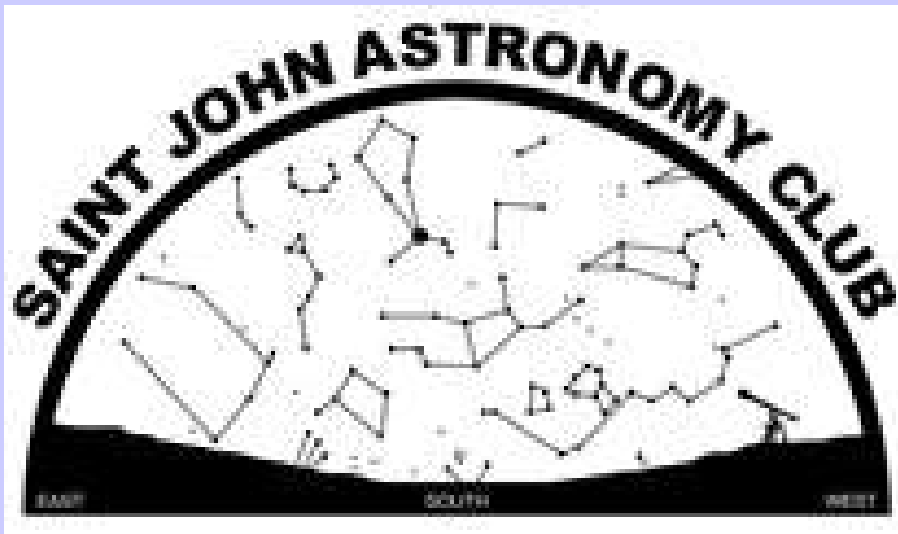


ROYAL  
ASTRONOMICAL  
SOCIETY  
OF CANADA



# Explore the Universe Observing Certificate and Pin



# Requirements

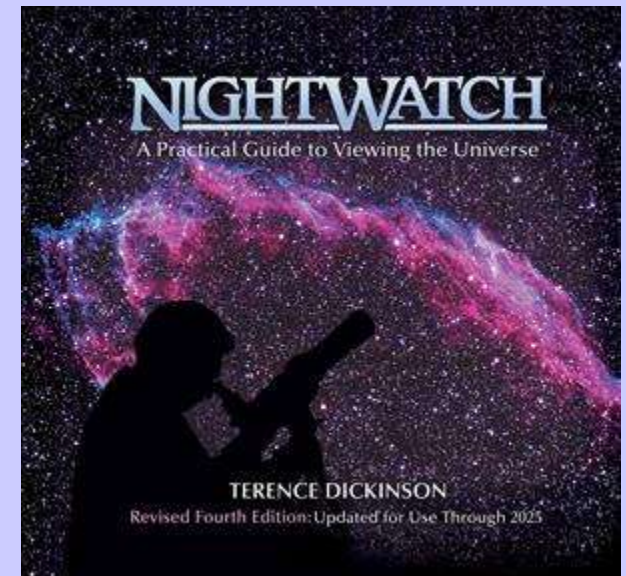
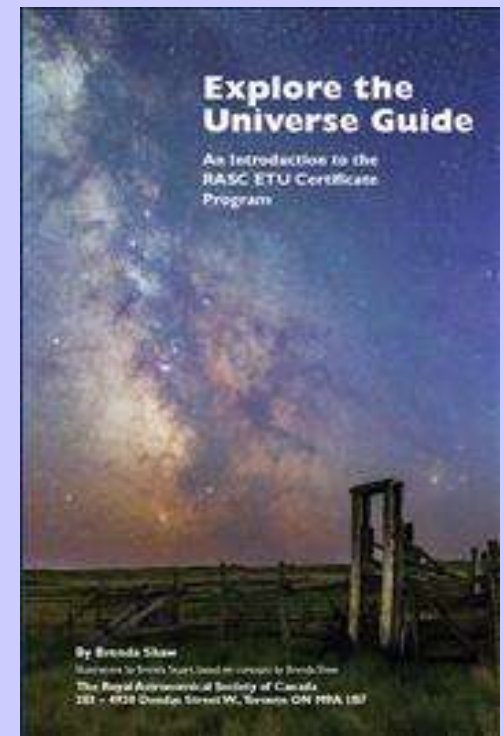
- Locate (by yourself) and document 55 of 110 objects in 5 categories:
- Constellations / Bright Stars: 12/24
- The Moon – phases, maria, craters: 16/32
- Solar System – planets, meteors, satellites: 5/10
- Deep Sky Objects – clusters, nebulae, galaxy, asterisms: 12/24
- Double Stars: 10/20

