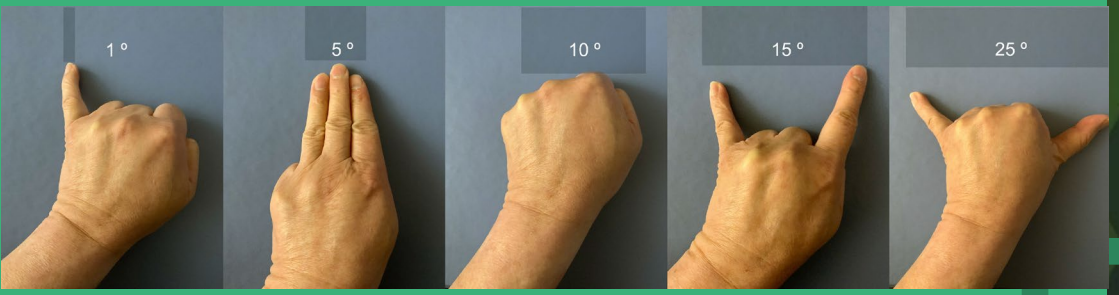
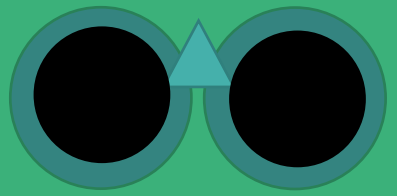
Getting Started in Astronomy





SIG Presentation March 2, 2021

Measuring Angles in the Sky

Fields of View

Without Instruments

With Binoculars

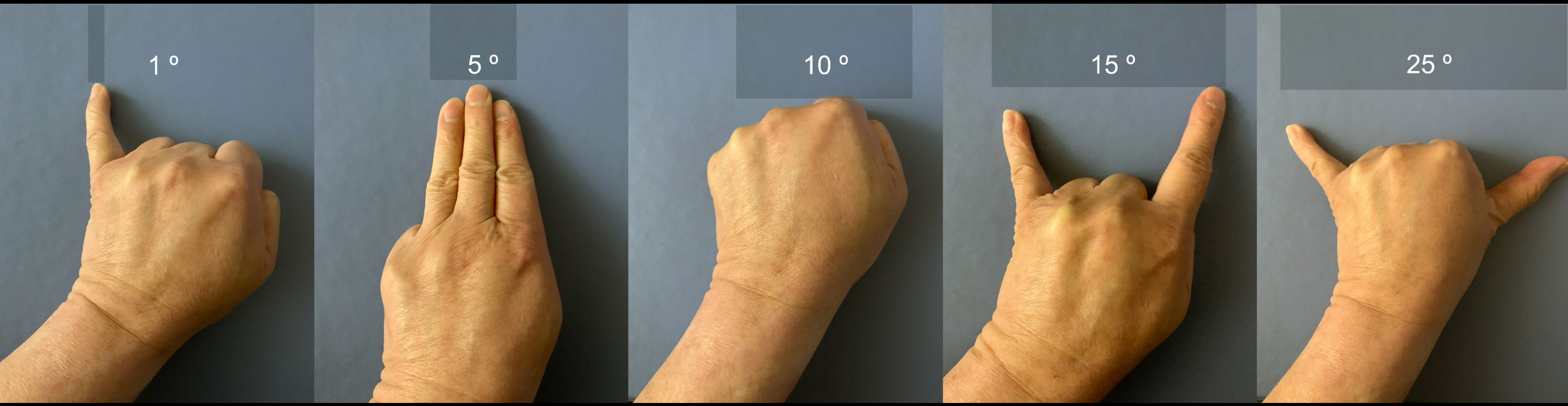
With Telescopes

Viewing Common Objects

 Version 1.0

Measuring Angles in the Sky Using Your Hand

with your arm outstretched



Note: Hand sizes vary and through experience you will understand the angles specific to you.

Using the Moon as a Reference Object

The angle covered by a full moon is approximately ½ a degree

In reality the Moon varies in size but this approximation is close enough.

Human Vision

“Humans have a slightly over 210 degree forward-facing horizontal arc of their visual field … The vertical range of the visual field in humans is around 150 degrees” - Wikipedia

Image: Jfrosty (2003) Wikipedia

Binocular Specifications

Image: Nikon

Magnification: 8x

Field of View: 6.3 degrees

Aperture: 42mm

The FOV of a binocular is based on optical design not necessarily magnification.

