Astrarium Pro — User Manual

For version 1.3

7 September 2026

Contents

1. Introduction

Astrarium Pro is a planisphere and astronomical simulator for iPhone and iPad. It shows the sky as it is now, but it also lets you drive the clock freely — back into the past, forward into the future — and it puts planetary phases, eclipses, meteor showers and comets on the same chart.

It also does satellites (the space stations, the naked-eye satellites, science satellites, Starlink and the weather satellites), AR (the chart drawn over the live camera) and the aurora forecast (chapter 11). Everything else is the same screen, and the same handling, as the free Astrarium.

Positions come from the JPL DE421 ephemeris, the IAU precession and nutation models and IERS Earth-orientation data, and are accurate enough to plan real observing sessions with.

1.1 Requirements

Devices	iPhone / iPad (iOS and iPadOS 17.0 or later)
Orientation	Portrait and landscape both supported
Price	Paid. No advertising
Network	The chart and all the astronomy run on the device — it works offline
Data collection	None. Your site and settings stay on the device

An internet connection is needed only to **update** four things:

- satellite orbital elements (TLEs, from Celestrak),
- the aurora forecast (NASA DONKI, NOAA OVATION),
- comet and asteroid elements (from the MPC and JPL),
- your current position (this uses location services, not the network). Where Precise Location is switched off, the app asks for it once, for that single fix: an approximate position can be kilometres out, and that changes what is visible near the horizon.

1.2 First steps

1. On launch, the app shows the sky over Tokyo at the present moment.
2. Press 📍 in the top bar and allow the use of your location. Astrarium switches to your position and tells you the nearest registered site and how far away it is. If you would rather not share your location, pick a site from the list or type in coordinates (chapter 3).
3. Outdoors, press 🔴 (night vision). The whole interface turns red so that it does not spoil your dark adaptation.

2. The screen

The screen is divided into five bands, from top to bottom.

Band	Where	What it does
Top bar	Top	Clock, observing site, location, panel, language, night vision

Band	Where	What it does
Chart	Middle	The sky itself — driven with your fingers
Quick bar	Below the chart	Magnitude slider and the common toggles (two rows)
Time bar	Below that	How the sky is shown (all-sky, horizon, AR, aurora) and the grids; moving and playing the clock (three rows)
Signature	Bottom	Logo and author, both links

The three rows of the time bar are, from the top,

1. **All-sky / Horizon / AR / Aurora / Grids** — how the sky is shown
2. **−syn −1d −1h −1m / +1m +1h +1d +syn** — moving the clock
3. **Date button / time / Now / ◀ ■ ▶** — the date and time themselves

Pressing the date button opens a calendar; the time field can be typed into.

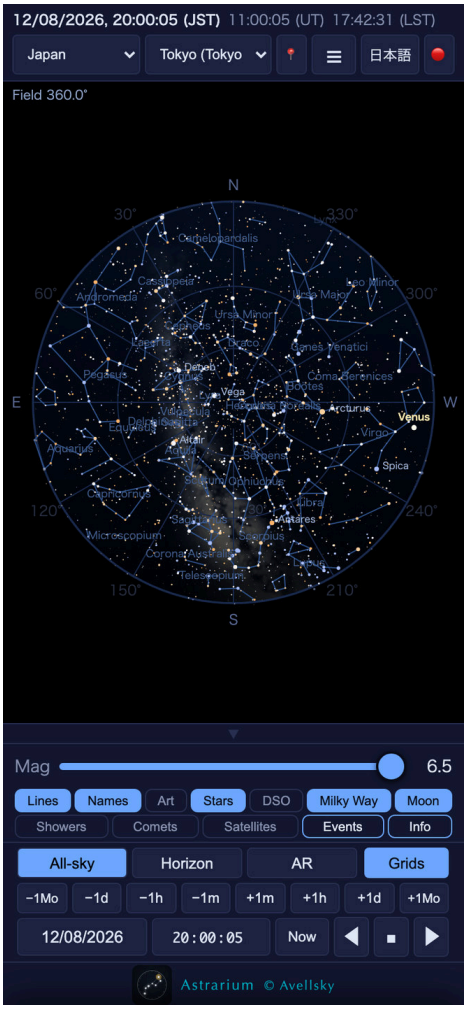

Figure 1. The all-sky view (Tokyo, 12 August 2026, 20:00)

