OAWS #2 NAVIGATING THE NIGHT SKY

Agenda

- 1- It’s Dark! Now What!
- 2- It’s Moving All the Time!
- 3- What’s That Pattern?
- 4- What Do I Need?
- 5- Find Me!
- 6- Books, Software and Catalogues
- 7- Next Challenges

It's Dark! Now What?

- As It Gets Dark
  - Moon, first stars, first planets
  - It takes between 1 to 2 hours after sunset before it gets dark.
  - Astronomy night begins when the Sun is 18 degrees below the horizon.
  - After sunset, planets and bright stars show up within half hour to 1 hour, dimmer stars and bright deep sky objects between 1 hour and 1.5 hours, Milky Way and dimmer deep sky objects after 1.5 hours.

It's Dark! Now What?

- Brightest Stars
  - Sirius, Arcturus, Procyon, Rigel, Betelgeuse, Aldebaran, Capella, Vega, Altair, Antares, Spica, Regulus, Fomalhaut
  - (demo)
- Recognizing Planets
  - Planets do not twinkle like stars.
  - Brightest planets: Venus, Jupiter
  - Other bright planets: Saturn, Mars, Mercury
  - Planets visible with a telescope: Uranus, Neptune, all minor planets

It's Moving All the Time!

- Evening, Midnight, Late Night
  - Objects rising in the evening will be in the South around midnight and set near sunrise.
  - Objects in East move towards South then West.
  - Evening objects in the West will set soon.
  - Late night objects in the East will rise earlier next month.

It's Moving All the Time!

- Sky Movement Throughout the Night
  - Objects rising in the Southeast will not stay in sky as long as objects rising the Northeast.
  - Objects rising the in South east will not get very high in the sky.
  - Objects rising due East will be 45 degrees above the horizon in the South because our latitude on Earth is 45 degrees North.
  - Objects in the North go around Polaris counter-clockwise.
  - Objects that are near the northern horizon will reach the zenith 12 hours later.
  - Polaris is about 45 degrees above the northern horizon from our latitude.

It's Moving All the Time!

- Sky Movement from Day to Day, Month to Month
  - Same time, next day, sky moved right by about 1 degree
  - Next month 2 hours earlier
  - Current evening sky is visible before sunrise the previous season.
  - (demo)

It's Moving All the Time!

- Moon Movement
  - Next day same time, about 12 degrees East
  - The Moon moves half a degree east (its own diameter) every hour with respect to the background stars.
  - Phases:
    - Full: visible all night, South near midnight
    - First quarter: South at sunset, sets near midnight
    - Last quarter: rises near midnight, South at sunrise
    - New: not visible at all
  - (demo)

What's That Pattern?

- Bright Star Patterns
  - Using a pattern to find another
  - Major Patters: Orion, Ursa Major, Summer triangle, Scorpius, Sagittarius, square of Pegasus Leo, Cassiopeia, Winter octagonal

Orion

Big Dipper (part of Ursa Major)

Summer Triangle

Sagittarius & Scorpius

Square of Pegasus

Cassiopeia

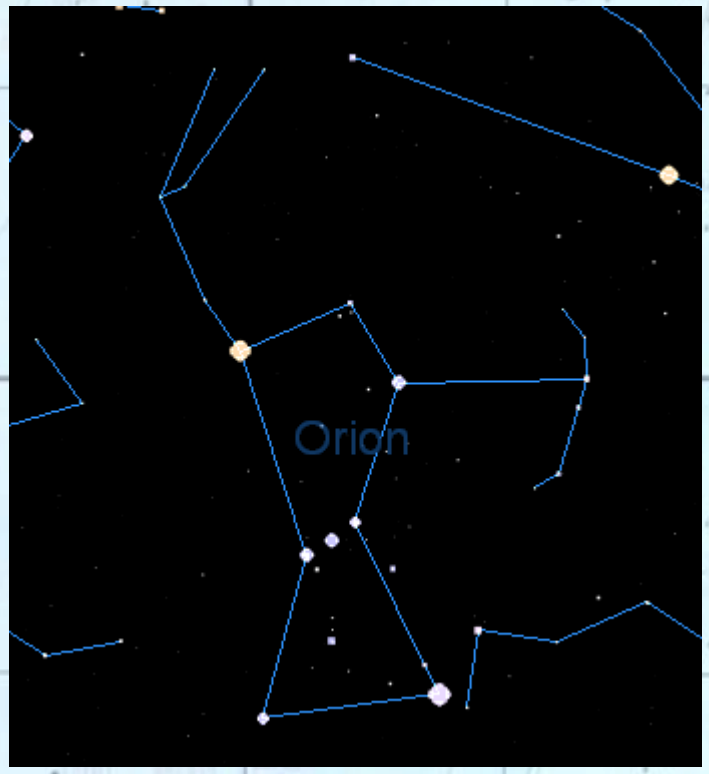
Winter Octagonal

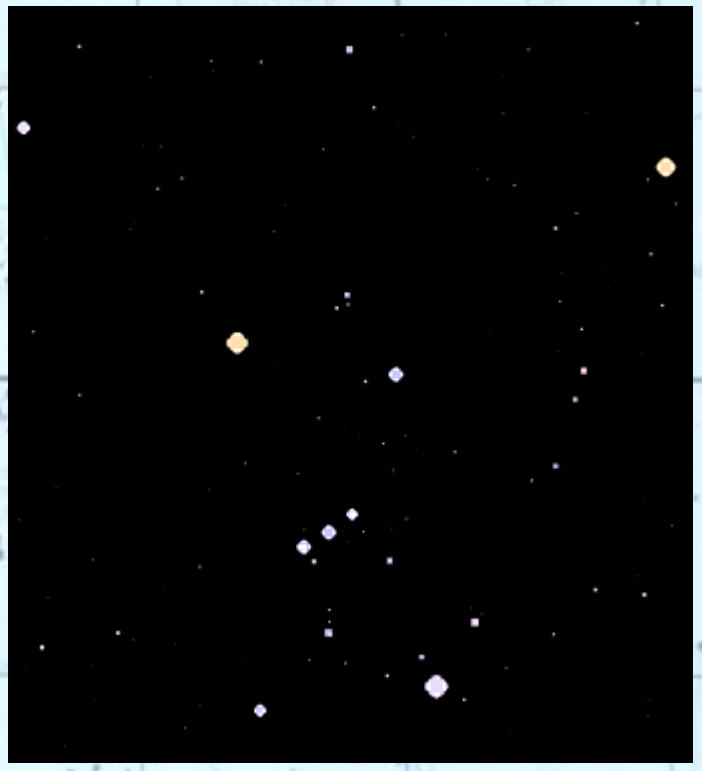
Leo

Leo and Jupiter

What's That Pattern?

- Constellation Patterns Lines
  - Imaginary lines linking the bright stars

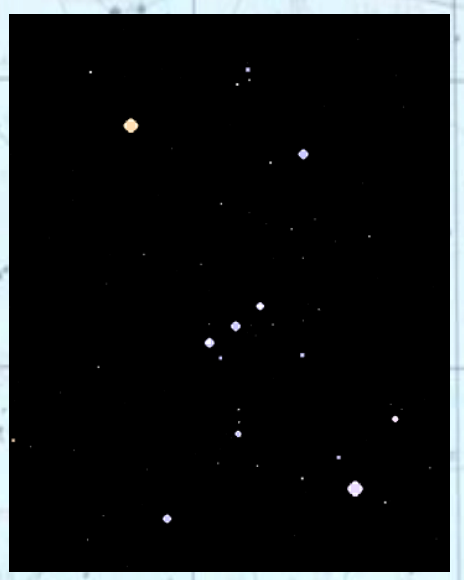




What's That Pattern?