# What You Need

- Star maps, Moon map
- Logbook / Observation Report Form
- One or two good eyes
- Binoculars
- Flashlight, preferably red light
- Patience
- The will to go outside and observe

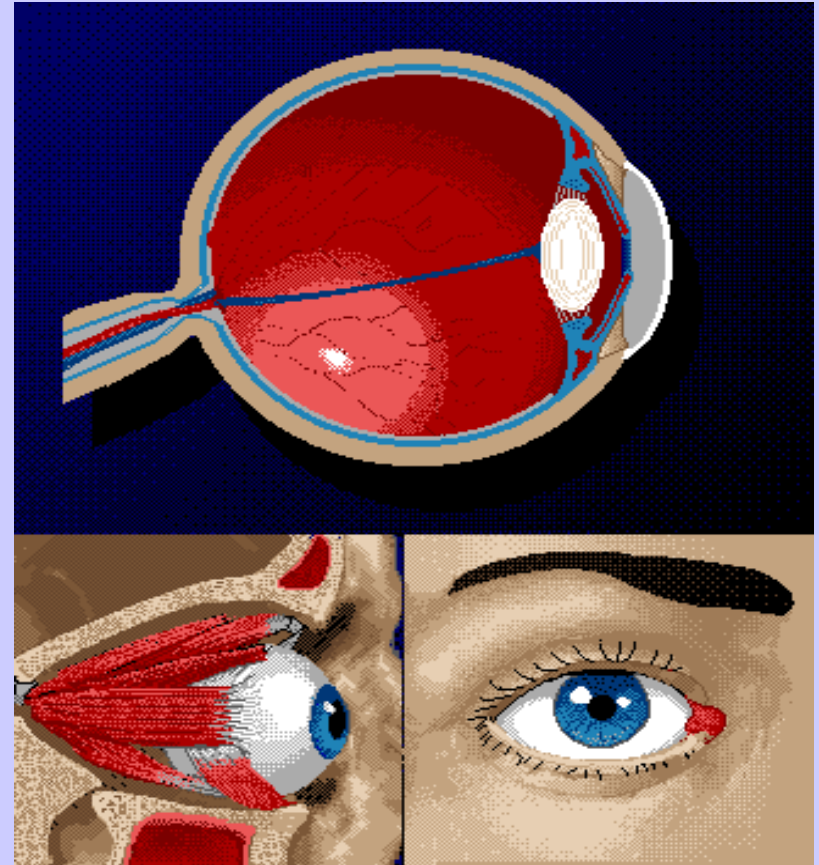
# What You Might Want

- NightWatch \$32.50+
- EtU Guide 2 ed.
- \$17.95+
- \$15.95+ (2-9 copies)
- \$13.95+ (10-25 copies)



