Want to See Stars? How to Use your Telescope at Night (Without getting hit on your head...)

Sifan Kahale Hōkū Wahine

How to use your Telescope at night

- Limits
- The Sky Above
- Sky Tour
- Observing
- Setting Up
- Sky Lore
- Hints & Tips
- References

Limits



Magnitude Limits

- When selecting objects to see at night, you need to know what your setup is capable of:
 - Magnitude (How faint of an object you can see)
 - https://www.cruxis.com/scope/limitingmagnitude.htm



FOV Limits

- Field of View (how large an area of sky you see)
 - Depends on both telescope and ocular use
 - FOV: AFOV/MAG (AFOV is the apparent FOV, from manufacture of eyepiece)
 - Planets are small, use as much magnification as feasible FOV not so important
 - Nebula, open clusters and galaxies can be huge some require a large FOV
 - https://astronomy.tools/calculators/field_of_view/







Resolution Limits

- Resolution (minimum distance between objects that you can see)
 - https://astronomy.tools/calculators/telescope_capabilities
 - Measured in degrees of arc°, arcmins' and arcsecs"
 - A fun 'sport' is to split binary stars, a good test both of your equipment and your abilities
 - https://www.skyandtelescope.com/observing/celestialobjects-to-watch/pretty-double-stars-for-everyone/







The Sky Above



Earth Coordinates

- Earth: Longitude/Latitude
 - Long/Lat (hours/degrees or degrees/degrees)



Sky Coordinates

- Sky: Right Ascension/Declination
 - RA/DEC (hours/degrees)



Telescope Coordinates

- Telescope: Altitude, Azimuth
 - Alt/Az (degrees/degrees)



Location and Time

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- Determine if an object is up tonight
 - Local time (LT): for us, PDT
 - Sidereal time (LST): Star time
 - (Vernal Equinox @ local meridian)
 - Easiest to use web sites or apps





What's Up

- Time/Location
 - Is it up tonight?
- Visible
 - How bright is it?
 - Will your scope be able to see it
 - What's the sky conditions (seeing and visibility)
- How High
 - Want it higher then 20° above the horizon murk
- Your Preferences
 - Planets, Galaxies, Nebulae, Dbl Stars, etc

Selecting Objects

- Great objects to start with:
 - Moon
 - Jupiter and it's moons
 - Saturn (amazing!)
 - Brighter Messier objects
- Use Stellarium or Telescopius or other sky chart program to check things out
 - Zoom in the see what it looks like
 - Click on the object to gets it's RA/Dec, Magnitude, Separation, etc.
 - If you have a GoTo scope, Stellarium can even command it!



Messier Objects



Creating an Observing Plan

- Some good online sources for what's up tonight
 - https://telescopius.com/deep-sky/search
 - http://www.skyandtelescope.com
- Best viewing is when object is straight overhead (zenith)
- Remember, Earth is turning: can wait for object to rise
 - Also, objects in west will be moving into the murk!

Observing



Finding Objects

- Best method:
 - Use setting circles or GoTo to move scope to approximate location
 - Center in finder scope, then use large ocular (large FOV) to center, then put in smaller ocular to view
- Dead Reckoning:
 - Line up 2 bolts/screws on OTA with closest visible star, then:
- Star Stepping
 - Study star charts, find closest visible star, then viewing through the finder, step to next star, ,etc. Or:
- Sweeping
 - Sometimes this will work ... Sweep in a grid pattern around where the object is supposed to be

Star Stepping – Sky Chart



Star Stepping – Finder View

Alkaid (Benetnasch) η UMa - 85 UMa - HIP 67301 - SAO 44752 - HD 120315 - HR 5191

Type: star Magnitude: 1.85

RA/Dec (J2000.0): 13h47m32.18s/+49°18'46.9" Az./Alt.: +318°11'24.6"/+22°22'43.1" Transit: 11h48m olar (never sets)

FOV 6.07° 19.9 FPS 2021-10-20 19:06:38 UTC-08:18

Star Stepping 2 – Finder View

Alkaid (Benetnasch) η UMa - 85 UMa - HIP 67301 - SAO 44752 - HD 120315 - HR 5191

Type: star Magnitude: 1.85 RA/Dec (J2000.0): 13h47m32.18s/+49°18'46.9" Az./Alt.: +318°16'06.9"/+22°18'10.4' Transit: 11h48m Circumpolar (never sets)