- Constellation Orientation East, South, West
  - When rising in the East, right side is higher in the sky compared to left side
  - When setting in the West, right side is lower in the sky compared to the left side

Orion from East to West



South

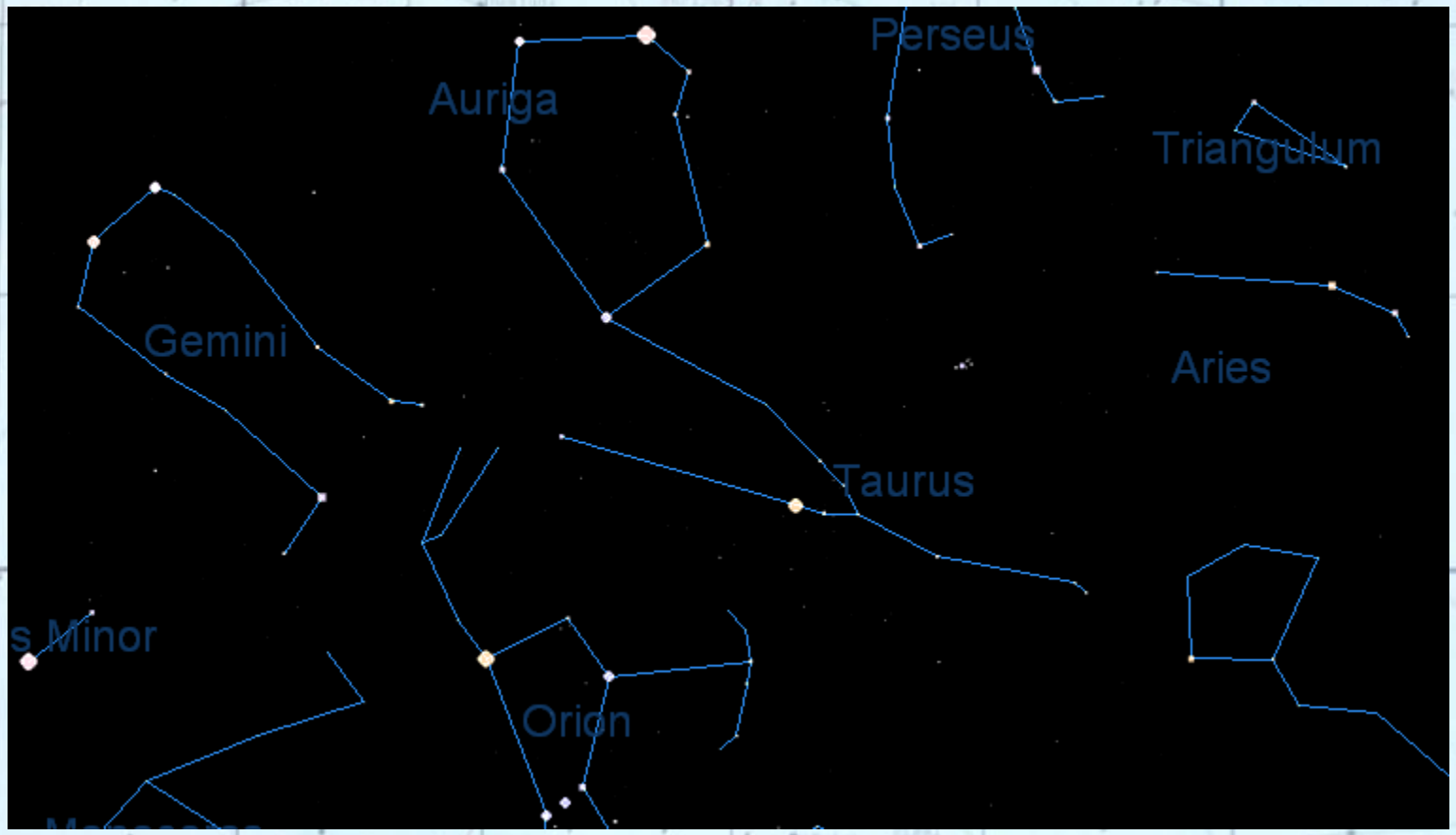
East

West

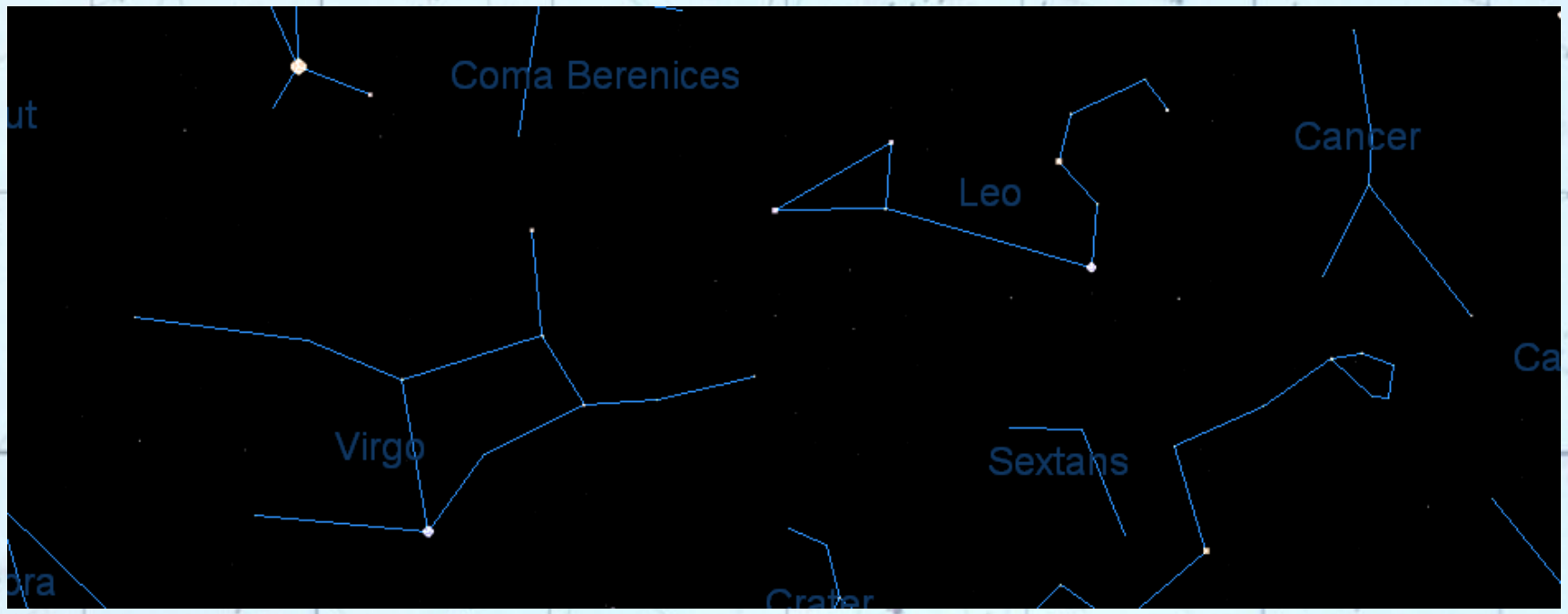
What's That Pattern?

- Zodiac Constellations
  - Constellations that the Sun goes through during the year
  - 12 classical constellations but Sun goes through 13, Ophiuchus is the extra one

