Luminos Pro User's Guide

Version 10.0

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Thank you for choosing to explore the Universe with Luminos!

Select a topic to learn more:

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Quick Tour

If you are just getting acquainted with Luminos but want to learn quickly, here are some ideas to help you get started:

Explore the sky

Using a single finger, drag across the Sky View to pan across the sky. Tap any object you see to select it. Successfully selecting an object will cause it show a pulsing crosshair, and its name will be displayed underneath it. At the same time, a representation of the object will display in the Selection Bar at the bottom-center of the screen. Tap the Info button in the Selection Bar to view that object's details in the Browser. Pinch to zoom the screen, and discover thousands of deep space images scattered throughout the sky.

Zoom on Mars—Try It Now!

While you can always view a planet by simply locating and tapping it in the Sky View, you can also browse to it using Luminos' Browser. To access it, tap the leftmost icon in the lower area of the screen (a magnifying glass). In this Browser, tap the Solar Sytem, and then Mars. Tap "Center on Screen" and Mars will glide into view. To get an even closer view, tap the "Zoom In" item in the Actions section of the browser, or tap the "Zoom In" button in the row of action buttons of the Selection Bar. You will now see a closer view of Mars, properly oriented to your current location.

Speed up time—Try It Now!

For an even more impressive view, tap the Clock Button in the bottom area of the screen. Here, you can change to a specific date and time to see how the sky would look at that point in time. You can also increase or reverse time itself. To see how Mars rotates over time, tap any of the buttons to change the flow of time (1x, 1 min/s, 10 min/s, etc.) By playing with the flow of time, you can see objects that might not be visible at your current location. To reverse time or stop it altogether, tap the Reverse, Stop, and Forward buttons, or spin the wheel control on the right side of the screen.

See the whole Solar System—Try It Now!

Being on the ground and exploring the sky is fun, but would you like to see the whole Solar System at once? Choose Solar System in the browser and look for the "Fly into orbit" option near the top. Tap it to be whisked away high above our Solar System where you can see the orbits of all the planets. Notice how the orbits aren't concentric rings, but rather some are tilted a little bit and some are off center. Speed up time to see how fast the planets move.

For an exciting (and somewhat frightening) view, turn on Near Earth Asteroids in the Small Bodies section of the browser and see just how many of those giant rocks are orbiting close to our planet! When you're ready to put your feet back on the ground just tap the Home icon in the upper left corner of the screen.

Plan your night viewing

Luminos makes it easy to schedule your night viewing with its "What's Up" display, located in the calendar. From here, you can see exactly which objects will be visible from your location at specific time ranges. Change your date with the calendar control to plan for an upcoming sky party, or create custom observation lists to see which objects will be easily viewable.

Locate surface features—Try It Now!

The notable geological features of all the planets and moons are tracked by the International Astronomical Union, and you can view them right inside Luminos. Select a planet or moon, such as Earth's moon, and tap "Fly into orbit". While the planet or moon is selected, all of the names of its surface features will be displayed in 3D. (If they aren't showing, make sure the "Show surface feature labels" action is highlighted in the planet's detail view.) Rotate the body to see all the features, zoom in for a better view, and tap any feature to find out its details and description. This is a great way to find the locations of lunar landings, for example.

Track satellites—Try It Now!

Luminos supports external satellite tracking data. To try it out, open the Satellites option in the Browser. From here you can toggle the individual types of satellites to display, which will be represented in the Sky View as distinctly-colored moving icons. Satellite passes visible at your location are shown directly in the information display. By speeding up time--as described earlier--you can follow the paths of the satellites around Earth.

For a unique perspective on Earth's satellite traffic, tap the Earth and then "Orbit" to see the satellites in motion around our planet. Also, try switching between the actual and apparent orbit paths of a satellite to see where the satellite appears to move relative to Earth by using the "Orbit style" action button on any selected satellite.

Ride along with the space station—Try It Now!

With satellites enabled, it is easy to see a close up view of the International Space Station. Simply select International Space Station from the satellites browser and tap the "Ride Along" option. While riding along with the space station--or any other detailed satellite model--you can pinch to zoom in and out or pan around for a better view.

Examine Hubble images

Luminos contains high-resolution images of deep space bodies taken by the Hubble telescope. To view these bodies in the context of the night sky, open the Browser with the magnifying glass icon in the lower left. Select the "Deep Space" category, then tap any of the thumbnail images for detailed information. Tap the image again for an even better view, complete with zooming.

Simulate being on another planet—Try It Now!

Luminos can quickly take you to another planet or moon in the Solar System. Select the Solar System category and then choose a planet from the list. In the Actions section of that objects page will be an item labeled "Land on the surface", and selecting that will quickly launch you into space and set you down on the surface of that planet. Try it with Saturn to see what the rings might look like if you were under them or try it with the Moon to see what it might have felt like to land there!

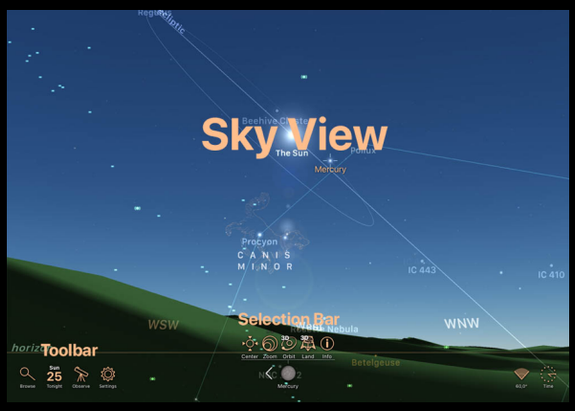
Find all the Messier Objects

For a real challenge, use Luminos' ability to track your viewing history to complete a Challenge Observation List. From the Browser, select the Deep Space Objects and the Messier list. Individual items in the Messier list will be shaded to represent their visibility at the current moment; faded items are below the horizon, and bright items are in the visible sky.

Select any item in the Messier list, and once you have located it in the night sky, tap the "Mark as seen" action. This will note the date and time you actually found the Messier Object. Take a note if you desire, using the "Notes" section of the object browser. There are more than a hundred Messier Objects. Spot them all!

Exploring the Interface

The primary display of Luminos consists of the Sky View with the Toolbar at the bottom of the display.



Sky View

The Sky View contains the main display area of Luminos. Here, you can see the sky objects and select them for more detail. To select any object in the sky, simply touch it on the screen. To re-orient the Sky View, drag your finger across the display in the direction you wish to point the camera. The currently selected object is represented by an animated crosshair:

When an object is selected, the most common actions you can do with the selection will be visible in the Selection Bar. To clear the selection, push the selection bar off the screen by swiping it down.

If you have changed your elevation or moved away from your location (such as landing on another planet), you can always return to your true location by tapping the "Home" icon in the upper left of the display:

If you have changed to a different time (such as by speeding up the flow of time, or setting time to be at the start of an eclipse), you can always return to your actual time by tapping the "Now" icon in the upper left of the display:

If you have selected a different orientation than horizontal, or have opted to always show the orientation button, the orientation control will also appear in the upper left.

Toolbar

The Toolbar is the main control area of Luminos. In the Toolbar, you will find the menus and controls to navigate through various astral bodies, as well as information on the current position and selection.

The Toolbar contains buttons to activate the panels:

Browser, for searching and browsing objects in the database as well as settings and help

Tonight, for viewing "What's Up" in the sky at your location this evening (or any evening you choose).

Observe, for accessing tools to assist with naked eye, binocular and telescope viewing

Settings, to configure Luminos to your preferences.

Time, speeding up of reversing the flow of time in order to observe its effects on the sky.

In the center of the Toolbar is an information display. If no object is selected, this area will be blank (or show the direction coordinates of your Sky View if you choose to turn that on in the Settings.).

If an object is selected the Selection Bar will be shown.

Selection Bar

When an object is selected the Selection Bar will be displayed at the bottom center of the screen. The Selection Bar includes icons for performing the most common actions on the selected object as well as controls for opening the Browser to the selected object.

If you accidentally tap another object you can easily return to your previous selection by either tapping the left arrow next to the icon in the selection bar, or by swiping the entire selection bar to the right. Luminos remembers the last ten objects you selected so this feature can also be used to switch between several objects quickly.

To clear the selection, push the selection bar off the screen by swiping down on it.

Action buttons

Buttons for the most common actions you will take with a selected object are displayed within the Selection Bar. Tapping an icon will perform its action on the selected object. Tapping the "Info" button will display the section in the Browser, where the full set of available Actions for the selection will be shown.

Center on screen

This action will center the selected object on the screen. While the object is currently centered the icon will be highlighted.

Zoom in

This action will zoom in on the object so that it fills the screen. If the object isn't already centered, the Zoom In button will first center the object.

Fly into orbit

This action will launch you into orbit around the selected object, allowing you to spin the object by dragging your finger on the screen.

Land on the surface

This action will transport you to the selected object (for example, another planet) and touch down on the surface, where you can see what space would look like from that object. If you're already orbiting the object then this action will land you at the location centered on your screen. Note that this action is only available for planets and moons.

Ride along

This action will transport you to the same location in space as the selected object. Note that this action is only available for comets, asteroids and satellites.

Goto

If you are currently connected to a remote telescope mount, this action gives you quick access to slew your mount to the current selection.

Add to a custom list

This action will open a browser containing your custom Observation Lists. Selecting one more more lists in this browser will add the selected object to those lists.

Add to Things You've Seen

This action will mark the selected object as having been seen at the current date and time. You can see a list of the objects you've already seen in the Browser.

Show surface feature labels

This action will toggle the display of surface feature names on a planet or moon. You can only access this action from a selected feature, or from the body on which it is located.

Set to ... time

This action will temporarily change the current time to one appropriate to the selected item, such as flyover time for a satellite or the greatest time of an eclipse.

Go to ... location

This action will temporarily change your current location to a location appropriate to the selected item, such as the greatest location of an eclipse.

Orbit style

This is a toggle between viewing the actual and apparent orbit paths for a satellite.

Flyover alarm

Turn this button on to receive notifications on your device when this satellite is making a visible pass over your location.

Info

The Info button opens the Browser to the selected object for quick access to additional information about the object.

Gestures

There are two modes of operation for Luminos: panning and motion tracking.

Panning mode

Normally, you can point the Luminos display by sliding your fingers across the display. The camera for Luminos will follow your finger, and you can point the display in any direction.

Tapping anywhere on the screen will always switch Luminos back to panning mode.

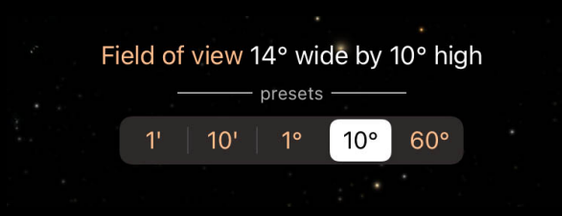
While using panning mode, you can interact with the Sky View using different gestures:

Single finger

With a single finger, you can pan across the Sky View, select any of the astral objects, or raise the Time display. You can also swipe left and right across the current selection to move back and forth in the selection history, or swipe down on the selection to clear it completely.

Two fingers

Using two fingers, you can zoom or expand your field of view. In effect, this allows you to zoom into or out of areas of the sky. Tapping two fingers on the screen will also bring up field of view controls.



You can pinch to a custom zoom level or select one of the preset values. To set the field of view quickly to one of the pre-determined values, simply tap the buttons on the screen representing the values 1 arc-minute, 10 arc-minutes, 1 degree, 10 degrees, or 60 degrees. Alternatively, while pinch zooming a field of view wheel will appear on the side of the screen, similar to the time wheel. Spin this wheel to fine-tune the field of view value.

Three fingers

By dragging three fingers up and down the display, you can change your elevation on the current location. In other words, dragging three fingers down will raise your perspective off of planet Earth.

Motion Tracking

An alternative mode of display -- motion tracking -- will point the camera's field of view based on the orientation of the device itself. This allows you to hold the device in any direction and see the actual sky behind the device represented in the display. When the device itself is moved, the Luminos display will track the movements and adjust accordingly. Luminos uses the compass and accelerometer of the device to find the correct position. As such, you may need to move the device for a few seconds when starting free look mode to calibrate the view.

Motion tracking is not supported on iPod Touch due to hardware limitations.

To switch into motion tracking mode, point the back of your device towards the sky. Luminos will activate the motion sensors in your device and use them to synchronize the display with the direction you're pointing your device.

To switch back to panning mode, simply touch anywhere on the Luminos display.

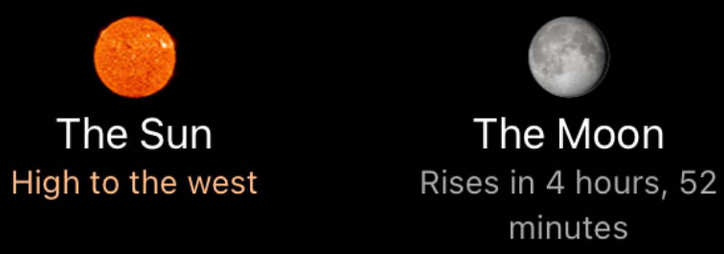
Browse

The Browser display is designed to help you navigate the millions of celestial objects tracked by Luminos. It also contains settings, help, and app information. You access the Browser either by tapping the magnifying glass icon in the lower left area of the Toolbar, or by hitting the "Info" action on a selected object. On a wide screen device, the Browser opens on the side of the screen by default whenever an object is selected. All objects in the Browser are organized in hierarchy, starting with a series of broad categories:

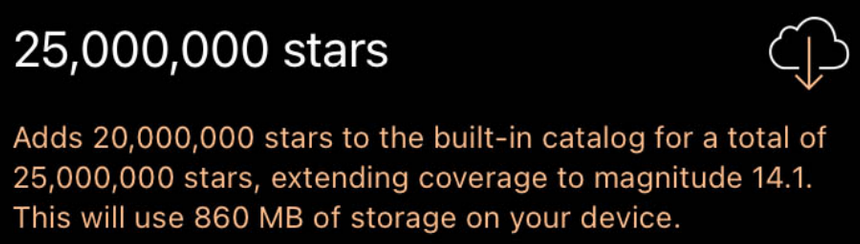
- Solar System
- Exoplanets
- Satellites
- Spacecraft
- Stars
- Constellations
- Asteroids
- Comets
- Deep Space
- Lists

Special items

Browser items with dark text descriptions are currently below the horizon. Items with a fully lit description are visible based on your location and the current viewing time.

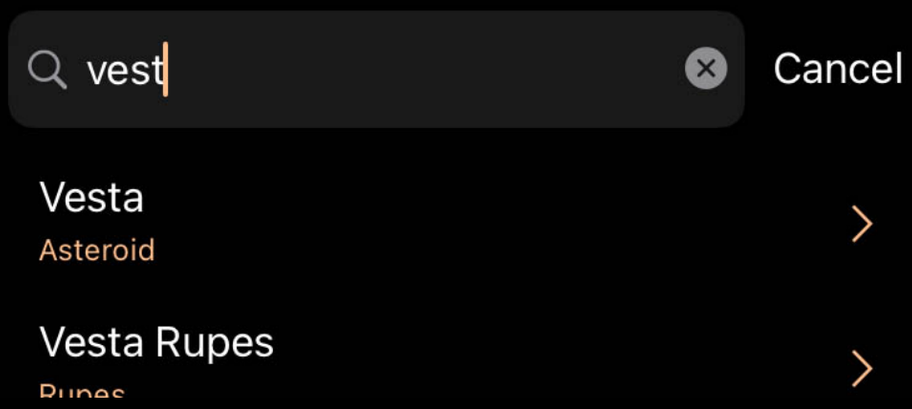


Some categories of Browser items, such as large star catalogs, do not ship with Luminos by default in order to keep the app install size to a minimum. However, these can be downloaded and installed freely from inside the application. If you encounter a Browser item with an "Install" button, tap the button to download and install that data set in the background.

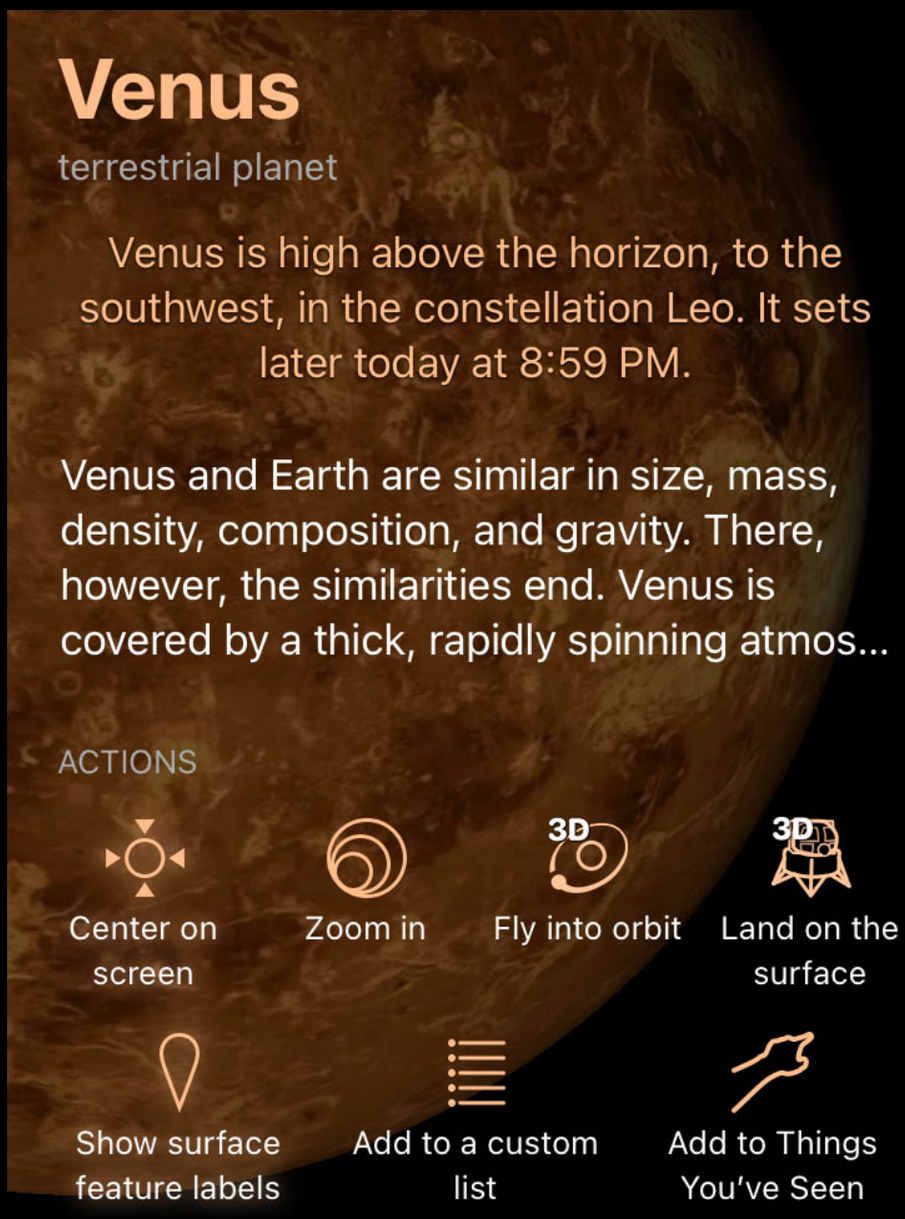


You can continue to use Luminos normally while the install completes. If you quit Luminos while downloads are in progress, you will need to resume them when the application restarts. However, Luminos will continue its progress where it left off before.

Many browser categories include search bars. If you do not see a search bar, you can pull down on the display to make it appear. Tap the search bar to display a keyboard and enter a search term. The results list shows all the browsable items that match your search term in that category or subcategories.



When you have any item selected, you will be shown a Detail View which lists specific characteristics of that item.



Surface Features

Article summaries can be tapped to expand or collapse the full text, and you can tap most data fields for more detailed information. Most Browser objects have an Actions section in their display, allowing you to perform activities specific to that item, such as "Land on the surface" or "Fly into orbit".

NOTES

Jul 25, 2021 Times shown in PDT

3:21 PM Bright, with visible polar ice caps

Add new note

Most items will allow you to add personal notes to them. If you are signed into iCloud and have an Internet connection, the notes will be synchronized across all device where Luminos is installed.

ARTICLES

Wikipedia

Guide

Certain categories of Browser item will include article links to external resources, such as a Wikipedia page or NASA resource. These require an Internet connection, and will launch Safari for access.

Solar System

The Solar System browser contains all planets, dwarf planets, moons, and the Sun itself. Hypothetical bodies such as Planet 9 are also included with theoretical positions. By selecting any Solar System object, you will be presented with a three-dimensional view of that object, as well as details related to the object itself.

The Solar System browser also includes an "Orrery" button. Tapping this button will lift you off of the Earth and into a distant orbit above the Solar System. From there you can view the planets and their orbits all at once.

The descriptive articles on Solar System objects can be tapped to expand or collapse the text in place.

A summary of the object's position will be featured in the display, giving a descriptive summary of where to find the object in the sky and when to look.

Venus is high above the horizon, to the southwest, in the constellation Leo. It sets later today at 8:59 PM.

If the object has moons, transits, surface features, or eclipses associated with it, those menus will appear next.

Moons

Surface Features

Details of an object's position, distance, size, and other information can be found in the "Live Data" section. Tapping on the coordinates gives you current coordinates in various coordinate systems.

LIVE DATA

Bright magnitude -3.83

Distance 1.353 au

Light-time 11.3 minutes

Elongation 31.56°

Apparent size 12 arcsec

Illumination 84%

Az +243° 41' 52.1" RA 10h 28m 43.70s

Alt +44° 17' 30.5" Dec +11° 7' 42.7"

More coordinates

The following legend describes the actions, and catalog data fields of Solar System objects:

Actions

Center on screen

Using this action will select the body and center it on the screen for ease of viewing. As time progresses, the camera will follow the object.

Zoom in

For an even better view, tap this button to enlarge the item in your display view.

Set to ... time

Event displays such as moon transits will include an action that will set the Luminos clock to the time of the event, allowing easier simulation.

Fly into orbit

This action launches you off of the Earth and puts you in orbit around the object. From there you can spin the object with one finger to view it from various angles. Use the Home buttton in the upper left corner of the screen when you're ready to return to Earth.

Land on the surface

This action launches you off of the Earth and lands you on the surface of the object, allowing you to look around and view space as if you were standing on that object. Use the Home buttton in the upper left corner of the screen when you're ready to return to Earth.

Show surface feature labels

(Surface features only) Toggle the display of surface feature label names on the planet or moon currently selected, if they exist.

Fly to the best location

(Solar eclipses only) Change the location to that of the greatest location of the current eclipse.

Set to peak location

(Meteor showers only) Change the location to that of the best viewing location for that meteor shower.

Set time to the maximum

(Solar and lunar eclipses only) Change the time to that of the greatest time of the current eclipse.

Set to peak time

(Meteor showers only) Change the time to that of the most visible moment for that meteor shower.

Show Analemma

(The Sun only) Turn on a display of the Sun's motion in the sky over time, from the current location.

Add to a custom list

Add the current item to an Observation List. You can define a new Observation List while you add the item.

Add to Things You've Seen

Mark the item as one that you have seen. It's time will be noted in the Things You've Seen list.

Live data

Magnitude

A logarithmic measure of the brightness of an object. Lower numbers are brighter.

Distance

The distance from your current location.

Light-time

Another measure of distance using the time it takes light to reach you from an object

Elongation

The angle between the Sun and the object. Used to determine how visible an object is due to its proximity to the Sun.

Apparent size

The angular diameter of an object, i.e. how many degrees, minutes, or seconds it occupies in the sky.

Illumination

The percentage of the spherical disc which is visible. For example, a half moon would have 50% illumination.

Position

Horizontal Az

Azimuth, a measurement from a viewer to the object projected on a reference plane. Part of the horizontal coordinate system, along with altitude.

Horizontal Alt

Altitude, the vertical elevation in degrees of the object from the horizon, measured in degrees. Part of the horizontal coordinate system, along with azimuth.

Equatorial (now) RA

Right ascension is the celestial equivalent of terrestrial longitude.

Equatorial (now) Dec

Declination is the celestial equivalent of terrestrial latitude.

Equatorial (J2000) RA

Right ascension referenced from the point in time at January 1, 2000.

Equatorial (J2000) Dec

Declination referenced from the point in time at January 1, 2000.

Ecliptic Lon

Longitude relative to the ecliptic plane, the plane formed by the path the Earth travels around the Sun.