# Rod and Cone Cells

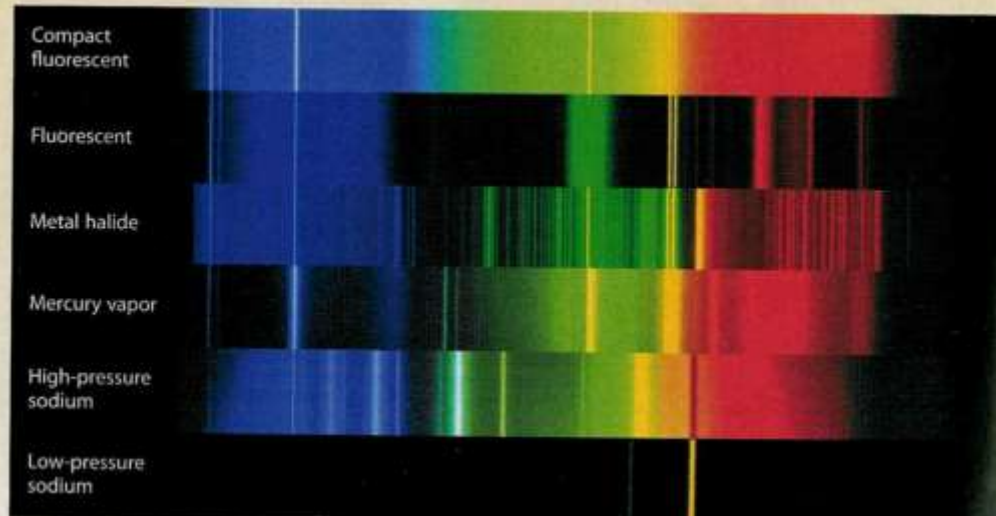
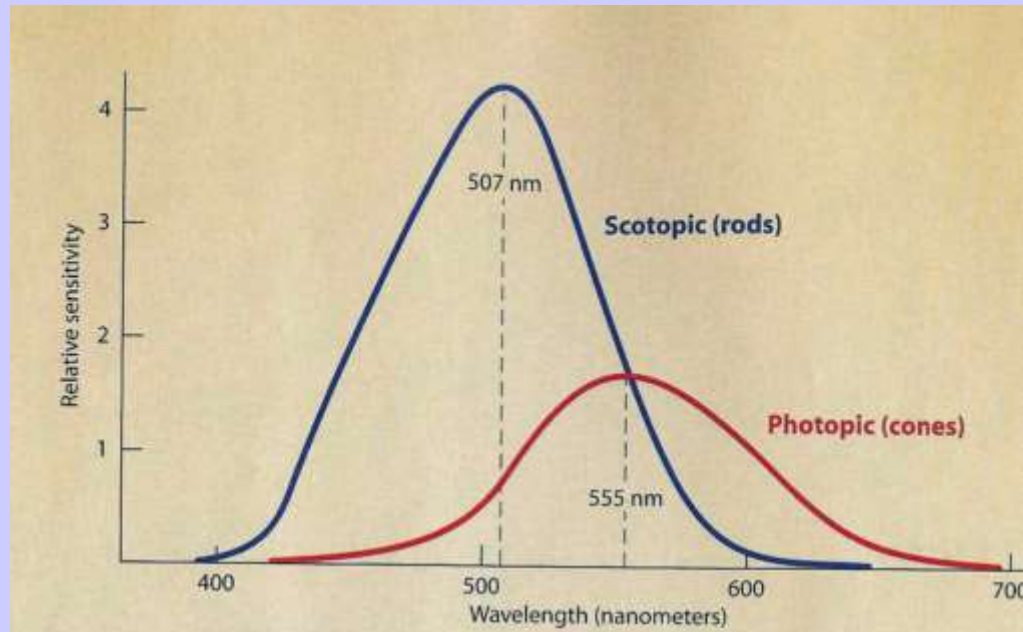
- **Cone cells – 7 million; red, green, blue; each with direct link to optic nerve for acuity / colour**
- **Rod cells – 120 million around centre, B&W only, ~ 1000 x more light sensitive, sees movement at corner of the eye**
- **Eye moves constantly, collects light for 0.1 s**



# **Astronomy Applications**

- **Look straight at brighter objects – colour**
- **Dim objects – use averted vision (rods)**
- **Use movement to detect faint objects**
- **Beware of blind spot from optic nerve**
- **0.1 s collection: Don't expect pictures**
- **Maintain dark adaptation (night vision)**
  - need ~ 15-20 minutes to obtain it
  - use red light to read maps and to see