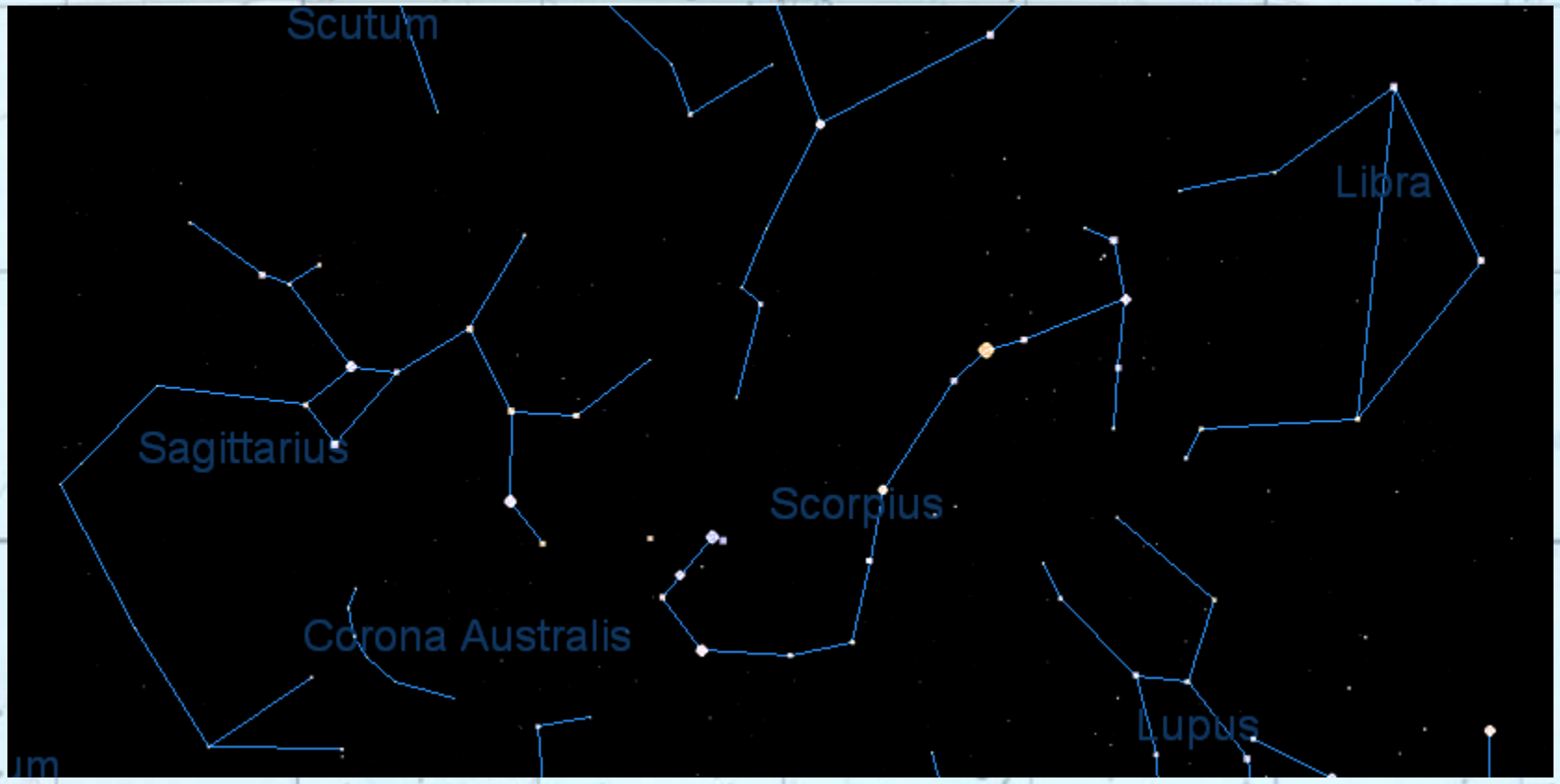
Gemini, Taurus, Aries



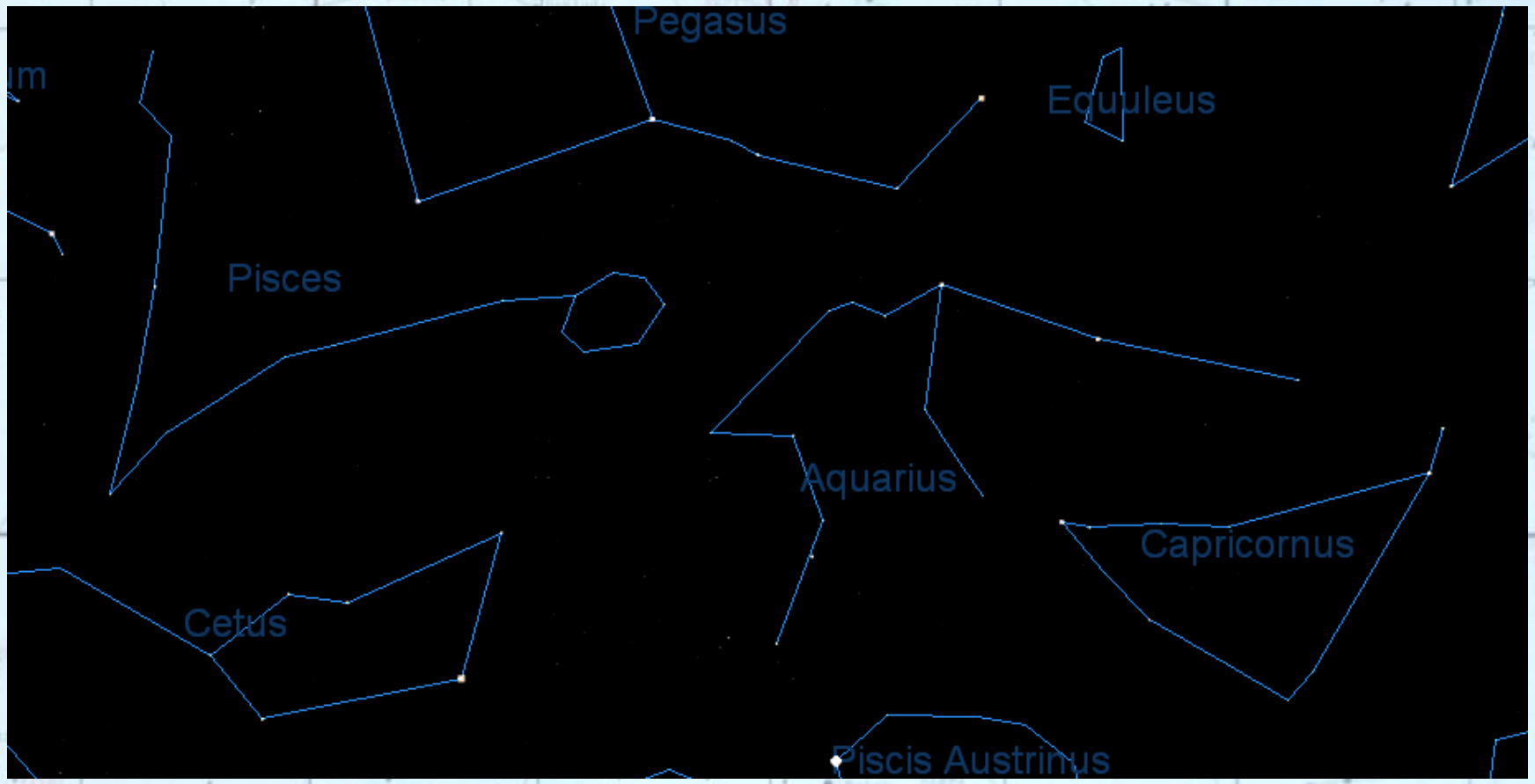
Virgo, Leo, Cancer



Sagittarius, Scorpius, Libra



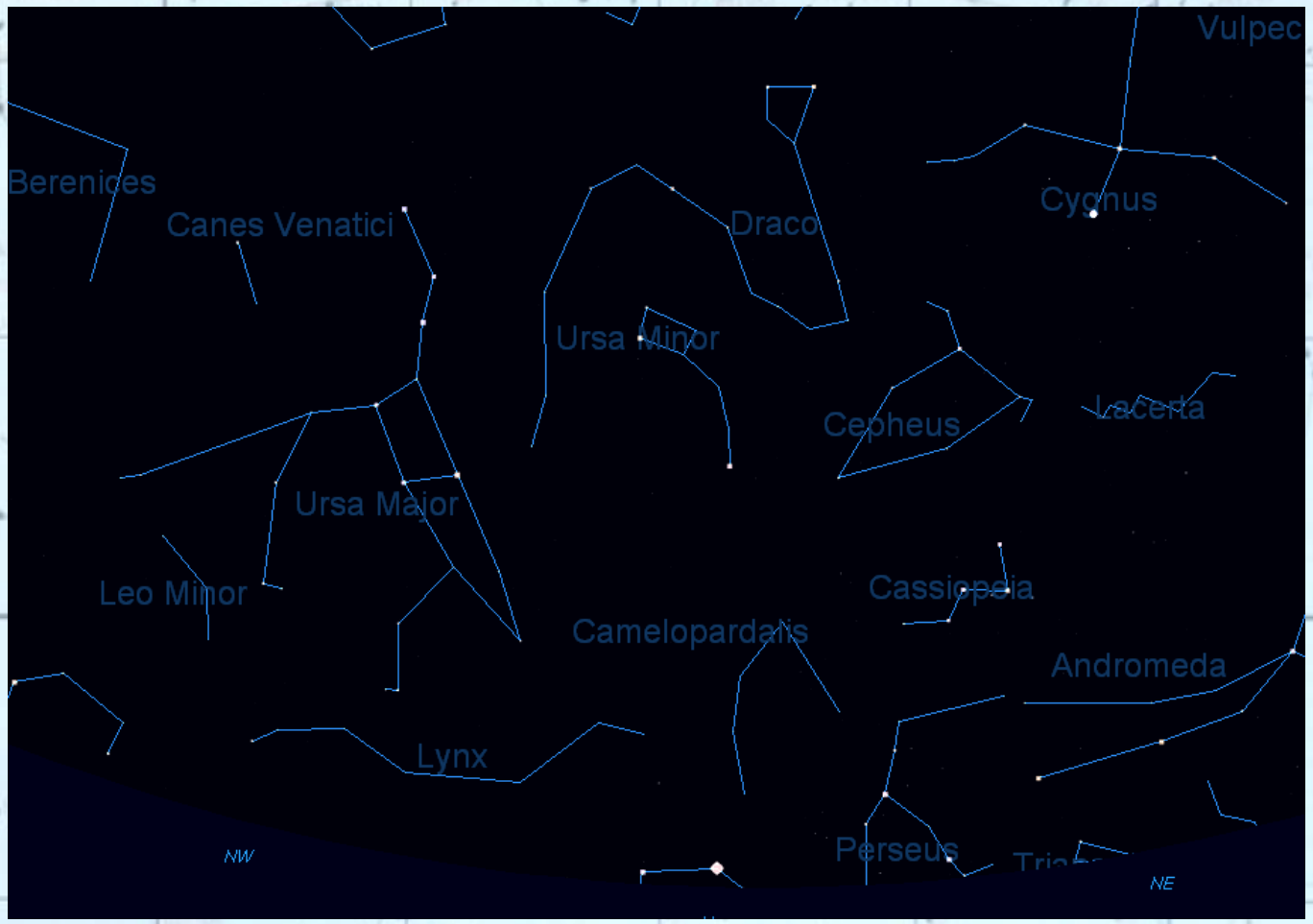
Pisces, Aquarius, Capricornus



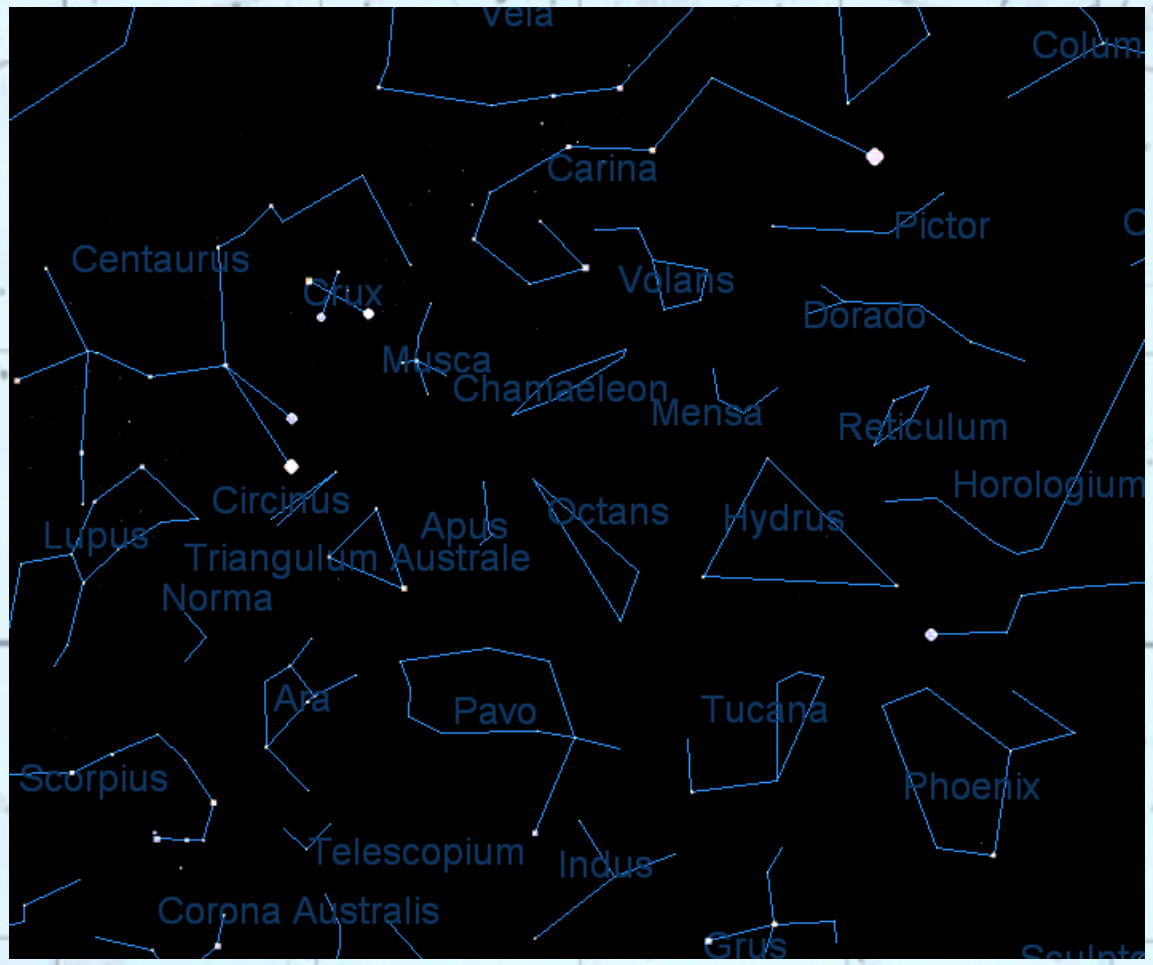
What's That Pattern?

- Circumpolar Constellations
  - Northern Constellations: Usra Major, Ursa Minor, Draco, Cepheus, Cassiopeia, Camelopardalis