Ecliptic Lat

Latitude relative to the ecliptic plane, the plane formed byt the path the Earth travels around the Sun.

Galactic Lon

Longitude relative to the galactic plane, the plane formed by the disk containing most mass in our galaxy.

Galactic Lat

Latitude relative to the galactic plane, the plane formed by the disk containing most mass in our galaxy.

Heliocentric X

X dimension of the Cartesian coordinates of the object relative to our Sun.

Heliocentric Y

Heliocentric Y dimension of the Cartesian coordinates of the object relative to our Sun.

Heliocentric Z

Z dimension of the Cartesian coordinates of the object relative to our Sun.

Catalog data fields

Bulk characteristics

Mass

The property of an object that is a measure of its inertia, the amount of matter it contains, and its influence in a gravitational field.

Volume

The quantity of space that this object occupies.

Mean radius (volumetric)

The average radius of a sphere with the same volume as this body.

Equatorial radius

The distance between the center of an object and its equator.

Polar radius

The distance between the center of an object and its north or south pole.

Ellipticity

A number indicating how far the object deviates from a perfect sphere (0). It is the ratio of major to minor axes.

Mean density

The average amount of mass per unit of volume in this object.

Surface gravity

The amount of estimated gravity on a negligible mass target at the object's surface.

Surface acceleration

The amount of estimated gravity on a negligible mass target at the object's surface, when rotation of the body is accounted for.

Escape velocity

Speed necessary to escape the gravitational field of the object.

Number of moons

Number of natural bodies orbiting this object.

Has ring system?

Whether or not this body has a ring system.

Has magnetic field?

Whether or not this body has a global magnetic field.

Orbit and rotation

Distance from Sun (now)

Current distance of this body from Sol.

Rotation period (sidereal)

Number of hours for a complete turn of the planet or body.

Length of day

Number of hours for a point to return to the same position facing Sol.

Perihelion

Distance when closest to Sol.

Aphelion

Distance when furthest from Sol.

Sidereal orbital period

Number of days for a full revolution around Sol.

Inclination to ecliptic

Angle between the body's plane and Earth's orbital plane.

Mean velocity

Average speed at which the body revolves around Sol.

Eccentricity

Amount by which the orbit deviates from a perfect circle. Numbers closer to zero are more circular, and numbers closer to one are more parabolic.

Axial tilt

The angle between an object's rotational axis, and a line perpendicular to its orbital plane.

Atmosphere

Mean temperature

Average temperature across the surface of the object.

Surface pressure

Pressure at the surface, relative to the same on Earth.

[Chemical composition]

Percentage, or parts-per-million, of various compounds in the object's atmosphere.

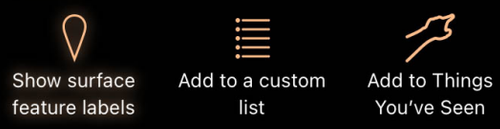
Surface Features

Many planets and moons in the Solar System have notable surface features such as craters or other geological formations. The International Astronomical Union (IAU) names and approves all of these features since its founding in 1919.

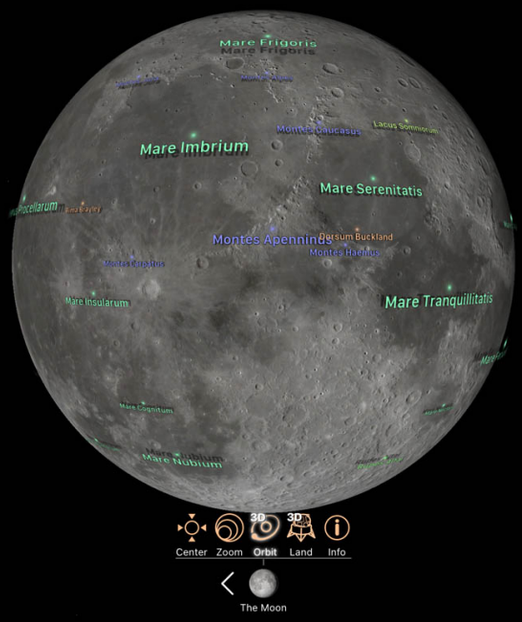
There are two ways to access features in Luminos. If a planet or moon has surface features, they will be accessible in the Browser page for that object in a special navigation menu.

Surface Features

In the surface features page for a planet or moon, the features are grouped by type. Selecting any individual feature brings up an information page containing location and description of the feature, as well as a set of actions. You can mark features as seen, add them to lists, or fly to their position to view them from space or from the ground.



The other way to view a feature is to select the planet or moon on which it is located and view it from space. Any body with surface features present will label them while the planet or moon is selected. Make sure the "Show surface feature labels" action is highlighted so that they will appear, then tap a feature name to select it.



To toggle the display of feature names on a planet or moon, tap the aformentioned "Show surface feature labels" action.

Eclipses

- Overview
- Eclipse summaries
  - Solar eclipse types
  - Lunar eclipse types
- Solar eclipses
  - Map
  - Actions
- Lunar eclipses
  - Map
  - Actions
- Solar eclipse data
- Lunar eclipse data

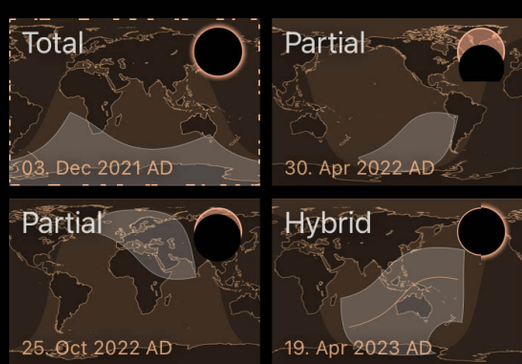
Overview

Luminos includes a catalog of 5000 years of solar and lunar eclipses, with the ability to visit them in time and observe their progression. Both eclipse categories can be accessed from the Browser page for Earth, while Solar Eclipses can also be found on the Sun's page and Lunar Eclipses can also be found on the Moon's page.

Eclipse summaries

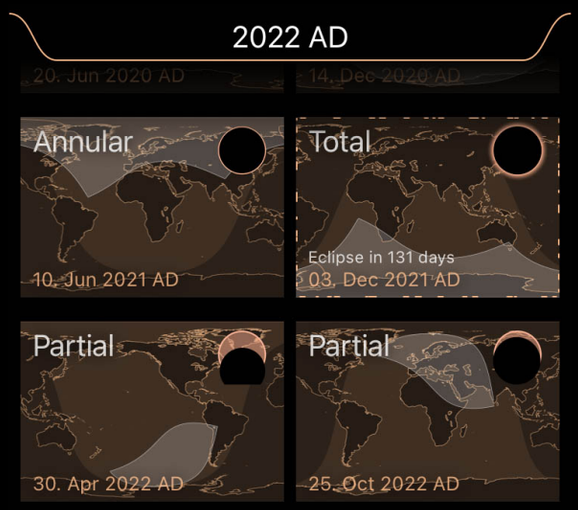
The Solar Eclipses and Lunar Eclipses sections both show a summary of the next four upcoming eclipses. Each eclipse shows a small map of the conditions of the eclipse, along with the date of the eclipse. For solar eclipses the light-shaded area of the map shows where the eclipse can be seen, while lunar eclipses can be seen anywhere there is darkness.

SOLAR ECLIPSES



All solar eclipses

Along with the four upcoming eclipses there is also a link to browse the entire eclipse catalog. Tap that link to browse the eclipse catalog by date, with past eclipses at top and future eclipses at the bottom. The next upcoming eclipse will be highlighted, and you can use the year pulldown at the top to quickly jump to other dates. Eclipses are available from 2000 BCE (BC) to 3000 CE (AD).



Each eclipse shows a small map of the conditions of the eclipse, along with the date of the eclipse. For solar eclipses the light-shaded area of the map shows where the eclipse can be seen, while lunar eclipses can be seen anywhere there is darkness.

Solar eclipse types

For solar eclipses the icon in the upper left indicates the eclipse type:

Partial solar eclipse

In a partial solar eclipse, the Moon passes betwen the Earth and the Sun in such a way that the Moon only blocks a portion of the Sun from view.

Total solar eclipse

During a total solar eclipse, the Moon passes between the Earth and the Sun, blocking the Sun completely from view, other than its aurora. This generally occurs when the Moon is at its closest orbit to Earth and the Earth is farthest from the Sun.

Annular solar eclipse

An annular solar eclipse is similar to a total solar eclipse, except that the Moon is not close enough to the Earth to fully obscure the Sun. The outer rim of the Sun remains visible.

Hybrid solar eclipse

Hybrid solar eclipses are total during parts of their path, and annular during others. They are rare occurences.

Lunar eclipse types

Lunar eclipses are shown with a rendering of the moon's predicted appearance in the upper left corner.

Partial lunar eclipse

During a partial lunar eclipse, a portion of the Moon passes through the Earth's umbral shadow. This allows much of the moon to retain its usual color.

Total lunar eclipse

When the Moon passes through the Earth's umbral shadow--where all sunlight is blocked--a total lunar eclipse occurs. This causes the Moon to take on strong shades of orange and red.

Penumbral lunar eclipse

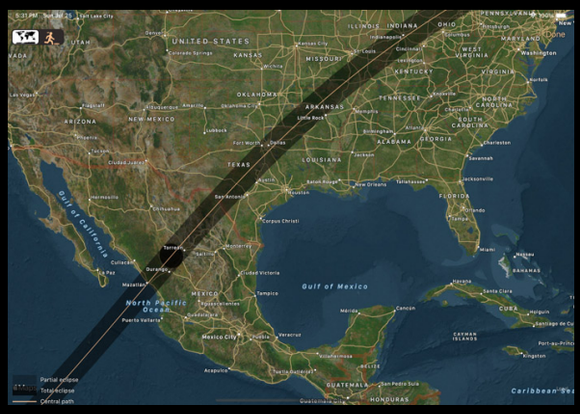
In a penumbral lunar eclipse, the Moon passes through the part of Earth's shadow which allows some light to reflect on to the Moon. This causes faint shadows across the Moon's surface.

Solar Eclipses

Tapping on any solar eclipse brings up an information display, an interactive map, and a set of actions. Tapping on "Catalog Data" will show full details of the eclipse:

Solar eclipse map

Tapping the solar eclipse map raises a dialog with a detailed map for the eclipse path and duration. The map can be zoomed and panned with pinch and drag gestures to see the effects of the eclipse around the world. When you are finished, tap the "Done" button in the upper right.



The orange line indicates the umbra path of a non-partial eclipse, while the dark shaded line shows the penumbral path.

The selector in the upper-left corner chooses between the full map and "Shadow Chaser". In Shadow Chaser mode you see a 3D flyover view of the eclipse with the camera centered on the shadow. The timeline and time controls can be used to see the shadow's location and size at any point along the eclipse.

Solar eclipse actions

In addition to the normal actions for "Center on screen", "Zoom in", "Add to a custom list", and "Add to Things You've Seen", solar eclipses include two additional actions:

Set time to the maximum

This will set the clock in Luminos to the time of greatest eclipse at your home location.

Fly to the best location

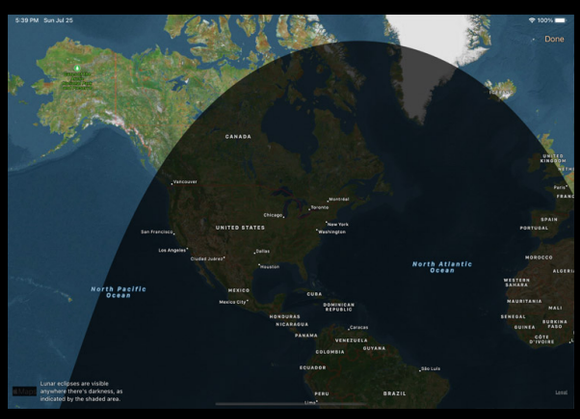
Tapping this action moves the camera to the location of the greatest eclipse for this entry.

Using these actions together with "Zoom in" and "Center on screen" allow you to simulate seeing an eclipse at its greatest time and location.

Lunar Eclipses

Lunar eclipse map

Similar to the solar eclipse map, tapping on a lunar eclipse map brings up an interactive map of the eclipse. There is no path for a lunar eclipse and a lunar eclipse can be seen from anywhere that's dark.



You can pan across the globe to see which locations are in darkness. Tap the "Done" button when you wish to exit the chart.

Lunar eclipse actions

Similar to solar eclipses, a lunar eclipse contains an addtional action:

Set time to the maximum

This will set the clock in Luminos to the time of greatest eclipse of this entry.

Solar eclipse data

General

Central duration

The central duration indicates how long the total phase of the eclipse lasts at the point of greatest eclipse. Central duration is not listed for partial solar eclipses.

Path width

The width of the Moon's umbra on Earth at its point of greatest eclipse. The path is the course of the Moon's shadow as it passes along the Earth.

Magnitude

The fraction of the eclipsed body which is in eclipse at greatest eclipse. Partial eclipses have magnitudes between 0.0 and 1.0, and total eclipses are greater than 1.0, with larger numbers indicating more coverage.

Gamma

The perpendicular distance of the Moon's shadow axis and Earth's center at greatest eclipse. The absolute value of the gamma can be used to determine the type of eclipse.

Apparent size

How large the eclipse will appear in the sky, in angular measurements.

Greatest longitude

The longitude location on Earth of the point of greatest eclipse.

Latitude

The latitude location on Earth of the point of greatest eclipse.

Catalog

Catalog

A sequential number given to eclipses by NASA.

Canon plate

A group number of eclipses in the catalog listing. Each plate include 20 sequential eclipses.

Saros

The number in a series used to track similar eclipses which occur 18 years and 11.3 days apart.

Lunation

The number of synodic months (time between similar Moon phases) since the new moon of January 6, 2006.

Appearance

ΔT

The difference between Universal and Terrestrial times when this eclipse occurs; essentially clock error.

Lunar eclipse data

Tapping a lunar eclipse entry brings up an information display, chart, and actions specific to that eclipse. As with solar eclipses, more detailed information can be found by tapping "Catalog Data":

General

Total phase

The amount of time that the Moon is totally eclipsed by Earth's umbral shadow.

Partial phase

The amount of time that the Moon is partially eclipsed by Earth's umbral shadow.

Penumbral phase

The amount of time that the Moon is partially eclipsed by Earth's penumbral shadow.

Umbra mag.

The fraction of the Moon's diameter that is obscured by the Earth's umbra.

Penumbra mag.

The fraction of the Moon's diameter that is obscured by the Earth's penumbra.

Gamma

The distance of the the axis of the Moon's shadow from the Earth's center at maximum eclipse. The absolute value of the gamma can be used to determine the type of eclipse, and the positivity or negativity of the number can indicate whether it occurs above or below the center of the Earth.

Catalog

Catalog #

A sequential number given to eclipses by NASA.

Saros

The number in a series used to track similar eclipses which occur 18 years and 11.3 days apart.

Lunation

The number of synodic months (time between similar Moon phases) since the new moon of January 6, 2006.

Canon plate

A group number of eclipses in the catalog listing. Each plate include 20 sequential eclipses.

Appearance

ΔT

The difference between Universal and Terrestrial times when this eclipse occurs; essentially clock error.

Quincena Solar Eclipse Param

Indicates which type of eclipse occurs prior to, or after (posterior) this lunar eclipse.

Meteor Showers

The meteor showers feature in Luminos can help you locate the most popular showers and determine when they will be at their peak rates. A meteor shower is represented in the Sky View by its radiant point and by occasional 3D meteor displays in the sky which increase at the shower's peak time.

Meteor showers are accessed in a section under the "Earth" item in the browser.

The graph shows the total meteor activity throughout the current year. Slide a finger along the graph to quickly change time to that point.

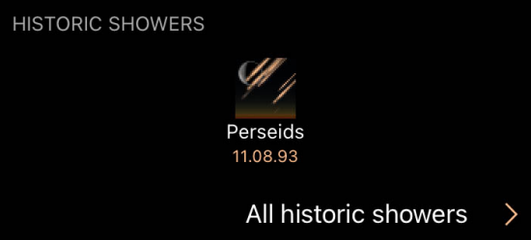
Choosing "All Meteor Showers" will bring up a list of all individual showers.

From the meteor showers list, you can identify the next peaking shower by the animated selection lines. The icon preview for each shower contains two helpful pieces of information: the relative strength of the shower as represented by the number of shown meteors, and the phase of the moon during that shower peak. A full moon can hinder the ability to spot meteors.

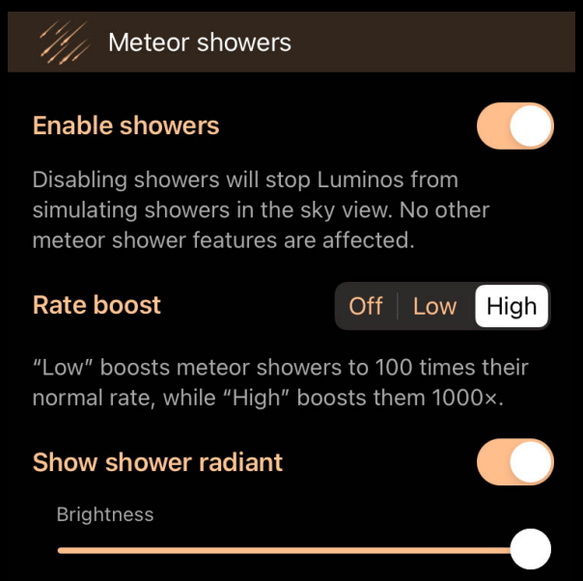
Tapping any particular meteor shower will present a detailed information page, as well as actions you can take related to that shower. The information includes the location of the radiant point where meteors of this shower originate in the sky; the start and end dates of the shower; the time at which the shower reaches its peak, and the zenith hourly rate (ZHR). The ZHR represents the theoretical maximum number of meteors a single person might see in one hour, although the actual number is usually lower. A "variable" rate indicates that this shower's activity changes greatly from year-to-year.

Meteor shower detail pages contain the standard actions available for most objects, such as marking them as seen and adding them to observation lists. There are two special actions for meteors. "Set to peak time" changes the Luminos clock to the moment when the meteor shower is at its peak. "Set to peak location" changes your position to the place on Earth where the shower is most visible at its peak.

For some historic meteor showers, Luminos can simulate the conditions that made them notable. If a shower has a "Historic showers" sub-menu, tap it to access a version of that shower from the past. Set Luminos to peak time and location for that historic shower to experience the show.



There is a section in the Luminos settings to adjust meteor showers. Use the main toggle to turn the display of 3D meteors in the sky view on or off. You can also adjust the quantity of meteors displayed using the "Rate boost": setting it to "Off" displays meteors in the sky at their actual ZHR; choosing "Low" or "High" will increase the number of meteors in the sky for a more noticeable effect. You can also turn the appearance of the radiant point on or off and adjust its brightness.



Tapping "Catalog Data" for any shower will list its full details:

General information

Name

The common name for the shower.

ID

The IAU designation for this shower.

orbits

The number of orbits used to calculate mean parameters.

Group

IAU numerical code of the main complex group.

Group serial

IAU serial number of the member of the complex group.

Parent body

The comet or asteroid from which this meteor shower originates.

Appearance

Solar longitude

The precise angular distance along the Earth's orbit where this shower is located.

RA / Dec (J2000)

The position of the shower radiant in the equitorial coordinate system.

RA / Dec Δ

Daily motion of the radiant coordinates.

Velocity

The pre-atmospheric speed of meteoroids in this shower.

Zenith hourly rate

The maximum number of meteors an ideal observer would see in perfectly clear skies with the shower radiant overhead.

Orbital Elements

Semimajor axis

A radius of the orbit at the orbit's two most distant points.

Peihelion distance

Distance when closest to our Sun.

Eccentricity

Amount by which the orbit deviates from a perfect circle. Numbers closer to zero are more circular, and numbers closer to one are more parabolic.

Argument of Perihelion

Angle between the ascending node and the perihelion, measured in the orbital plane.

Ascending node

The point on the orbit where the object moves north through the Earth's orbital plane.

Inclination

Angle between the body's plane and Earth's orbital plane.

Exoplanets

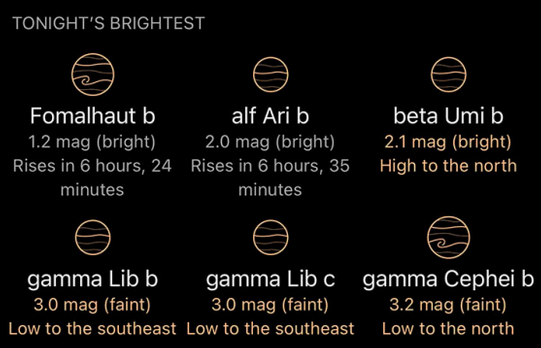
- Overview
- Tonight's Brightest
- All exoplanets
- Categories
- Sorting and filtering

Overview

The Exoplanets section of Luminos can be found under the Browse menu. Luminos contains thousands of known exoplanets, which can be located in the sky, and can be explored virtually.

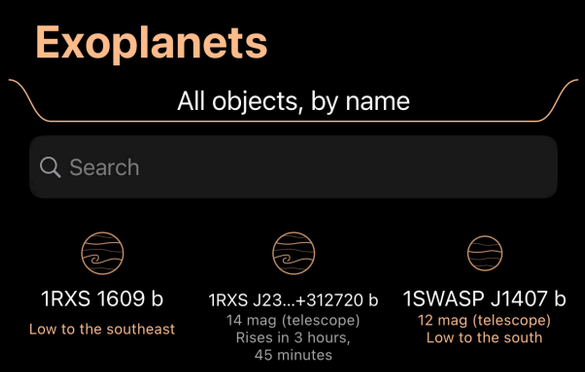
Tonight's Brightest

The Tonight's Brightest section shows a selection of the brightest stars with exoplanets which will be visible this evening. Exoplanets themselves are too faint to see, even with most telescopes, but you can see their host star.



All exoplanets

In addition to the recommendations for tonight, there is a link to view all exoplanets



The list of all exoplanets shows an icon for each planet indicating its relative size and composition, as well as a summary of its position and the host star's brightness.

The list of all exoplanets shows an icon for each planet indicating its relative size and composition, as well as a summary of its position and the host star's brightness.

At the top of the list is a filtering control to help reduce the list to the most interesting objects.

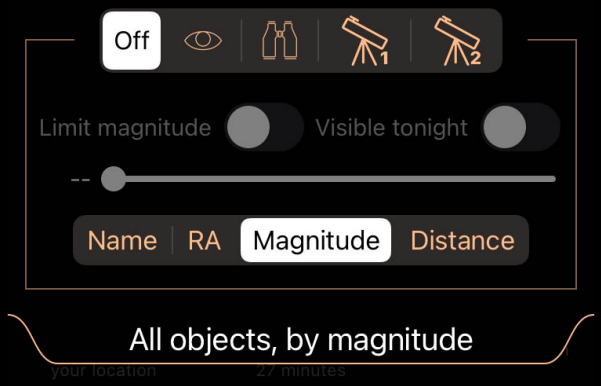
Categories

The exoplanets are also grouped by size and temperature characteristics, as well as the "Habitable Zone Earths" category which contains objects which are both the right size and right temperature to possibly harbor life.

Just like the "All Exoplanets" list, each category will present a list showing an icon representing the relative size and composition, and a summary of its position and the host star's brightness.

At the top of each list is a filtering control to help reduce the list to the most interesting objects.

Sorting and filtering



The list can be sorted and filtered using the pulldown at the top of the list. You can either tap the pulldown tab or drag it down to open it.

The selector at the top is used to switch between filter sets. Although the icons suggest uses for each filter set – visual, binocular, and two telescope settings – all the filter sets are identical in behavior and can be used for any purpose.

When a filter set is selected, any adjustments you make are remembered by that set. When you return to that set later, the adjustments will be as you left them the last time you had that filter set selected.

Use the Limit Magnitude switch and the slider beneath it to limit the list to stars brighter than the selected magnitude. Adjust the slider to choose the cutoff magnitude.

Use the Visible Tonight switch to only list objects which will be up during the current/coming night.

The sorting selector at the bottom is used to sort the objects by the criteria shown on the selector.

Spacecraft

- Overview
- Spacecraft
- Mission
- Actions
- Timeline

Overview

Luminos contains a selection of spacecraft to explore, which can be accessed in the Browse menu by tapping the Spacecraft tile.

The Spacecraft browser lists the available spacecraft with a brief summary of their purpose. Tapping a spacecraft will show details about it.

