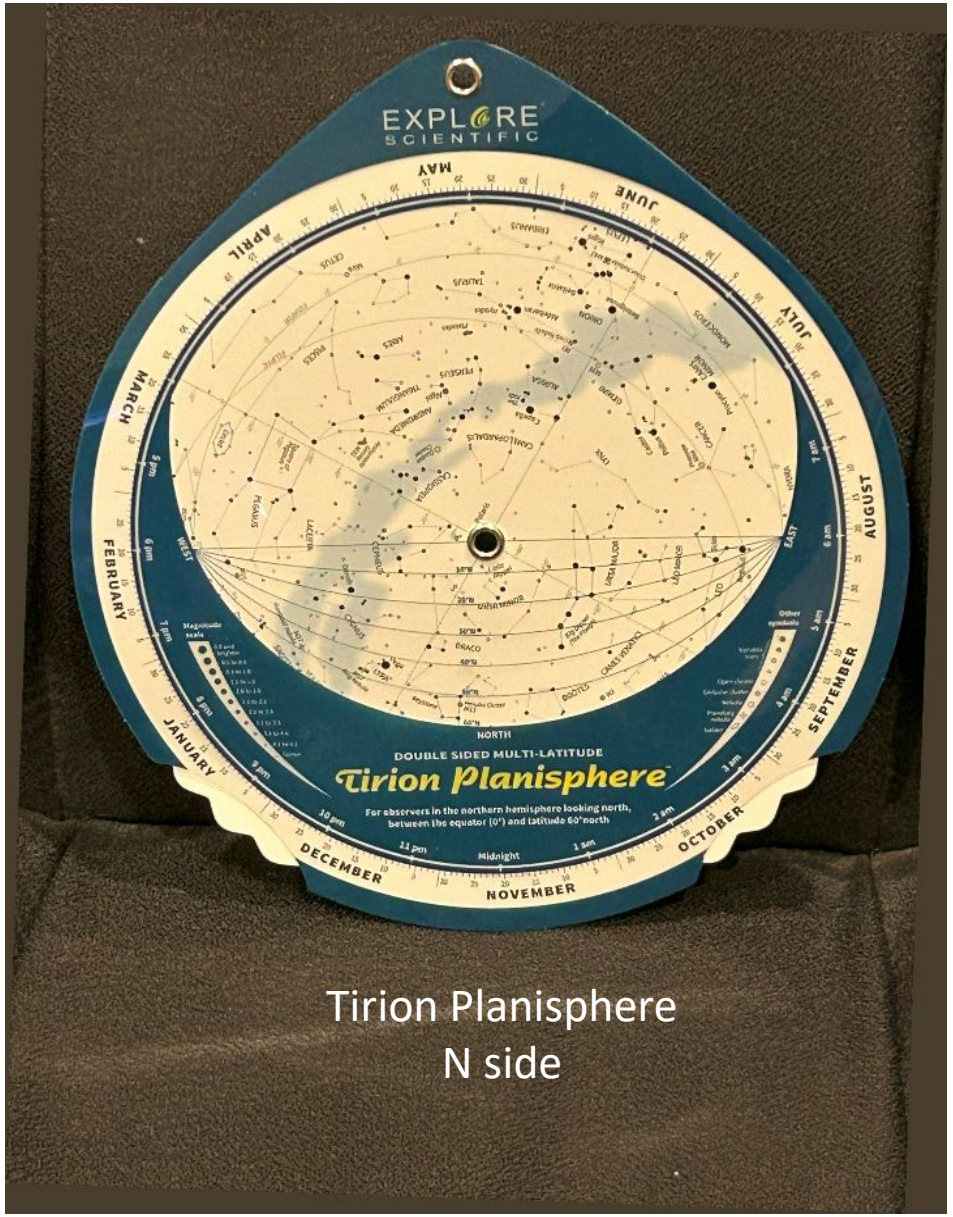
- **“What’s in the skies tonight”** Tools to identify stars, planets, nebulae and events in the April skies
- Introducing the planisphere a manual, programmable star map
- Using a planetarium app Stellarium with a gps smart phone
- Constellations and Bright Stars: Ursa Major, Leo, Virgo, Boötes & Spring Diamond asterism
- Double stars, star and galaxy clusters for small and larger size telescopes
- Along the way some history and mythology of the constellations
- Guidelines for MN ***Outdoor early Spring*** observations

# The Planisphere Guide to Spring Stars

- This is a manual, programmable star chart
- Set the date and time
- The window shows the observable stars
- Hold the guide with your **facing direction** down (have a compass)
- Connect the guide and your view of the sky
- Also turn this planisphere over for an incredible wealth of helpful information for the observer. Ken Graun is the creator of this treasure