2.1 The top bar

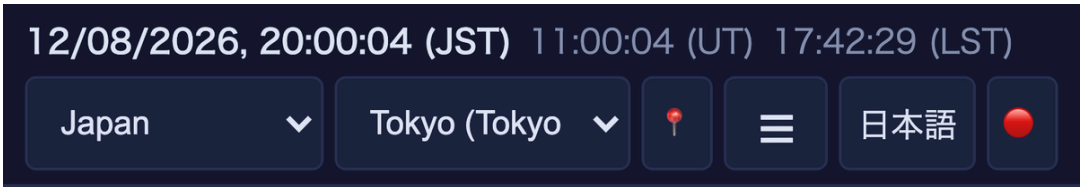

Figure 2. The top bar: site category and site, location, panel, language, night vision

- **Clock** — local time at the observing site, Universal Time (UT) and Local Sidereal Time (LST) side by side. LST tells you which right ascension is on the meridian right now, which is what you need when pointing a telescope.
- **Site category** — Japan (the 47 prefectural capitals), Japanese dark-sky sites, observatories, aurora viewing sites, major cities other than capitals, the capitals of each continent, and the Antarctic research stations. Observatories at home and abroad are one list. Each menu is named for exactly what is in it: “Asia · capitals” holds one national capital per country. Choosing observatories adds a second **Region** menu so you can narrow the list down by continent.

- **Site** — the place itself. The prefectures and the dark-sky sites run north to south; the world cities are alphabetical, by the reading of the name when the app is in Japanese.
- 📍 — use your current position.
- ≡ — open or close the detail panel (six tabs).
- **EN / 日本語** — switch language. Object names, constellation names and every description change with it.
- 🔴 — night vision; press again to return to normal colours.

2.2 The signature line

The logo at the bottom opens the Astrarium Pro home page and `© Avellsky` opens the author's page, both in the browser.

3. Choosing where you are

Pick a place from the category and site menus in the top bar, or press 📍 to open the **site screen**, which holds a map, coordinate entry and your saved places on one panel.

Pick it from the list

Use the category and site menus in the top bar. The app carries the capital of each of the 47 Japanese prefectures — "Sapporo (Hokkaido)", named with its prefecture — recommended dark-sky sites in Japan ordered by prefecture from the north, every national capital named with its country, the major cities that are not capitals, the Antarctic research stations, and the world's observatories with their MPC codes. Each place appears in one menu only. **Aurora viewing sites** collects the places people go to see the aurora (23 of them): Fairbanks, Yellowknife, Tromsø, Abisko, Rovaniemi, Akureyri and Longyearbyen in the north, Hobart, Invercargill and Ushuaia in the south, and two in Japan — the Nayoro and Rikubetsu observatories. The bracket after each name is **the country**: Japan comes first, then the countries in order, and the places within a country by name.

Open the site screen

Press 📍. Nothing moves the moment you press it.

- **Get current position** — choose "While Using the App" when iOS asks. If Precise Location is off, the app asks once for the precise fix (an approximate one can be kilometres out, which changes what sits on the horizon). Tick "Get position at launch" and it will do this on every start.

- **Map** — drag the map (OpenStreetMap) until the centre mark is on the spot; + and – zoom.
- **Latitude, longitude, altitude** — type degrees, minutes and seconds, and the altitude; the arrows step one unit at a time. “Use this position” applies it.
- **List** — save up to **ten** places by name and tap a row to go there.

Changing the site updates the clock, the rise and set times and the whole geometry of the chart together.

4. Driving the chart

4.1 All-sky and horizon views

Switch with **All-sky** and **Horizon** at the left of the time bar.

- **All-sky** — the whole sky as a circle centred on the zenith, north up and east to the left, exactly as on a cardboard planisphere. The Milky Way is drawn in this view.
- **Horizon** — part of the sky drawn as you would actually see it looking out. The menu beside the button chooses which way you face: **N**, **E**, **S**, **W**.