  - Southern Constellations : Octans, Chameleon, Apus, Mensa, Hydrus, Volans, Pavo, Carina, Triangulum Australe, Dorado, Reticulum, Tucana, Pictor, Crux, Circinus, Centaurus, Ara, Indus, Horologium, Phoenix, Vela, Norma, Musca, Telescopium

Northern Circumpolar Constellations



Southern Circumpolar Constellations

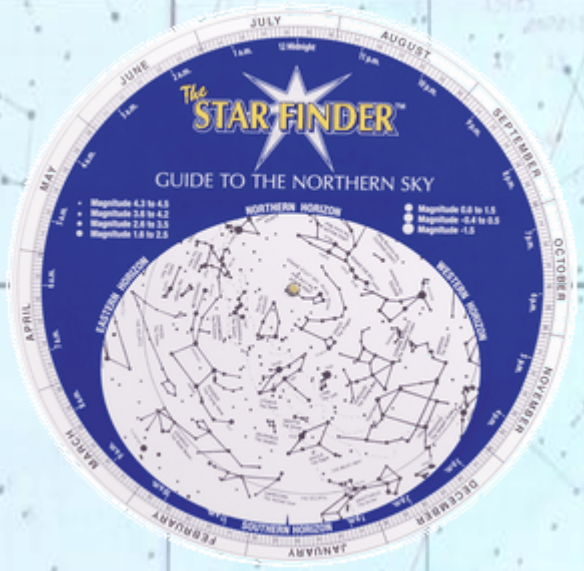


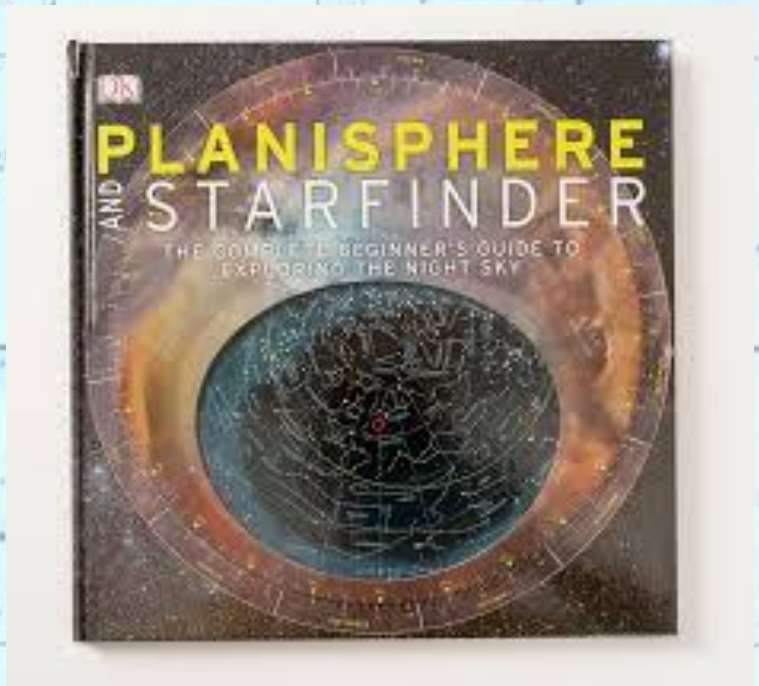
What's That Pattern?