# The Planisphere Guide to Spring Stars


# The Tirion Planisphere




Tirion Planisphere
N side

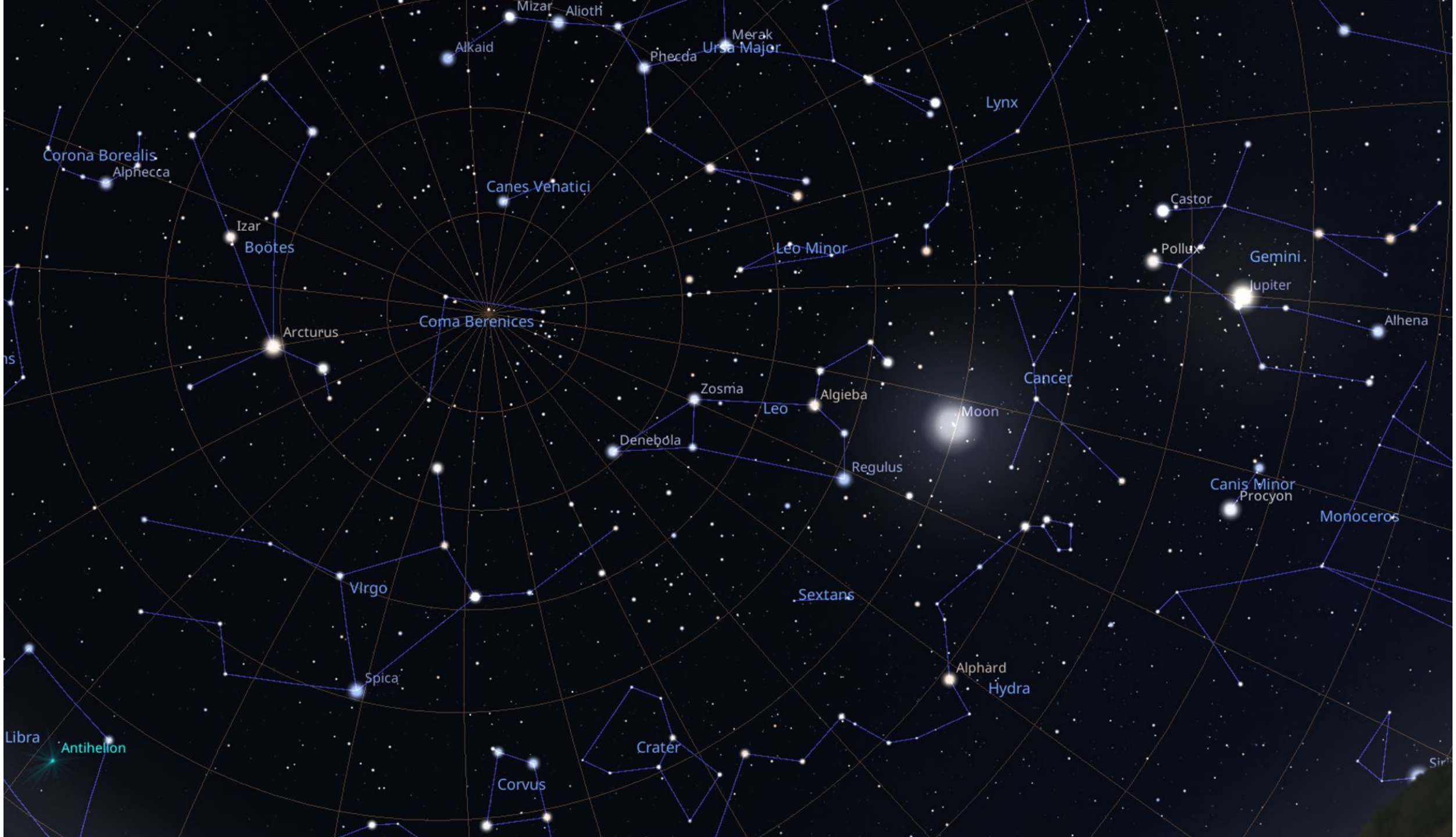

Tirion Planisphere
S side

# The Tirion Planisphere (details)

- The planisphere has two sides one labelled North and a flip side labelled South
- Turn the cardboard map until the month and day and the local time (on the plastic top sheet) match the time and date of your observation.
- Looking North use the North side of the planisphere and hold it up with the grommet at a 45 degree angle (Big Dipper will appear upside down)
- Face East and then West turning the planisphere to read the direction right side up and match the stars on the map to what is in  the skies
- Turn over the planisphere, face South to see whats above the Southern horizon

# Using Stellarium

- Download free app
- Set your location, the date and time you will observe
- Set the direction you are facing (use your compass) to match that on the bottom of the screen
- You can scroll to all directions and with a gps smart phone see the stars on the screen you phone camera is pointing at (point the camera at the sky to activate)
- You can zoom in/out, put in constellation lines and names etc.


Mizar
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Bootes
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Gemini
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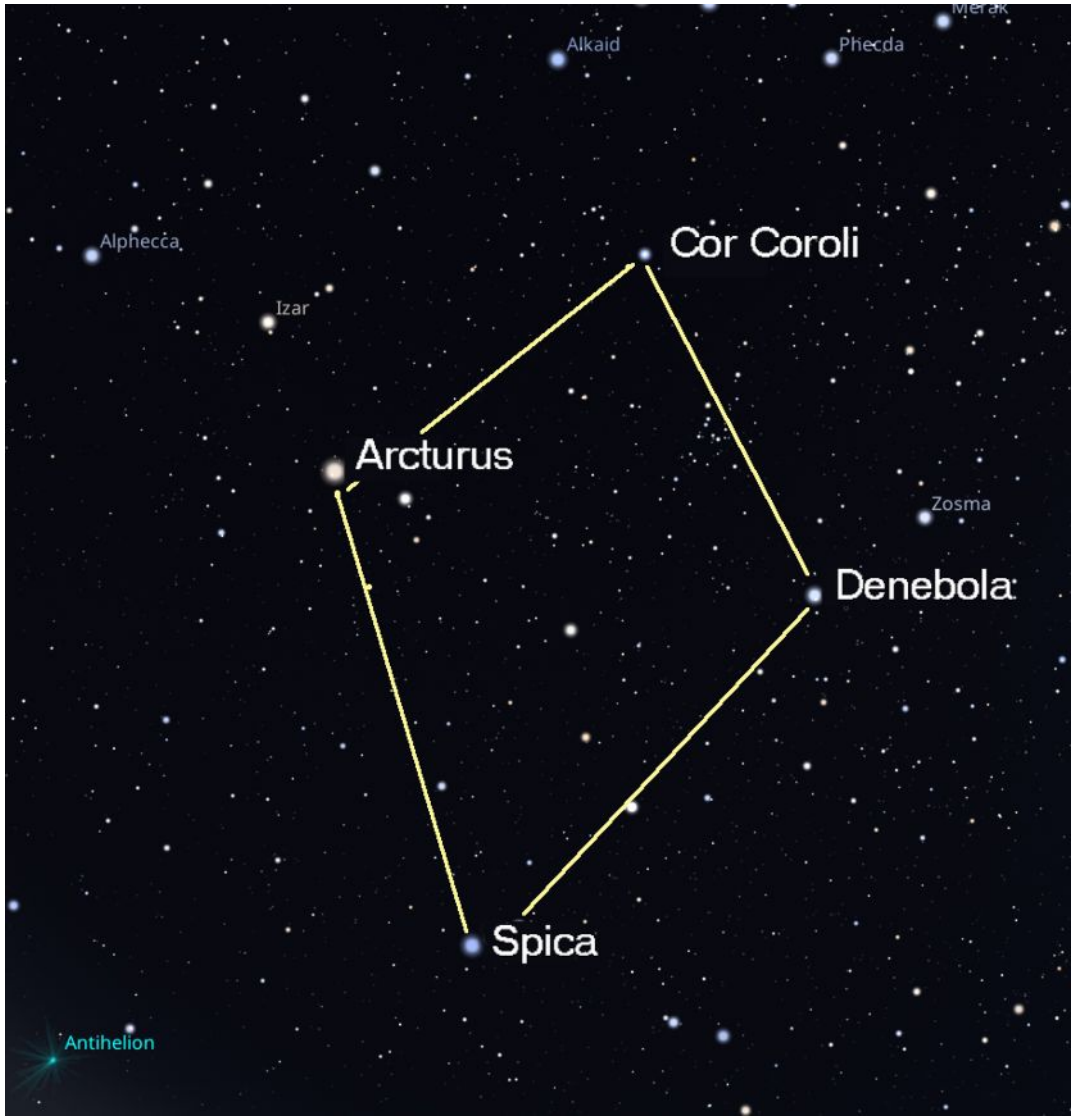
Alhena
Coma Berenices
Arcturus
Cancer
Zosma
Algieba
Leo
Moon
Denebola
Regulus
Canis Minor
Procyon
Monoceros
Virgo
Sextans
Spica
Alphard
Hydra
Libra
Antihelion
Crater
Corvus

# The ‘GREAT DIAMOND’ of Spring

- The ‘Great Diamond’ is a massive, kite-shaped asterism that dominates the northern hemisphere's night sky during spring. It is a guidepost for finding the constellations: Boötes, Virgo, Leo, and Canes Venatici.
- This Cosmic Signpost has Four stellar Pillars:
  - Arcturus (Boötes): The brightest star in the diamond, an orange giant often found by following the arc of the Big Dipper's handle.
  - Spica (Virgo): A brilliant blue-white star that forms the southern tip.
  - Denebola (Leo): A star marking the tail of Leo the Lion.
  - Cor Caroli (Canes Venatici): The northernmost tip of the diamond.
- The space within this diamond is home to the Coma Berenices constellation, polar projection of the Milky Way galactic plane, and the Coma and Virgo galaxy clusters, a massive collection of over 2,000 galaxies.