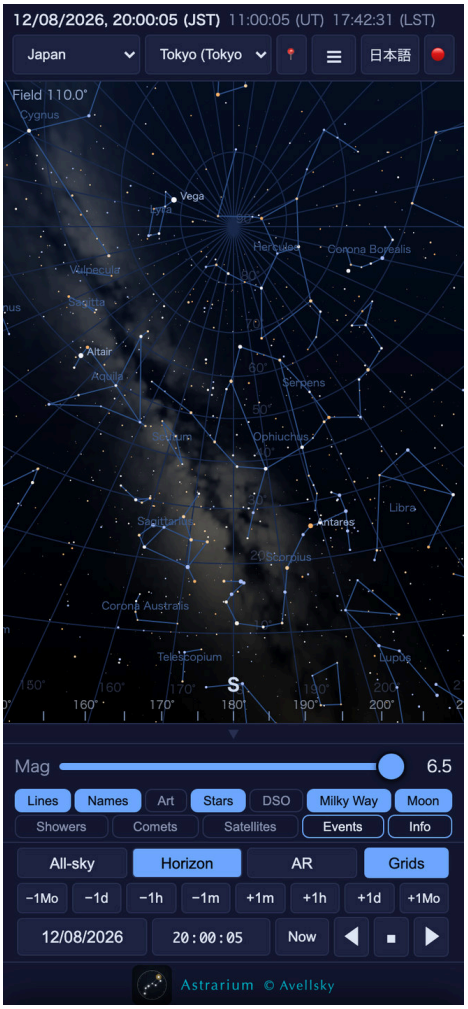

Figure 3. Horizon view, facing south, 110-degree field

4.2 Gestures

Gesture	All-sky	Horizon
One-finger drag	**Diurnal rotation** — the sky turns about the celestial pole and the clock follows your finger	Pans the view
Two-finger pinch	Zoom about the point between your fingers	The same
Double tap	Recentre on the zenith	—
Tap an object	Opens its information popup	The same
Mouse wheel	Zoom	Zoom
SHIFT + drag	Pans the view centre without rotating	—

Dragging in all-sky view is the planisphere gesture: the dial turns and the simulated time turns with it, so you can feel out how high Orion will be in two hours' time with a fingertip.

4.3 What a tap tells you

The popup gives the name, right ascension and declination, azimuth and altitude and the magnitude, with buttons underneath. **The readings follow the clock while the card is open.** Azimuth and altitude are recomputed twice a second, α and δ, distance, elongation and phase angle each time the sky is refreshed, and the rise, transit and set times when the local date turns over. "(below the horizon)" is added once the object has set.

The Sun, the Moon, the planets and the moons drawn in the zoom view also carry a sentence or two on what they are, and every card gives the **distance** — in astronomical units for the solar system (kilometres for the Moon) and in light years for the stars, from the Hipparcos parallaxes.

Close a card with the **pin (📌) in its top-right corner**. Tapping the body of the card does not close it, so a long description can be read without it vanishing under your finger.