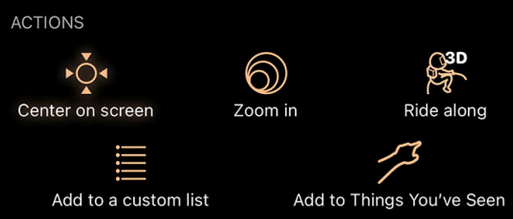
Spacecraft

The first time you open the page for a spacecraft, position data is downloaded from NASA's HORIZONS database. This can take a few minutes, so if the craft appears to be in the center of the sun, wait a minute or two for the data to be retrieved.

Mission

The top of the page shows the mission status and where the spacecraft is located in the sky. You can't see spacecraft, but radio telescopes may be able to detect them, or you may just want to know which way it is right now.

Actions



Center on screen

Using this action will select the spacecraft and center it on the screen for ease of viewing. As time progresses, the view will stay centered on the craft.

Zoom in

For an even better view, tap Zoom In to enlarge the spacecraft in your display view. There are multiple levels of zoom. The first level is the "field" level and shows a 5 degree field of view, the second level will show the spacecraft itself, if possible. Tapping the button once more will zoom out to a 60 degree field of view.

Ride along

This action launches you off of the Earth and puts you in the same position in space as the craft. From there you can examine a model of the spacecraft or pinch-zoom out to see what space looks like from the spacecraft.

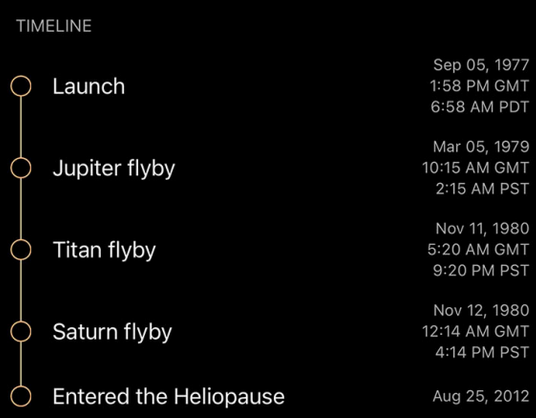
Add to a custom list

Add the spacecraft to an Observation List. You can define a new Observation List while you add the craft.

Add to Things You've Seen

Mark the spacecraft as one that you have seen. It's time will be noted in the Things You've Seen list.

Timeline



The timeline has key points in the spacecraft's mission. Tapping any entry will change Luminos' clock to the time of that event.

Satellites

Tonight's flyovers

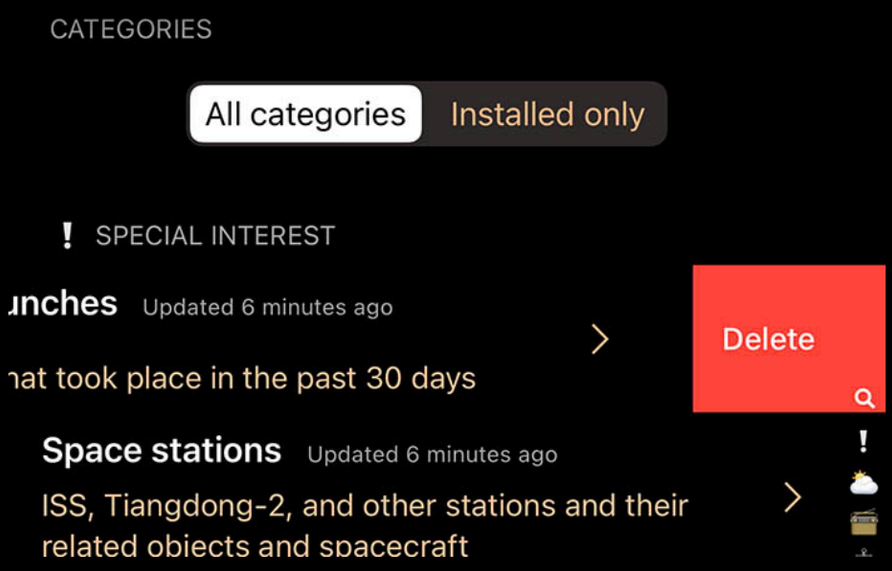
From the main satellites page, you can quickly see which satellites will be in prime viewing tonight from your current location. This list will automatically update throughout the night to show the currently- or soon-to-be- visible satellites.

Categories

Initially, the satellites browser will contain four categories of satellites: Recent launches, Space stations, Visual, and Geostationary. Many more categories are available, and those four pre-selected categories can also be turned off.

To install additional categories, change the selector at the top of the Categories list to "All categories" instead of "Installed only". This will reveal all of the available categories, where you can then use the download button to install any category. Once you have finished adding categories, change the selector back to "Installed only" to remove the uninstalled categories from your display.

To remove an installed category, swipe left on that category to reveal a Delete button.



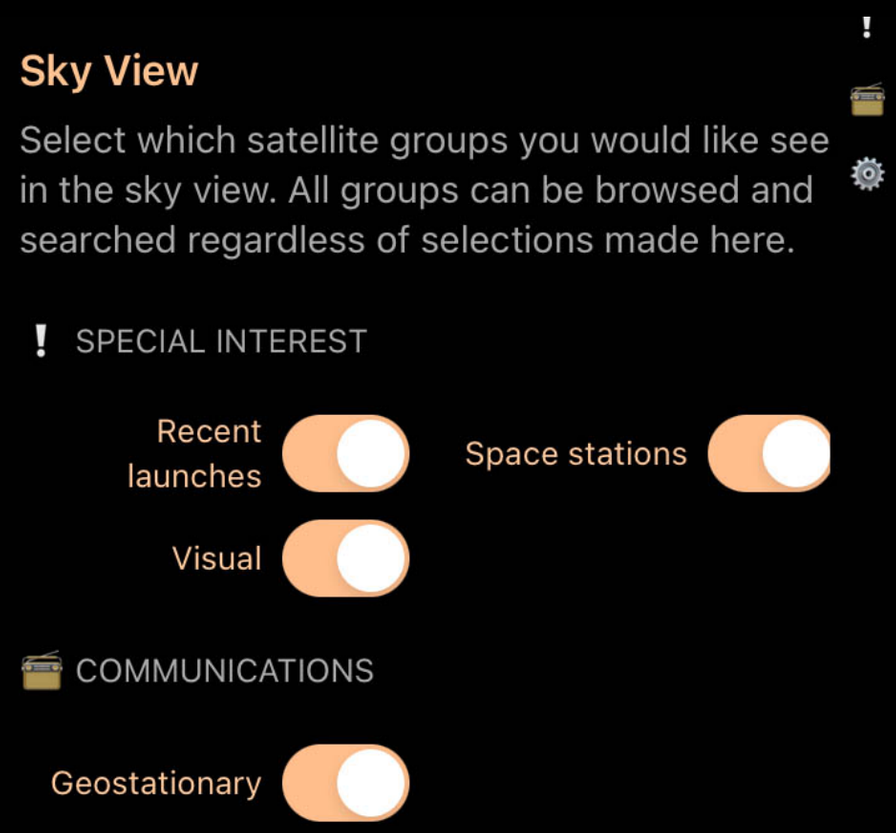
Satellite settings

Satellites settings can be found in Luminos' Settings panel and the same settings are also found at the bottom of the Satellites page.

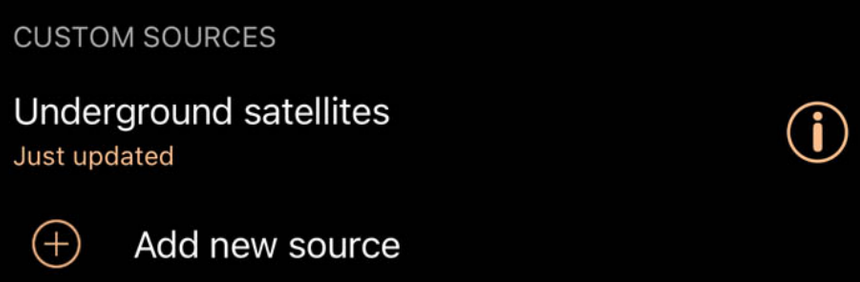
The first option is "Automatic Downloads". Set Automatic Downloads to "On" for Luminos to download satellite information for your selected satellite categories every three days. If you prefer more control, you can turn off automatic downloads and instead use the Update Now button to update your data. Note that you can also pull down on the Satellites page in the browser to update the data.

Sky View

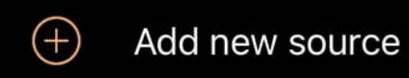
You will also find a Sky View section with switches for all installed satellite categories. Use these switches to show or hide entire categories in the sky view. Note that these switches only affect whether the sky view shows that category, and you can search and browse all of your categories regardless of whether they're shown in the sky view.



Custom sources



In addition to the categories provided by CelesTrak, you can add custom TLE sources. Satellite data is generally distributed in the form of TLE (two-line element) files. Luminos can import TLE files from public locations on the Internet and will update them every three days at the same time it updates the built-in categories. They are also updated when you use the Update Now or pull-to-refresh gestures to update the other categories.



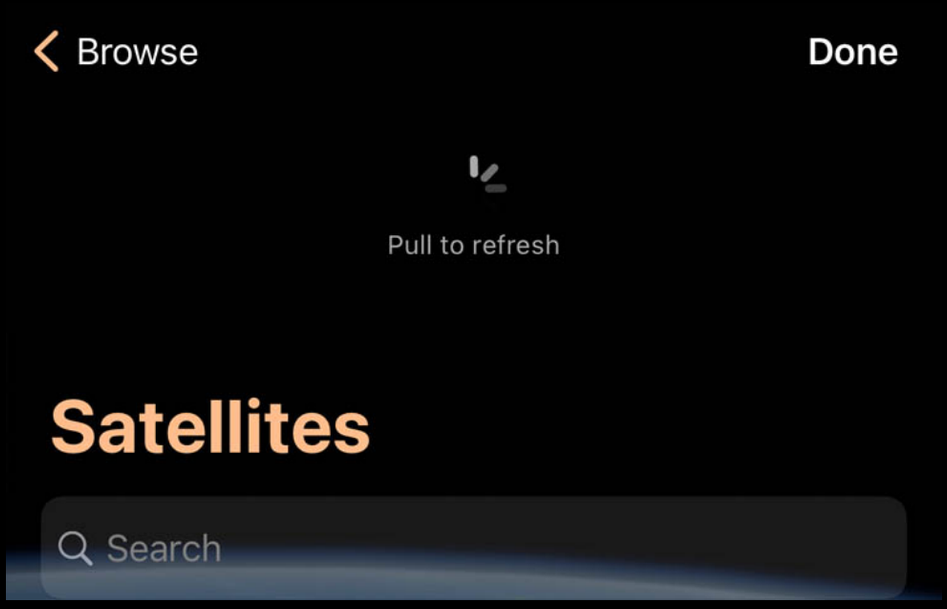
To add a custom TLE source, tap "Add new source" in the Custom Sources section. You will be presented with a dialog where you can enter the URL for the source as well as give it a friendly name for your own reference.

To delete a custom TLE source, swipe left on it to reveal a Delete button.

About satellite data

Satellite data in Luminos is obtained from CelesTrak, a tracking resource from Dr. T. S. Kelso and the Center for Space Standards and Innovation (CSSI). Luminos also supports custom sources for satellites from two-line element set (TLE) files.

Satellite data becomes less accurate over time and stays accurate for about a week. Luminos automatically updates satellite data every three days to maintain the highest accuracy. If you choose to disable automatic updates, you can manually refresh the satellite data at any time by pulling down on the Satellites page in the browser. When you stop using Luminos the automatic updates will also stop, and will resume when you start using Luminos again.



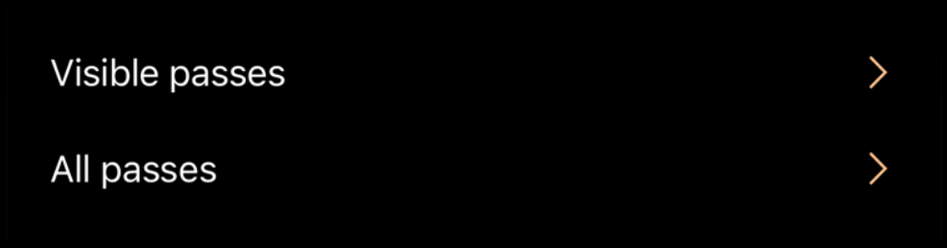
Sky icon

In the Sky View, a satellite is represented by this icon:

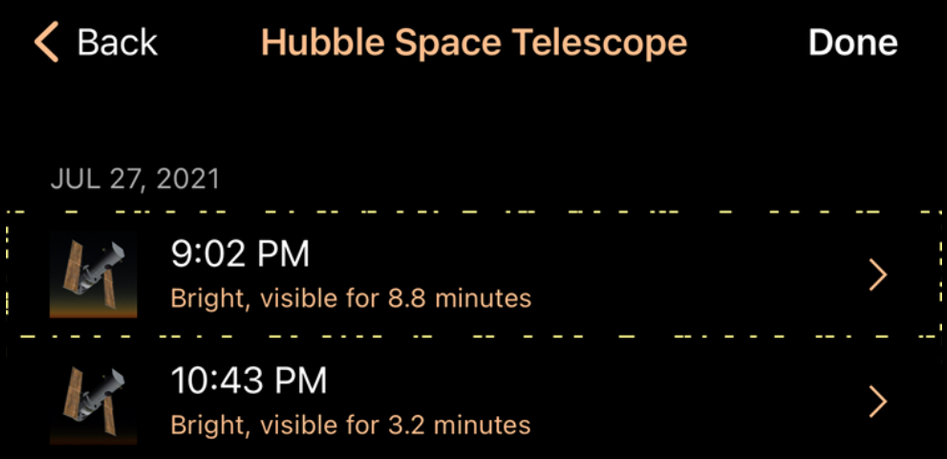
Satellite passes

Tapping on the detail view of any satellite offers the ability to view passes of that satellite over your current location. You can choose to view only passes that are visible or the complete list of passes.

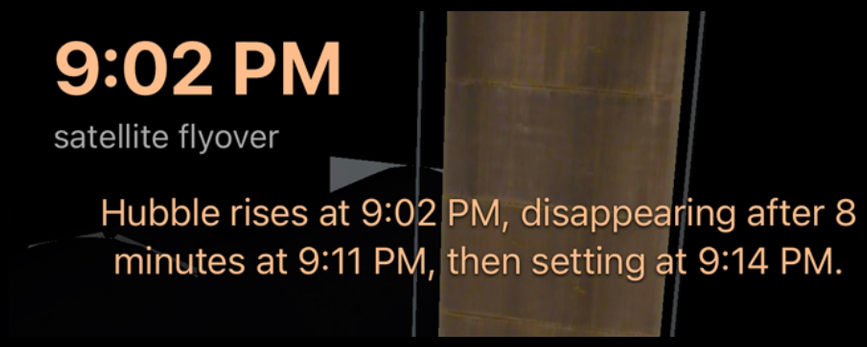
The Visible passes list shows those passes where the satellite is above the horizon, and in Earth's shadow, and being illuminated by sunlight. The All passes list shows all satellites above the horizon, regardless of their lighting.



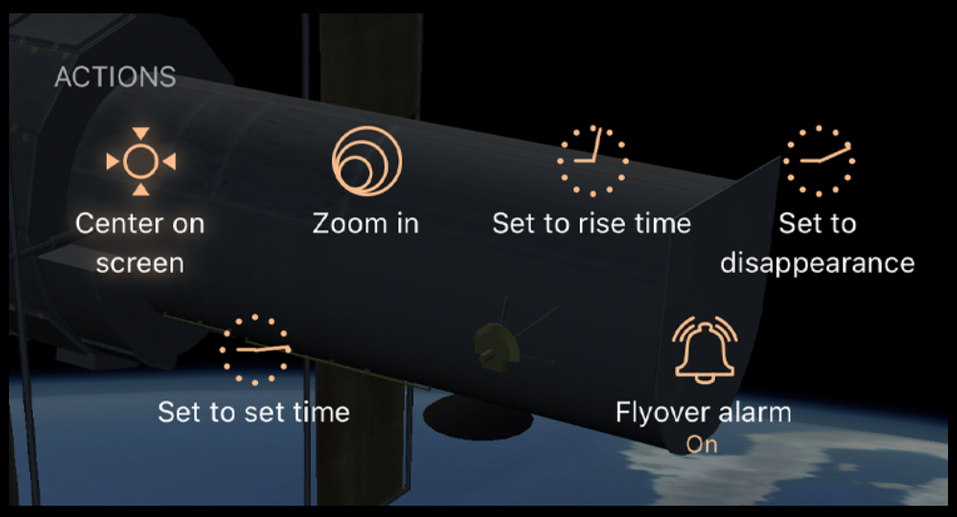
In either list, the upcoming satellite flyover passes are chronological by date. Summary information for each pass is shown, and the icon reflects the sky appearance of the satellite at peak flyover. The next scheduled pass will be highlighted.



Tapping a pass shows details of that pass.

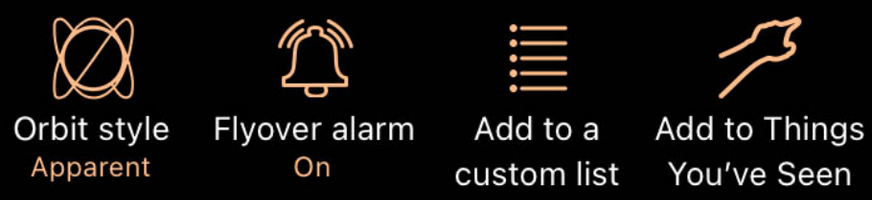


From this same display, there are actions to center or zoom in on the satellite. Use the time buttons to set to the various phases of the flyover, which makes it easy to see the path it will take across the sky.

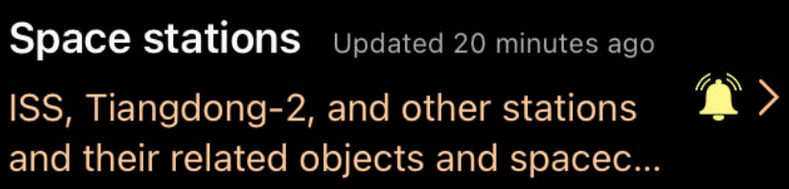


Satellite alarms

Toggling on an alarm for any particular satellite will prompt Luminos to schedule a notification on your device when that satellite becomes visible at your location. Turn off the alarm to disable further notifications. The first time you enable an alarm, Luminos will request permission to send notifications, which is required for this feature.



Any category of satellites with an active alarm will be indicated by a special icon to make them easier to locate and disable.



Satellite alarms will cease scheduling if you have not run Luminos recently. Activating the app will update the list of scheduled alarms for the near future.

The following actions are available for any selected satellite:

Actions

Center on screen

Using this action will select the body and center it on the screen for ease of viewing. As time progresses, the camera will follow the object.

Zoom in

For an even better view, tap this button to enlarge the item in your display view.

Set to...time

When viewing information about a particular satellite flyover event, you can set the Luminos clock to the rise or set time of that flyover to simulate it.

Ride along

This action launches you off of the Earth and puts you in the same position in space as the satellite. From there you can watch the Earth passing beneath you or look around at what space looks like from a satellite. This is especially effective with the International Space Station - search for ISS in the Satellites database to locate the entry for the Space Station.

Orbit style

Switch the appearance of the orbit path between the actual orbit and apparent orbit. The apparent orbit shows the locations above Earth where the satellite travels over time. It is a convenient and interesting way to see a satellite's path relative to locations on Earth.

Flyover alarm

When a satellite has alarms set to "On", Luminos will send notifications to your device when the satellite is appearing overhead at your location. Turn the flyover alarm "Off" to disable these messages.

Add to a custom list

Add the current item to an Observation List. You can define a new Observation List while you add the item.

Add to Things You've Seen

Mark the item as one that you have seen. Its time will be noted in the Things You've Seen list.

Set to rise time (Satellite passes only)

Change the internal clock on Luminos to the time that this satellite is scheduled to rise above the horizon.

Set to set time (Satellite passes only)

Change the internal clock on Luminos to the time that this satellite is scheduled to set below the horizon.

Articles

Many satellites include more descriptive information from external sources:

Wikipedia

If the satellite or satellite group has a Wikipedia article, tapping this option will display the article in the Luminos Browser.

National Space Science

NASA includes helpful web pages with details on many satellites. Tapping this option will open an external browser to the information page of this satellite. Note that many satellites do not have a page at the NSSDC and will show an error message when accessing those pages.

User's Guide

Tapping this option jumps directly to the Luminos User's Guide page for satellite viewing and configuration.

Position

Additional coordinates for the satellite can be accessed by tapping on the coordinates display:

Horizontal Az

Azimuth, a measurement from a viewer to the object projected on a reference plane. Part of the horizontal coordinate system, along with altitude.

Horizontal Alt

Altitude, the vertical elevation in degrees of the object from the horizon, measured in degrees. Part of the horizontal coordinate system, along with azimuth.

Equatorial (now) RA

Right ascension is the celestial equivalent of terrestrial longitude.

Equatorial (now) Dec

Declination is the celestial equivalent of terrestrial latitude.

Equatorial (J2000) RA

Right ascension referenced from the point in time at January 1, 2000.

Equatorial (J2000) Dec

Declination referenced from the point in time at January 1, 2000.

Ecliptic Lon

Longitude relative to the ecliptic plane, the plane formed by the path the Earth travels around the Sun.

Ecliptic Lat

Latitude relative to the ecliptic plane, the plane formed byt the path the Earth travels around the Sun.

Galactic Lon

Longitude relative to the galactic plane, the plane formed by the disk containing most mass in our galaxy.

Galactic Lat

Latitude relative to the galactic plane, the plane formed by the disk containing most mass in our galaxy.

Heliocentric X

X dimension of the Cartesian coordinates of the object relative to our Sun.

Heliocentric Y

Y dimension of the Cartesian coordinates of the object relative to our Sun.

HeliocentricZ

Z dimension of the Cartesian coordinates of the object relative to our Sun.

Satellite data

Details for the data used in calculations can be accessed by tapping on Catalog Data for any satellite:

Designations

Satellite Cat. #

The unique satellite catalog number for this object.

Int'l Designation

The international designation for this satellite. The first part of the number represents the year of launch. The second represents the order in which the satellite was launched that year. The final letter represents which item the satellite was in that particular launch.

Elements

Data epoch

The time at which this snapshot position was taken.

Revolution #

Number of total revolutions this satellite has orbited around the Earth.

Revolutions / day

Number of times per day that the satellite orbits the Earth.

Inclination

One of the six orbital parameters, indicating the angular distance of this satellite's orbit from the Equator.

Ascending node

Represents the point where the orbit of a satellite crosses the equatorial plane going from south to north.

Eccentricity

Represents how circular this satellite's orbit is. Values closer to zero are more circular, and values closer to 1 represent longer, thinner orbits.

Arg. of Perigree

The argument of perigree defines the angle of the object when it is nearest the Earth. Used to orient the orbit in the orbital plane.

Mean anomaly

An angle that represents how far along the orbit a satellite is at a given point in time.

Time derivative

Acceleration of the mean motion of the object.

Second derivative

Acceleration of the acceleration of the mean motion of the object.

BSTAR drag

The rate at which the satellite is spiraling towards Earth. Represented in revolutions per day.

Ephemeris type

A type indicator which is always zero for publicly-released tracking information.

Stars

- Overview
- Star lists
- Sorting and filtering
- Stars
- Exoplanets
- Live Data
- Additional data
- More coordinates
- Gaia DR2 entry
- Hipparcos entry
- Tycho-2 entry

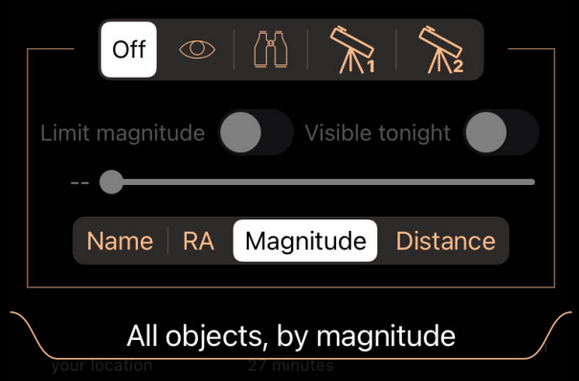
Overview

The stars section allows you to browse thousands of stars and find them in the sky. Stars are grouped into useful categories such as "Named", "Brightest", "Nearest", and "Navigation." Luminos has 5 million stars built-in, but additional stars can be installed to increase the number of stars up to 250 million, giving coverage down to magnitude 17.4. Additional data can also be installed, such as Tycho and Hipparcos data, as well as additional data from the Gaia catalog such as proper motions and additional magnitudes.