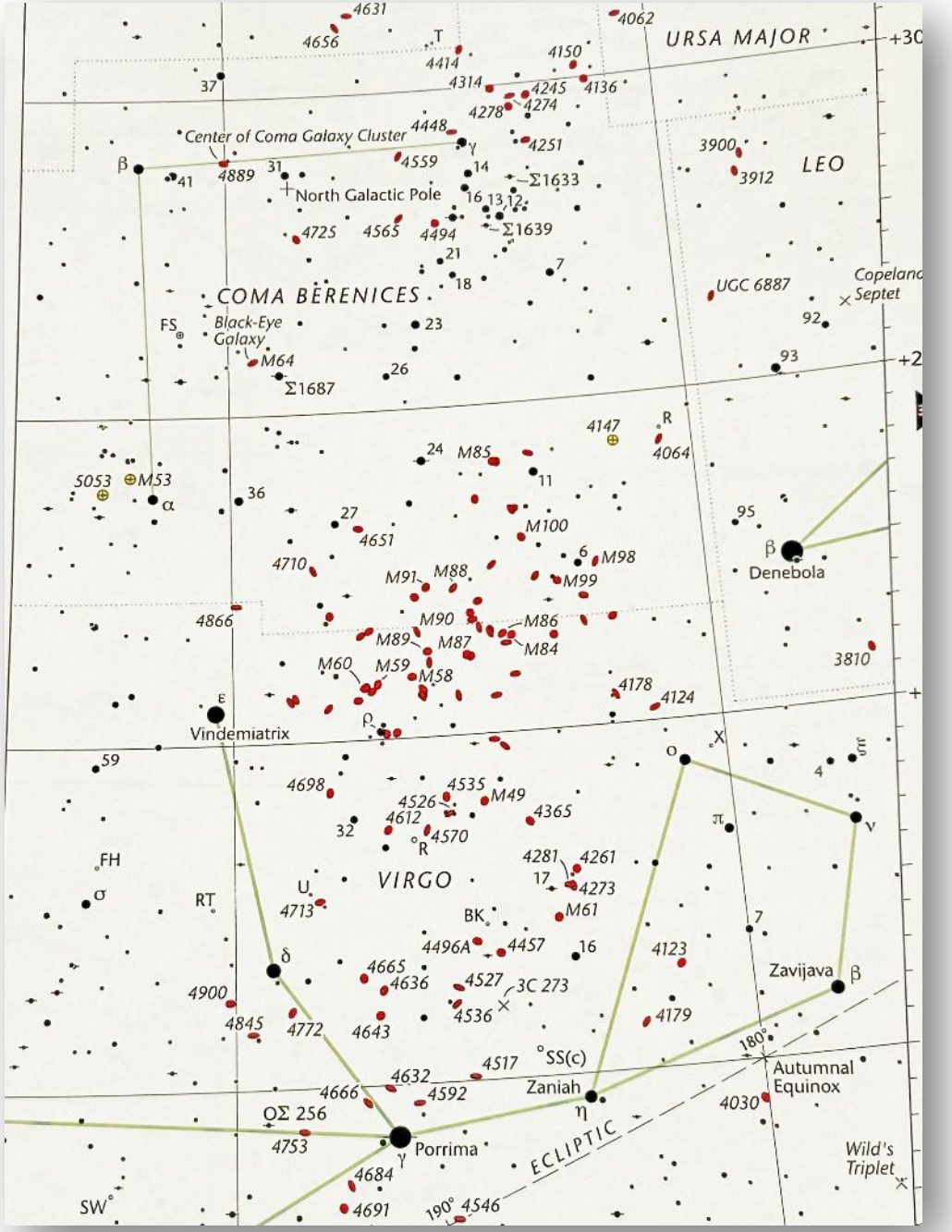
# Why we see galaxies in spring

- Key Reasons for Spring Galaxy Viewing:
- Avoiding the Milky Way's Dust: Throughout winter and summer, we are looking through the thick, star-studded plane of our own galaxy, which blocks our view of distant, faint objects. In spring, our gaze is directed above or below this plane into intergalactic space.
- Prime Position of Clusters: Many of the closest, brightest galaxy clusters, such as the Virgo Cluster and the Coma Cluster, are positioned optimally for viewing in the spring sky, especially near the constellations Leo and Virgo.
- Darkest View: Because we are not looking through the bright, dense stars of the Milky Way, the "background" of the night sky is darker, making faint, distant galaxies easier to spot.
- "The Realm of the Galaxies": This period is often called "the realm of the galaxies" by astronomers because dozens of galaxies, including those in the Coma and Virgo groups, are visible with telescopes.
- Charles Bracken

The two most prominent galaxy clusters are in Coma Berenices and Virgo

**Coma galaxy cluster:** 1000+ 320 Mly distant
Don't confuse with Coma open star cluster 'Berenices's Hair'
Requires larger telescopes (8 in or greater) to see
M 64 (Black Eye galaxy) is not part of Coma cluster
Giant elliptical galaxies predominate (like NGC 4889)

**Virgo galaxy cluster:** 1200-2000 members 60Mly distant
Most located between stars Denebola and Vindemiatrix
Easier to see in small telescopes
M87 largest elliptical has a 6 billion sun-mass black hole at Its center and long jet of particles traveling a significant fraction of light speed. The EHT (event horizon telescope) has imaged the shadow of the black hole

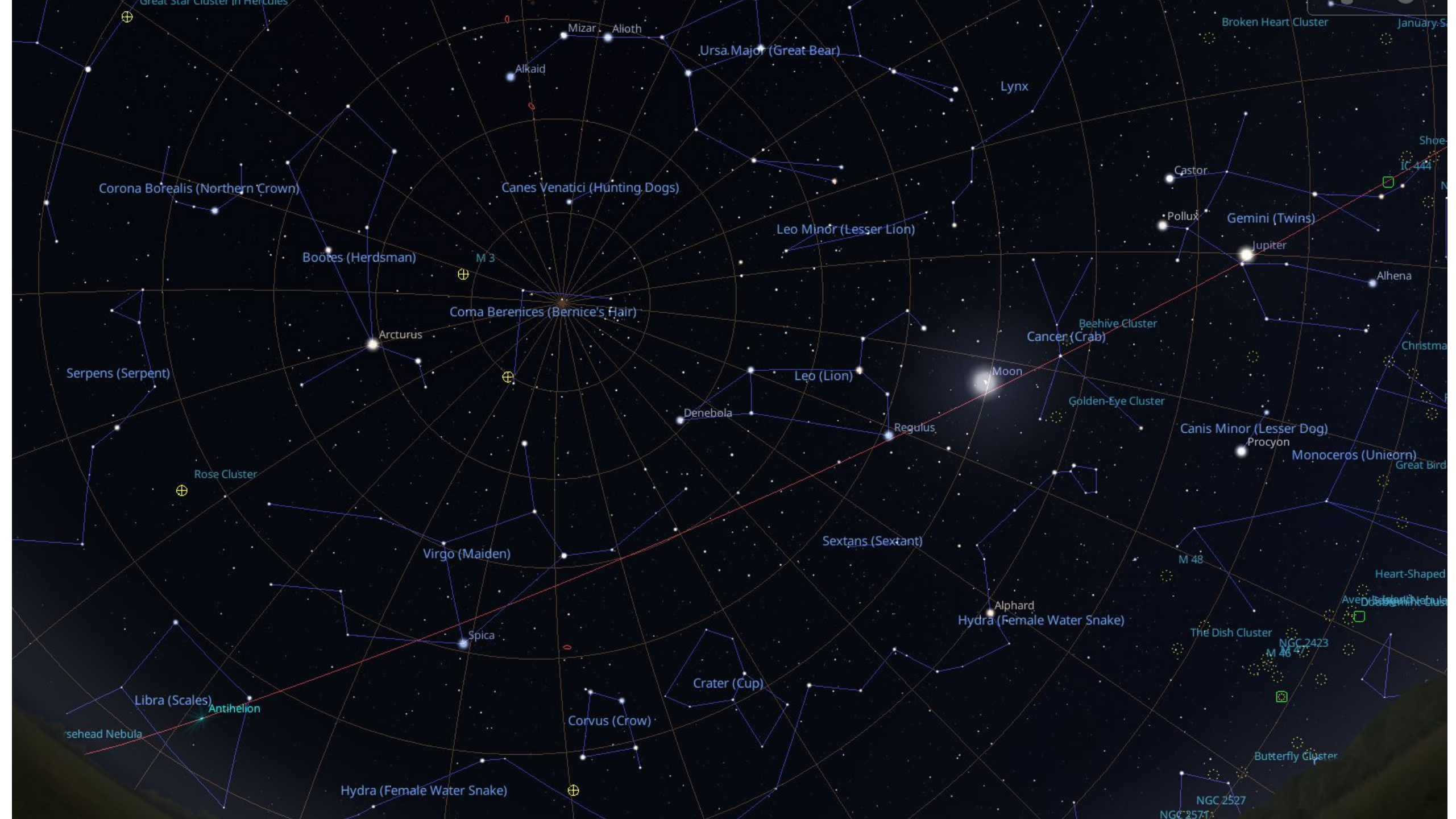


# COMA GALAXY CLUSTER Taavi Niittee/Tõrva Astronoomiaklubi/Tõrva Astronomy Club (Estonia)

# Virgo Galaxy Cluster with M87

M87 is one of the largest elliptical galaxies known
It harbors a central, 6 billion solar mass black hole recently imaged with the Event Horizon Telescope
A jet of subatomic particles traveling at a significant fraction of light speed emanates from the central accretion disc around the black hole