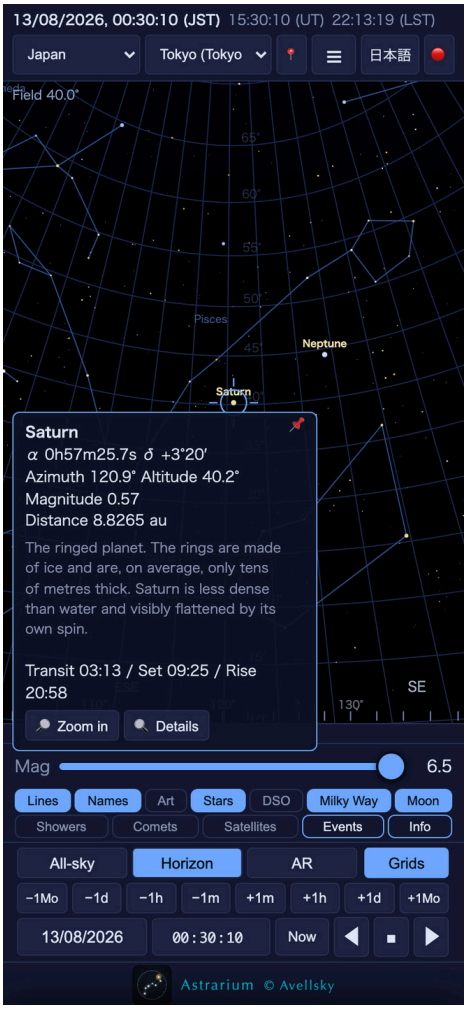

Figure 4. Saturn tapped: coordinates, magnitude, rise and set, and two buttons

- 🔎 **Zoom in** — puts the object in the middle of the screen, zooms in and starts **tracking** it. While tracking, the object stays centred as the clock runs. Release it with the **Release** button on the chart or the Esc key; panning the view does not break the tracking.
- 🔍 **Details** (Sun, Moon and planets) — opens a window that draws the body as a disc, recomputed every five seconds so its distance, elongation, phase angle and libration follow the clock too. The figures include the **physical data** — diameter, mass, mean density, rotation period, axial tilt and surface gravity — and scroll inside the window when there are more than it can show.
- 🧭 **Polar alignment** (Polaris only) — opens the polar scope's field, with Polaris on an hour-angle ring that follows the clock. The red button in that window switches night vision on and off. The Moon comes with its age, illuminated fraction, libration and popular name (Pink Moon, supermoon and so on); Jupiter with the four Galilean moons; Saturn with the rings and Titan; Mars with Phobos and Deimos. You can drag inside the window.

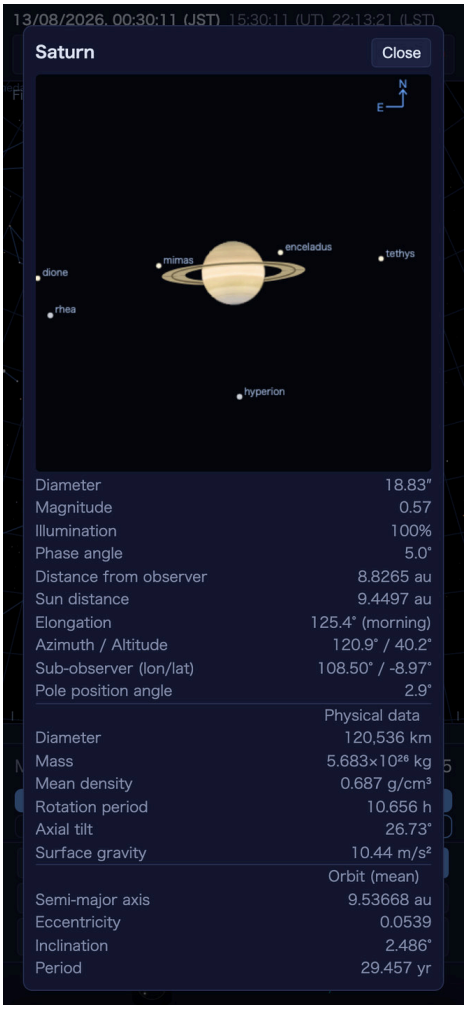

Figure 5. The zoom view of Saturn, with the rings and its moons

Picking a deep-sky object brings up a photograph and a short description; a comet or asteroid brings up its orbital elements and estimated brightness; a satellite brings up its range, height and apparent magnitude with a **Next visible passes** button. Deep-sky names, constellations and descriptions are available in both languages; an object with no Japanese name is listed by its catalogue number in Japanese, with the English name beside it.

Tapping a meteor shower's radiant gives its azimuth and altitude as well as its coordinates, and these follow the clock — so you can see at a glance whether the radiant is up yet.

With constellation art switched on, tapping one of the twelve zodiacal constellations shows the corresponding astrological sign and its birth dates, together with a note that precession has moved the signs about a month away from where the Sun really is.

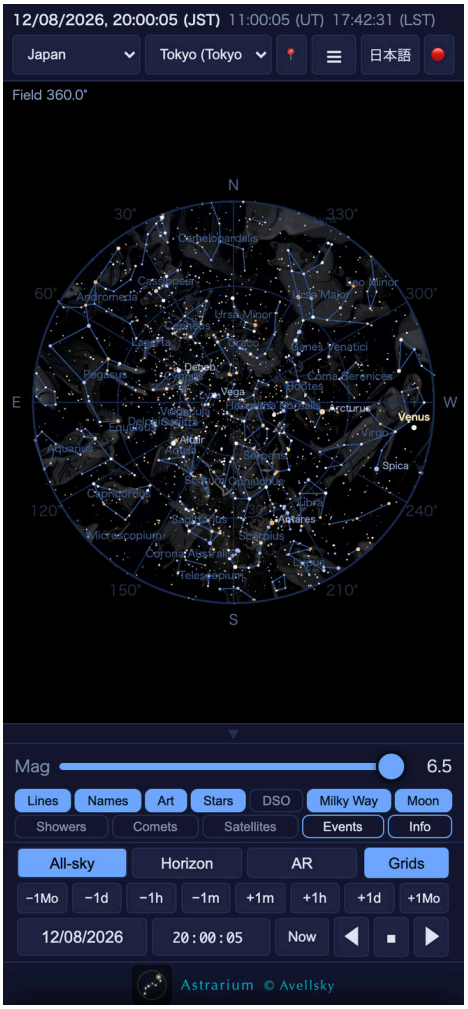

Figure 6. The whole sky with the constellation figures drawn

5. Moving through time

The lower two rows of the time bar do this.