# Eye Cell Colour Sensitivity



# **Binocular Stargazing**

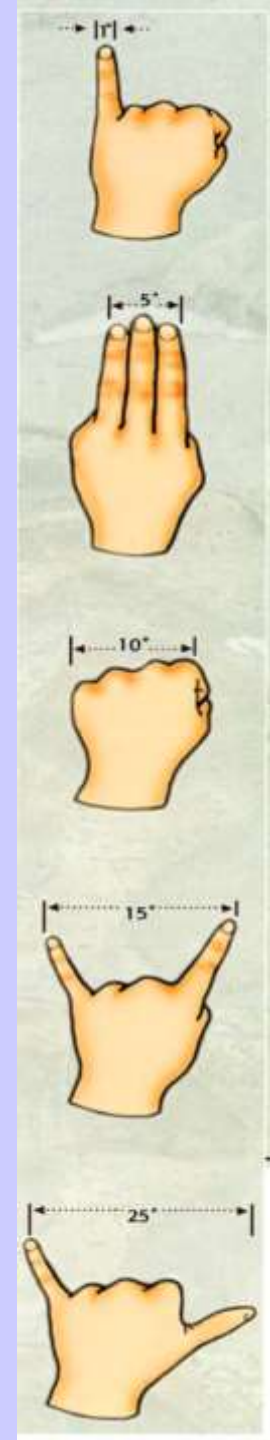
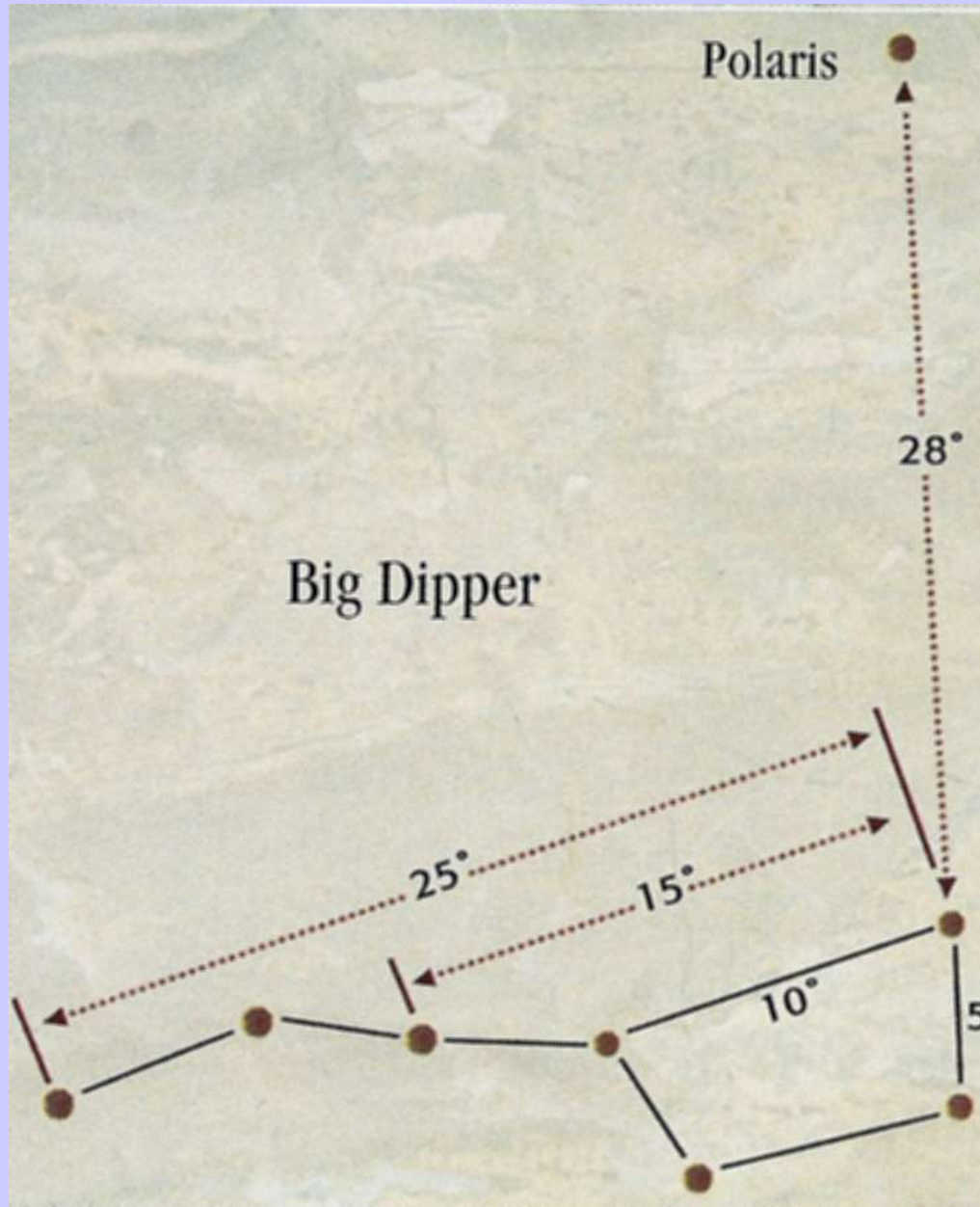
- **Best beginner's telescope, other uses**
- **2 eyes more comfortable than 1**
- **Eliminates problem of floaters**
- **Wide field of view, stars 2-3 mags fainter than with naked eye (cluster of a handful of stars becomes dozens of stars)**
- **See patterns too wide for most scopes**
- **Decent binos for a good price**
- **Correct image (upright)**



# About Binoculars

- **Size of objective lens (50 mm in 10x50); gather more light – fainter stars, sharper view but heavier**
- **Magnification – (10 power in 10x50); higher gives more detail but harder to hold steady**
- **Field of view; given in degrees for sky or feet/1000 yd ( $\div 50 = \text{degrees}$ )**