M87 is visible as a round fuzzy smudge even in small telescopes

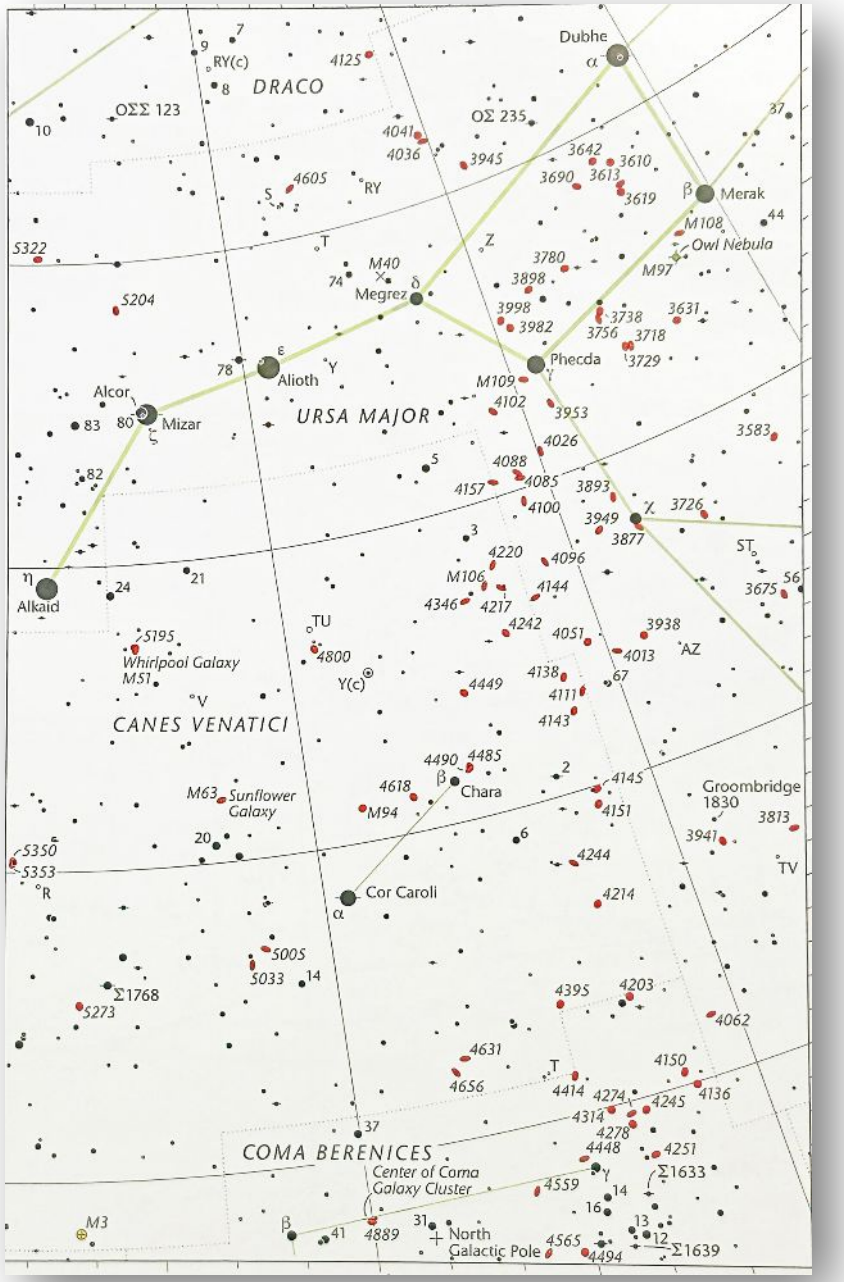

Great Star Cluster in Hercules
Mizar
Alioth
Alkaid
Ursa Major (Great Bear)
Lynx
Broken Heart Cluster
Corona Borealis (Northern Crown)
Canes Venatici (Hunting Dogs)
Castor
Pollux
Gemini (Twins)
IC 444
Leo Minor (Lesser Lion)
Bootes (Herdsman)
M 3
Jupiter
Alhena
Coma Berenices (Bernice's Hair)
Arcturus
Beehive Cluster
Cancer (Crab)
Serpens (Serpent)
Leo (Lion)
Moon
Denebola
Regulus
Golden-Eye Cluster
Canis Minor (Lesser Dog)
Procyon
Monoceros (Unicorn)
Rose Cluster
Great Bird
Sextans (Sextant)
Virgo (Maiden)
M 48
Heart-Shaped
Alphard
Hydra (Female Water Snake)
Spica
The Dish Cluster
NGC 2423
M 46
M 47
Crater (Cup)
Libra (Scales)
Antihelion
Corvus (Crow)
sehead Nebula
Butterfly Cluster
Hydra (Female Water Snake)
NGC 2527

# BIG DIPPER in URSA MAJOR

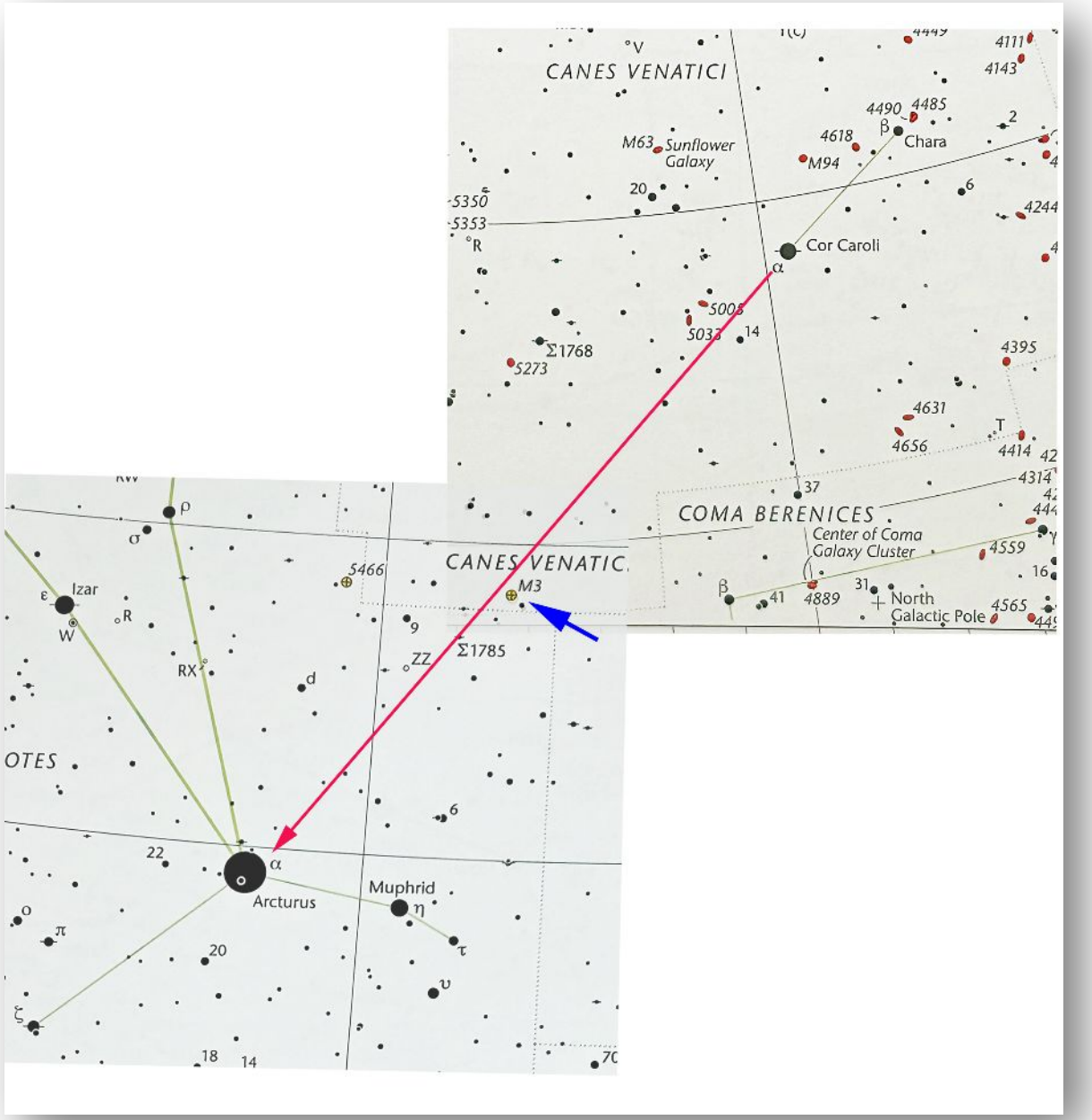
Ursa Major rides high overhead in Spring
it's Big Dipper asterism prominent