Earth, Depoe Bay, Or, 8 m

FOV 6.07 19.8 FPS 2021-10-20 19:07:16 UTC-08:18

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Star Stepping – Ocular View

Whirlpool Galaxy (Question Mark Galaxy - Rosse's Galaxy -Spiral Nebula - Whirlpool Nebula) M 51 - NGC 5194 - PGC 47404 - UGC 8493 - Arp 85 - VV 1

Type: galaxy (SA(s)bc pec) Magnitude: 8.10 RA/Dec (12000.0): 13h29m52.70s/+47°11'42.9" Az,/Alt.: +319°11'40.9"/+18°28'30.5" Transit: 11h30m Circumpolar (never sets) Size: +0°11'12.00" x +0°06'54.00" Orientation andle: 57°



		9
	Ocular #2: Plossl 14mm (50deg)	
	Ocular FL: 14.0 mm	
	Ocular aFOV: 50.00°	
	Telescope #0: Generic 60x700	
	Magnification: 50.0× (0.83D)	
	Exit pupil: 1.20 mm	
	FOV: 1.0000°	
41	Lens: None	۶Þ
	Multiplicity: N/A	

Setting UP



Things to Remember

- Best viewing is when object is straight overhead (zenith)
- Remember, Earth is turning: can wait for object to rise
 - Also, objects low in west will be moving into the murk!
 - Objects low in the east will be move up higher
- Objects close to the meridian will always be the best it can get (even far south)

Good Location

- Good views down to 20° of the horizon
- Polaris should be visible to align to
- High, away from lights, ocean, car lights, etc.
- Firm base, comfortable position
 - Survey site for obstacles you may trip on
- Power available (if using GoTo, Cameras, Computers)

During Daylight

- During the day:
 - Create an observing plan for what's up tonight
 - Clean scope if needed
 - Pack equipment for travel to site
 - Site Survey
 - Assemble telescope, mount and accessories on site
 - Align finder scope to OTA
 - Attach the intravenous coffee drip to your arm ...



After Twilight

- Can usually see Polaris after nautical twilight
- Align mount to Polaris
- Initialize Telescope (move to marks and zero circles)
- Use setting circles to point scope at area of interest
- Using a sky chart and the finder scope, adjust where you are pointing
- If it's a faint object, use star stepping
- Enjoy!!

Sky Lore

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Sky Lore

- A lot more fun when you know some of the stories
- Different cultures have different stories
 - Western: Hercules and Scorpio
 - Hawaiian: Maui and the hook he used to pull up the islands
- Stellarium can be set to display different sky images for a number of cultures
 - Arabic, Hawaiian, Lakota, Chinese, Korean, etc (30!)

Hawaiian Sky Lore



Dakota Sky Lore



HINTS & TIPS

Common Disappointments

- Our eyes will not register color for faint objects
 - You are not going to see wonderful color nebulae !!
 - You will be able to see the colors of brighter stars
 - (blues, yellows, golden, red and even green!)
- Stars are 'point' objects
 - Sort of boring .. (look for those with bold colors and dbl stars)
- Best time for astronomy is ... WINTER !!
 - Yup, longer nights, crisper, cleaner, clearer sky
 - Orion, Andromeda galaxy and other spectacular objects are out
 - But it's COLD !!

Hints

- Use Averted Vision and Movement
 - Sides of eye are more sensitive don't look directly at faint objects
 - Very slightly move telescope in one axis back and forth to pick up really faint objects
- Scope Vibrations
 - Allow to settle
 - Don't touch when viewing
- Be alert for changing conditions
 - Feel setup for dew
 - Watch street lights for halo
 - Watch for blank areas of sky

Other Hints ...

- Seeing and Visibility
 - Visually look for how many stars you can see
 - Notice any 'spots' where there are no stars
 - Careful of dew
 - Watch/feel the telescope/mount for dew
 - Notice halos around lights
 - Dark adapt your eyes (use red flashlight to read, etc)
- Ideal Locations
 - High
 - Away from lights
 - Good southern view
 - Horizon down to 20° (horizon is always murky)

References

- Interactive Tools:
 - http://www.skyandtelescope.com/observing/interactive-sky-watching-tools/
- What's Up:
 - https://telescopius.com/
 - https://www.skyandtelescope.com/observing/sky-at-a-glance/
 - http://www.astronomy.com/
- Sun and Comets
 - https://sohowww.nascom.nasa.gov/
- Charts
 - http://www.stellarium.org/
 - https://kde.org/applications/education/org.kde.kstars
 - https://www.celestron.com/pages/skyportal-mobile-app
 - Weather
 - http://clearoutside.com/forecast/44.81/-124.06?view=midnight
 - http://www.cleardarksky.com/c/LnclnCtORkey.html?1

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Mahalo!

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