- Seasons & Constellations
  - Winter: Orion, Taurus, Gemini, Aries, Canis Major, Auriga, Perseus, Eridanus, Lepus, Canis Minor
  - Spring: Leo, Cancer, Virgo, Hydra, Canes Venatici, Coma Berenices, Corvus, Crater, Ursa Major
  - Summer: Scorpius, Sagittarius, Libra, Bootes, Hercules, Cygnus, Lyra, Aquila, Ophiuchus, Serpens
  - Autumn: Capricornus, Aquarius, Pisces, Andromeda, Pegasus, Cetus, Piscis Austrinus

What Do I Need?

- Star Finder
  - Good starter tool to learn the sky and how it moves through time





What Do I Need?

- Sky Charts
  - Wide variety
- Binoculars
  - To recognise dimmer star patterns
  - To see brightest deep sky objects

What Do I Need?

- Telescope Types and Features
  - Refractor, Newtonian, Dobsonian, Maksutov, Schmidt Cassegrain, Ritchey-Chrétien
  - Goto
  - Tracking

What Do I Need?

- Finding Tool
  - Finder's Scope
  - Telrad
  - Dot/Star Pointer Finder

What Do I Need?

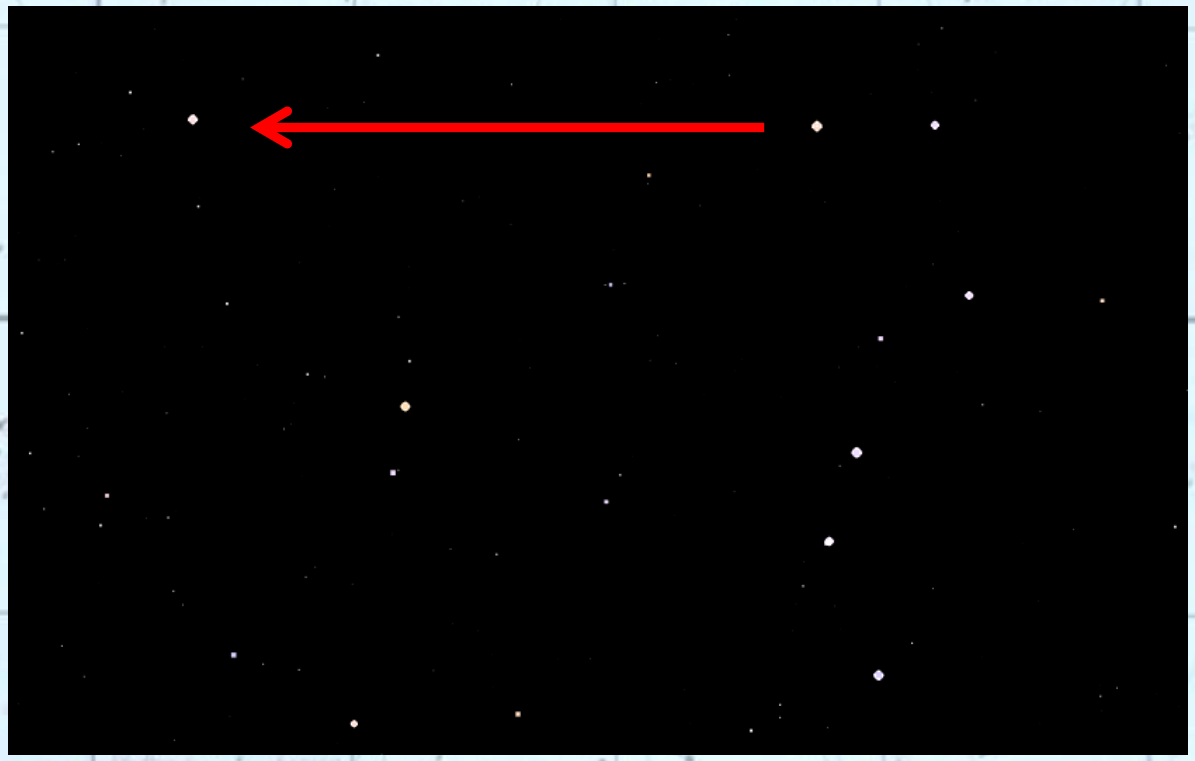
- Cameras
  - Video cameras (such as Mallincam)
  - DSLR cameras
  - CCD cameras
- Tablets, Smart Phones, Laptops, Notebooks
  - Portable, lots of software to choose from

Find Me!

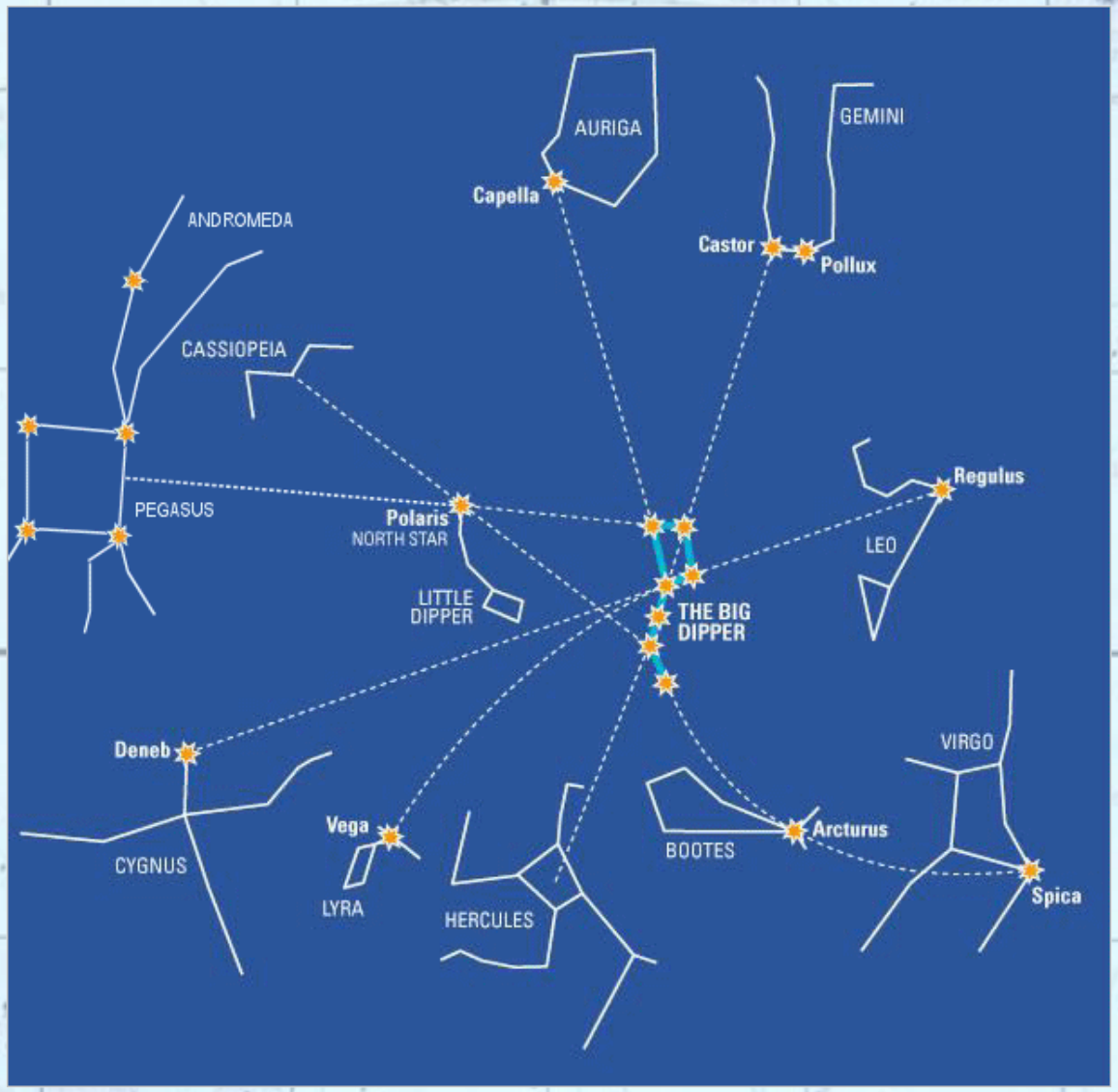
- Star Hopping / Sky Navigation
  - Navigate from star patterns to star patterns until reaching the location of target objects
  - Using sky charts
  - Using a star finder
  - Using of tablets with astronomy software
  - (demo)

Find Me!