The bowl 'spills' galaxies down towards the Coma Cluster and Messier objects abound (Owl Nebula M97, Whirlpool Galaxy M51, Sunflower Galaxy M63 are great examples)

Note the star **Cor Caroli** (apex of the Spring Diamond circled in red) in the constellation Canes Venatici (KAY-neez vin-AT-iss-eye) below the handle of the dipper. A line from that star to Arcturus will help one find the magnificent globular cluster M3, close to the half-way point (as shown in the next slide)



# Globular Star Cluster M3

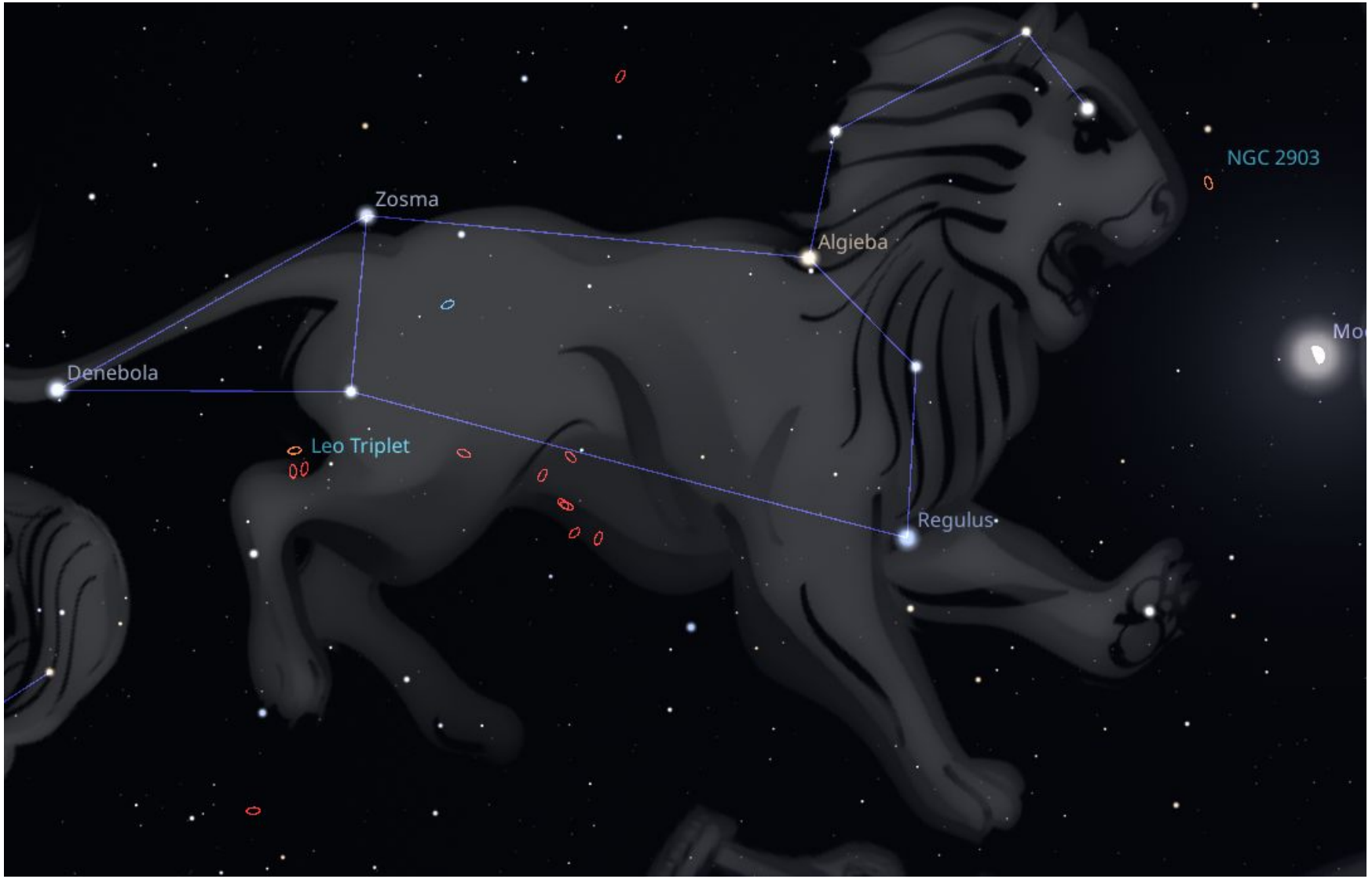


# LEO

Note the reverse ‘question mark’ shape or sickle shape with **Regulus** a bright B7 luminous star at Leo’s heart

**Algieba** is a bright, golden-yellow double star pair located roughly 130 ly away. Star separation is only 4.4 arc seconds but with good seeing and high power they can be separated in 4-6 inch scopes

There a 2 Leo Triplet galaxy groups; the one below the back leg of Leo is shown in next slide