# Angular Measurement



# More About Binoculars

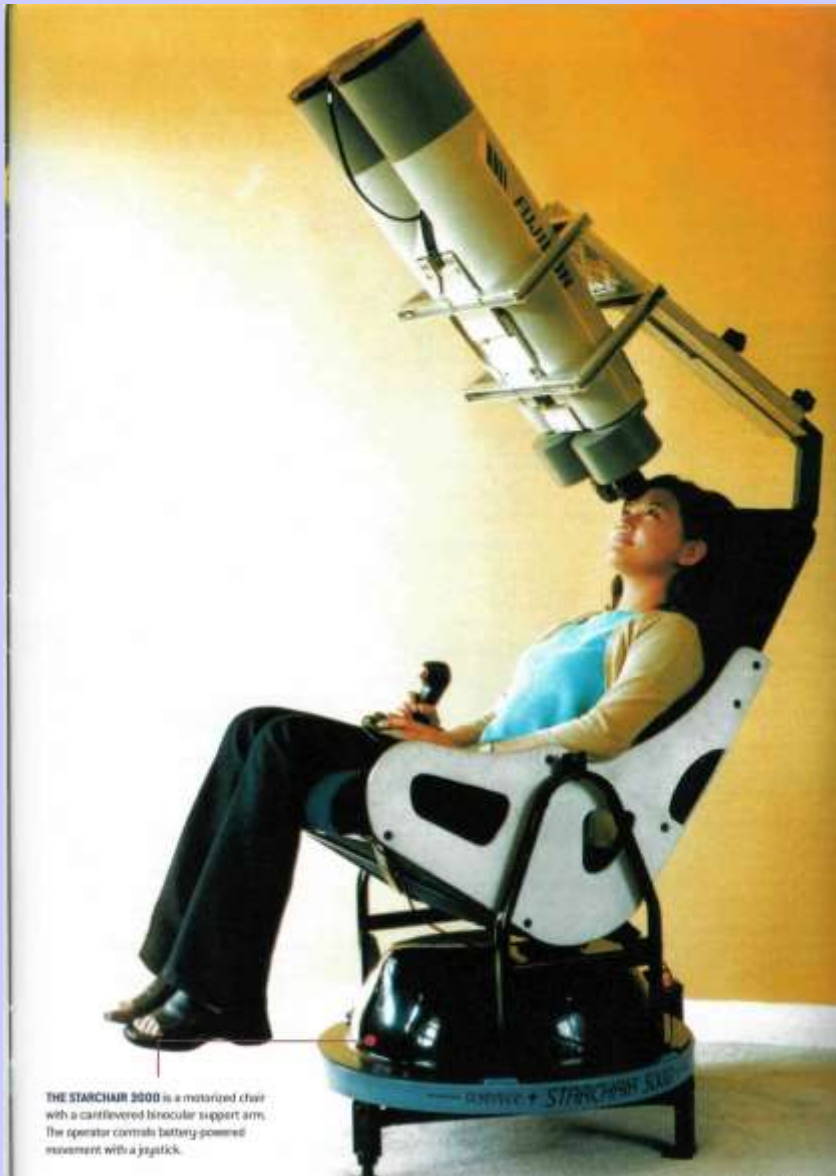
- **Collimation – both lenses point at same thing**
  - can you switch between eyes and binos OK?
  - no double image, stars not elongated in middle
- **Coatings improve light transmission – fully, multi, fully-multi**
- **Prisms – BaK-4 better than BK-7**

# Using Binoculars

- **For steady view: hold at far ends, rest arms on car, table, knees if in lawn chair**
- **Tripod mount for high magnification, heavy binos, extended viewing**
- **Cheap home-made monopod is useful**
- **Cap lenses before coming in from cold to prevent moisture**
- **Get a wide strap and use it**

# **More About Binoculars**

- **Eye relief = mm from eyepiece for full view, long eye relief good for eyeglass wearers**
- **Eyecups – block stray light and guide eye, roll down for eyeglasses**
- **Focus – knob smoother than lever**
- **Initial focus: spread to comfort, close right eye and focus, set diopter (R) with left eye closed, then check focus for both eyes**



THE STARCHAIR 3000 is a motorized chair with a cantilevered binocular support arm. The operator controls battery-powered movement with a joystick.