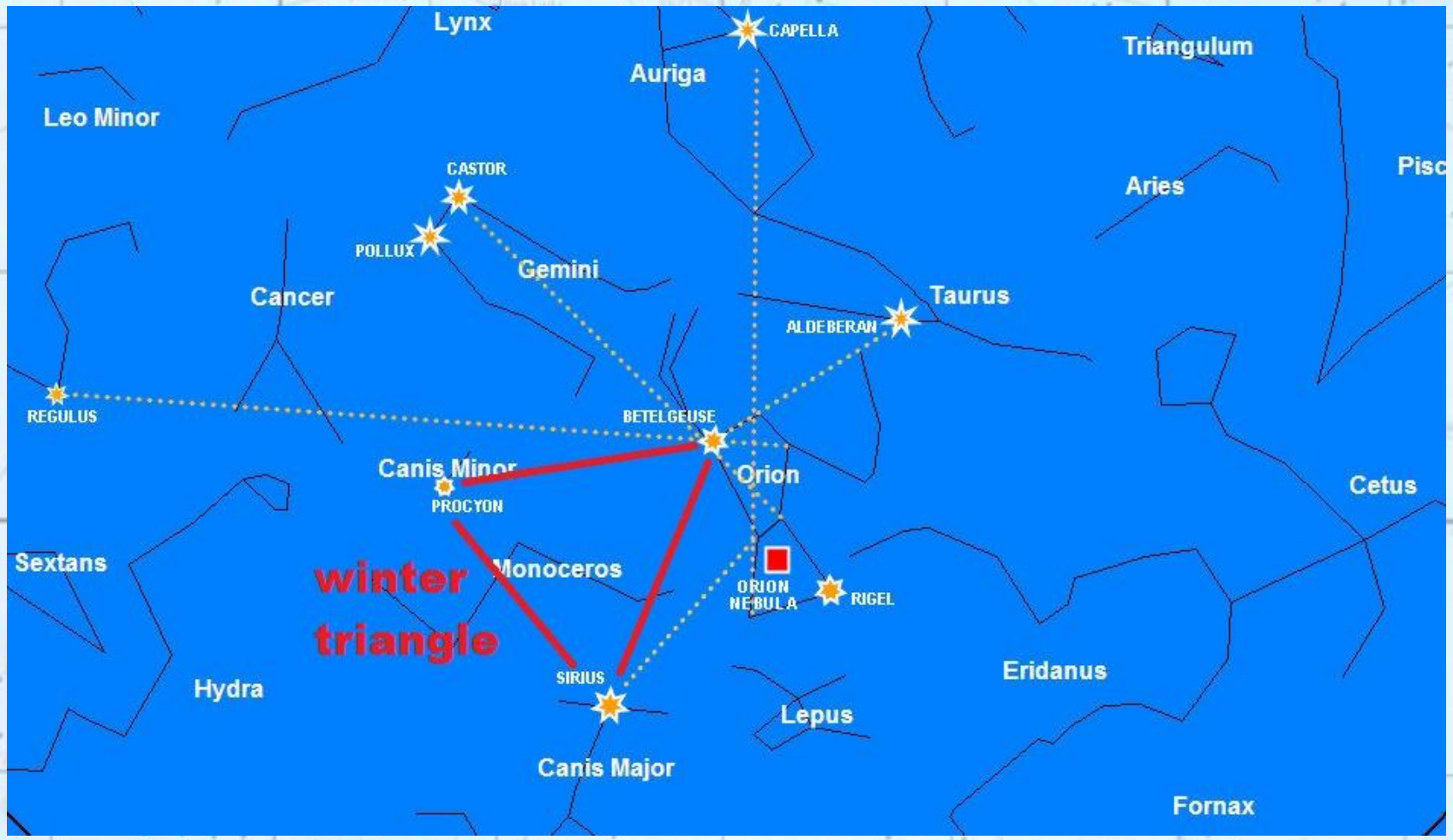
- Finding Polaris
  - Use star Dubhe (alpha) and star Merak (beta) of the Big Dipper (Ursa Major), they lineup to Polaris



From the Big Dipper (Ursa Major)



From Orion


Lynx
CAPELLA
Auriga
Triangulum
Leo Minor
CASTOR
POLLUX
Gemini
Aries
Cancer
Taurus
ALDEBERAN
REGULUS
BETELGEUSE
Canis Minor
PROCYON
Orion
Cetus
Sextans
winter
triangle
Monoceros
ORION
NEBULA
RIGEL
Eridanus
Hydra
SIRIUS
Lepus
Canis Major
Fornax

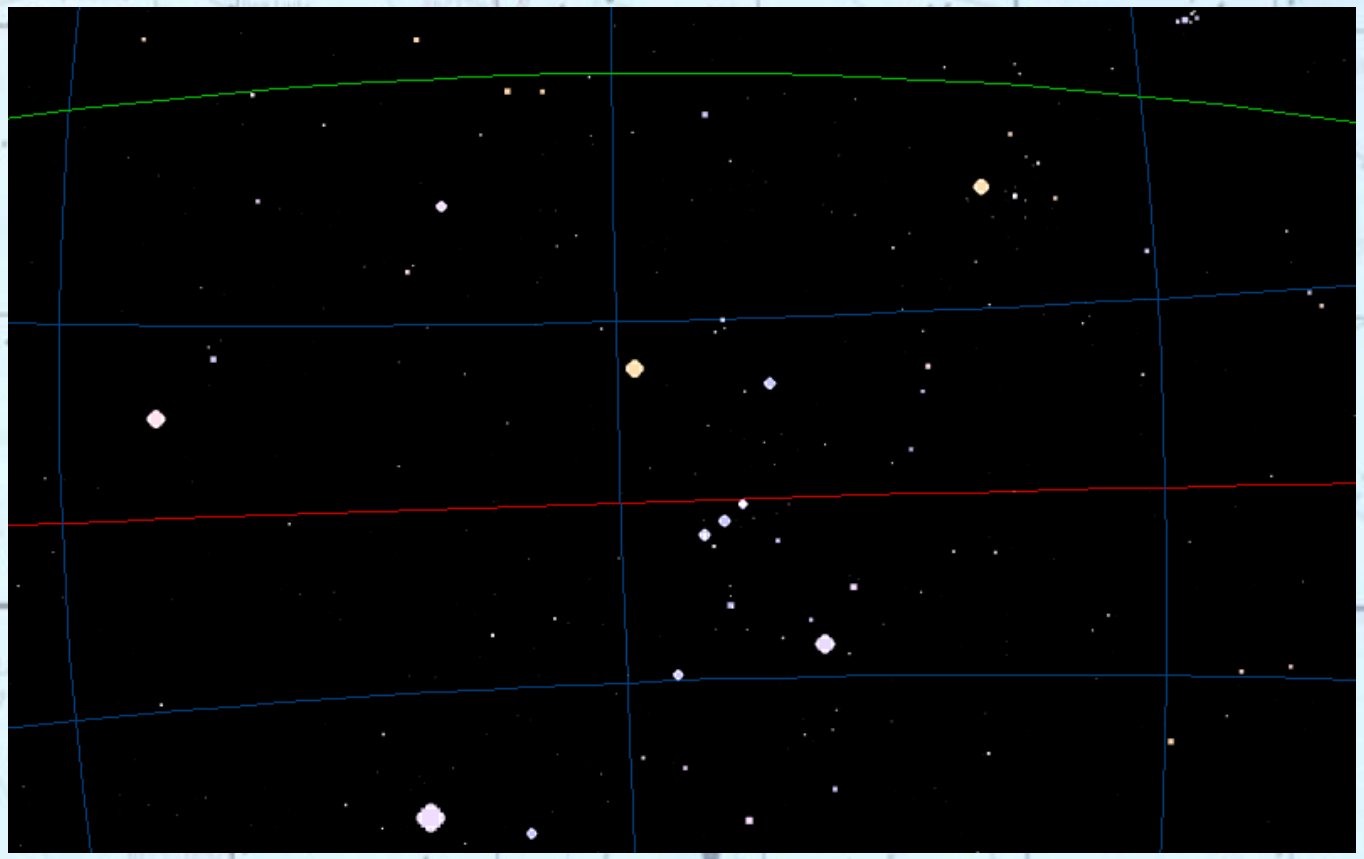
Find Me!