Aperture determines the ability to observe dimmer objects. This is enhanced even further by observing at a darker site and/or on moonless nights.

Telescope Field of View

Images: Celestron

The Field of View (FOV) and Magnification of a Telescope is determined by the focal length of the telescope and the focal length and apparent field of view of the eyepiece.

For example the focal length of this SCT is 2350mm and the 30mm eyepiece has an apparent field of view of 70 degrees.

Magnification: 2350mm / 30mm = 78x
True FOV: 70 degrees / 78 = 0.90 degrees

Telescopes of shorter focal length and eyepieces of longer focal length and greater apparent FOV will provide wider True FOV.

Researching Objects as related to FOV

Trapezium
θ1 Ori A - 41 Ori A - V1016 Ori - HIP 26220 D - HD 37020 - HR 1893 - WDS J05353-0523AB

Type: **eclipsing binary system, double star** (EA)
Magnitude: **7.45** (reduced to **7.68** by **1.76** Airmasses)
Color Index (B-V): **0.00**
Magnitude range: **6.72÷7.65** (Photometric system: V)
RA/Dec (J2000.0): 5h35m16.12s/-5°23'06.9"
RA/Dec (on date): 5h36m17.61s/-5°22'20.2"
HA/Dec: 1h01m50.35s/-5°20'55.2" (apparent)
Az./Alt.: +198°47'43.2"/+34°32'19.2" (apparent)
Gal. long./lat.: -150°59'39.0"/-19°23'00.1"
Supergal. long./lat.: -37°53'40.2"/-67°52'34.4"
Ecl. long./lat. (J2000.0): +82°58'48.2"/-28°40'26.3"
Ecl. long./lat. (on date): +83°16'16.8"/-28°40'16.4"
Ecliptic obliquity (on date): +23°26'14.2"
Mean Sidereal Time: 6h38m10.1s
Apparent Sidereal Time: 6h38m09.2s
Rise: 13h49m
Transit: 19h29m
Set: 1h09m
IAU Constellation: Ori
Proper motion: 0.9 mas/yr towards 276.3°
Proper motions by axes: -0.9 0.1 (mas/yr)
Period: 65.4323 days
Next minimum light: 2021-04-01 21:15:08 UTC
Duration of eclipse: 1%
Position angle (2014): 31.70°
Separation (2014): 8.690"

Telescope FL 2350mm

Eyepiece 30mm FL with apparent 70 degree FOV

Using software like Stellarium you can construct a field of view for your combination of telescope and eyepiece for a specific object such as the Orion Nebula.

M42 Orion Nebula through two 30mm Eyepieces with different apparent FOV

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Ocular #20: Celestron Ultimate Edge
Ocular FL: 30.0 mm
Ocular aFOV: 70.00°
Telescope #24: Celestron 9.25"
Magnification: 78.3× (0.33D)
Exit pupil: 3.00 mm
FOV: 0.8936°
Lens: None
Multiplicity: N/A

Apparent FOV = 70 degrees

Earth, Victoria, 6 m FOV 1.28° 17.9 FPS 2021-02-24 20:30:35 UTC-08:00

M42 Orion Nebula through two 30mm Eyepieces with different apparent FOV

Apparent FOV = 100 degrees

Common Objects and their FOV

M42 Orion Nebula

65 x 60 arcminutes
or 1.08 x 1 degree

M45 Pleaides

110 arcminutes
or 1.83 degrees

M31 Andromeda Galaxy

3.167 degrees by 1 degree

Some useful math; 1 degree = 60 arcminutes; 1 arcminute = 60 arcseconds

Exercises

1. For your current telescope or one you are contemplating buying. Calculate the magnifications and FOVs of five eyepieces. These may be ones you own or hope to acquire some time in the future. HINT: It's useful to use a spreadsheet so you can sort under different attributes.

2. If you own a long focal length telescope try the above exercise with a short focal length telescope like a wide field refractor. Likewise if you have a wide-field telescope perform the exercise on a longer focal length telescope.

3. What objects are better in binoculars than a telescope and why?