# Got Money?

**\$3950 US**  
(binos not included)

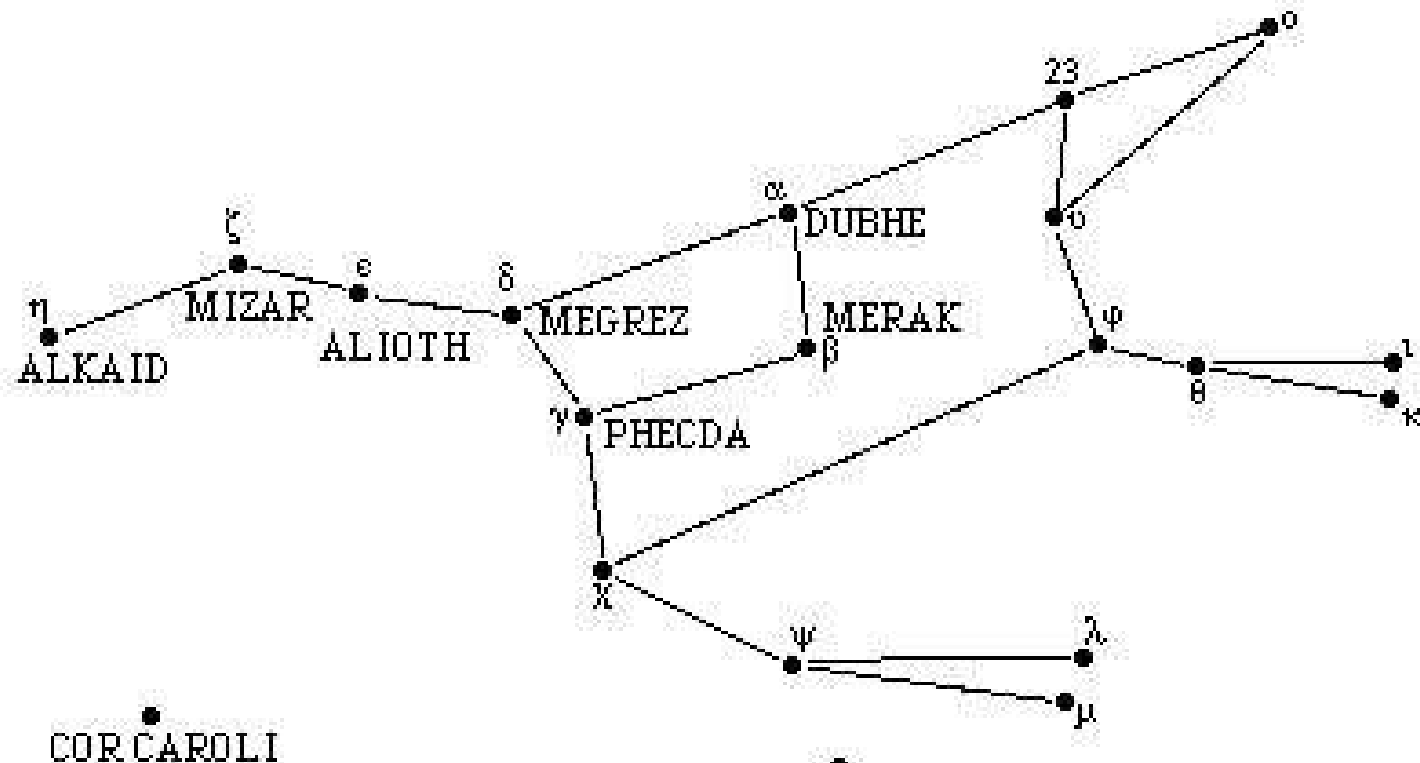


# Star Names

- Common name – 330 stars have a common name, often based on its position in the constellation figure (Betelgeuse – armpit of the giant)
- Bayer designation – set in 1602 by Johann Bayer, Greek letters generally in order of brightness ( $\alpha$  Orionis or Alpha Orionis or  $\alpha$  Ori)
- Flamsteed designation – set in 1725 by John Flamsteed, numerical from west to east in constellation (58 Orionis)