- Telescope Star Hopping / Sky Navigation
  - Easier with a Telrad or Star Pointer
  - Harder with a finder scope
  - Navigate from star patterns to star patterns until reaching the location of target objects
    - Tricky with some telescopes
    - Need detailed sky charts
    - Easier to use sky charts with a newtonian telescope, no diagonal prism
  - A diagonal prism will flip the view
  - Using tablets with astronomy software
  - (demo)

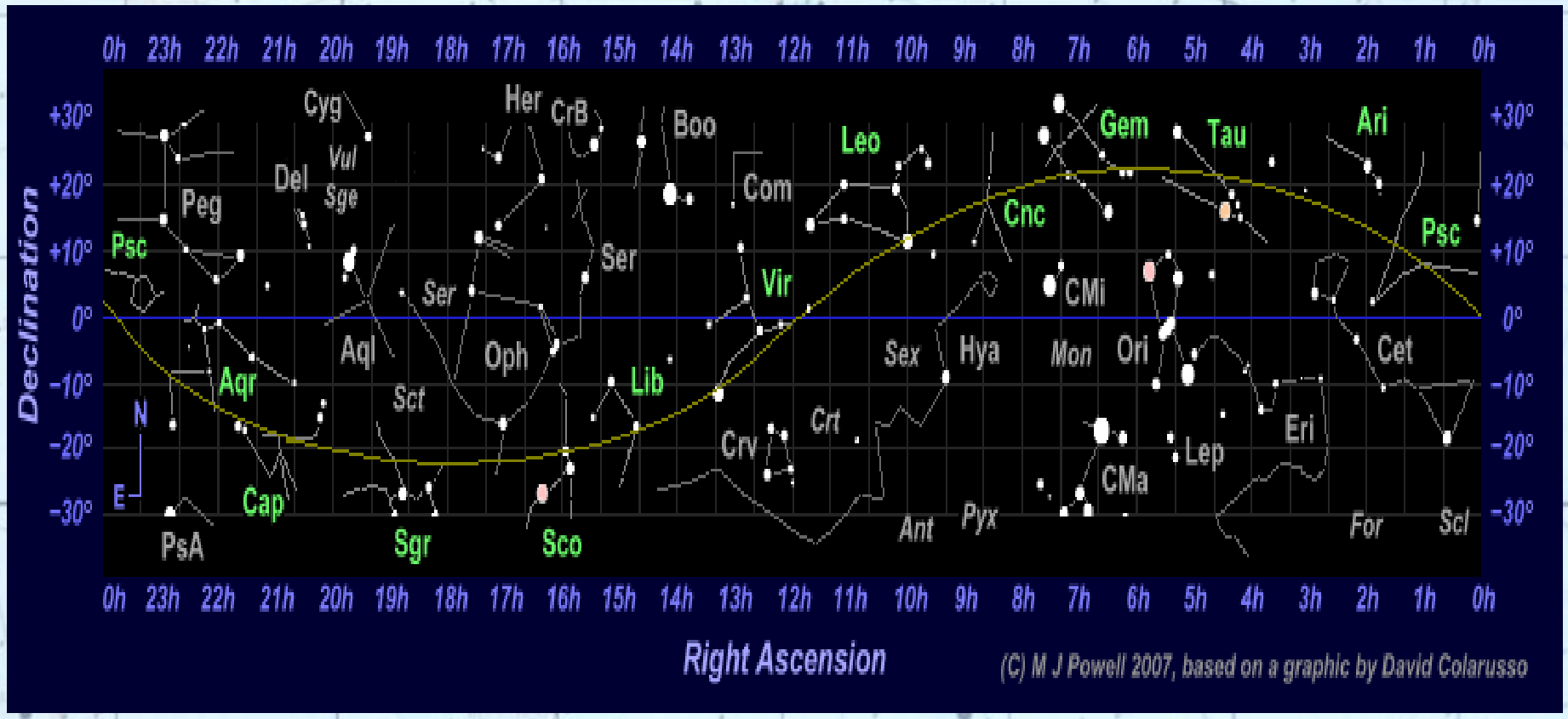
Find Me!

- RA, Dec
  - Right Ascension (RA), divides the sky into 24 hours, similar to longitudes on Earth
  - Declination (Dec): parallel lines from the North pole to the South pole, from +90 degrees to -90 degrees, similar to latitudes on Earth
  - RA and Dec values from stars and deep sky objects changes over time mainly due to precession
  - The lowest Dec we can see depends on our latitude. For Ottawa at 45.5 N latitude means that technically we see as far south at Dec -44.5
- Celestial Equator: Declination of 0 degree
- Ecliptic: The path followed by the Sun though out the year

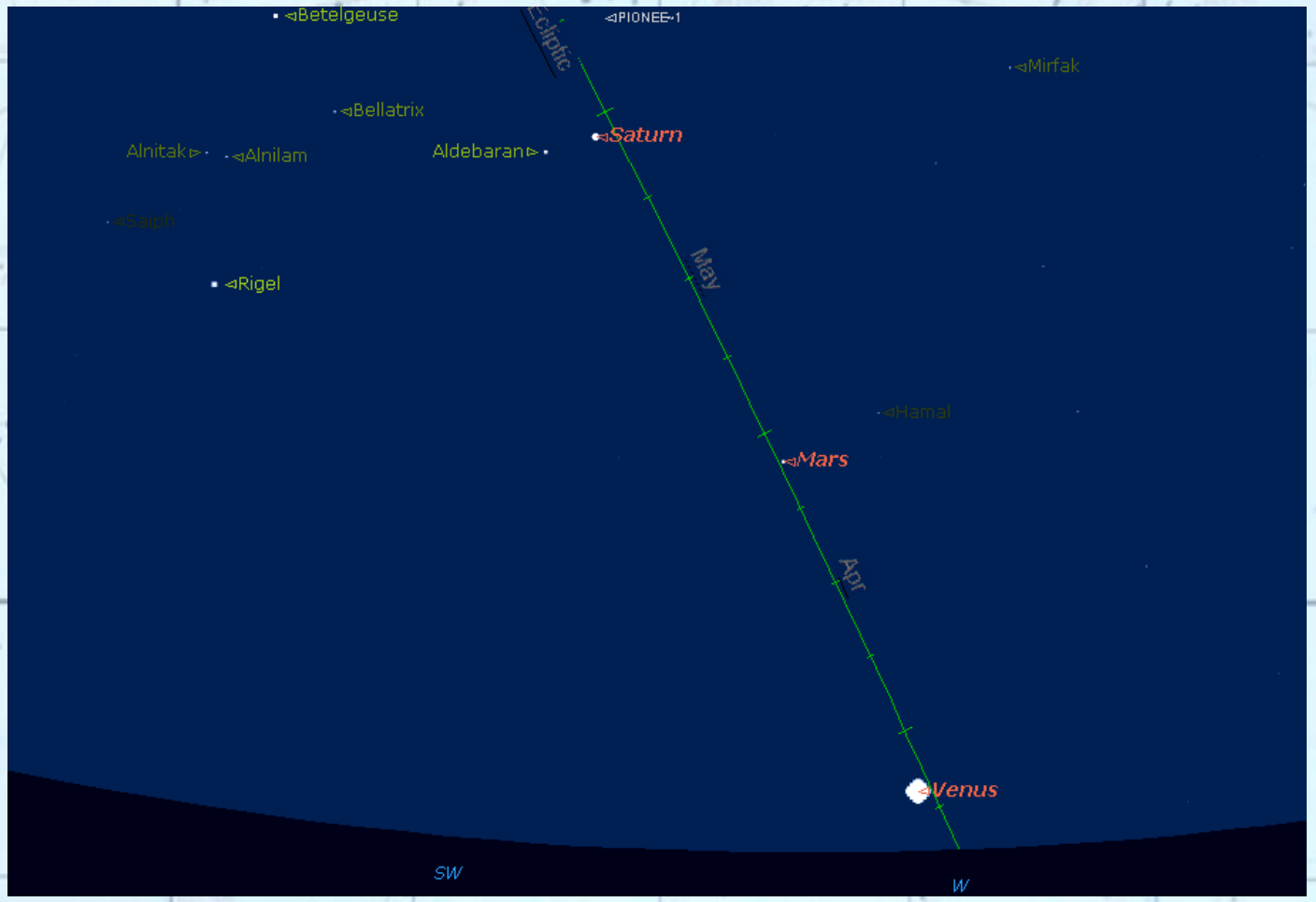
Find Me!