5.1 Steps and playback

Control	What it does
−syn / +syn	Back or forward one synodic month (29.53 days) — the same lunar phase
−1d / −1h / −1m	Back one day, hour or minute
+1m / +1h / +1d	Forward one minute, hour or day
Date button	Opens a calendar. Picking a day keeps **the time of day** and moves the date
Time field	Type `21:30` and the clock goes to that time on the same day
Now	Return to the present

Control	What it does
◀ / ▶	Play backward / forward; each press steps ×1 → ×60 → ×600 → ×6000 and round again
■	Hold the clock still; press again and it runs from where it stopped
Rate	The speed it is running at — “stopped” when held, “real time” when idle

While it runs the arrow carries the rate in its heads: ▶ ×1, ▶▶ ×60, ▶▶▶ ×600, ▶▶▶▶ ×6000, and a minus sign on the rate when running backwards. At ×600 one second of yours is ten minutes of sky.

■ also detaches the chart from real time. Idle, the sky still moves at the rate the real sky moves; ■ stops it dead. Stepping the clock still works while it is held, and it stays wherever you step it to.

With a keyboard, ← and → move ±10 minutes, with `Shift` ±1 day, with `Alt` ±1 minute, and ↑ ↓ move ±1 hour.

Every date and time is the time at the observing site. Choose a site abroad and the clock, the date button and the time field all switch to that place’s time — not the device’s. The zone abbreviation (JST, GMT and so on) follows the clock in brackets.

In the horizon view the altitude lines run all the way to **90° (the zenith)**, numbered like the rest. In the whole-sky view 90° is a point, not a line.

5.2 Grids

The **Grids** button opens a menu of overlays; you can have several at once.

Overlay	What it is
Alt-Az grid	Horizontal coordinates — azimuth and altitude
RA-Dec grid	Equatorial coordinates, the system star catalogues use
Ecliptic grid	Ecliptic coordinates; the planets and the Moon keep to this band
Galactic grid	Galactic coordinates; the Milky Way lies along latitude 0°
Celestial equator	Drawn as a single great circle

Overlay	What it is
Ecliptic	The Sun’s path, likewise
Galactic plane	The great circle at galactic latitude 0° — the centre line of the Milky Way
Meridian	The north–south great circle objects transit

The spacing of the lines and the precision of the labels follow the zoom level.

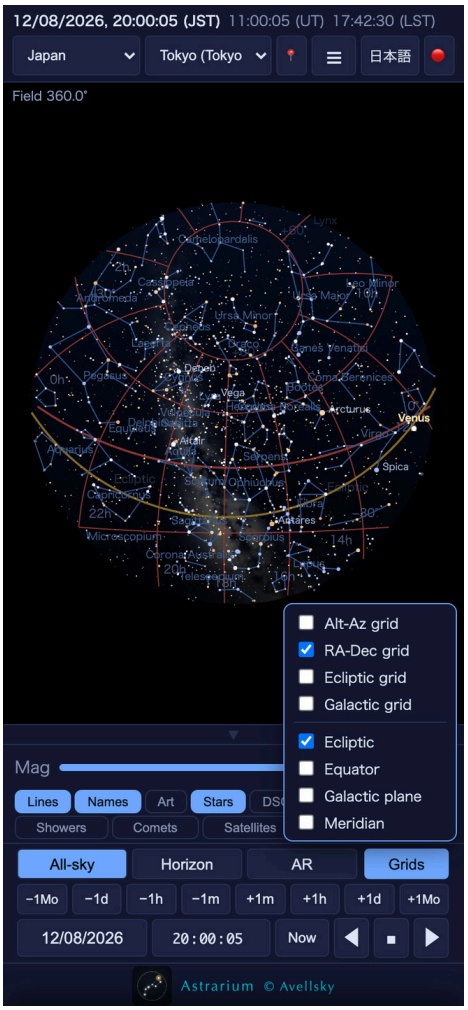

Figure 7. The grid menu, with the RA-Dec grid and the ecliptic drawn

6. What the chart shows

6.1 The quick bar

The slider on the left is the **magnitude limit**. Lower it and the faint stars go, which is much closer to a city sky; raise it and the chart goes to magnitude 6.5, the naked-eye limit.