Star lists

Browsing any of the lists will show the stars for that category. The color and size of the star in the list is indicative of the actual star color and magnitude, and below each star is a summary of its appearance and location.

Sorting and filtering



Lists can be sorted and filtered using the pulldown at the top of the list. You can either tap the pulldown tab or drag it down to open it.

The selector at the top is used to switch between filter sets. Although the icons suggest uses for each filter set – visual, binocular, and two telescope settings – all the filter sets are identical in behavior and can be used for any purpose.

When a filter set is selected, any adjustments you make are remembered by that set. When you return to that set later, the adjustments will be as you left them the last time you had that filter set selected.

Use the Limit Magnitude switch and the slider beneath it to limit the list to objects brighter than the selected magnitude. Adjust the slider to choose the cutoff magnitude.

Use the Visible Tonight switch to only list objects which will be up during the current/coming night.

The sorting selector at the bottom is used to sort the objects by the criteria shown on the selector.

Stars

Tapping on any star in the list, or using the Info button on the Sky View's Selection Bar, will bring up a page with details about that star. At the top is a description of the star's position in the sky and its appearance, or information about when it rises if it is not up yet.

An essay, about the star, if one is available, appears below the position description. Tap on the essay to expand it for reading, tap it again to compact it.

Actions

A set of actions are available for each star.

Center on screen

Using this action will select the star and center it on the screen for ease of viewing. As time progresses, the view will stay centered on the star.

Zoom in

For an even better view, tap Zoom In to enlarge the star in your display view. There are multiple levels of zoom. The first level is the "field" level and shows a 5 degree field of view, the second level will zoom to show orbiting planets around the star, if any, and the third level will show the star itself. Tapping the button once more will zoom out to a 60 degree field of view.

Fly into orbit

This action launches you off of the Earth and puts you in orbit around the star. From there you can spin the star with one finger to view it from various angles. If the star has planets, then the Orbit will have two levels. The first tap will take you into orbit far from the star so you can see the planets. The second tap will take you close to the star, and each tap after that will switch back-and-forth between the two modes. Use the Home buttton in the upper left corner of the screen when you're ready to return to Earth.

Land on the surface

This action launches you off of the Earth and lands you on the surface of the star, allowing you to look around and view space as if you were standing on the star. The atmosphere effect is colored to approximate the color of the star's corona. Use the Home buttton in the upper left corner of the screen when you're ready to return to Earth.

Add to a custom list

Add the star to an Observation List. You can define a new Observation List while you add the star.

Add to Things You've Seen

Mark the star as one that you have seen. It's time will be noted in the Things You've Seen list.

Exoplanets

If the star has exoplanets then they will be listed next. Tap on any exoplanet to view details, and see the Exoplanets section for more about those.

Live data

The live data section shows current information about the star, including magnitude, distance, and apparent size. There is also a coordinate display showing RA/Dec and Az/Alt coordinates. Tap that coordinate display for additional coordinate systems such as Galactic or Ecliptic coordinates.

Magnitude

A logarithmic measure of the brightness of an object. Lower numbers are brighter.

Distance

The distance from your current location.

Light-time

Another measure of distance using the time it takes light to reach you from an object

Apparent size

The angular diameter of an object, i.e. how many degrees, minutes, or seconds it occupies in the sky.

Temperature

The temperature of the star's corona in degrees Kelvin. Our Sun is around 5,700 °K, while hot blue stars can be 10,000 °K or more, and cool infrared stars can be just a couple thousand degrees.

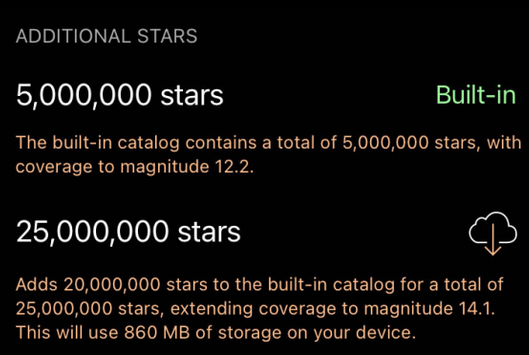
Position

The position display shows azimuth, altitude, right ascension, and declination for the current instant. Tapping on the display will show coordinates in several other reference coordinate systems.

Additional data

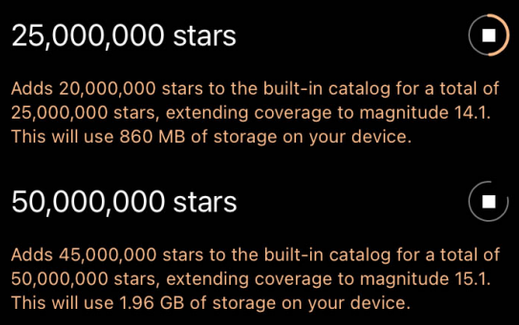
The star database can be increased up to 250 million stars, and additional data entries can be added such as proper motion or Hipparcos New Reduction entries. The available downloads are at the bottom of the main Stars page in the Browse menu.

Installing additional data



Use the download button to install addtional data. Multiple downloads can be queued up, but keep in mind that Luminos needs to be kept running in order for the downloads to complete. If a download is interrupted, tap its download button again and it will resume from where it left off.

Note that additional data will require additional device storage space – up to many gigabytes – depending on the chosen supplement. Additional storage above and beyond the listed size of the catalog will be necessary during installation, but will be available again on the device afterwards. Make sure that your device has at least twice the listed storage available during installation to avoid any errors.

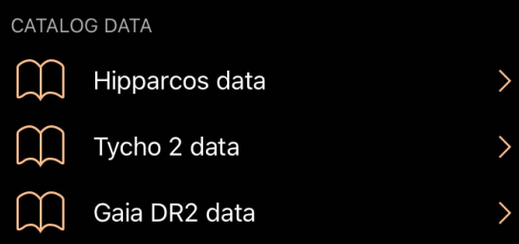


The download button will change to a progress indicator during the download and installation process. The progress indicator is also a Stop button, which you can tap to cancel that download.

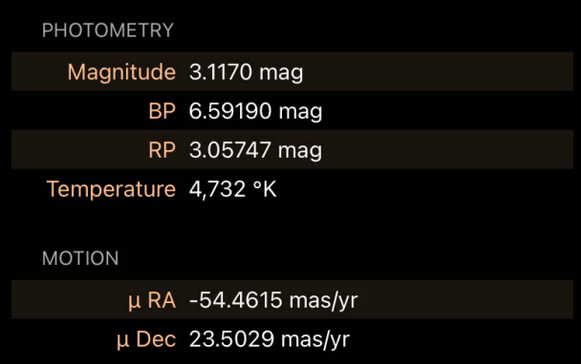
Removing additional data

To remove a supplemental data set, swipe left on that item to reveal a Delete button.

More fields



When additional data is installed you will find more fields in the Catalog Data for a star. The Gaia supplements will show up as additional fields in the "Gaia DR2 Data" link from the Catalog Data section, while Hipparcos and Tycho data will be found under the Catalog Data section as "Hipparcos Data" and "Tycho 2 Data" links.



More coordinates

Tapping on the coordinates display on any star's page will bring up more coordinates in several reference coordinate systems:

Horizontal Az

Azimuth, a measurement from a viewer to the object projected on a reference plane. Part of the horizontal coordinate system, along with altitude.

Horizontal Alt

Altitude, the vertical elevation in degrees of the object from the horizon, measured in degrees. Part of the horizontal coordinate system, along with azimuth.

Equatorial (now) RA

Right ascension is the celestial equivalent of terrestrial longitude.

Equatorial (now) Dec

Declination is the celestial equivalent of terrestrial latitude.

Equatorial (J2000) RA

Right ascension referenced from the point in time at January 1, 2000.

Equatorial (J2000) Dec

Declination referenced from the point in time at January 1, 2000.

Ecliptic Lon

Longitude relative to the ecliptic plane, the plane formed by the path the Earth travels around the Sun.

Ecliptic Lat

Latitude relative to the ecliptic plane, the plane formed byt the path the Earth travels around the Sun.

Galactic Lon

Longitude relative to the galactic plane, the plane formed by the disk containing most mass in our galaxy.

Galactic Lat

Latitude relative to the galactic plane, the plane formed by the disk containing most mass in our galaxy.

Heliocentric X

X dimension of the Cartesian coordinates of the object relative to our Sun.

Heliocentric Y

Heliocentric Y dimension of the Cartesian coordinates of the object relative to our Sun.

Heliocentric Z

Z dimension of the Cartesian coordinates of the object relative to our Sun.

Hipparcos entry

If you've installed the Hipparcos data supplement and a star has an entry in Hipparcos, then you will see a Hipparcos Data link in the Catalog Data section of that star's page. Tapping Hipparcos Data will show you the entry from Hipparcos, The New Reduction:

Position

RA (J2000)

Right ascension is the celestial equivalent of terrestrial longitude.

Dec

Declination is the celestial equivalent of terrestrial latitude.

Parallax

Difference in a star's position at multiple measurements throughout the year. Used to determine a star's distance.

Reference flag

Reference flag for astrometric parameters of double and multiple systems. Consult the Hipparcos guide for more information.

Motion

pmRA

Change in position of the right ascension per year.

pmDE

Change in position of the declination per year.

Spectrum

Vmag

The magnitude in the Johnson UBV photometric system.

BT magnitude

Blue magnitude (445 nanometers). Refers to the photometric system used to measure the stars.

VT magnitude

Visual magnitude (551 nanometers). Refers to the photometric system used to measure the stars.

Johnson B-V

Difference between blue and visual magnitudes.

Cousins' V-I

Difference between visual and infared magnitudes.

Combined flag

Consult the Hipparcos guide for more information.

Reduction V-I

Difference between visual and infared magnitudes.

Spectral type

A classification of stars based on their spectral characteristics. According to an informal tradition, O stars are "blue", B "blue-white", A stars "white", F stars "yellow-white", G stars "yellow", K stars "orange", and M stars "red", even though the actual star colors perceived by an observer may deviate from these colors depending on visual conditions and individual stars observed.

Variability

Variable type

'C' for constant, 'P' for periodic, 'D' for duplicity-induced, 'M' for micro-variable, 'R' for revised color index.

Period

Cycle duration of brightness of the star.

Hip. magnitude

Median magnitude in the Hipparcos photometric system.

Range

Difference in brightness between brightest and dimmest readings.

 # observations

Number of Hipparcos magnitude observations.

Scatter

Scatter of the Hipparcos magnitude observations.

Reference

Reference flag for the photometric parameters. Consult the Hipparcos guide for more information.

Additional info

More information on variability.

Designations

Hipparcos

Unique identifier in the Hipparcos catalog.

Henry Draper

Unique identifier in the Henry Draper catalog.

Bonner DM

Unique identifier in the Bonner Durchmusterung.

Cordoba DM

Unique identifier in the Cordoba Durchmusterung.

Cape Photo. DM

Unique identifier in the Cape Photographic Durchmusterung.

Multiple star

CCDM

Identifier in the Catalogue of Components of Double and Multiple Stars.

Historical status

'H': determined multiple by Hipparcos; 'I': determined multiple by an input catalog; 'M': determined by miscellaneous catalogs.

Num. entries

Number of separate catalogue entries with the same CCDM identifier.

Num. components

Number of components into which the entry was resolved.

Add'l info in annex

Double and multiple systems annex flag. 'C': component solutions, 'G': acceleration terms , 'O': orbital solutions, 'V': variability-induced movers, and 'X': stochastic solution.

Measurement

Source

This field qualifies the source of astrometry. 'F': fixed system; 'I': independent system; 'L': linear system; 'P': primary target; 'S': single-star merging.

Solution quality

This provides an indication of the reliability of the double or multiple star solution: 'A','B','C', 'D'.

Component IDs

Letter combinations representing the reference of brightness between two components.

Pos. angle

The position angle between components.

Angular sep

The angular separation between components.

Magnitude diff

This field gives the magnitude difference between the components, expressed in mag.

Is survey star

The 'survey' was the basic list of bright stars added to and merged with the total list of proposed stars, to provide a stellar sample (almost) complete to well-defined limits. A flag 'S' indicates that the entry is contained within this 'survey'.

Chart

Where identification of the star using ground-based telescopes might prove difficult or ambiguous (e.g. for faint stars, for crowded zones, or for components of double or multiple systems), identification charts were constructed. A value of 'D' indicates charts produced directly from the STScI Digitized Sky Survey, while a value of 'G' indicates charts constructed from the Guide Star Catalog.

Notes

Flag indicating that the Hipparcos catalog contains additional notes about this star.

Correlation

DE:RA

Correlation coefficient for declination over right ascension.

pmDE:pmRA

Correlation coefficient for declination over right ascension.

pmRA:DE

Correlation coefficient for proper motion right ascension over declination.

pmRA:RA

Correlation coefficient for proper motion right ascension over right ascension.

pmRA:Plx

Correlation coefficient for proper motion right ascension over parallax.

Plx:RA

Correlation coefficient for parallax over right ascension.

Plx:DE

Correlation coefficient for parallax over declination.

pmDE:DE

Correlation coefficient for proper motion declination over declination.

pmDE:RA

Correlation coefficient for proper motion declination over right ascension.

pmDE:Plx

Correlation coefficient for proper motion declination over parallax.

Goodness of fit

This number indicates the goodness-of-fit of the astrometric solution to the accepted data.

Rejected

This field gives the percentage of data that had to be rejected in order to obtain an acceptable astrometric solution.

Tycho-2 entry

Tycho-2 is a catalog of more than 2.5 million stars compiled by the European Space Agency. For Tycho-2 catalog stars, the following data will be present if the supplemental data is installed:

Position

Mean RA

The mean right ascension in decimal degrees in the ICRS system and J2000 equinox. Several catalogs are used to determine the Mean RA.

Mean RA epoch

The epoch of the mean right ascension in Julian years.

Dec

The mean declination in decimal degrees in the ICRS system and J2000 equinox. Several catalogs are used to determine the declination.

Mean Dec epoch

The epoch of the mean declination in Julian years.

positions used

The number of positions used in order to compute the mean position and proper motion.

Observed RA

The Right Ascension of the star, in the ICRS system (J2000 equinox), at the epoch specified by the parameter ra_epoch, and given in decimal degrees.

Observed RA epoch

The epoch of the observed right ascension in years.

Observed Dec

The declination of the star, in the ICRS system (J2000 equinox), at the epoch specified by the parameter dec_epoch, and given in decimal degrees.

Observed Dec epoch

The epoch of the observed declination in years.

Motion

μ RA

The proper motion in the RA direction, in milliarcseconds per year.

μ DE

The proper motion in the declination direction, in milliarcseconds per year.

Spectrum

BT magnitude

The Tycho-2 BT (blue) magnitude, blank when no magnitude is available.

VT magnitude

The Tycho-2 VT (visible) magnitude, blank when no magnitude is available.

Designations

Tycho

The TYC identifier is constructed from the Guide Star Catalog region number, the running number within the region and a component identifier which is normally 1. All are separated by hyphens.

Hipparcos

If this star has a Hipparcos designation, it will be listed here.

Measurement

Is Tycho-1 star

A flag which specifies whether or not the star was in the original Tycho Catalog (Tycho-1).

Solution type

A flag describing the type of Tycho-2 solution, where 'D' = double star treatment, 'P' = photocentre treatment, and no value = normal treatment.

Proximity

A proximity indicator, being the angular distance in units of 100 mas to the nearest entry in the Tycho-2 main catalog or first supplement.

Statistics

DE:RA

The correlation coefficient of the observed right ascension and declination.

GoF Mean RA

The goodness-of-fit parameter for the mean right ascension. This goodness of fit is the ratio of the scatter-based error to the model-based error.

GoF Mean Dec

The goodness-of-fit parameter for the mean declination. This goodness of fit is the ratio of the scatter-based error to the model-based error.

GoF Motion RA

The goodness-of-fit parameter for the proper motion in right ascension. This goodness of fit is the ratio of the scatter-based error to the model-based error.

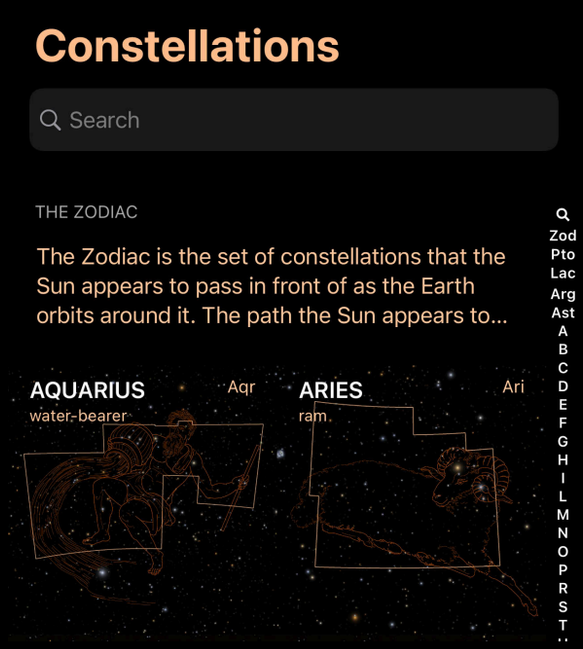
GoF Motion Dec

The goodness-of-fit parameter for the proper motion in declination. This goodness of fit is the ratio of the scatter-based error to the model-based error.

Constellations

Overview

The Constellations page is found at the root level of the Browse menu and allows you to browse the 88 formally recognized IAU constellations, as well as common asterisms, by various groupings and find their position in the sky.



Constellations

Constellations are grouped into categories such as Zodiac, Ptolemy's constellations, Lacaille's dark constellations, and the Argo Navis, as well as an alphabetical list of all 88 official constellations.

Asterisms

Asterisms are included as a group and can be found as the last group, after the Argo Navis and before the alphabetical indexes.

The index control

An index along the right-hand edge gives quick access to the categories ("Pto" for "Ptolemy's", "Ast" for "Asterisms", etc...). Slide your finger along the index to page quickly between the sections or tap on a location to jump to it in the list.

To learn more about the various constellations and asterisms, select one from the list. Each contains an information summary and article, and will center the sky view on the figure.

Actions

Each constellation and asterism has several actions available on its detail page:

Center on screen

This action will center the selected object on the screen. While the object is currently centered the icon will be highlighted.

Zoom in

This action will zoom in on the object so that it fills the screen. If the object isn't already centered, the Zoom In button will first center the object.

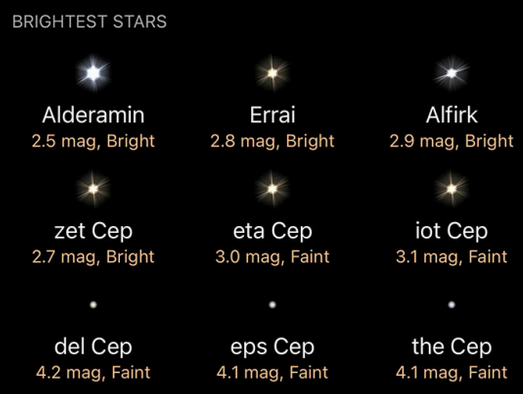
Add to a custom list

This action will open a browser containing your custom Observation Lists. Selecting one more more lists in this browser will add the selected object to those lists.

Add to Things You've Seen

This action will mark the selected object as having been seen at the current date and time. You can see a list of the objects you've already seen in the Browser.

Brightest Stars



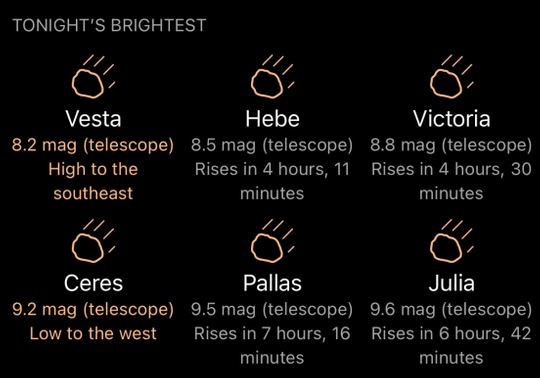
Constellations have a Brightest Stars section at the bottom of their pages. This section lists the 9 brightest stars in the constellation. Tap on any star to view its details.

Asteroids

- Overview
- Asteroid lists
- Sorting and filtering
- Asteroids
- Settings
- More coordinates
- MPC asteroid data

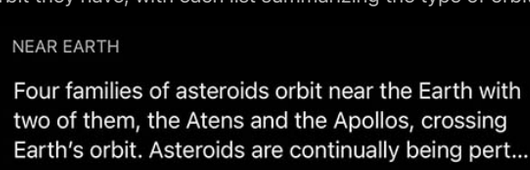
Overview

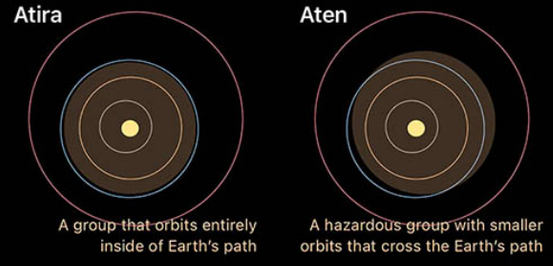
Asteroids are located at the top level of the Browse menu. The Asteroids page divides the asteroids into several categories, and the brightest asteroids visible from your location tonight are grouped together at the top. Tap on any of the asteroids to get details about its location and appearance, or to perform actions such as centering the display or taking a ride with the asteroid.



Asteroid lists

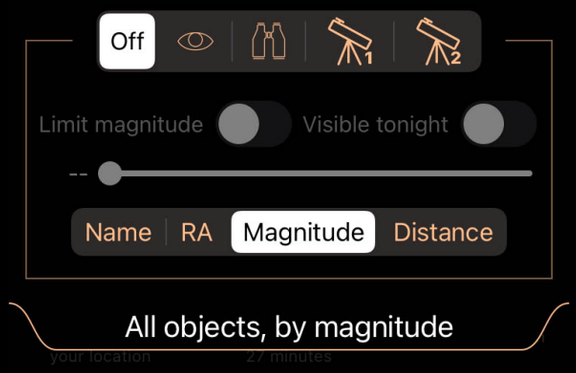
The asteroids are grouped into lists based on the type of orbit they have, with each list summarizing the type of orbit it contains.





Scrolling through any of the lists will display the asteroids in that category, with each asteroid in the list showing a summary of its appearance and position in the sky.

Sorting and filtering



Lists can be sorted and filtered using the pulldown found at the top of the list. You can either tap the pulldown tab or drag it down to open it.

The top selector on the filters tab is used to toggle between filter sets. Although the icons suggest uses for each filter set - visual, binocular, and two telescope settings - all filter sets behave identically and can be used for any purpose.

When a filter set is selected, any adjustments you make are remembered by that set. If you return to that set later, the settings will be as they were the last time you selected that filter set.

Use the Limit Magnitude switch and the slider below it to limit the list to objects that are brighter than the selected magnitude. Drag the slider to select the cutoff magnitude.

Use the Visible tonight switch to list only objects that will be visible during the current / upcoming night.

The Sort selector at the bottom is used to sort the objects according to the criteria shown on the selector.

Asteroids

Tapping on any asteroid in the list, or using the Info button on the Sky View Selection Bar, will bring up a page with details about that asteroid. At the top is a description of the asteroid's position in the sky and its appearance.

Actions

Below the description are the available actions for that asteroid:

Center on screen

This action will select the asteroid and center it on the screen for easy viewing. The camera will follow the object over time.

Zoom in

Tap this button to zoom in on the item on your screen for a better view.

Ride along

Move your location to approximate as if you were riding on the asteroid. Return home using the Home button in the upper left corner.

Add to a custom list

Add the asteroid to a Custom List. You can create a new list while you add the item.

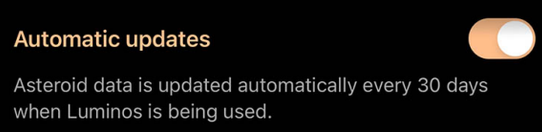
Add to Things You've Seen

Mark the asteroid as one that you have seen. The date and time will be noted in the Things You've Seen list.

Settings

Asteroid settings can be found in Luminos' Settings panel as well as at the bottom of the Asteroids page in the browser.