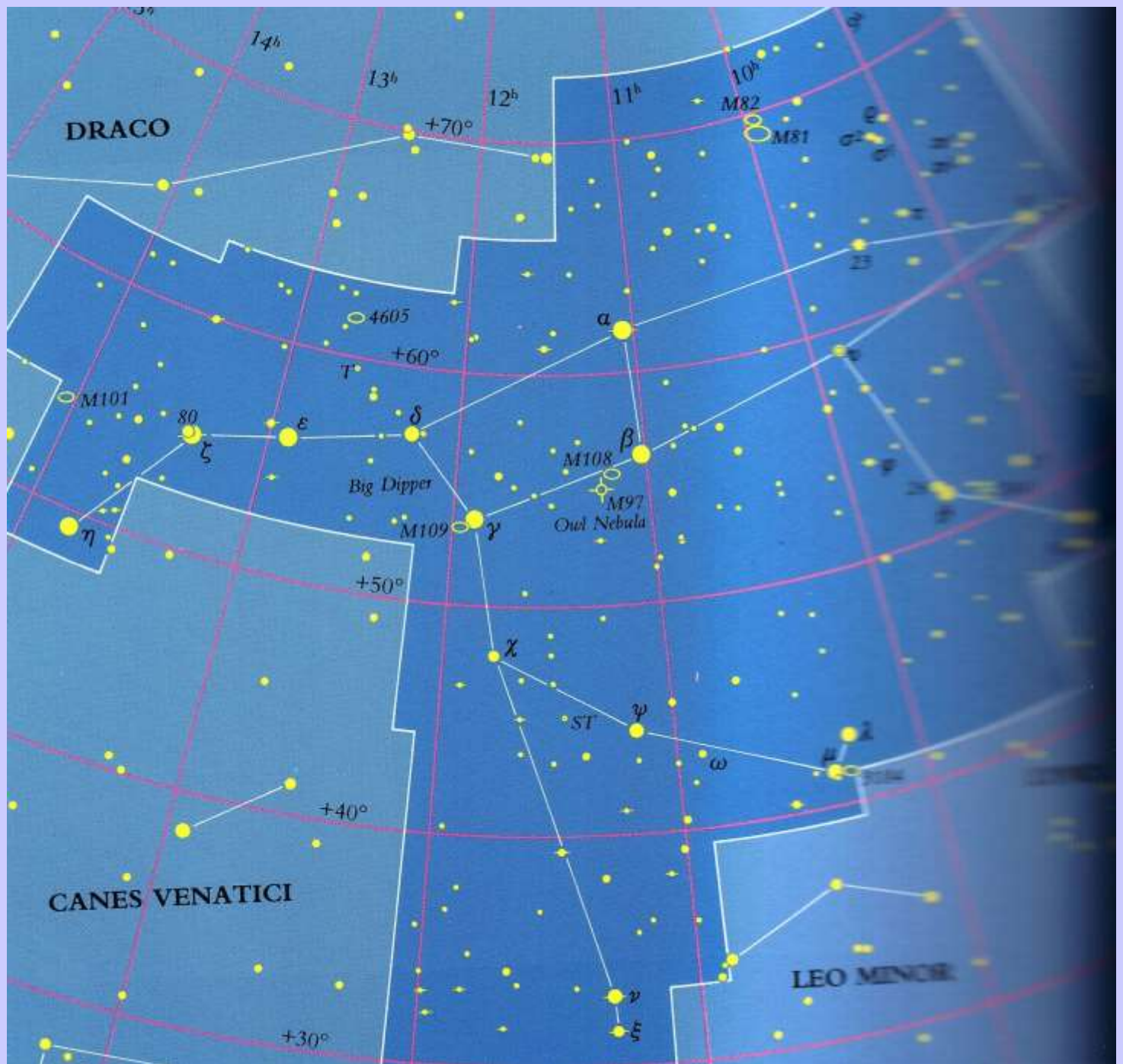
# Ursa Major, the Great Bear (The Big Dipper)