The first row controls the chart itself, the second the kinds of object.

Button	Shows
Lines	The figures of the 88 constellations
Names	Constellation names
Art	Constellation drawings (86 of them; shown whatever the magnitude limit)
Stars	Names of the named stars
DSO	Messier and Caldwell objects
Milky Way	The Milky Way — drawn in the all-sky view, unbroken down to the horizon
Moon	Sky brightness from moonlight
Showers	Radiants and expected rates of the active meteor showers (chapter 7)
Comets	Every comet currently bright enough (fetches elements the first time)
Satellites	Satellites on the chart (fetches TLEs the first time; chapter 11)
Events	Opens the Events tab
Info	Opens the Info tab

AR, in the first row of the time bar, draws the chart over the camera image, and **Aurora** opens the aurora forecast (chapter 11).

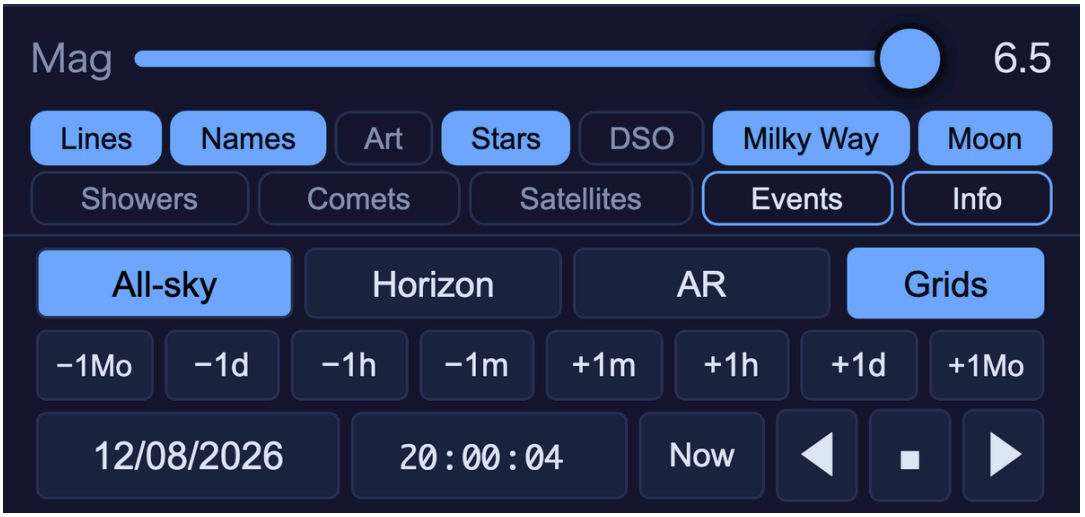

Figure 8. The quick bar and the time bar

6.2 The View tab (≡ → View)

Everything the quick bar does not carry lives here.

- **Sun, Moon & planets** — show or hide them.

- **Stars** — show or hide the stars. Switch them off and the constellation lines stand on their own.
- **Sunlight** — daylight and twilight. Switch it off to draw the sky as if it were always dark, which is how you check where the stars are in the daytime.
- **Moonlight** — the wash of a bright Moon. It switches separately from sunlight, so you can leave the daytime sky as it is and take out only the moonlight to see what the stars would do.
- **Mirror** — flips the image for a telescope finder that inverts.
- **Star trails** — leaves a trail behind moving objects during playback, so diurnal motion and satellite passes are drawn as lines.
- **Long exposure** — keeps the trails instead of letting them fade, so the tracks build up as they would on film (switching it on switches trails on too).
- **FOV frames** — rectangles for a camera field or circles for an eyepiece, laid over the chart. “Add frame”, then give it a sensor size and focal length, or an apparent field and a magnification. Drag the centre to move the frame, click the centre to zoom to it, drag a corner to rotate. Useful for framing a photograph, or for seeing what will fit in the field.
- **Mag limit** — the same slider as on the quick bar.