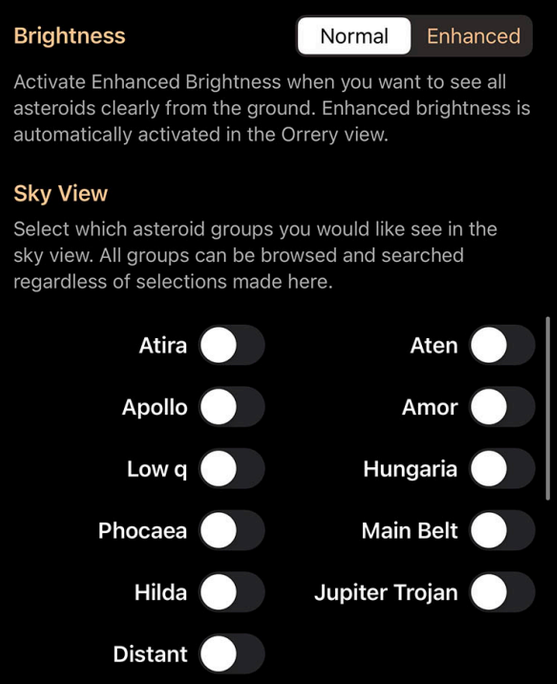
Updates



Updated 2 days ago

Update Now

"Automatic Updates" controls whether Luminos will automatically update the asteroid data. Luminos updates asteroid locations by contacting the IAU Minor Planet Center every two weeks, ensuring high accuracy of orbital data. Sometimes new asteroids are discovered that won't appear until the next update. To update the list sooner, pull down the Asteroids page to activate the "Refresh" control, or tap the "Update Now" button at the bottom of the page in the Settings section.



Brightness

The Brightness setting controls how asteroids are displayed in the Sky View. When set to Normal, asteroids are displayed at their actual brightness, which is generally dim from Earth. Setting the Brightness to Enhanced will make them brighter, making them easier to see.

Sky View

Use the switches in the Sky View section to select which categories of asteroids you want shown in your Sky View. These switches only affect whether the asteroid is drawn in the Sky View – you can still search and select any asteroid regardless of these switches.

In the Sky View, an asteroid is represented by a hollow circle, like this:

More coordinates

Tapping on the coordinates display on any object's page will bring up more coordinates in several reference coordinate systems:

Horizontal Az

Azimuth, a measurement from a viewer to the object projected on a reference plane. Part of the horizontal coordinate system, along with altitude.

Horizontal Alt

Altitude, the vertical elevation in degrees of the object from the horizon, measured in degrees. Part of the horizontal coordinate system, along with azimuth.

Equatorial (now) RA

Right ascension is the celestial equivalent of terrestrial longitude.

Equatorial (now) Dec

Declination is the celestial equivalent of terrestrial latitude.

Equatorial (J2000) RA

Right ascension referenced from the point in time at January 1, 2000.

Equatorial (J2000) Dec

Declination referenced from the point in time at January 1, 2000.

Ecliptic Lon

Longitude relative to the ecliptic plane, the plane formed by the path the Earth travels around the Sun.

Ecliptic Lat

Latitude relative to the ecliptic plane, the plane formed byt the path the Earth travels around the Sun.

Galactic Lon

Longitude relative to the galactic plane, the plane formed by the disk containing most mass in our galaxy.

Galactic Lat

Latitude relative to the galactic plane, the plane formed by the disk containing most mass in our galaxy.

Heliocentric X

X dimension of the Cartesian coordinates of the object relative to our Sun.

Heliocentric Y

Heliocentric Y dimension of the Cartesian coordinates of the object relative to our Sun.

Heliocentric Z

Z dimension of the Cartesian coordinates of the object relative to our Sun.

MPC asteroid data

Detailed data from the Minor Planet Center is available by tapping MPC Data:

General

Number

The provisional designation of this object.

Abs. magnitude

The brightness of the object. Lower and negative numbers are brighter.

Slope parameter

A parameter of visual brightness.

Reference

Unique reference number as listed at the Minor Planet Center.

Computer name

Who or what computed this object's orbit.

Readable designation

A code consisting of the year of discovery, a letter representing the half-month of discovery, and another letter representing the order of discovery in that half-month.

Observation

# of observations

Number of measurements taken of this object.

# of oppositions

Number of times the object has been seen in opposite position from the Sun.

Year first observed

Last two numbers of first observation year.

RMS residual

A measure of precision of the solution.

 # coarse perturbers

Hexidecimal representation of coarse perturbers, as listed in the Minor Planet Center documentation.

 # precise perturbers

Hexidecimal representation of precise perturbers, as listed in the Minor Planet Center documentation.

Hexdigit flags

A series of bits used to encode the orbit type. For more information, visit the Minor Planet Center documentation.

Last observation in solution

Last time at which the object was observed in this calculated orbit.

Elements

Epoch

The moment in time at which this reference was taken.

Mean anomaly

The mean anomaly is a parameter relating position and time for a body moving in a Kepler orbit.

Arg. of perihelion

The orbital element describing the angle of an orbiting body's periapsis (the point of closest approach to the central body).

Ascending node

The point at which the object's orbit passes Sol's ecliptic plane.

Inclination

The angle between the plane of orbit of Sol and Sol's ecliptic. The inclination is measured relative to the equatorial plane of Sol, which is perpendicular to Sol's rotation.

Eccentricity

The amount by which the trajectory deviates from a perfect circle. Numbers closer to zero are more circular and numbers closer to one are more parabolic.

Mean motion

How fast the object travels around its elliptical orbit.

Semimajor axis

Length of the orbit's longest diameter.

Uncertainty param

Value from zero (least) to nine (greatest) representing uncertainty in the orbit.

Comets

- Overview
- All Comets
- Sorting and filtering
- Comets
- Settings
- More coordinates
- MPC comet data

Overview

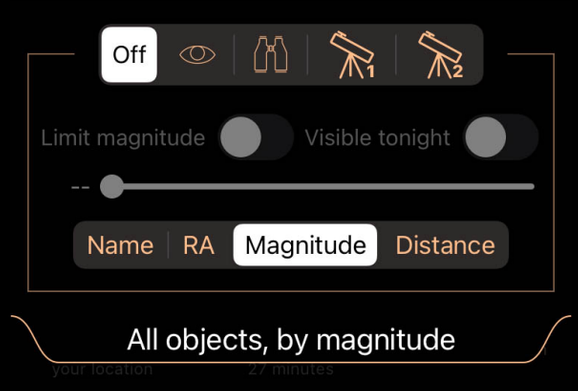
Comets can be found at the top level of the Browse menu.

At the top of the Comets page is a summary of comets visible tonight from your location. Tap on any comet to get details about its location and appearance, or to use actions like centering the display or riding along with the comet.

All comets

Below the list of tonight's brightest comets is a link for "All comets." Tapping this will bring up a list of every comet in the database. Below each comet is a description of its location and brightness, and at the top of the list is a filter which can be used to reduce the list to just those objects you are interested in.

Sorting and filtering



Lists can be sorted and filtered using the pulldown found at the top of the list. You can either tap the pulldown tab or drag it down to open it.

The top-most selector in the filter tab is used to switch between filter sets. Although the icons suggest uses for each filter set – visual, binocular, and two telescope settings – all the filter sets are identical in behavior and can be used for any purpose.

When a filter set is selected, any adjustments you make are remembered by that set. When you return to that set later, the adjustments will be as you left them the last time you had that filter set selected.

Use the Limit Magnitude switch and the slider beneath it to limit the list to objects brighter than the selected magnitude. Adjust the slider to choose the cutoff magnitude.

Use the Visible Tonight switch to only list objects which will be up during the current/coming night.

The sorting selector at the bottom is used to sort the objects by the criteria shown on the selector.

Comets

Tapping on any comet in the list, or using the Info button on the Sky View's Selection Bar, will bring up a page with details about that comet. At the top is a description of the comet's position in the sky and its appearance, or information about when it rises if it is not up yet.

Actions

Center on screen

Using this action will select the object and center it on the screen for ease of viewing. As time progresses, the camera will follow the object.

Zoom in

For an even better view, tap this button to enlarge the item in your display view.

Ride along

Move your location to approximate as if you were riding on the object. Return home using the Home button in the upper left corner.

Add to a custom list

Add the object to a Custom List. You can create a new list while you add the item.

Add to Things You've Seen

Mark the object as one that you have seen. The date and time will be noted in the Things You've Seen list.

Settings

Comet settings can be found in Luminos' Settings panel as well as at the bottom of the Comets page in the browser.

Updates

"Automatic updates" controls whether Luminos will update comet data automatically. Luminos updates comet locations by contacting the IAU Minor Planet Center every two weeks, which ensures high accuracy of the orbital data. Sometimes new comets are discovered and won't appear until the next update. To refresh the list sooner, pull down the Comets page to activate the "Refresh" control or tap the "Update Now" button at the bottom of the page in the settings section.

Luminos updates comet locations by contacting the IAU Minor Planet Center every two weeks, as they will otherwise become inaccurate. They can also be updated immediately by pulling down the Comets page to activate the "Refresh" control. If you would prefer to only update comet data at the time of your choosing, you can switch the Automatic Downloads setting for Comets to "Off" in the Comets settings at the bottom of the Comets page or in Luminos' Settings page.

Brightness

Use the Brightness setting to control how comets are shown in the Sky View. When set to "Normal", comets will display at their actual brightness, which is generally dim from Earth. Setting the Brightness to "Enhanced" will draw them brighter so that it is easier to see them from the ground.

Show in the Sky View

Turn this on to have comets shown in the sky view.

In the Sky View, an comet is represented by a hollow circle, like this:

More coordinates

Tapping on the coordinates display on any comet's page will bring up more coordinates in several reference coordinate systems:

Horizontal Az

Azimuth, a measurement from a viewer to the object projected on a reference plane. Part of the horizontal coordinate system, along with altitude.

Horizontal Alt

Altitude, the vertical elevation in degrees of the object from the horizon, measured in degrees. Part of the horizontal coordinate system, along with azimuth.

Equatorial (now) RA

Right ascension is the celestial equivalent of terrestrial longitude.

Equatorial (now) Dec

Declination is the celestial equivalent of terrestrial latitude.

Equatorial (J2000) RA

Right ascension referenced from the point in time at January 1, 2000.

Equatorial (J2000) Dec

Declination referenced from the point in time at January 1, 2000.

Ecliptic Lon

Longitude relative to the ecliptic plane, the plane formed by the path the Earth travels around the Sun.

Ecliptic Lat

Latitude relative to the ecliptic plane, the plane formed byt the path the Earth travels around the Sun.

Galactic Lon

Longitude relative to the galactic plane, the plane formed by the disk containing most mass in our galaxy.

Galactic Lat

Latitude relative to the galactic plane, the plane formed by the disk containing most mass in our galaxy.

Heliocentric X

X dimension of the Cartesian coordinates of the object relative to our Sun.

Heliocentric Y

Heliocentric Y dimension of the Cartesian coordinates of the object relative to our Sun.

Heliocentric Z

Z dimension of the Cartesian coordinates of the object relative to our Sun.

MPC Comet entry

General

Name

The unique name of the comet, which contains the family name of the discoverer or team.

Abs. magnitude

The brightness of the object. Lower and negative numbers are brighter.

Number

Some comets are sequentially numbered. In these cases, the numbers are listed here.

Orbit type

Periodic (P) or Non-Periodic (C). Periodic comets as expected to return within 200 years.

Prov. designation

Temporary name given to the comet on initial discovery.

Reference

Designation of the comet from the Minor Planet Center.

Elements (J2000)

Perihelion (Year/Month/Day)

Time when the comet is closest to Sol.

Perihelion distance

Distance when the comet is closest to Sol.

Eccentricity

Amount by which the orbit deviates from a perfect circle. Numbers closer to zero are more circular, and numbers closer to one are more parabolic.

Arg. of perihelion

The orbital element describing the angle of an orbiting body's periapsis (the point of closest approach to the central body).

Ascending node

The point at which the object's orbit passes Sol's ecliptic plane.

Inclination

The angle between the plane of orbit of Sol and Sol's ecliptic. The inclination is measured relative to the equatorial plane of Sol, which is perpendicular to Sol's rotation.

Data epoch (Year/Month/Day)

Time at which the solution was measured.

Slope param

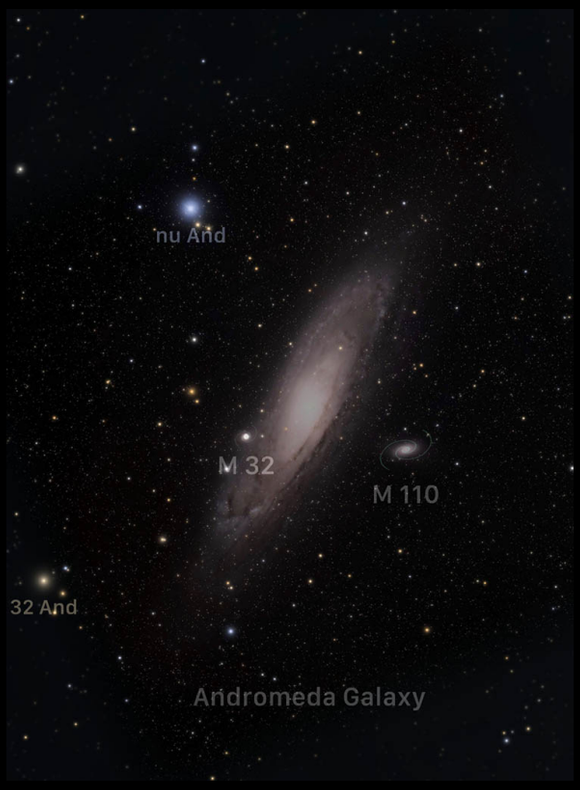
A parameter of visual brightness.

Deep Space

- Overview
- Gallery
- Lists
- Categories
- Sorting and filtering
- Deep Space objects
- Image viewer
- Settings
- More coordinates
- NGC/IC data
- Barnard data
- Sharpless data
- RCW data

Overview

The deep space browser gives you access to tens of thousands of deep space objects and images. The deep space section divides objects up by their type and structure to make browsing easier.



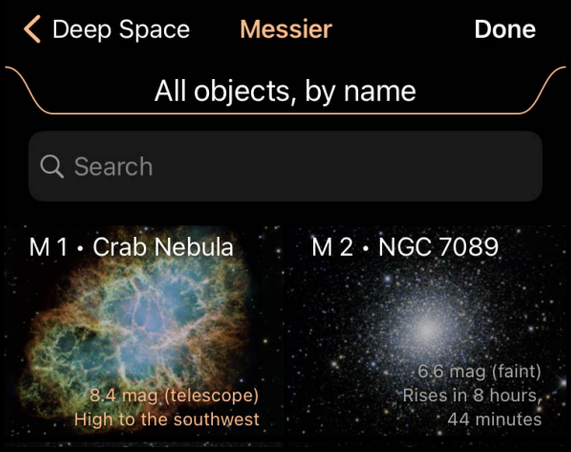
Deep space objects will appear as small dots or star chart symbols in the Sky View from a distance, but will fade into images as you zoom closer in. If you prefer not to show deep space images in the Sky View, they can be disabled in the Settings.

Gallery

GALLERY

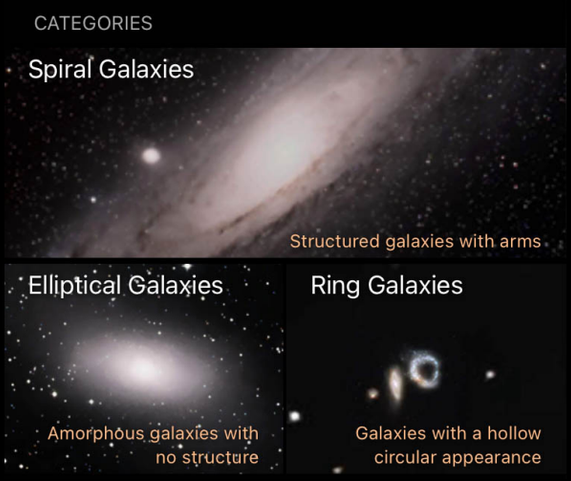
At the top of the Deep Space browser page is a gallery of exceptional images from the Hubble telescope. Swipe horizontally across the images to browse them, and tap an image to view its details, such as where to find it in the sky.

Lists



Luminos offers three popular lists of deep space targets: Messier, Caldwell, and Herschel. These lists make great challenges to "find them all" for telescope users. Tap on a list to view its contents.

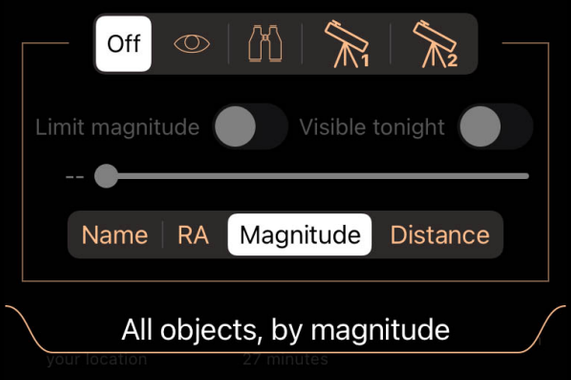
Categories



In addition to the challenge lists, Luminos groups deep space objects by category according to the type of object and its structure. Each category includes a brief description, and you can tap the category to view its contents.

Sorting and filtering

The challenge lists and the category lists can both be sorted and filtered using the pulldown found at the top of that list. You can either tap the pulldown tab or drag it down to open it.



The top-most selector in the filter tab is used to switch between filter sets. Although the icons suggest uses for each filter set – visual, binocular, and two telescope settings – all the filter sets are identical in behavior and can be used for any purpose.

When a filter set is selected, any adjustments you make are remembered by that set. When you return to that set later, the adjustments will be as you left them the last time you had that filter set selected.

Use the Limit Magnitude switch and the slider beneath it to limit the list to objects brighter than the selected magnitude. Adjust the slider to choose the cutoff magnitude.

Use the Visible Tonight switch to only list objects which will be up during the current/coming night.

The sorting selector at the bottom is used to sort the objects by the criteria shown on the selector.

Deep Space objects

Tapping any object in the lists will present a page of details about that object, including where to find it, and an image if one is available.

Image viewer

Tapping the image on any object's detail page will present the image in a full-screen viewer.

Use a pinch gesture to zoom in on the image, or swipe left or right to view other images from the same collection.

If the image includes a descriptive article at the bottom, tap the article to expand it for reading, and tap it again to collapse it. The article will automatically hide if you zoom in on the image.

To dismiss the image viewer, tap once on the image and you will be returned to the detail page.

Settings

Deep Space settings can be found in Luminos' Settings panel as well as at the bottom of the Deep Space page under the Browse menu.

Show labels

This toggle controls whether deep space objects are automatically labeled in Luminos. To disable all automatic deep space labels, set this switch to "Off". To adjust how many labels are shown, use the "Density" slider under "Show labels". To adjust the brightness of the labels, use the "Brightness" slider under "Show labels".

Show images

If you want to disable or enable the display of images in the Sky View, use this toggle.

Show symbols

Use this toggle to turn off the chart symbols indicating the location of all deep space objects.

Sky view

Use the switches in the Sky View section to control which object types appear in the Sky View. You will still be able to browse and search all categories regardless of how these switches are set.

More coordinates

Tapping on the coordinates display on any object's page will bring up more coordinates in several reference coordinate systems:

Horizontal Az

Azimuth, a measurement from a viewer to the object projected on a reference plane. Part of the horizontal coordinate system, along with altitude.

Horizontal Alt

Altitude, the vertical elevation in degrees of the object from the horizon, measured in degrees. Part of the horizontal coordinate system, along with azimuth.

Equatorial (now) RA

Right ascension is the celestial equivalent of terrestrial longitude.

Equatorial (now) Dec

Declination is the celestial equivalent of terrestrial latitude.

Equatorial (J2000) RA

Right ascension referenced from the point in time at January 1, 2000.

Equatorial (J2000) Dec

Declination referenced from the point in time at January 1, 2000.

Ecliptic Lon

Longitude relative to the ecliptic plane, the plane formed by the path the Earth travels around the Sun.

Ecliptic Lat

Latitude relative to the ecliptic plane, the plane formed byt the path the Earth travels around the Sun.

Galactic Lon

Longitude relative to the galactic plane, the plane formed by the disk containing most mass in our galaxy.

Galactic Lat

Latitude relative to the galactic plane, the plane formed by the disk containing most mass in our galaxy.

Heliocentric X

X dimension of the Cartesian coordinates of the object relative to our Sun.

Heliocentric Y

Heliocentric Y dimension of the Cartesian coordinates of the object relative to our Sun.

Heliocentric Z

Z dimension of the Cartesian coordinates of the object relative to our Sun.

NGC/IC Catalog data

For Revised New General Catalog and Index Catalog objects, the following detailed data applies. Not all data will be availble on all object types:

Catalog

ID

The catalog number of the NGC or IC object. Some will have extension letters.

Status

The kind of object, such as galaxy, nebula, cluster, star, or special catalog reference.

Type

Detailed information on the object type, such as the type of galaxy or cluster. This information is coded, and described in detail online.

Dreyer object

Indicates whether or not this object was in Dreyer's original catalog.

Position

High precision

Specifies whether or not this object uses high precision data.

RA (J2000)

The right ascension coordinate in J2000 epoch.

Dec (J2000)

The declination coordinate in J2000 epoch.

Photometrics

Blue magnitude

The magnitude of the object in the blue spectrum.

Visible magnitude

The magnitude of the object in the visible spectrum.

B-V Color

Difference of visual and blue magnitude.

Surface brightness

The magnitude of the object per unit of size.

Small diameter

The diameter of the object on its smallest axis.

Large diameter

The diameter of the object on its largest axis.

Position angle

For galaxies, the angle of rotation for the object .

Redshift

Amount that radiation from the object is shifted towards the red spectrum. Used to measure whether remote objects are moving toward or away from the observer.

Distance

Distance of the object in mega parsecs.

ID

PGC

The catalog number of the object in the *Catalog of Principle Galaxies*.

IDx

A series of identifiers of this object in other catalogs, followed by any remarks on the object.

Barnard Catalog

For Barnard Catalog objects, the following data applies:

Description

E.E. Barnard's description of the object.

ID

The unique designation in the Barnard Catalog.

RA (1875)

Right ascension value in the 1875 epoch.

Dec (1875)

Declination value in the 1875 epoch.

RA (2000)

Right ascension value in the 2000 epoch.

Dec (2000)

Declination value in the 2000 epoch.

Diameter

Size of the object.

Sharpless Catalog data

For Sharpless Catalog objects, the following data applies:

ID

The unique designation in the Sharpless Catalog.

Galactic Lon

The Galactic longitude.

Galactic Lat

The Galactic latitude.

Galactic Lon (Lund)

The Galactic longitude based on the Lund pole (pre-IAU system).

Galactic Lat (Lund)

The Galactic latitude based on the Lund pole (pre-IAU system).

RA (B1950)

Right ascension value in the B1950 epoch.

Dec (B1950)

Declination value in the B1950 epoch.

RA (B1900)

Right ascension value in the B1900 epoch.

Dec (B1900)

Declination value in the B1900 epoch.

Diameter

Maximun angular diameter of H II region.

Structure

Classification as to structure, from 1=amorphous to 3=filamentary.

Form

Classification as to form: 1=circular; 2=elliptical; 3=irregular.

Brightness

Classification as to brightness, from 1=faintest to 3=brightest.

Number of stars

Number of associated stars with the H II region.

RCW Catalog data

For RCW Catalog objects, the following data applies:

ID

The unique designation in the RCW Catalog.

Galactic Lon

The Galactic longitude.

Galactic Lat

The Galactic latitude.

RA (B1950)

Right ascension value in the B1950 epoch.

Dec (B1950)

Declination value in the B1950 epoch.

Minor axis

The angular diameter of the short axis of the encompassing ellipse.

Major axis

The angular diameter of the long axis of the encompassing ellipse.

Brightness

Classification as to brightness, (v) very bright (b) bright (m) medium or (f) faint.

IDs

Other catalog identifiers for this object.

Has remarks?

Indicates whether this entry has observational or editorial remarks asociated with it. Luminos will display those remarks in the "Description" section above the Details section.

Lists

- Overview
- Things You've Seen
- Custom Lists
- Creating a new list
- Deleting a list
- Adding objects

Overview

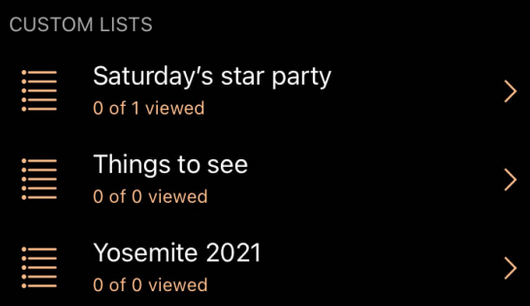
The Lists section of the browser contains custom lists of objects as well as the "Things You've Seen" list. Lists can be found under the browser menu at the top level.