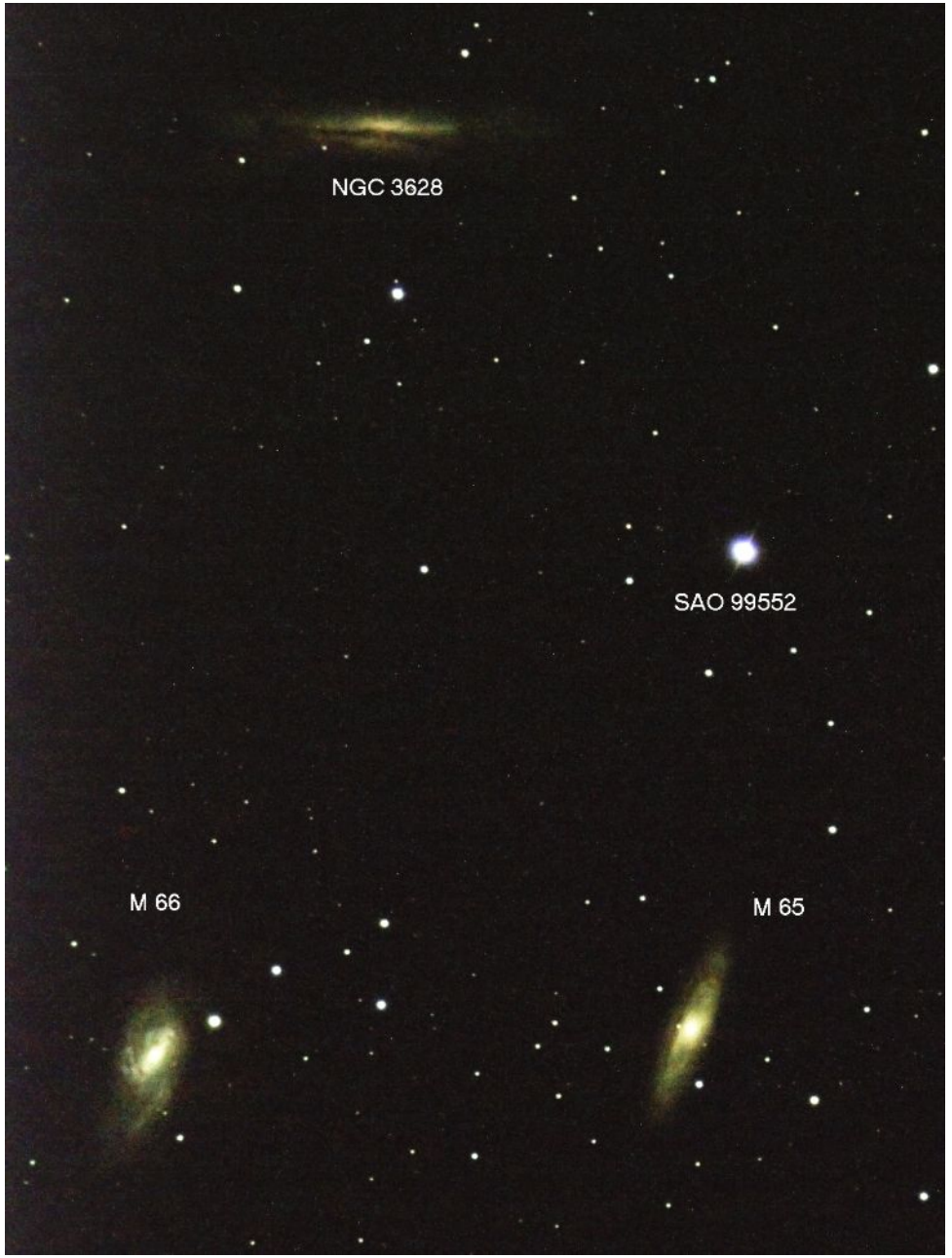
# Leo Triplet Galaxies

The three galaxies shown were taken with an 80 mm ED refractor and ZWO ASI 183MC camera.

The shape of NGC 3628 (warp in dust lane) and M66 (drawn out spiral arms) suggest there is an interaction

NGC 3628 (top) is also known as the hamburger galaxy

All these galaxies are about 35 Mly away



# VIRGO

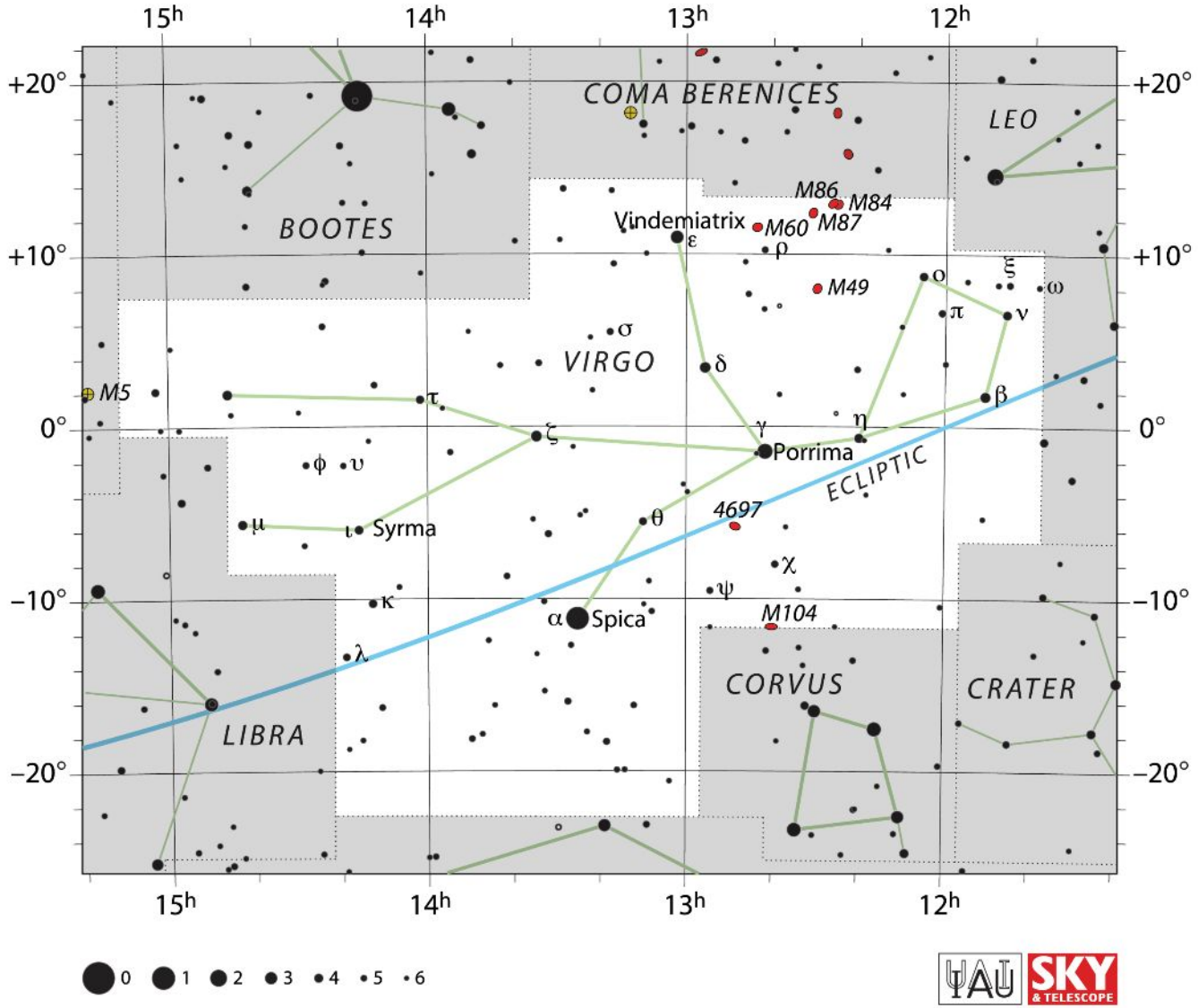
One of the largest constellations and biggest of the Zodiac's