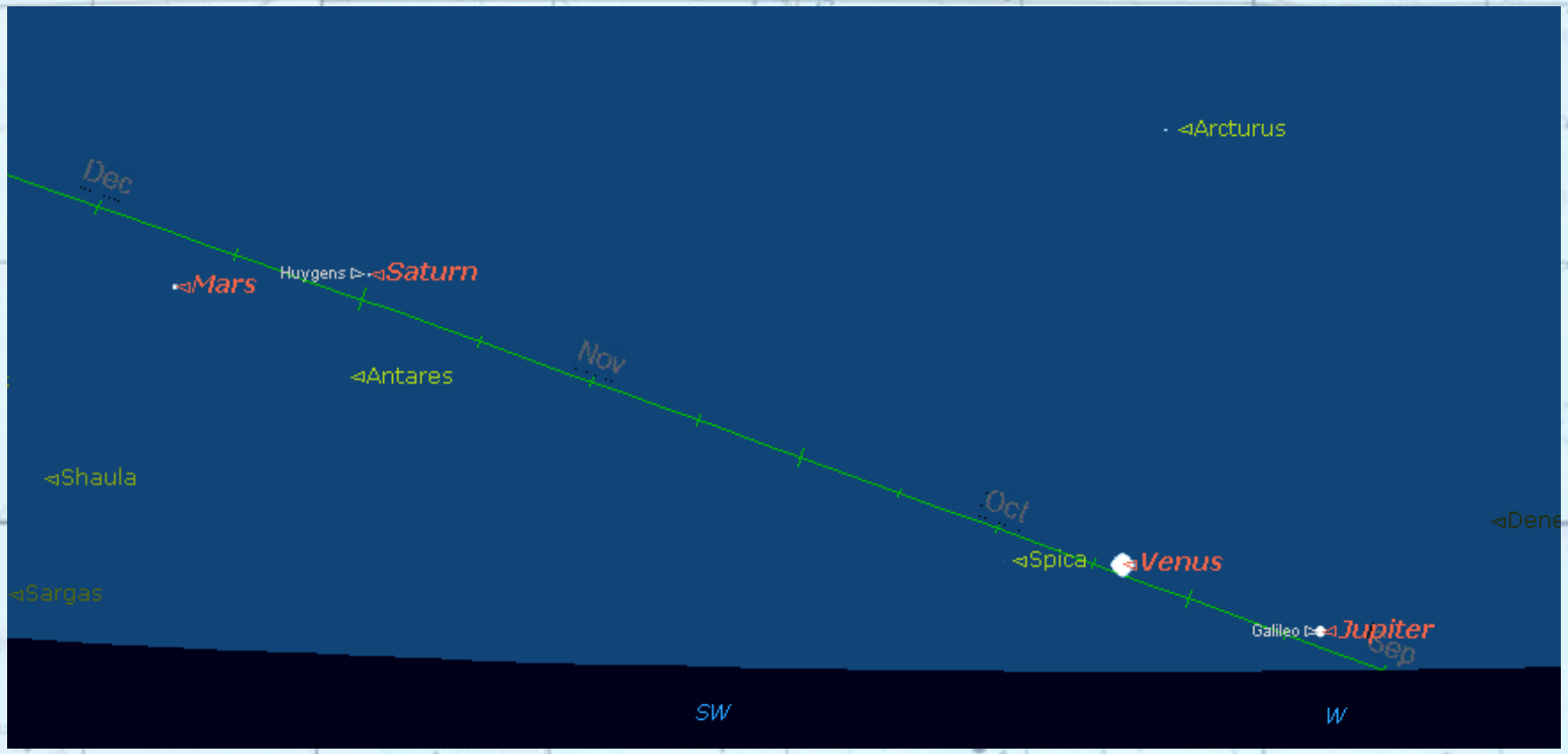
Ecliptic


0h 23h 22h 21h 20h 19h 18h 17h 16h 15h 14h 13h 12h 11h 10h 9h 8h 7h 6h 5h 4h 3h 2h 1h 0h
+30° +20° +10° 0° -10° -20° -30°
Declination
Cyg
Her
CrB
Boo
Leo
Gem
Tau
Ari
Vul
Del
Sge
Peg
Com
Cnc
Psc
Ser
Vir
CMi
Ser
Aql
Oph
Sex
Hya
Mon
Ori
Cet
Aqr
Lib
Sct
Crv
Crt
Eri
N
Lep
E
Cap
CMa
PsA
Sgr
Sco
Ant
Pyx
For
Scl
Right Ascension
(C) M J Powell 2007, based on a graphic by David Colarusso

Ecliptic, Spring at Sunset



Ecliptic, Fall at Sunset



Find Me!

- Brightness Magnitude
  - Logarithmic scale of brightness, negative means very bright, positive means dimmer
  - Sun at -26, Moon between -9 and -13, Venus -4, Jupiter -2.5, Sirius -1.46, other bright stars between -0 and +2, Saturn near 0, Mars between +2 and -2, Uranus +5.7, Neptune +8, Pluto +14
  - Dimmest magnitude visible to the unaided eye from the city: +2 to +4 depending on the sky conditions.
  - Dimmest magnitude visible to the unaided eye from a very dark site: +7
  - Dimmest magnitude visible from an 8 inch telescope without cameras from a dark site: +13
  - Dimmest magnitude visible from an 8 inch telescope with video camera such as the Mallincam from a dark site: +20

Books, Software and Catalogues

- Books
  - Peterson Field Guides, Starts and Planets
  - The Audubon Society, Field Guide to the Night Sky
  - NightWatch
  - Sky Atlas 2000
  - Sky Atlas 2000 Companion
  - Uranometria (3 volumes)
  - Millenium Atlas (3 volumes)
  - Burnham Celestial Handbook (3 volumes)
  - Sky Catalog 2000
  - The Night Sky Observers Guide (2 volumes)

Books, Software and Catalogues

- Software
  - Too many to list
  - Some of the most popular:
    - Sky Safari, Starry Night, Red Shift, The Sky, Voyager, Starmap, SkyView, Astromist, GoSkyWatch, Desktop Universe, Guide 8

Books, Software and Catalogues

- Deep Sky Catalogues
  - Messier
    - 110 objects
  - Caldwell
    - 109 objects
  - NGC
    - 7000+ objects
  - IC
    - 5000+ objects
  - Many other catalogues
    - UGC, PGC, ESO, Barnard, Abell, Hickson, Zwickey,
    - Stock, Mellote, Collinder, Trumpler, Palomar, PK, lots more

Next Challenges

- Finding all the constellations
  - 88 total
  - 67 we completely or partially see form our latitude
  - 21 not visible or almost entirely not visible from our latitude
- Observing all Messier objects
  - 110 objects
  - Contains mostly open clusters, globular clusters, nebulae, galaxies
  - Odd Messier objects: M24, M40, M73
  - Contested Messier objects: M102, M110
  - All visible from our latitude

Next Challenges

- OAOG Challenge
  - List for the Ottawa area (45°N)
  - 600 objects
  - 5 levels
- RASC Observing Lists
  - Deep-Sky Gems
  - Finest NGC Objects

Next Challenges

- Messier Marathon
  - 5 minutes for each objects
  - Last 2 weeks of March
  - Tough Messiers objects during the marathon: M74, M77, M55, M72, M73, M75
  - No M30 for us during the marathon
- Make your own list
  - Globular Cluster Marathon
  - List of Double Stars
  - List of Variable Stars
  - Open Cluster Marathon

Questions

- Web sites:
  - OAOG yahoo groups:
    https://groups.yahoo.com/neo/groups/OAOG/info
  - RASC:
    http://www.rasc.ca/
  - CPO (Couch Potato Observatory):
    http://www.astrocpo.com/
  - Heavens Above:
    http://www.heavens-above.com

- Software used for this presentation:
  - Starry Night Pro Plus version 5.8