Things You've Seen

Most objects and events in Luminos can be marked as having been seen by using the Mark As Seen button on the object's detail page. Those objects you've marked can be found here under the Things You've Seen list.

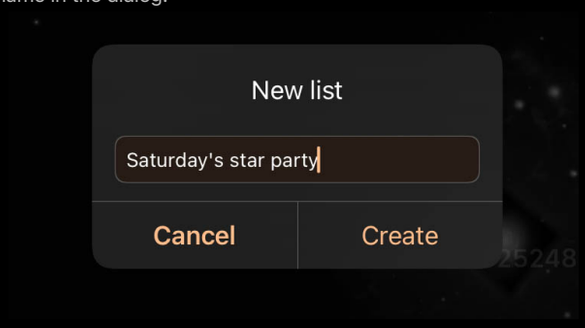
Custom Lists

Custom Lists section are used to manage personal lists of objects. You can create as many lists as you like and each list can have as many objects as you wish. Custom lists are stored on iCloud Drive, allowing them to be accessed on all devices with Luminos installed, as long as you are logged into your iCloud account and have suitable Internet connectivity. If you disable iCloud Drive access for Luminos then your lists will be stored locally on your device and your data will not automatically synchronize.

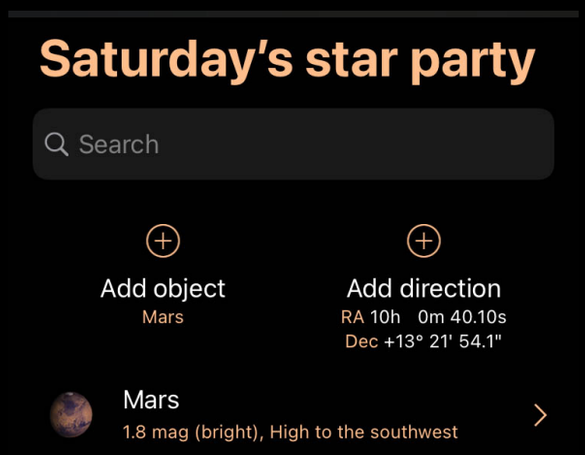


Creating a new list

To create a new list, tap the "New list" item and enter a name in the dialog:

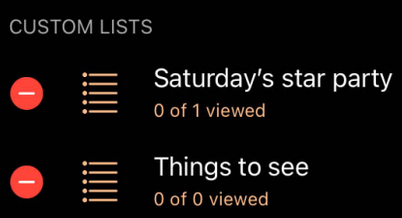


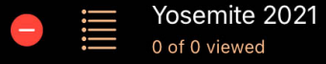
Once the list is created, you can use the "Add selected object" or "Add current direction" buttons to add items immediately, if desired.



Deleting a list

A list can be deleted by swiping left on it to reveal a Delete button.

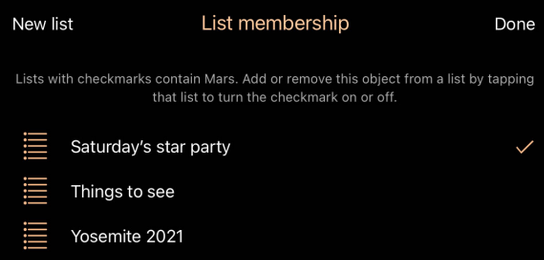




Alternatively, tap the Edit button at the top of the Lists page and then use the delete controls

Adding objects

To add an object to a list, select the object in the sky view or find it in the browser. The Actions section of the object's detail page will include "Add to a custom list," which you can tap to open a dialog with your custom lists.



The picker which opens can then be used to add the object to one or more lists at once.

To add the object to a list, tap on the list. A checkmark will appear next to the list to indicate the object is now a member.

If the object is already in a list, that list will have a checkmark. Tapping on a list which already contains the object will remove the object from that list.

Things You've Seen

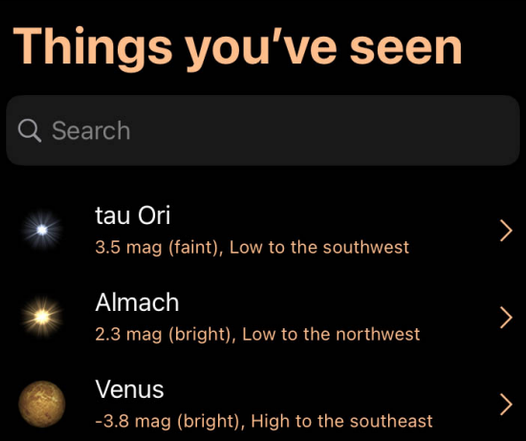
Luminos has a built-in utility for tracking any night sky objects you've seen, along with the date and notes pertaining to the item. For any object you are browsing in Luminos, simply tap

Add to Things You've Seen

to let Luminos know the time when you first saw the object. If you make a mistake, simply tap the icon again to remove the object from the list. If you are logged into iCloud and have a suitable Internet connection, your list of seen objects will be sychronized across any device with Luminos installed.

Luminos Pro marks an object as seen using its current date settings. Therefore, if you saw the object on an earlier date and want to record that, use Luminos' Time controls to change Luminos to your desired date and then tap "Add to Things You've Seen".

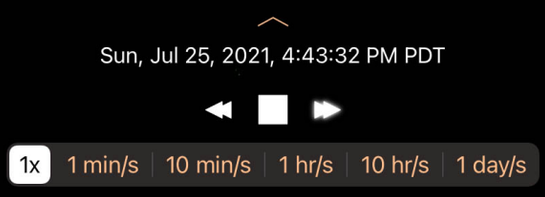
Things you've seen



To see a full list of "Things you've seen", open the Browser and tap on Lists. You will find a "Things you've seen" list containing everything you've marked so far.

Time

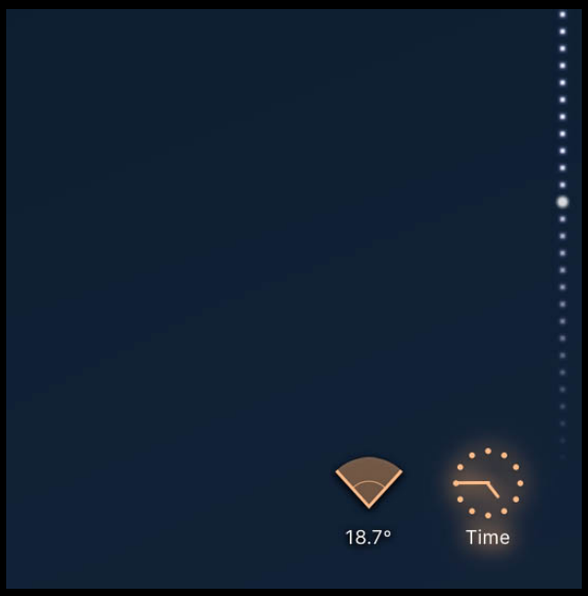
The time controls let you change the date and time as well as control the flow of time. To access the time controls, tap the Clock button in the Toolbar. If at any point you wish to return to the actual date and time, simply tap the "Now" button in the upper left corner of the screen.



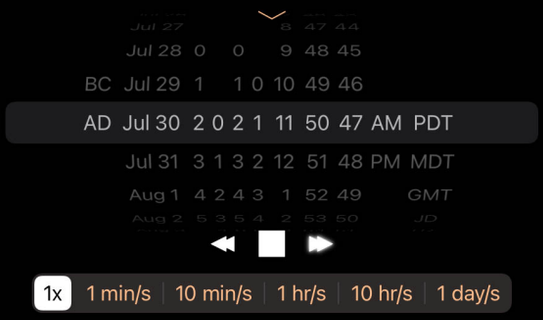
Time Display

Tap the square button to stop time completely. Tap the right button to make time move in the normal (forward) direction. Tapping it again will make time move faster. Tapping the left arrow will slow time, eventually making it flow in reverse.

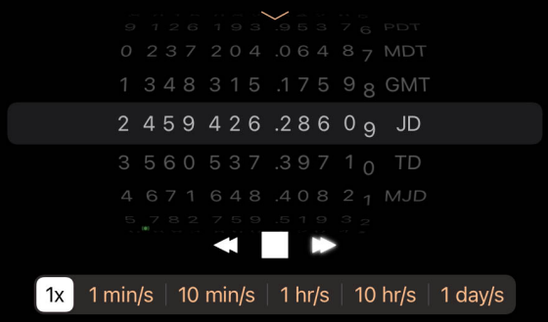
To change the rate of time, you can alternatively use the bar located at the bottom of the screen. Normal time flow is "1x". By setting the choice to "1 min/s", "10 min/s", "1 hr/s", "10 hr/s", or "1 day/s", you can accelerate time. The direction of time flow is toggled with the "Rev", "Stop", and "Fwd" buttons representing reverse, stopped, and forward time flow, respectively.



For a shuttle control of time, a moving wheel will be available on the side of the screen when the time mode is active. Slide up and down on the wheel to jog the time backwards or forwards.



If you want to set to an exact time, tap the disclosure arrow on the time control to open the time setting dials. Slide them to the appropriate time, then close the display using the disclosure arrow again.



This control can also be used to convert from one time system to another. By using the right-most tumbler, you can choose between your local time zone, Coordinated Universal Time (UTC), Julian Date (JD), Dynamical Time (TD), and Modified Julian Date (MJD). This is a convenient way to convert a moment in time between these systems.

To hide the Time Display, hit the Clock button in the Toolbar again.

Tonight

- Overview
- Choosing a date
- Events
- Categories
- Tonight's objects
- Sorting
- Objects
- Sky Chart

Overview

Use the Tonight button at the bottom of the Sky View to access the "What's Up" page, where you can find suggestions for things to look at tonight as well as news about the sky around you.

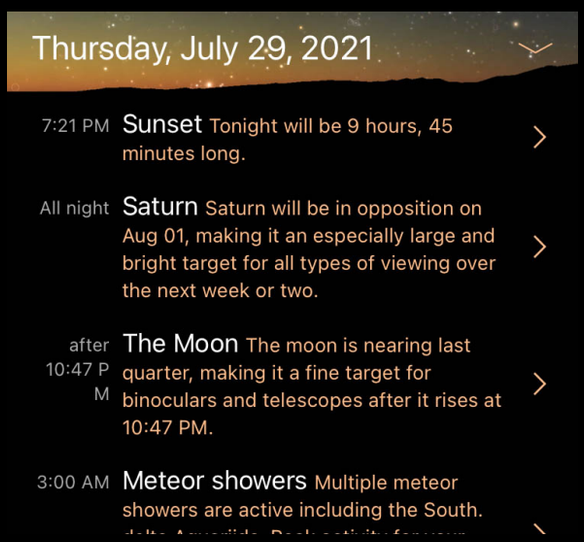
A pull-down calendar is found at the top of the page so you can quickly change to other dates for planning future time under the stars.

Choosing a date

The Tonight page always starts by showing the current date, but you can easily change to other dates. Tap the date at the top of the page, or swipe down on it, to reveal a calendar.

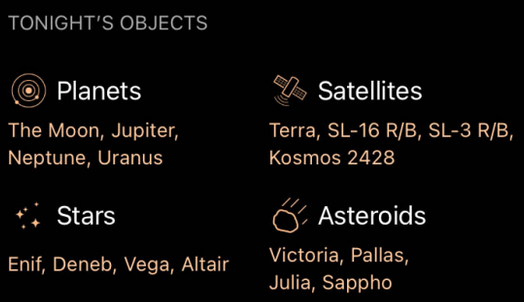
Swipe left or right on the calendar to change to other months, and tap any date on the calendar to change Luminos' date to match. The calendar also shows the phase of the moon for each day to help you plan your next dark sky session.

Events



Below the date is a list of significant events for the date, such as when sunset occurs, meteor shower conditions, upcoming conjunctions, and passing asteroids. Tapping a news item will take you to a page detailing that event or showing details about the object for that event.

Categories

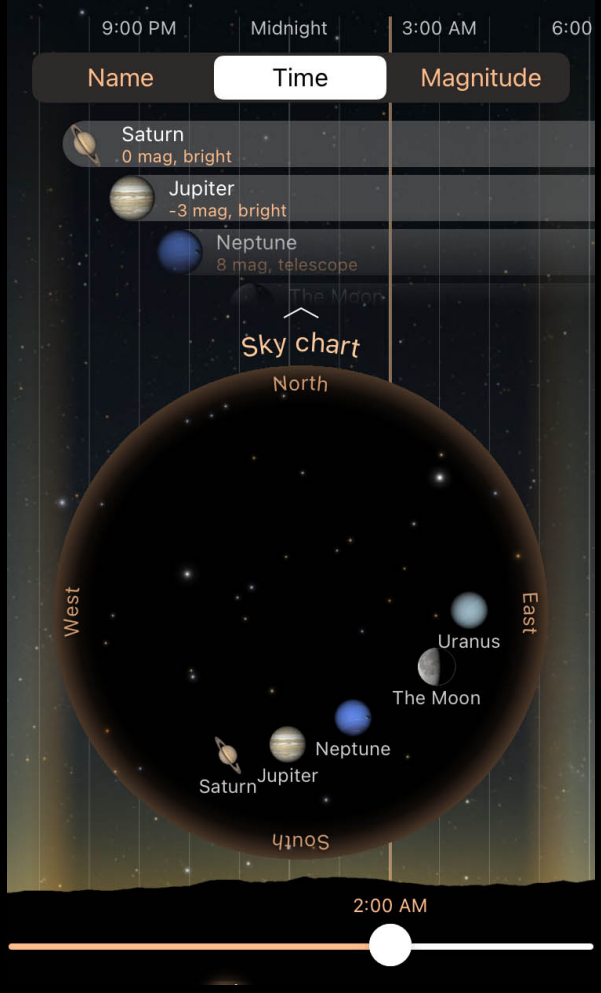


At the bottom of the What's Up page is a list of categories and for each category there is a summary of the brightest objects this evening in that category.

Below the built-in categories you will find your own observation lists, also with summaries of their brightest objects this evening.

Tap on any category or observation list and you will be presented with a time chart showing when each object will be above the horizon, as well as a popup sky chart to show where each object is right now in the sky.

Tonight's objects

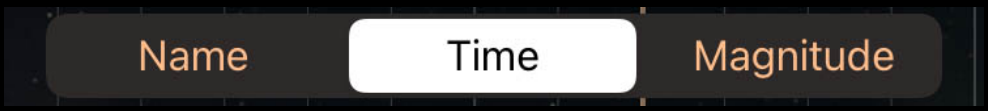


Tapping any category or list in the What's Up page will show you a timeline of all objects from that category or list. This timeline shows the coming/current evening, with earlier times on the left and later times on the right.

Use the slider at the bottom of the chart to explore each object's movement throughout the evening to help in planning your time under the stars.

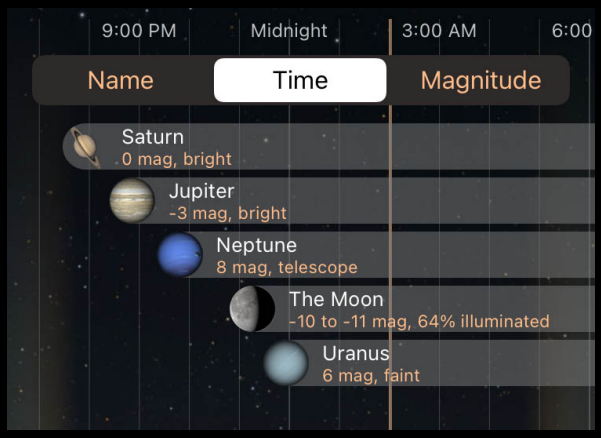
The current time is indicated by a vertical orange line. Note that if the current time is not within the evening hours then the vertical orange time indicator won't be shown.

Sorting



At the top of the time chart is a sorting control, which you can use to sort the objects by the critera shown on each segment of the control. Most lists can be sorted by Name, Time (earliest first), or by magnitude (brightest first).

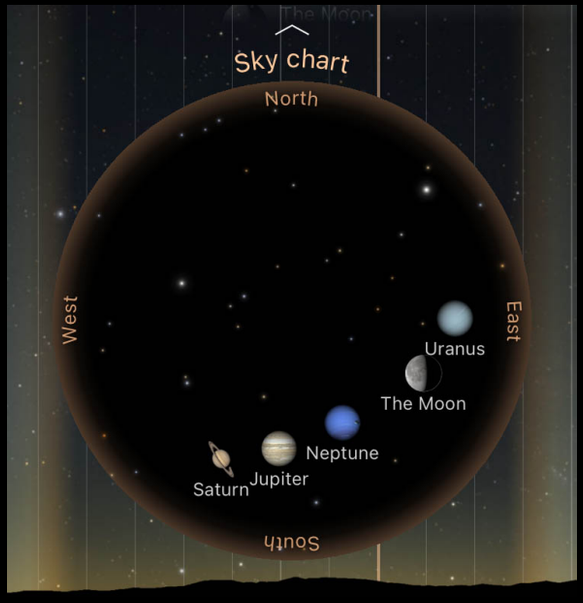
Objects



All objects which are visible during the evening are listed in the timeline. The starting and ending points of their bars indicate when they rise or set, and objects which are up all night will span the entire width of the chart.

Magnitude values appear on each row, while tapping the row will take the display to details for that item.

Sky Chart



At the bottom of the timeline is a popup sky chart. Tap on the Sky Chart label or drag it upward to reveal the chart.

The chart shows the position of each visible object in the sky and will update as you drag the time slider below it. Use the chart with the time slider to aid in planning your viewing sessions.

Observe

- Overview
- Site
- Remote control
- Equipment
- Calculator
- Settings

Overview

Luminos has tools to assist you with your telescope or binoculars to simplify tasks like choosing eyepieces and other equipment, determining the view through your equipment, or controlling compatible mounts.

Luminos uses iCloud Drive to store your equipment data and this will synchronize automatically across all devices running Luminos. You will find your equipment data files in the Files app, under iCloud Drive > Luminos Pro. If you don't use iCloud Drive or you have disabled it for Luminos, then Luminos will instead store your equipment on your device in the "On My iPad/iPhone" folder of the Files app.

To view the observation tools, tap the telescope icon in the Toolbar.

The observation display is divided into four major sections: Remote control, Equipment, Calculator, and Settings.

Site

Luminos organizes your telescope and equipment as part of a site named "Home". Use the Edit button at the top of the page to change the name of your site.

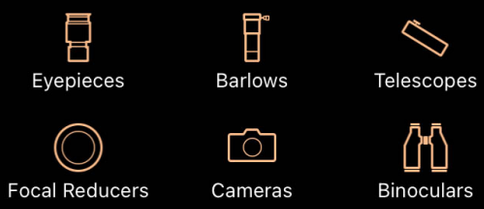
To control more than one telescope at a time you will need to create additional sites. Use the Back button to get to the list of all sites, where you can create additional sites and configure the connection for each site.

Remote control

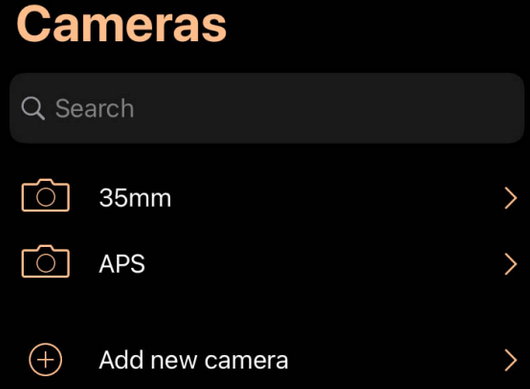
If you have a computer-controllable telescope, Luminos can help control it to make it easy to find targets in the sky. For details on using telescope control, see the chapter on Remote Control.

Equipment

Luminos maintains lists of your observation equipment. Once your equipment is added, the Calculator can be used to calculate the optical properties of various equipment combinations, and a reticle overlay can be shown in the Sky View to indicate the field of view for the selected equipment.



Tap on any equipment category to see the list of equipment in that category, and to add or remove pieces of equipment.



All equipment lists are operated similarly. You add a new piece using the "Add new ..." button and you remove any piece by swiping left on it to reveal a Delete button.

You can also reorder any list by tapping the Edit button at the top and then dragging the items using the grips at the right-hand end of each item.

All equipment has an optional name field. You can leave the name blank to have Luminos generate a name for you.

Eyepieces

Eyepieces require the focal length of the eyepiece (in millimeters), and the field of view (in degrees).

Once the eyepiece is defined, tap Back or Done.

Barlows

Barlows only require the magnification.

Once the barlow is defined, tap Back or Done.

Telescopes

The focal length and aperture of the telescope should be entered in millimeters. The entries for these fields will be used to calculate other values such as the focal ratio and magnification.

Once the telescope is defined, tap Back or Done.

Focal reducers

Focal reducers only require a focal ratio.

Once the reducer is defined, tap Back or Done.

Cameras

Cameras require the size of their imaging sensor in millimeters. Suggested values are shown in the instruction text, or you can consult your camera manual for specifics for your model.

Once the camera is defined, tap Back or Done.

Binoculars

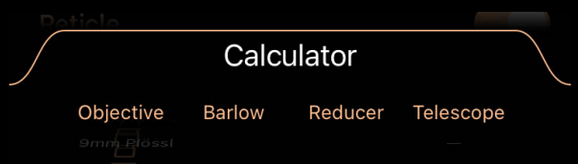
The magnification and diameter of your binoculars are required, with the diameter in millimeters.

You must enter one of the three field of view values. Enter the value into whichever field matches the format printed on your binoculars.

Once the binoculars are defined, tap Back or Done.

Calculator

The calculator contains information and tools to assist you with your viewing session, and can be found under the Observe menu on the site page ("Home") as well as the Remote Control page (while connected to a telescope).



Here you can select combinations of the equipment you've added to your equipment lists, and see the effects your choices have on your magnification, field of view, and exit pupil.

You must choose at least one item from the Objective column.

Binoculars don't need any additional selections, but if you're using an eyepiece or a camera then you must also select a Telescope (OTA).

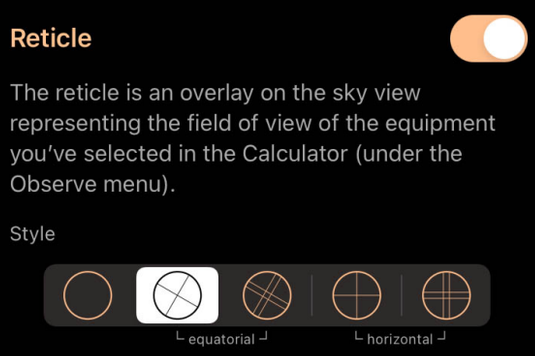
You can also try different barlows and focal reducers to see their effect on your telescope's optical path.

Selections made in the calculator also affect the reticle overlay in the sky view. The reticle overlay will change size to reflect the field of view through the equipment you've selected. If you've selected a camera, the reticle will also show a framing rectangle to help you decide on the best rotation for your capture.

Settings

The observation settings can be found in Luminos' Settings panel, as well as at the bottom of the main page under the Observe menu.

Reticle

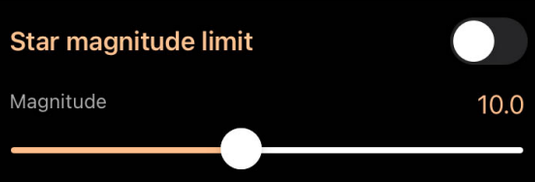


The Reticle overlay shows how much you'll be able to see when looking through the equipment you've selected in the calculator. Change the equipment in the calculator and the overlay will adjust to match those changes. Fields of view are often small so you may need to zoom in on the Sky View before you can see the reticle overlay. If you select a camera instead of an eyepiece in the calculator's Objective column, then the reticle will show a camera frame, which you can rotate to help figure out the angle for photographing an object.

Flipping buttons

Flipping controls provide a simple way to flip the screen display along the horizontal or vertical axis, making it more comfortable to use with a telescope. When the "Enable flipping" option is set to "On", buttons will appear in the upper left area of the Sky View, near to where the "Home" and "Now" buttons often appear. Tapping the flip buttons will toggle horizontal or vertical reversal of the display, or both.

Star magnitude limit



Turning magnitude limits on will reduce the number of stars shown in the sky view to only reflect those of a brighter magnitude than the number limit you have chosen.

This setting is different than the star brightness slider (found in the Stars setting section). Whereas the brightness slider adjust the appearance of the stars, this setting instead sets a hard limit for the magnitude to which stars will be drawn. No matter how high the star brightness is set to, stars dimmer than the magnitude limit will never be drawn.