47 Ursae Majoris

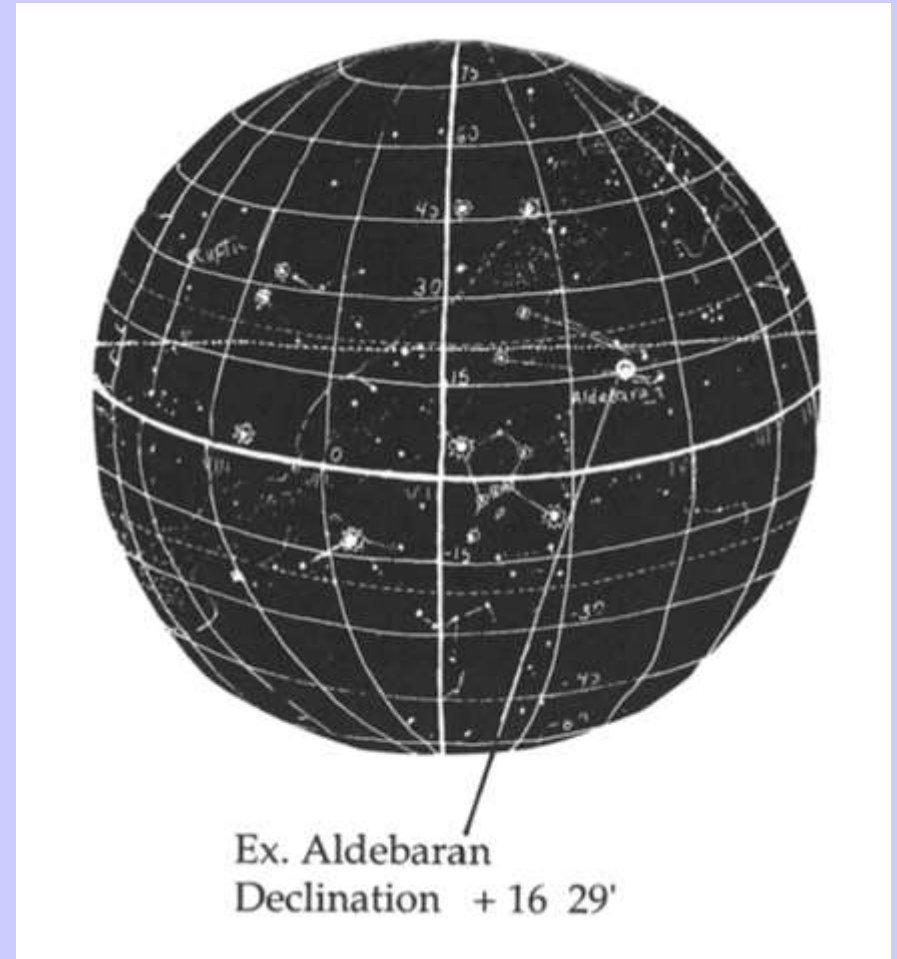


# Star Maps

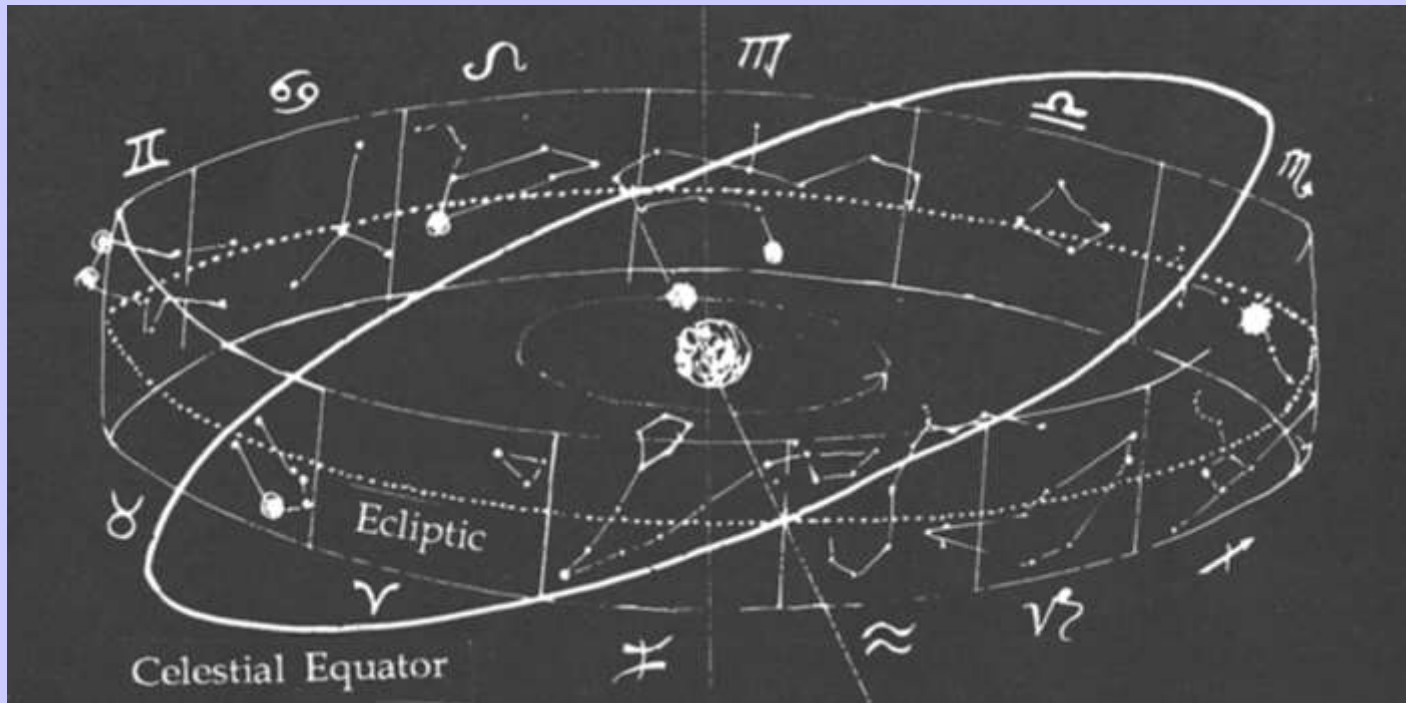


# Coordinates: Declination

- **Similar to latitude**
- **Measured in degrees, minutes, seconds**
- **Celestial equator =  $0^\circ$**
- **North star  $\sim 90^\circ$**
- **Dec.  $\sim 45^\circ$  overhead**
- **Dec.  $< -45^\circ$  unseen**



# Coordinates: Right Ascension



- **Similar to longitude**
- **Measured in hours, minutes, seconds**
- **Zero point where ecliptic crosses celestial equator (Vernal Equinox or first day of Spring)**

# The Magnitude Scale

- 1 mag = 2.5 x
- 2 mag = ~ 6 x
- 3 mag = 16 x
- 4 mag = 40 x
- 5 mag = 100 x
  
- Lower magnitude = brighter star