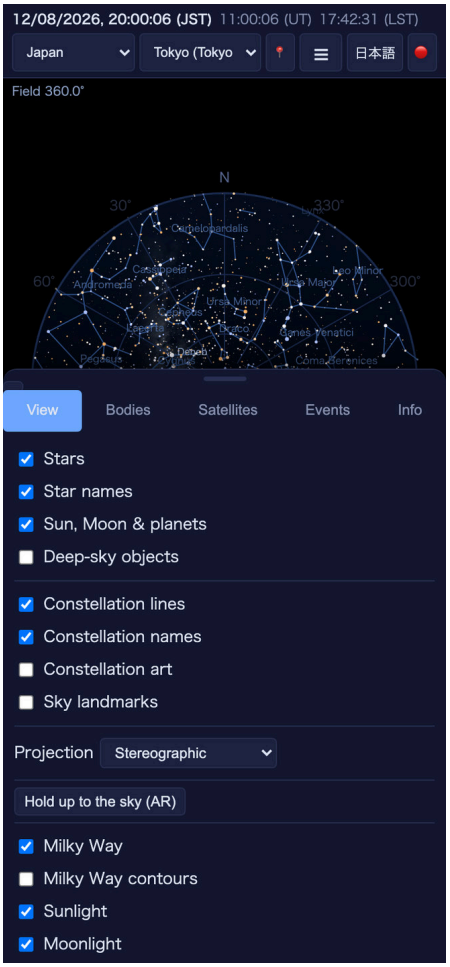

Figure 9. The View tab

6.3 Export as PNG or PDF

Saves the chart for the current time and site as an image. Because these are meant to be printed and taken outside:

- the background is white paper and the stars and lines are black,
- sky brightness (sunlight and moonlight) is left out,
- the Milky Way is drawn **as contours only**, not filled,
- the date, time and `Astrarium Pro © Avellsky` appear in the bottom right corner.

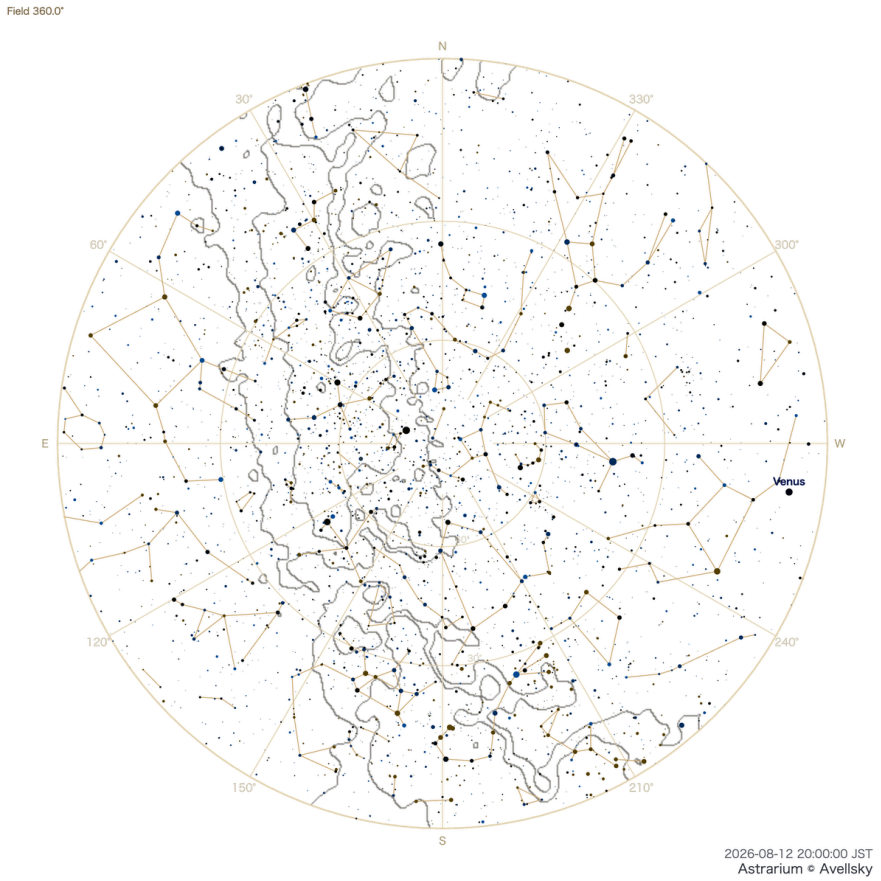

Figure 10. An exported chart: the Milky Way drawn as contours on white paper

6.4 Demo and recording

Demo is a tour of a few minutes. It plays without sound; each scene is described in captions below the chart. It runs through twilight, the Milky Way and moonlight, the apparent size of a planet, Saturn's rings and moons, FOV frames, the Moon's libration, deep-sky objects with photographs, a meteor shower, a long exposure, the language switch and diurnal motion. Touching the screen ends the tour and restores what you had.