Whenever the magnitude limit feature is enabled, a button is added to the upper-left corner of the sky view. This reminds you that the limit is enabled and provides quick access to the setting for turning it off later.

Telrad circles

The Telrad circles option shows a series of concentric circles matching those found on a Telrad finder. The circles on Luminos' display can be used to assist in aiming your telescope when using a Telrad device. Use the switch to turn the circles on and off, and use the brightness slider to adjust the overlay's intensity.

Disable sleep while connected

Luminos automatically re-connects to your telescope if your device goes to sleep while you're connected. Sometimes you may want to keep your device awake instead and this switch can be turned on to do that. Once you disconnect from your telescope your device will resume sleeping like normal.

Remote Control

- Overview
- Compatibility
- Zero-configuration
- Manual configuration
- Simulator
- Connecting
- Status display
- Using Goto
- Centering and Guiding
- Syncing
- Mount Features
- Protocols
- Connection logs

Overview

The remote control features of Luminos allow you to use Luminos to assist you with using a computer-controllable mount. To access the remote control feature, tap the Observe icon in the main display and then choose the Remote Control item.

Compatibility

If your mount is capable of being controlled by a computer then it's likely that you can use Luminos to control it. Mounts which can be controlled will have either a Serial Port connector, a USB connector, or an Ethernet port designed for the purpose of control by a computer.

Regardless of which interface your mount has, your iOS device will require an adapter in order to connect. A popular choice is a WiFi adapter which can be connected via Serial or USB cable to your mount. Your iOS device can then connect to the WiFi device wirelessly to control your mount. If your mount has an Ethernet connector then you'll need a router to connect your mount to a network so that this device can communicate with it.

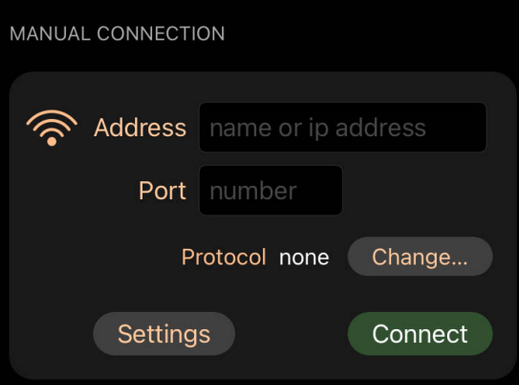
Luminos is compatible with a wide variety of mounts and supports common protocols such as Celestron NexStar, Meade, Astro-Physics and LX200-compatibles. Note that Celestron wifi interfaces are unsupported.

Zero-configuration

Zero-configuration is available for Astro-Physics mounts with either the CP3 or CP4 control panel. Tap the Scan button to find your mount on the network, and then use the Connect button to connect to it.

You only have to ever use the Scan button once, after that it will scan automatically. You will then be able to connect with a single tap on the Connect button.

Manual configuration



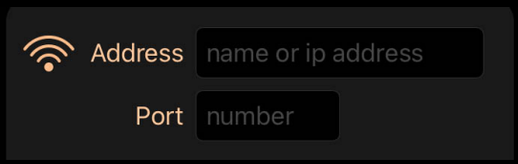
Most mounts will use manual configuration, which consists of selecting the protocol to use for communicating with your mount, and entering the ip address and port number to use for connecting to your mount.

Protocol

Selection of the correct protocol is important and is similar to knowing what language to speak to another person in. The language in this case isn't a human language but instead specifies the commands the mount understands, how the computer should phrase those commands, and how the mount will reply. See below for a list of the protocols which Luminos understands.

Address

When connecting via a WiFi serial device you must specify the IP address of your device, as well as the port number it is listening on.



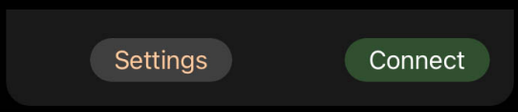
For popular devices such as the SkyFi interface using their default "ad hoc" mode, the settings are 10.0.0.1 for the IP address and 4030 for the port number. If you are using another device or have changed the default settings you may need to enter different values for these fields.

Note that there are no serial port settings available when connecting via WiFi. Those settings must be configured on your WiFi Serial Device by following the manufacturer's instructions. Devices designed specifically for connecting to telescopes will usually have the settings configured at the factory to the correct values for most telescopes (9600 baud, 8 data bits, no parity, one stop bit).

Settings

Most mount protocols support customization and these adjustments can be found under connection's Settings button while not connected. These settings can usually be left at their default values, and include adjustments such as whether to set the time and location on the mount, or how fast to poll the mount for status updates.

Connecting



Once the connection is configured you can connect to your mount by tapping the Connect button. Luminos will then establish the connection and configure your mount. You may receive a message if Luminos can't connect to your mount:

Connection failed

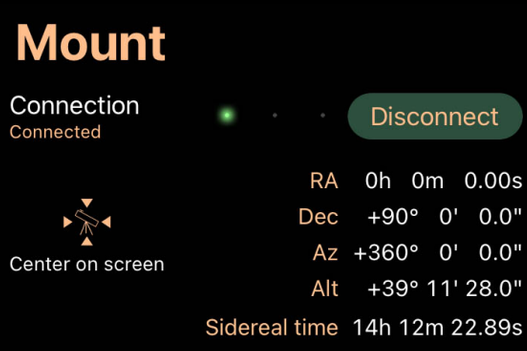
If the connection fails you should check your settings and make sure your WiFi device is turned on. You should also make sure that your iOS device is connected to the WiFi network and is using the correct settings for that network. Some WiFi Serial Devices are known to have bugs in certain versions of their firmware. If you're experiencing dropped connections intermittently check with the manufacturer to see if updates are available.

Mount not responding

This message occurs if Luminos is able to connect to the mount but isn't able to talk to it. The cause may simply be that your mount isn't turned on or that it isn't connected correctly to your WiFi device or cable. This message may also be displayed if the wrong protocol is selected, which would cause the mount to not understand what Luminos is saying to it.

Status display

Once Luminos has successfully connected to your mount the display will change and show status lights, the mounts current direction and various features for controlling the mount.



Status lights

Three lights are shown next to the Connection switch which indicate communication with the mount is occurring. The first light will be green to indicate that the connection is established and working properly. If it is yellow then something has gone wrong while talking to the mount and it may be necessary to re-connect or to change the protocol used. The second and third lights show activity by flashing when data is being sent to the mount (the second light) or being received from the mount (the third light).

Coordinates

The coordinates display shows the direction readings obtained from the mount.

Local Sidereal Time (LST)

Local Sidereal Time is the Right Ascension of the Zenith, which is straight up from wherever you are. Luminos will compare the LST reported by your mount with its own notion of LST and will warn you if there is a difference by showing a warning icon. Tapping the warning icon will show details about the difference so you can decide if it warrants any action. When there is a difference it means that the calculations used for pointing your mount will be different in Luminos than what your mount will come up with, possibly resulting in pointing errors. LST is determined by time, date and location settings, so if there's a difference you should verify those settings both in Luminos and in your mount.

Follow mount

Selecting this will instruct Luminos to keep the Sky View centered on the mount's current position, updating the view as the mount moves. Even if you're not having Luminos stay centered on the mount, there will be a marker in the sky view showing where the mount is currently pointed.

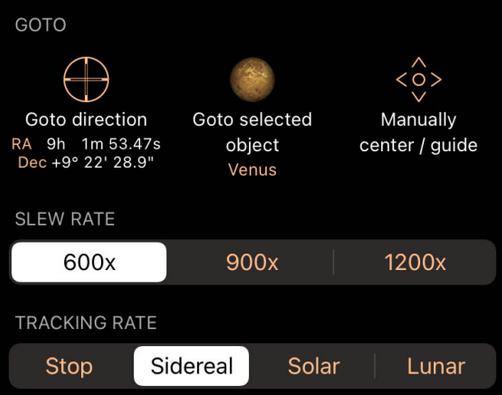
Progress

The progress display is only shown while the mount is slewing (moving) as a result of a Goto command.

The progress bar shows how far along the movement is to its destination and there is also a Stop button which can be used to abort the Goto. Note that the progress bar will sometimes not move initially, or may start to move and then go backwards. This happens because some mount types can't always go directly to a target and must move the telescope out of the way of your tripod or pier before it can go to the destination.

Using Goto

The Goto feature of Luminos makes it simple to aim your telescope at a target.



Goto current direction

This option will instruct the mount to aim itself in the same direction that the Sky View in Luminos is currently centered on.

Goto selected object

This option is only available if you have selected an object in Luminos and will instruct your mount to aim itself at that object.

Slew rate

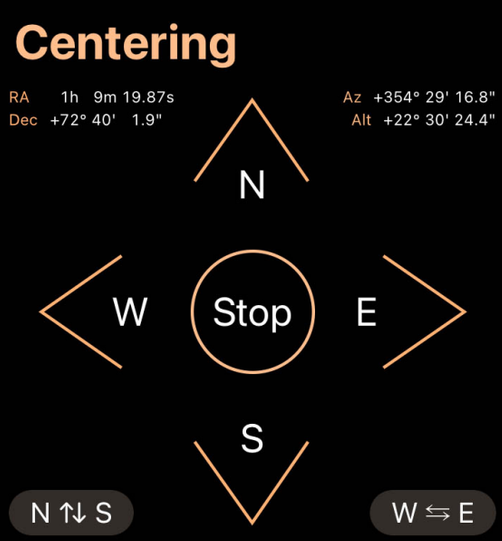
Some mounts support changing the speed at which Goto commands will move the scope. If multiple speeds are supported then Luminos will display those in a segmented control. Speed changes only take effect at the start of a slew. To change speed during a slew first stop the slew, then change speed, then start the slew again. Slower speeds will take longer to reach your target but will generally be much quieter and, for some telescopes, may be a safer choice than a fast speed.

Tracking rate

Tracking rate selects what the mount should do when it isn't slewing. Normally you will want Sidereal tracking selected, which means the mount will track the sky at the same speed as the stars. Other tracking modes may also be available, such as Lunar for tracking at the speed the moon moves, or Solar for tracking when using a solar telescope.

Centering and Guiding

After you've instructed the mount to aim itself at an object using the Goto features, you can use the Centering and Guiding feature to fine-tune the direction.



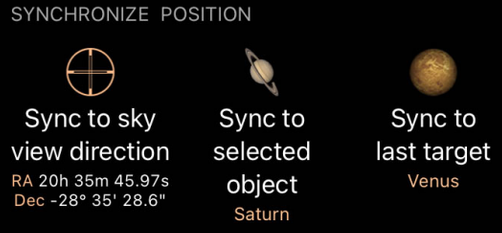
The four arrow buttons can be used to move the mount in a manner similar to the keypad which came with your mount. You can also use the Swap East/West and Swap North/South buttons to reverse the directions moved on those axis in order to compensate for directional differences caused by aiming your mount at different parts of the sky.

If your mount supports multiple speeds then Luminos will offer those in the form of a segmented control below the arrows.

The actual speeds offered, if any, will vary based on your mount's capabilities.

Syncing

To improve accuracy Luminos also includes syncing options. Syncing instructs the mount to treat whatever direction it's currently aimed as being the same as the direction of the sync option selected. The actual sync options offered will vary based on the capabilities of your mount and some mounts may not offer this feature at all. The Sync options are found below the arrow buttons in the Centering / Guiding section.



Syncing is especially useful for finding dim objects by first having the mount Goto something bright and easy to find which is near the desired dim object. After the Goto the arrow buttons are used to accurately center that bright target. Finally, tapping on the Sync To Target button will re-calibrate the mount so that it knows it's now pointing exactly at the bright object. Now any Goto commands within a short distance of that target will now be much more accurate which should make it easier to find dim targets nearby.

There are up to three sync options offered, all of which have the same basic behavior and differ in what they sync to.

Sync to target

This option is offered if you recently used one of the Goto features within Luminos to point your telescope at a target. This is the option normally chosen for sync'ing.

Sync to selected object

This option is offered if you have an object selected in Luminos and want the mount to sync to it without having to Goto it first. This option is used if you used your mount's hand controller to perform the Goto but you've switched to Luminos to do the sync.

Sync to current direction

This is similar to the Sync to Selected Object option except that it uses the coordinates of the center of Luminos' Sky View as the sync target.

Mount Features

If Luminos supports additional features of your mount then they will be listed under the Features section while you are connected to the the mount.

Features may include the ability to view Info gleaned from your mount, Park and Unpark your mount, adjusting the brightness of a reticle, or adjusting an attached focuser.

Which features are available and the options available within those features will vary depending on what your mount supports.

Protocols

Luminos supports many popular telescope protocols, making it compatible with a wide variety of models and manufacturers.

Meade

This protocol should be used if you have any Meade mount. This protocol includes features which Meade supports in their mounts but which other manufacturer's often either omit or modify from their Meade-defined behavior. If you have another manufacturer's mount which is Meade-compatible you should probably choose the LX200 Compatible protocol instead, which is the subset of the Meade protocol supported by most manufacturers.

Celestron

This protocol is used by all Celestron NexStar mounts. It may also be appropriate to choose if you have a non-Celestron mount which claims to be compatible with the Celestron protocol. Note that Luminos can only control Celestron mounts when connected through the hand controller. Celestron's wifi interfaces, both built-in and modular, are incompatible with Luminos.

Orion

This protocol should be chosen for Orion brand mounts, as it has behavior specific to that brand.

iOptron V3

This protocol is specific to iOptron brand mounts and should not normally be used with other brands.

LX200 Compatible

This is the most common 'standard' protocol and is understood by a wide variety of computer-controllable mounts. If your mount claims to be Meade-compatible this is the best choice to ensure reliable operation.

Astro-Physics

This protocol should be used if you have any Astro-Physics GTO mount. It should not normally used for other manufacturer's mounts unless the manufacturer specifically claims that the Astro-Physics protocol is appropriate for your mount.

SkyWatcher App

This protocol works with Sky-Watcher compatible mounts via the SynScan Pro app. The app is used to establish the connection and calibrate the telescope, then control is handed to Luminos for performing gotos and slewing.

Takahashi Temma

This protocol controls Takahashi Temma 1 & 2 mounts.

Vixen Starbook

This protocol works with Vixen mounts using Starbook 10 controllers.

Other protocols

More protocols are being added over time to Luminos. If your mount isn't compatible with one of the available protocols and you'd like to see it supported, contact Wobbleworks at mount-protocols@wobbleworks.com with details. It will be especially helpful if you're willing to beta test a driver for your mount, as it isn't possible or practical to have one of every mount in-house for development.

Settings

Luminos offers many ways to configure the application to meet your needs. The Settings can be accessed by tapping the settings icon in the toolbar.

To reset all settings back to their default values, tap the "Reset" button in the upper left of the Settings display.

Location

Luminos contains a special display for you to choose your location automatically, through coordinates, or using a list of city names.

Night settings

Night settings make Luminos more useful during evening viewing by helping to preserve your vision in the dark and by prolonging the battery life of your device.

Night vision

In night vision mode, the Luminos display will reduce the amount of light in non-red wavelengths. Using only red wavelengths allows the rods in the eyes to adjust to low light settings, as the rods cannot detect red light. As such, night vision mode will allow you to see the Luminos display and controls with minimal negative effect on your night vision. Night vision can be enabled or disabled without restarting Luminos. To further reduce the effect on your night vision you should also turn down the brightness on your device.

Battery saver

Battery saver disables certain animations which would otherwise increase battery drain due to increased rendering demands. When enabled, battery saver will stop animations for the sparkle highlight which is shown when an object is selected and will also stop the twinkle animations on constellation images.
To further reduce battery drain you should avoid zooming in to extreme fields of view for long periods, as these also require more updates to the display in order to maintain smooth motion. For best results, use a field of view of at least one degree. Below a field of view of 10 arcminutes the rendering rate is nearly the same as without the battery saver feature enabled and any savings will be negligible.

Grids

The "Settings" > "Grids" controls allow you to turn off individual grid displays for different coordinate systems. The "Brightness" slider will adjust screen brightness only for any visible grid lines.

Alt / Az

The values on the Alt / Az (Altitude / Azimuth) coordinate system correspond to the latitude and longitude values on a terrestrial globe. To view the Alt / Az values, set the toggle to "On". If you choose the "meridian only" option, only the meridian line will be drawn in the sky.

Direction

This toggle controls whether or not compass directions are displayed in the Sky View.

Equatorial

Enabling this toggle will display the equatorial grid, a projection of coordinates onto the celestial sphere. When locating an object in the equatorial grid, the object exists at the same coordinate no matter where it is viewed on Earth. If you choose the "equator only" option, only the equator itself will be drawn in the sky.

Ecliptic

When this setting is enabled, the sky will show or hide a representation of the ecliptic coordinate system. Ecliptic coordinates are focused on the path that Sol follows across the sky over the course of a year. As such, ecliptic coordinates are often used to chart solar objects. If you choose the "path only" option, only the ecliptic itself will be drawn in the sky.

Galactic

To view the galactic coordinate system grid, enable this option in the "Settings" menu. The galactic coordinate system centers on Sol and is aligned with the center of the Milky Way galaxy.

Brightness

The grid section contains a slider bar to control how bright the grid lines are relative to the rest of the application interface.

Various grid components are useful by themselves and can be enabled separately from their grid. Enabling a component has no effect if its grid is already enabled.

Local meridian

Enabling Local Meridian shows the dividing line between the Eastern and Western halves of the sky. This can be useful when planning for meridian flip operations while using a telescope.

Celestial poles

The Celestial Poles option shows a small marker at the North and South celestial poles, which may be useful while aligning a telescope.

Equator

Enabling Equator shows the equator line from the equatorial grid, which shows the path the stars appear to follow as the Earth rotates.

Ecliptic path

The Ecliptic Path option shows the equatorial line from the ecliptic grid, which is the path planets more-or-less appear to follow as they orbit the Sun.

Horizon

Enabling Horizon shows the horizon line from the alt/az grid.

Direction labels

The Direction Labels option shows 16 compass direction labels just above the horizon.

Coordinates

The "Coordinates" controls allow you to specify your preference for the formatting of coordinates displays.

Degrees

This control will change the format of angles which are displayed in degrees. "Deg" will format those angles as decimal degrees, for example 34.8482°. "DM" will format the angles as degrees and minutes, such as 34° 50.892'. "DMS" will format the angles as degrees, minutes and seconds like this 34° 50' 53.52". The default setting is DMS.

Hours

This control will change the format of angles which are displayed in hours. "Hours" will format those angles as decimal hours, for example 2.3232h. "HM" will format the angles as hours and minutes, such as 2h 19.392m. "HMS" will format the angles as hours, minutes and seconds like this 2h 19m 23.52s. The default setting is HMS.

RA format

Changing this control will change the format of the Right Ascension portion of equatorial coordinates to either be displayed in degrees or in hours. The default format for Right Ascension is hours.

Reckoning

This toggle controls whether Azimuth angles are reckoned from the North or from the South. Users located in the Northern hemisphere normally measure azimuth from the North pole, while those in the Southern hemisphere measure azimuth from the South pole. The default value is North.

Onscreen display

This toggle controls whether or not coordinates will be displayed at the bottom center of the Sky View.

Orientation

The "Orientation" selector adjusts which plane of motion is used for panning gestures. The chosen orientation will be represented by the horizontal line in the center of the Sky View.

Orientation

Choose which plane is represented by the device orientation:

- Horizontal : (Default) The view is oriented to someone looking across the horizon while standing on the ground.
- Equatorial : The view is oriented to a projection of the Earth's equator onto the celestial sphere.
- Ecliptic : The view is oriented to the plane of the Earth's orbit around the Sun, which is useful for observing many Solar System bodies.
- Galactic : The view is oriented to the plane of the Milky Way galaxy.

Always show button

The orientation indicator will appear in the Sky View if the current setting is not Horizontal. Enabling this options causes the indicator to always appear.

Show matching grid

If this option is turned on, the corresponding grid which matches the orientation setting will always be shown.

Solar System

The "Solar System" settings control the visibiilty of solar body names and orbits.

Show labels

This selector controls whether or not planets and moons of our solar system are displayed in the Sky View. You can also adjust the brightness of their display.

Orbits

This control decides how solar system body orbits are displayed. Setting this to "On" will always display orbits. Setting it to "Auto" will only show them when you are not located on the Earth's surface. You can also adjust the brightness of the orbits.

Meteor Showers

The "Meteor Showers" settings control the display and intensity of meteor events.

Meteor showers

This selector determines whether or not 3D meteors are displayed in the Sky View. Use the "Rate boost" option to adjust the frequency of the meteors: "Off" shows them at their true hourly rate, while "Low" and "High" increase the amount shown in the sky.

Show radiant

This option allows you to turn the display of the radiant point of a meteor shower on or off. You can also control its brightness. The radiant point is the area from which meteors appear to originate in the sky.

Stars

The "Stars" settings allow you to control the overall display of stars. All star catalogs are affected by the settings in this section.

Show stars

This toggle controls whether any stars are shown in Luminos. To disable all visible stars, set this slider to "Off". The "style" option controls the level of visible sharpness of the stars in the sky. To adjust the relative brightness of visible stars, use the "Brightness" slider under "Show stars".

Show labels

This toggle controls whether bright stars are automatically labeled in Luminos. To disable all automatic star labels, set this switch to "Off". To adjust how many labels are shown, use the "Density" slider under "Show labels". To adjust the brightness of the labels, use the "Brightness" slider under "Show labels".

Proper names

If this setting is turned on, you will see specific star names such as Aldebaran. Without this setting, only constellation designations are shown.

Constellations

The "Constelations" settings allow you to control the display of constellations.

Images

This switch controls whether the star-rendered constellation images are shown. To raise or lower the brightness of constellation figures, use the corresponding "Brightness" slider.

Lines

This selector controls when the line-figures of the constellations are shown. Setting this to "Off" never renders them, while "On" renders them all at all times. Setting the control to "Auto" will only show the line drawing you are centered on. To raise or lower the brightness of constellation lines, use the corresponding "Brightness" slider.

Boundaries

Boundaries between the constellations separate the sky into 88 distinct regions. To view all of the boundaries between the constellations, set this to "On". To see only the boundary of the constellation centered on your screen set this to "Auto". Similarly, the brightness of the constellation boundaries is adjustable using the "Brightness" slider directly underneath the toggle.

Labels

Labels for the constellations make it easy to identify which constellation you're seeing. To have all of the constellation names shown all the time set this to "On". To see only the name of the constellation centered on your screen set this to "Auto". To not show any names set this to "Off". Similarly, the brightness of the constellation names is adjustable using the "Brightness" slider directly underneath the toggle.

Asterisms

The "Asterisms" settings adjust the display of asterisms in the sky.

Asterisms

This selector toggles when the line-figures of the asterisms are shown. Setting this to "Off" never renders them, while "On" renders them all at all times. Setting the control to "Auto" will only show the line drawing of any asterism you are centered on. To raise or lower the brightness of asterism lines, use the corresponding "Brightness" slider.

Labels

To have all of the asterism names shown all the time set this to "On". To see only the name of the asterism centered on your screen set this to "Auto". To not show any names set this to "Off". Similarly, the brightness of the asterism names is adjustable using the "Brightness" slider directly underneath the toggle.

Comets

Asteroids

The "Comets and Asteroids" section adjusts the settings for small bodies. These settings are also found under the Browser section for Comets and Asteroids.

Automatic Downloads

Luminos will automatically contact the IAU Minor Planet Center once a month to update data for comets and asteroids. If you turn off Automatic Downloads, you must refresh the data manually by pulling down in the "Comets and Asteroids" Browser page until the refresh control fully appears.

Brightness

Luminos normally draws comets and asteroids in the Sky View at their actual brightness to keep the sky from becoming too cluttered. Choose "Enhanced" to view these small bodies at brighter-than-normal levels to aid in tracking their positions.

Deep Space

The "Deep Space" settings allow you to control the display of labels on deep space objects.

Show labels

This toggle controls whether deep space objects are automatically labeled in Luminos. To disable all automatic deep space labels, set this switch to "Off". To adjust how many labels are shown, use the "Density" slider under "Show labels". To adjust the brightness of the labels, use the "Brightness" slider under "Show labels".

Show images

If you want to disable or enable the display of images in the Sky View, use this toggle.

Show symbols

Use this toggle to turn off the chart symbols indicating the location of all deep space objects.

Milky Way

Luminos displays a visual representation of our Solar System's galaxy, the Milky Way Galaxy. Normally, the Milky Way forms a glowing strip of light across the night sky. To adjust the visibility of the Milky Way in the Luminos sky, use the following sliders:

Brightness

Use this to control the overall brightness of the Milky Way in the display.