Note how Spica, Arcturus and Denebola form a triangle

Note the 'Y' shape of the constellation

Note the famous galaxies at the north (M87) and south (M104) borders

Note the path of the ecliptic through the lower part of the constellation

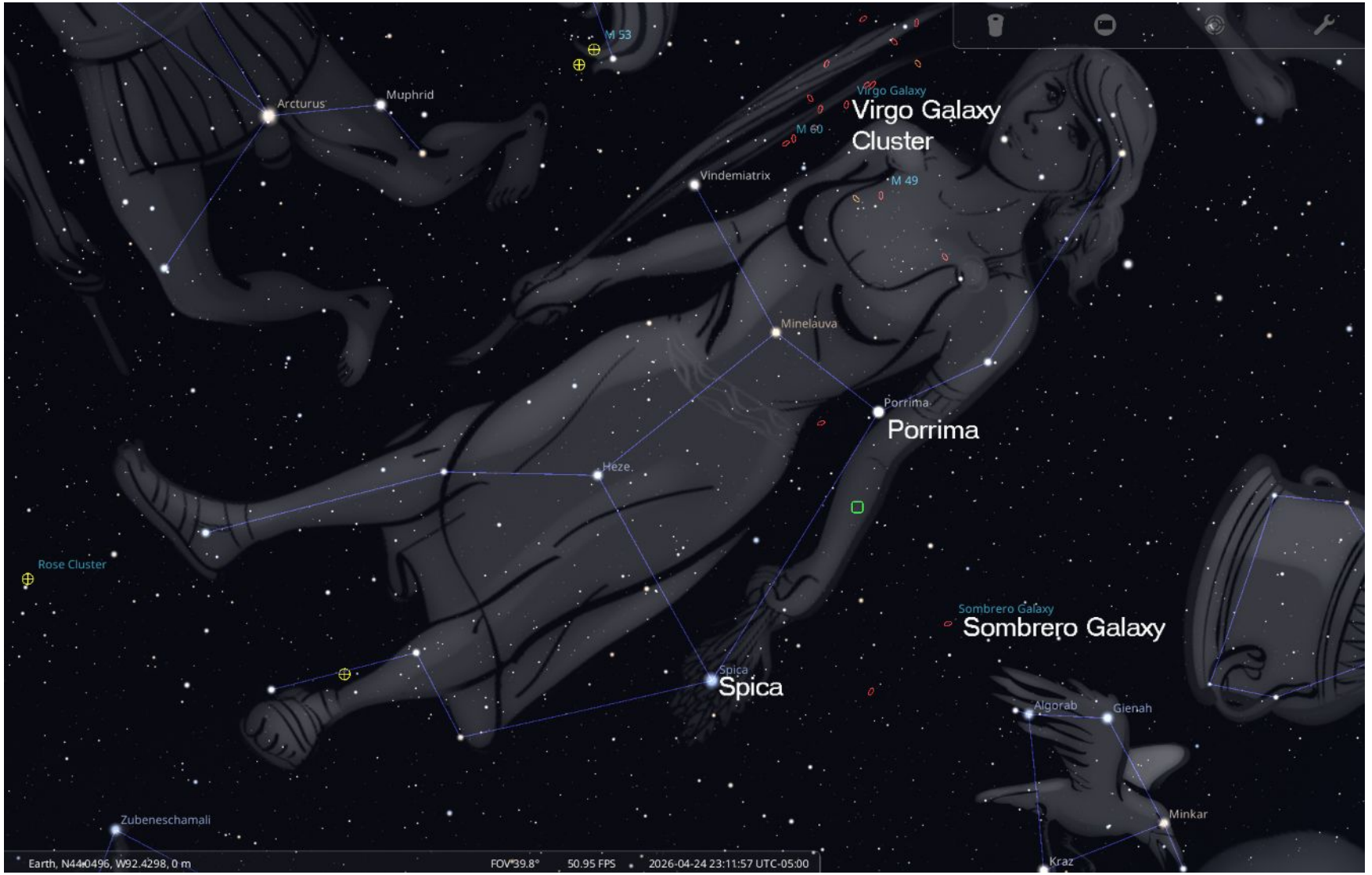


# VIRGO

**Spica** is a hot, spectroscopic binary B star 250 ly away
The name means ‘ear of grain’

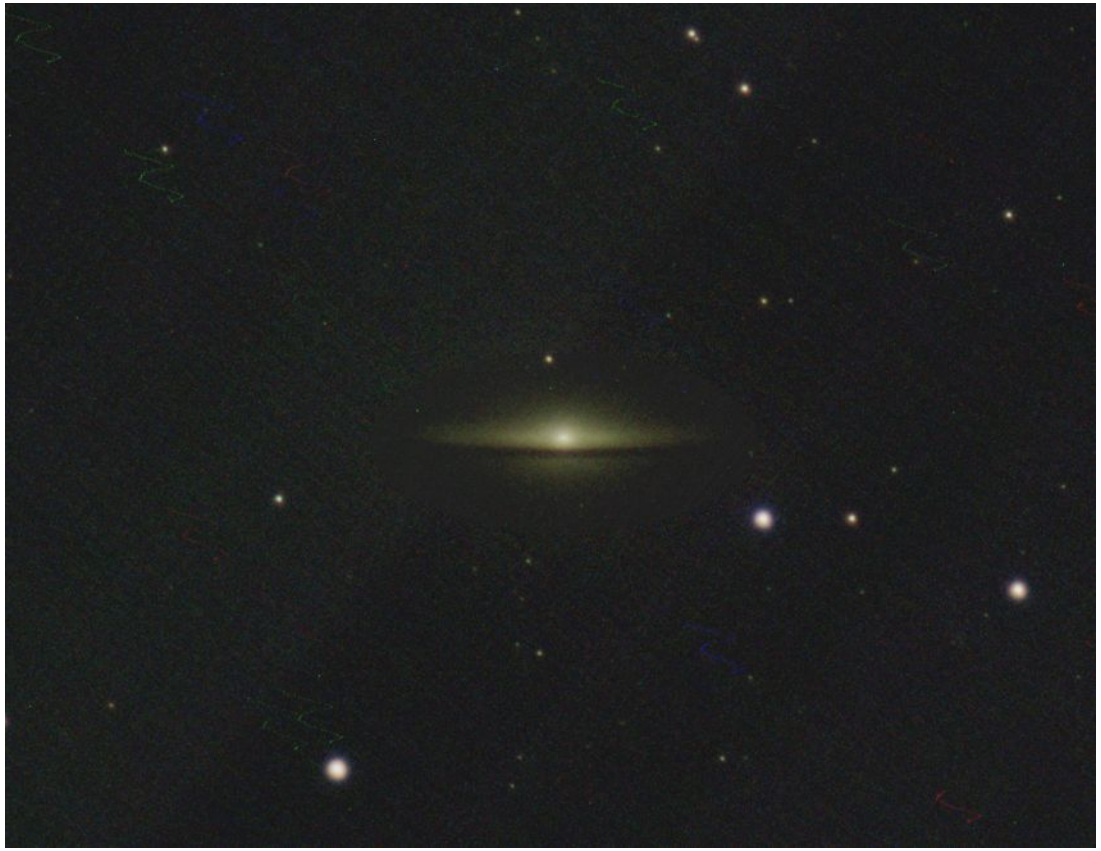
**Porrima** is a bright double star (two nearly identical yellow-white F0V stars with a 169-year orbit. To view them as separate, a medium-sized (4-inch or larger) telescope at high magnification (100x–200x) is generally required.