Wavelength

Use this control to choose between the visible and infared representations of the Milky Way. In the infared view, it is possible to see the dust clouds located in our galaxy.

Environment

Luminos gives you detailed control over the realism of the environment while exploring the sky. You have the ability to customize your display to present a more realistic environment, or a more sparse environment which emphasizes only the sky.

Terrain

Setting the terrain to "Off" completely hides the ground and allows you to see the entire sky without obstacles. Choosing "Flat" will show the ground, but with no elevation. The "3D" option will cause Luminos to display terrain features which match your actual environment. Luminos will fetch terrain data based on your current location setting and display the corresponding hills, mountains, and valleys. You must be connected to the Internet to load new terrain data.

Translucent

If terrain is visible, this option will display the ground with a partially transparent appearance, allowing you to see some objects normally obscured by the ground.

Atmosphere

This toggle determines whether or not Sol will light up the atmosphere during daytime. Although the atmosphere can provide a more realistic and appealing display, disabling it will give a clearer view of the sky, even during daytime. The atmosphere will only display if the "Terrain" setting is also enabled.

Lens flare

Lens flare causes visual artifacts when the view is pointed in the direction of a bright light source, such as Sol, providing a more realistic appearance in the atmosphere. To disable lens flare, set this toggle to "Off".

Selection

This toggle adjusts the cursor of the selected object between an animated crosshair and a high-motion flare.

Motion effects

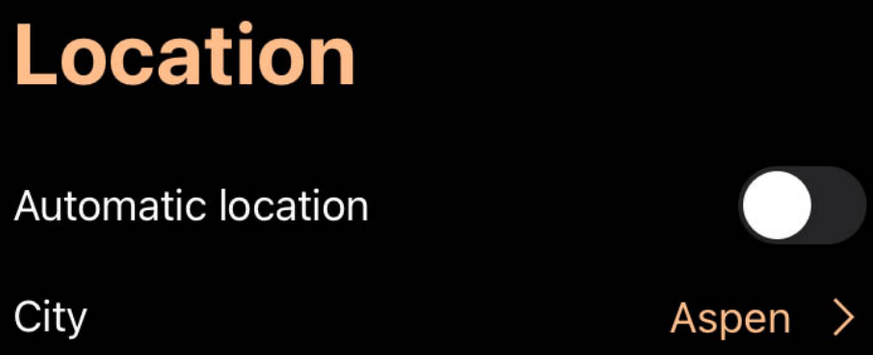
This setting controls whether or not the 3D holographic effect is active in the display. This effect adjusts the view of the 3D display as the device position is adjusted, to create a more striking 3D effect.

Show status bar

Toggles whether or not to show the system status bar at the top of the Luminos display. This also controls whether device functions such as multitasking and the device control panel require more than one tap to activate.

Location

The celestial objects you see are affected by your viewing location. Luminos will default to using your current position on Earth as its viewing location. When you start Luminos, it will ask you for permission to determine your current location. If you allow this, Luminos will download and display terrain which matches the geographical features of the area in which you reside. If you don't allow Luminos to detect your location, you can set it manually in the Location Display.



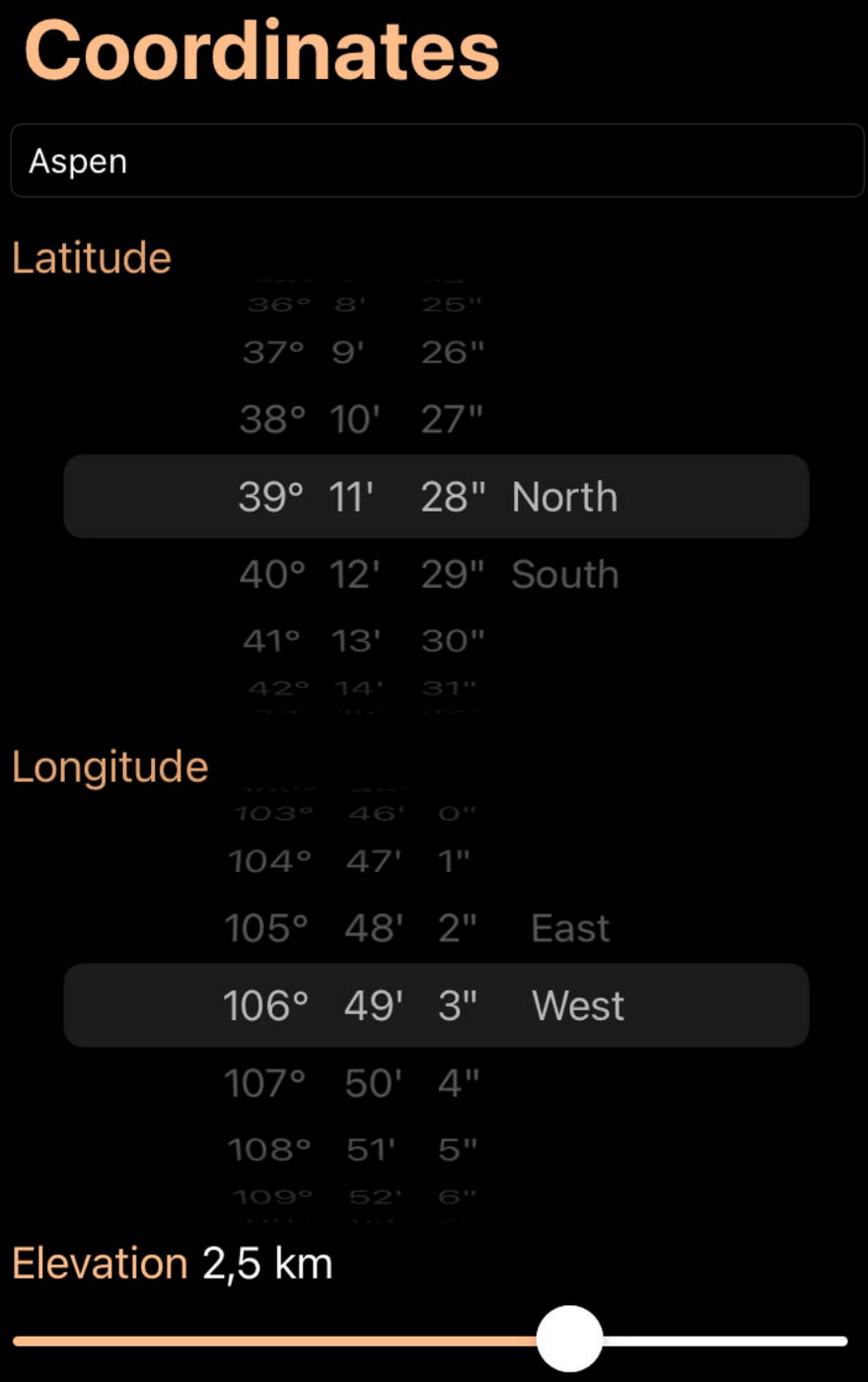
Alternatively, you can set your location to other areas on Earth to see how your position affects the night sky.

To view the Location Display, tap the "Location" indicator at the top of the Settings.

Location detection

In the Location Display, you will be shown your current latitude and longitude, according to Luminos. These values are either determined at startup or set manually here. To request that Luminos retrieve your position at startup, make sure the "Automatic location" slider is set to "On". You must have the device's Location Services enabled for Luminos to find your whereabouts.

Manual location



If you prefer to set your location to a specific latitude and longitude, simply tap the currently displayed coordinate values. You will be presented with dial controls to set the latitude and longitude directly, and a slider to raise or lower your elevation at that location. Your Sky View will update in real time as you change your settings, and terrain will adjust as appropriate.

Location browsing

Another way to set your current location is to navigate the "City" list. After tapping into the countries list, you can choose a specific city or area in which you would like your Sky View to be located. Countries will be divided by state or province, as appropriate. Inside this selector, you can further refine your location by typing into the search bar located at the top of the display.

Recent locations

Luminos includes a set of recently entered cities or coordinates. If you have changed your location to other places, they will appear in the list underneath the main controls so that you may quickly revisit them.

Terrain display

Luminos not only adjusts the sky to match your location; it also alters the terrain which is displayed in the Sky View landscape to match that of your location. If you are connected to the Internet, Luminos will download terrain appropriate for your chosen location. If the terrain data is not already available to Luminos--or if terrain is turned off in the Settings display--no land will display at all.

Sharing

Luminos makes it easy to share your experiences in the app with those you know, and even those nearby. Using the sharing feature, you can share screen captures of your current view in the app, as well as your current environment so that other Luminos users can re-create it.

To get started with sharing, tap the share button located in the upper left corner of the main Browser display.

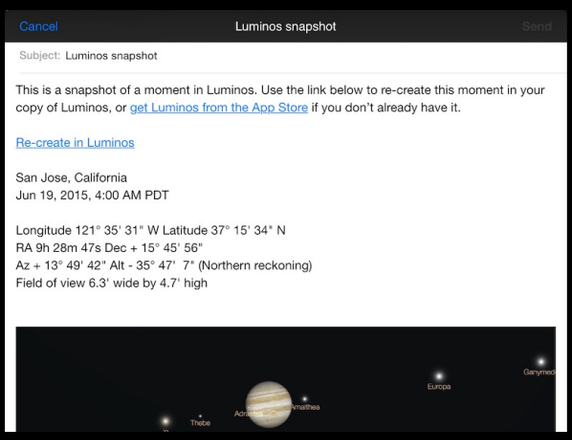
You will then need to choose the account or device with which you would like to share. If you choose a destination that allows images, you will automatically share a screenshot of your current view of Luminos.

In some cases, you will also share information related to your current location and direction in the app. Your location will only be shared if it is not your "Home" location.

For services that support URLs, Luminos will create a link known as a "sequence". A sequence is a special URL beginning with the prefix

luminos://

and a series of commands. Tapping a sequence link on a device with Luminos installed will launch the app and activate the sequence. This allows you to share your current environment in Luminos with others, or save it and recreate it later. You can use the iOS AirDrop feature to share a Luminos sequence with other people nearby, and their copy of Luminos will open to match the state of your own. Your location will only be included in the sequence if you are not at your "Home" location. This allows you to share activities that others can recreate wherever they are.



Sequences can also be created manually to control Luminos as you choose. You can create tours, simulate events, and share them with friends. For more information on creating your own sequences, consult the appendix.

Tips and Tricks

The following tips and tricks can help you get the most out of your Luminos exploration:

Centering your view

In motion tracking mode, you are free to tilt the display in any angle you choose. The user interface will follow you at any angle or rotation. Touching any part of the display will switch to panning mode. Touching the warning notice will re-orient the camera to the horizon, making the sky visible again.

Following the selection

If you lose track of your current selection, an arrow will appear which points toward the selected object. Follow the pointer by panning your view, or press the "Center" button on the Toolbar to bring the selection back into view.

Clearing the selection

To clear out any selected item completly, just swipe down the Selection Bar as if you were pushing it offscreen.

Selection history

Luminos will also keep an internal list of the objects you have selected recently. If you want to return to a recently selected object, swipe across the Selection Bar.

Returning home

If you ever get overwhelmed or lose your place in the application, simply hit the Home icon in the upper left of the Sky View. The Home button will always return you to your default location on Earth and re-center the view.

Zooming in

To select objects which are close by, try zooming in using the two-finger zoom. Once the objects are separated, they are easier to select.

Appendix I: Greek Alphabet

The Greek alphabet is frequently used in astronomy to identify stars. To help you familiarize yourself with the alphabet the following table summarizes the letters, their abbreviations and their names.

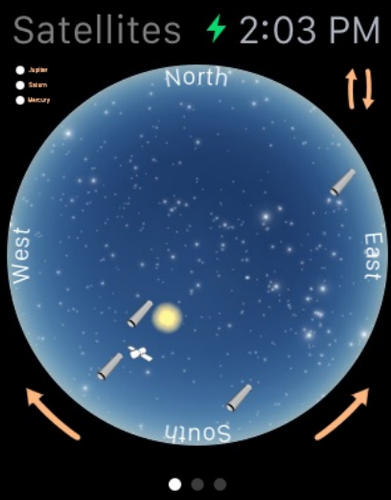
Upper	Lower	Abbrev.	Name
Α	α	alf	Alpha
Β	β	bet	Beta
Γ	γ	gam	Gamma
Δ	δ	del	Delta
Ε	ε	eps	Epsilon
Ζ	ζ	zet	Zeta
Η	η	eta	Eta
Θ	θ	the	Theta
Ι	ι	iot	Iota
Κ	κ	kap	Kappa
Λ	λ	lam	Lambda
Μ	μ	mu	Mu
Ν	ν	nu	Nu
Ξ	ξ	ksi	Xi
Ο	ο	omi	Omicron
Π	π	pi	Pi
Ρ	ρ	rho	Rho
Σ	σ	sig	Sigma
Τ	τ	tau	Tau
Υ	υ	ups	Upsilon
Φ	φ	phi	Phi
Χ	χ	chi	Chi
Ψ	ψ	psi	Psi
Ω	ω	ome	Omega

Apple Watch

Installing Luminos on an Apple Watch gives you more ways to access astronomy data quickly.

You will receive notifications for any satellites you have configured for flyover alerts if your phone is locked and the Apple Watch is being worn.

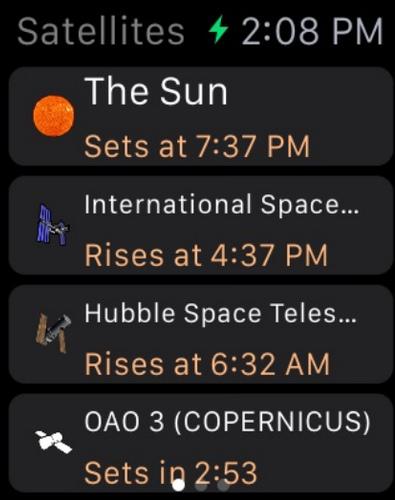
Running the Luminos watch app gives you more detailed data and control. At start, the watch will display a live sky view at your location with satellites from the hundred brightest category displayed at their current positions. The satellites will move in real time as long as the watch app is active.



The sky chart is configured by default with North at the top. To flip the view, tap the double arrows in the upper right corner. To rotate the view ninety degrees, tap the directional arrows at the bottom of the watch screen.

Swiping left or right on the display will bring up similar live sky views for Planets and Stars. Tapping on the main sky view will animate a legend pointing to any active satellites, planets, or stars currently being shown.

On any sky chart, swiping down will move to a detail list of any item currently in the sky.



Tapping any item in the detail list brings up its summary, including where it is located in the sky from your position.

Scrolling down in any detail page will present live data related to the object such as rise and set time, position, and velocity.

Sequence Scripting

Luminos includes a powerful protocol for sharing and scripting state and sequences. Using this protocol, you can create URLs to save your current state, show timed guided tours, and more. Launching one of these URLs on a device with Luminos installed will activate the sequence.

You can also create sequences by using the sharing action in the Browser main view.

This appendix documents how to manually create Luminos sequences using your own URLs.

Syntax

A Luminos sequence consists of the luminos scheme (`luminos://`), followed by the sequence indicator (`sequence/`), followed by a list of commands. Each command is separated by a forward-slash (`/`).

Each command is a verb with zero or more parameters. Parameters are surrounded by parentheses and separated by commas.

```
luminos://sequence/[command_list]
command_list: command[/command_list]
command: verb[(params)]
params: value[,params]
```

For example, a Luminos sequence with three commands might look like the following:

```
luminos://sequence/command1/command2(parameter1,parameter2)/command3/
```

Commands

The following list includes all commands currently supported by Luminos sequences:

Delay

Syntax

```
delay(seconds)
```

Examples

```
delay(3) // delay 3 seconds
```

The `delay()` command pauses the execution of the sequence for the number of seconds specified in its parameter. This is useful for giving the viewer time to experience a view or text message.

Message

Syntax

```
message("title")
message("title", "subTitle")
message("title", duration_secs)
message("title", "subTitle", duration_secs)
message(location)
```

Examples

```
message("One line message")
message("Two line message","With a subtitle and duration",10)
message(location) // shows current location
```

The `message()` command shows an onscreen message, with an optional subtitle and duration in seconds. Note that commands following this one will continue to execute while the message is displayed, which may overwrite the message contents. To pause on a message, consider following it with a `delay()` command. Messages embedded in HTML files will need to have their quotes escaped with %22 for quote and %20 for space.

Select

Syntax

```
select(objectID)
```

Use the `select()` command to select an object in the Luminos database. A selected object can be centered, or zoomed. The following is a list of the object types that can be selected, and the syntax for doing so.

Planets and moons

```
select(<planet or moon name>)
```

Examples:

```
select(earth)
select(sol)
select(luna)
select(jupiter)
select(ceres)
select(io)
```

Hipparcos Stars

```
select(hp.<hipparcos catalog number>)
```

Example:

```
select(hip.11767) // Polaris
```

Tycho Stars

```
select(tyc.<tycho catalog number>)
```

Example:

```
select(tyc.2540-291-1)
```

The optional Tycho-2 catalog must be installed.

Henry Draper Stars

```
select(hd.<henry draper catalog number>)
```

Example:

```
select(hd.61421) // Procyon
```

Satellites

```
select(satellite.<satellite catalog number>)
```

Example:

```
select(satellite.25544) // ISS
```

Satellite catalog number can be found in the detail view Designations.

Meteor showers

```
select(shower.<IAU meteor shower code>)
```

Example:

```
select(shower.per) // Perseids
```

Shower codes are lower case, and can be found in the detail view as "ID"

Comets

```
select(comet.<IAU comet identifier>)
```

Examples:

```
select(comet.1p) // Halley's Comet
select(comet.c2012s1) // C/2012 S1 (ISON)
```

For numbered comets, the identifier is the number followed by the letter"p". For periodic and non-periodic comets, the identifier is the full name with punctuation and the discovered removed, all lower case.

Asteroids

```
select(asteroid.<IAU asteroid identifier>)
```

Examples:

```
select(asteroid.00001) // (1) Ceres
select(asteroid.F5140) // (155140) 2005 UD
select(asteroid.K10K69E) // 2010 KE69
select(asteroid.01566) // (01566) Icarus
```

The identifier is the packed number designated by the IAU. It can be found in Luminos by viewing the detail for any asteroid in the "Number" field.

New General Catalog deep space

```
select(ngc.<Revised NGC catalog number>)
```

Example:

```
select(ngc.1952)
```

Index Catalog deep space

```
select(ic.<Revised IC catalog number>)
```

Example:

```
select(ic.2764)
```

Barnard deep space

```
select(barnard.<Barnard catalog number>)
```

Example:

```
select(barnard.18)
```

Sharpless deep space

```
select(sh2.<Sharpless catalog number>)
```

Example:

```
select(sh2.49)
```

RCW deep space

```
select(rcw.<RCW catalog number>)
```

Example:

```
select(rcw.131) // War and Peace Nebula
```

Surface features

```
select(<planet or moon name>.feature.<IAU surface feature number>)
```

Examples:

```
select(luna.feature.3691) // Sea of Tranquility
select(phobos.feature.5707) // Stickney Crater on Phobos
```

Constellations

```
select(const.<IAU 3 letter constellation code>)
```

Example:

```
select(const.ori) // Orion
```

Asterisms

```
select(asterism.<lower case name, no punctuation, underscore separated>)
```

Examples:

```
select(asterism.teapot) // Teapot
select(asterism.kembles_cascade) // Kemble's Cascade
```

Solar eclipses

```
select(sol.eclipse.<Catalog number of NASA 5 millennium solar eclipses>)
```

Example:

```
select(sol.eclipse.9543) // Total Solar Eclipse March 9, 2016
```

Lunar eclipses

```
select(luna.eclipse.<Catalog number of NASA 5 millennium lunar eclipses>)
```

Example:

```
select(luna.eclipse.9685) // Total Lunar Eclipse September 28 2015
```

Clear

Syntax

```
clear
```

Examples

```
clear
```

The `clear` command clears the current selection.

Center

Syntax

```
center
```

Examples

```
center // center on current selection
```

The `center` command only takes action if there is a current selection.

Zoom In

Syntax

```
zoom_in
```

Examples

```
zoom_in // zoom the camera in
```

The `zoom_in` command magnifies the current camera onto the selection. This takes no action if no object is selected.

Zoom Out

Syntax

```
zoom_out
```

Examples

```
zoom_out // zoom the camera out
```

The `zoom_out` command reduces the current camera magnification on the selection. This takes no action if no object is selected.

Equatorial coordinates (JNow)

Syntax

```
eq(ra_deg, dec_deg)
```

Examples

```
eq(269.6380,66.6358) // Location of Cat Eye Nebula
```

Use the `eq()` command to point the camera at a specific equatorial coordinate. This command uses coordinates in the JNow epoch. Both coordinates are in decimal degrees.

Equatorial coordinates (J2000)

Syntax

```
eq2k(ra2k_deg, dec2k_deg)
```

Examples

```
eq2k(85.4250,-1.8567) // Location of Flame Nebula
```

Use the `eq2k()` command to point the camera at a specific equatorial coordinate. This command uses coordinates in the J2000 epoch. Both coordinates are in decimal degrees.

Horizontal coordinates

Syntax

```
horiz(az_deg, alt_deg)
```

Examples

```
horiz(0,30) // Look north, slightly above the horizon
```

The `horiz()` command will direct the camera at a horizontal coordinate specified in decimal degrees.

Location

Syntax

```
location(objectID, longitude_deg, latitude_deg, elevation_meters)
location(objectID, longitude_deg, latitude_deg)
location(longitude_deg, latitude_deg) // Earth
location(longitude_deg, latitude_deg, elevation_meters) // Earth
```

Examples

```
location(mars,137.81,-5.37) // Gale crater on Mars
location(-73.967,40.783) // Manhattan
```

The `location()` command changes the location of the viewer to a specific longitude, latitude, and elevation relative to another object. If the first parameter is a number, the body is assumed to be Earth. Note that the longitude and latitude must be in decimal format.

Orbit

Syntax

```
orbit(objectID)
orbit(objectID, longitude_deg, latitude_deg, distance_au)
orbit(objectID, longitude_deg, latitude_deg)
orbit(longitude_deg, latitude_deg) // Earth
orbit(longitude_deg, latitude_deg, distance_au) // Earth
```

Examples

```
orbit(luna) // Orbit the Moon
orbit(-73.967,40.783,0.0001) // Orbit .0001 AU over Manhattan
orbit(solsys) // Show the solar system orrery
```

The `orbit()` command places the view in orbit over the specified object. If no object ID is specified, the orbit is over Earth. Note that the longitude and latitude must be in decimal format. If no distance value is provided, it will be defaulted. If provided, it must be in astronomical units.

Home

Syntax

```
home
```

Examples

```
home
```

The `home` command returns the viewer to the home location and restores the default camera field of view.

Field of View

Syntax

```
fov(vertical_degrees)
```

Examples

```
fov(62.4) // set the camera field of view to 62.4 degrees
```

The `fov()` command sets the camera field of view to a specific value of vertical degrees.

Home View

Syntax

```
home_view
```

Examples

```
home_view
```

The `home_view` command resets the default camera field of view.

Julian Date

Syntax

```
jd(julianDateUTC)
jd(julianDateUTC, duration)
```

Examples

```
jd(2457193.138579) // change the Luminos clock to June 19, 2015 instantly
jd(2457193.138579,3) // change the Luminos clock to June 19, 2015 over 3 seconds
```

Use the `jd()` command to change the internal clock in Luminos to a specified Julian Date in Coordinated Universal Time. An optional second number specifies how many seconds to take during this transition. Providing no second parameter changes the time instantly. This command also stops the internal clock.

Dynamical Time

Syntax

```
td(julianDateTD)
td(julianDateTD, duration)
```

Examples

```
td(2457193.4236785644) // change the Luminos clock to June 19, 2015 instantly
td(2457193.4236785644,4) // change the Luminos clock to June 19, 2015 over 4 seconds
```

Use the `td()` command to change the internal clock in Luminos to a specified Julian Date in Dynamical Time. An optional second number specifies how many seconds to take during this transition. Providing no second parameter changes the time instantly. This command also stops the internal clock.

Speed

Syntax

```
speed(multiplier)
```

Examples

```
speed(86400) // change the Luminos clock to one day per second
speed(1) // change the Luminos clock to normal time flow
speed(-60) // change the Luminos clock to 1 minute per second in reverse direction
speed(0) // stop the Luminos clock
```

Use the `speed()` command to change the rate of time flow in Luminos. The parameter is a multiplier on seconds every second. A negative value reverses the flow of time.

Now

Syntax

```
now
```

Examples

```
now // set the Luminos clock to the current time
```

Note that using the `now` command also sets the time flow to normal speed.