**Sombrero Galaxy** is a beautiful edge-on spiral and favorite of amateur astrophotographers



# M 104 galaxy in Virgo

Hubble image

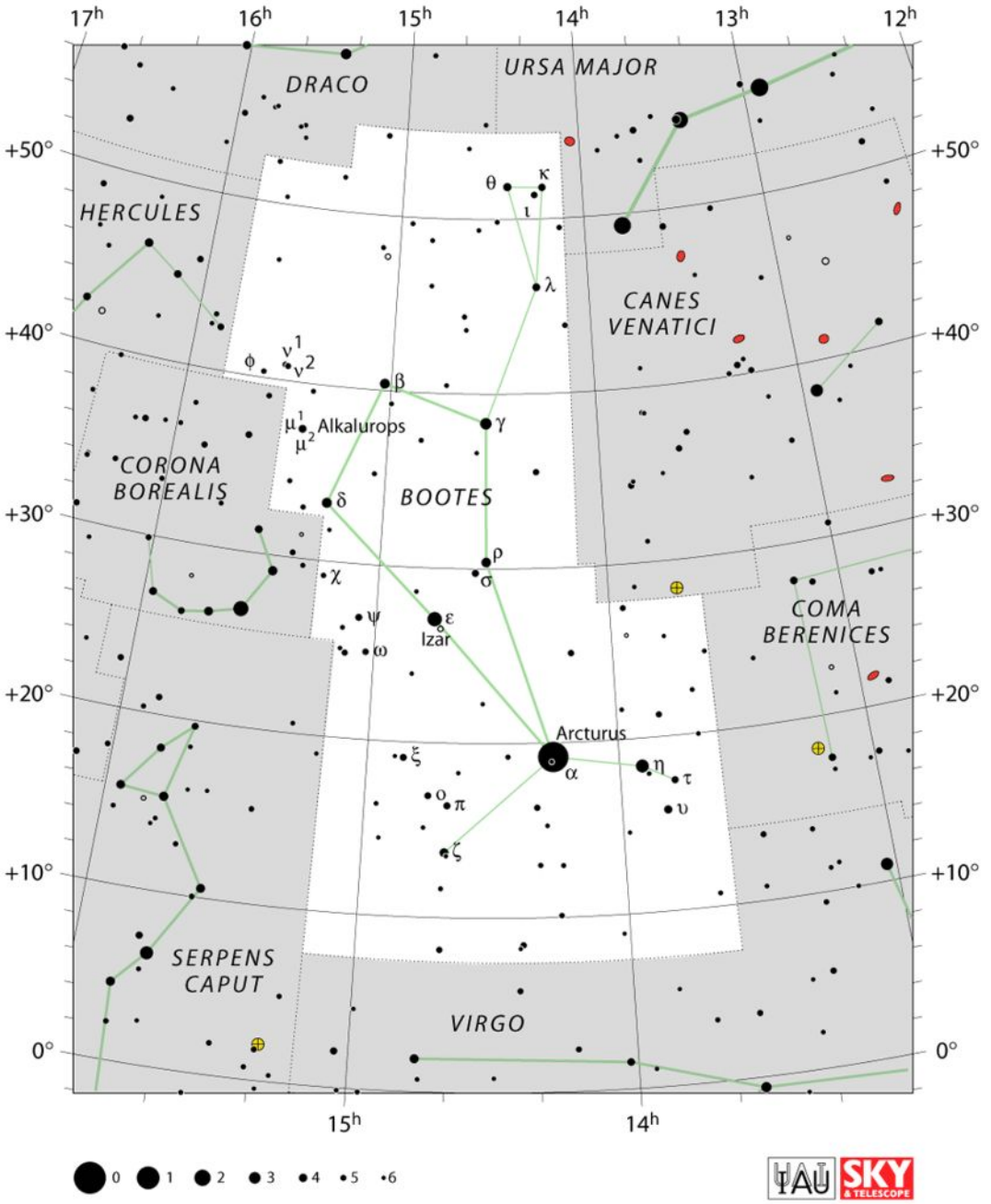


Small scope image

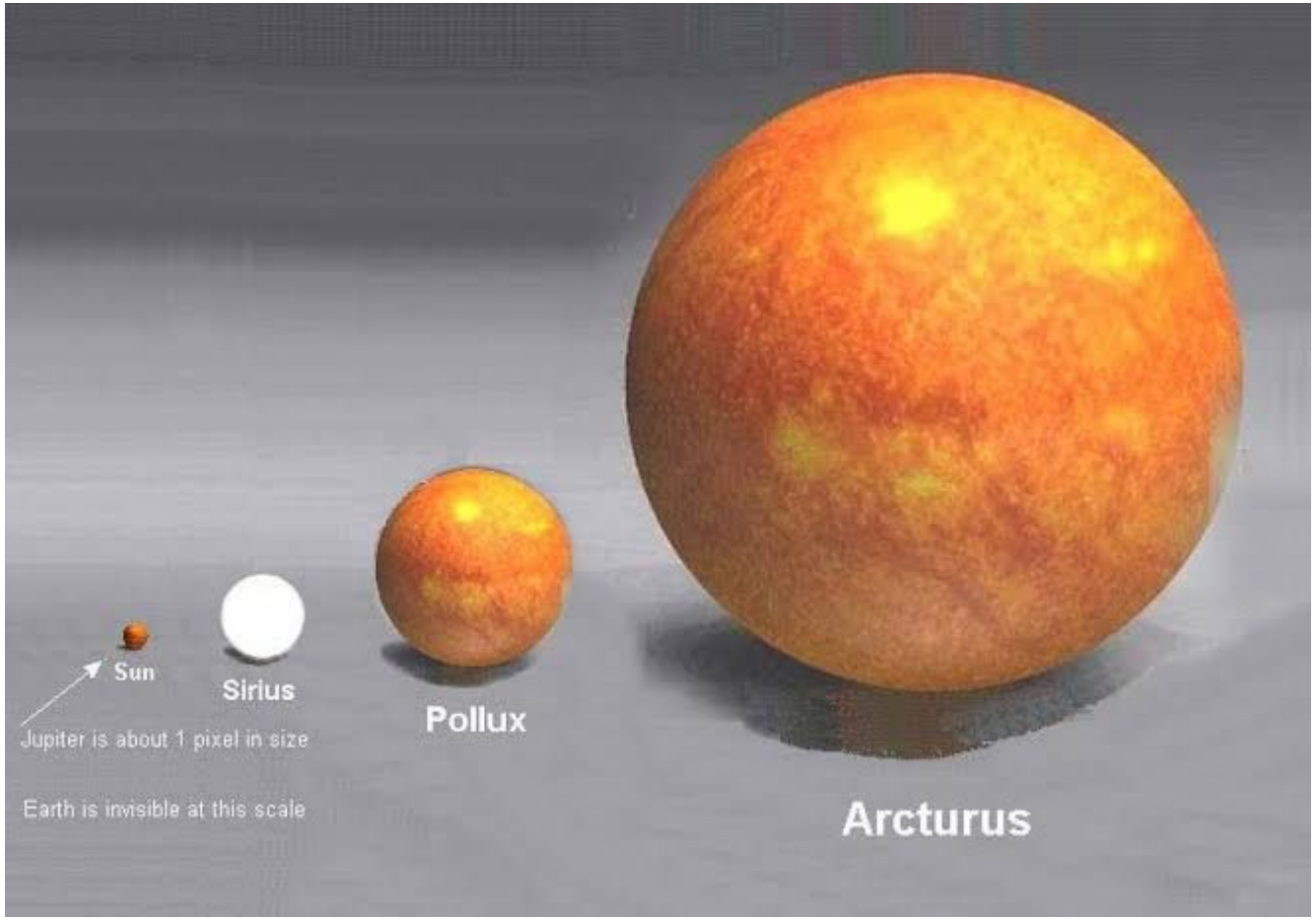
# Boötes (boh-OH-teez)

- Follow the arc of the Big Dipper handle to Arcturus and Boötes
- Looks a bit like a kite extending NE
- The star Izar (Pulcherrima) is a difficult double star to see in a small telescope
- Arcturus is a large orange giant and 4$^{th}$ brightest star in sky. It's 37 ly distant
- Boötes is depicted as a herdsman or a ploughman in mythology

# BOOTES


17h
16h
15h
14h
13h
12h
+50°
+40°
+30°
+20°
+10°
0°
DRACO
URSA MAJOR
HERCULES
CANES VENATICI
CORONA BOREALIS
BOOTES
COMA BERENICES
SERPENS CAPUT
VIRGO
Alkalurops
Izar
Arcturus
0 1 2 3 4 5 6
IAU
SKY & TELESCOPE

# Boötes (boh-OH-teez) and brilliant Arcturus




A 6-inch reflector view of Arcturus

# Spring observing in MN

BEFORE venturing outside due the following

1. Study a star map or the planisphere set for the proper date and time to become familiar with the visible constellations (especially the Big Dipper).
2. Use a compass or Stellarium to determine due south.
3. Choose a location away from bright lights and when the moonlight is minimal.
4. Dress warm and  have a pair of gloves
5. Bring your binoculars, red flashlight, compass, cell phone and extra batteries.
6. Spend 15 to 20 minutes in a dark room to acclimate night sky vision.
7. If you only use binoculars, a gravity chair will allow more stable and comfortable views and prevent (in older observers) neck strain.
8. Let someone know where you are going and when you will return