It takes a moment to get ready before the first scene appears — a note under the button says so. While it runs, the button turns red and reads **Stop demo**, so you can end it at any point.

Record saves the moving chart as a video (if the device cannot do it, the button says so). Start recording during the demo and the file saves itself when the tour ends.

7. Meteor showers

Use the **Bodies** tab or the **Showers** button on the quick bar.

7.1 The list

The menu holds the principal showers of the year, sorted by **how close their maximum is to the date on the chart**. Choosing one moves the clock to **the moment of that maximum** and opens the details; where the maximum falls in daylight, it moves to about 1 a.m. that night instead. Clicking the radiant on the chart itself leaves the clock where it is.

Field	Meaning
Maximum	Given both in Universal Time and in the local time of your site
Radiant	Right ascension and declination, with its altitude at maximum and now
Entry speed	How fast the meteoroids meet the atmosphere
Population index r	The proportion of bright meteors; the smaller, the brighter
Parent body	The comet or asteroid the stream came from
Expected rate	Meteors per hour, from the model below

7.2 How the rate is worked out

The figure in “per hour” is not the ideal ZHR — it is **what you can expect from your site at that moment**. Four factors are multiplied together:

1. **Distance from the maximum.** A Gaussian profile: about a day either side the rate has fallen to the sporadic background, and outside the activity period nothing is shown at all.
2. **Radiant altitude.** The lower the radiant, the fewer meteors; below the horizon, none.
3. **Twilight.** Zero between sunrise and sunset, reduced during twilight in proportion to how bright the sky is.
4. **Moonlight.** Reduced according to the Moon's phase and altitude.

Active showers are also listed in an orange box at the top of the chart. Tapping a name in the box opens its details; **Release** clears the box (and turns off the Showers button on the quick bar with it).

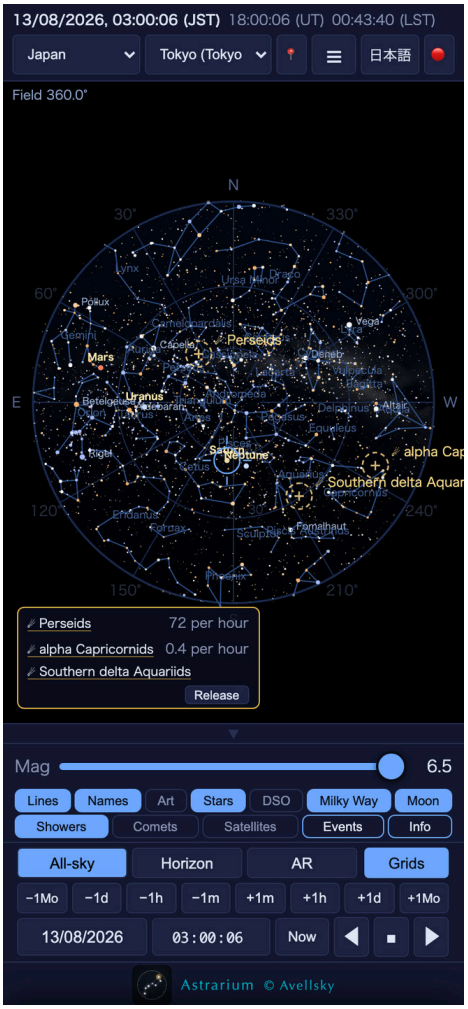

Figure 11. The Perseid maximum (13 August, 3 a.m., 72 per hour expected)

8. Comets and asteroids

The lower half of the **Bodies** tab.

- **List bright now** — the comets and asteroids in the sky, brightest first.

- **Search** — by any part of a name or designation. If the object is not in the local data, Astrarium asks JPL for it and adds it (needs a connection).
- **All / Comets / Asteroids** — filters the list.
- **Selected** — the objects drawn on the chart. Anything you put here is plotted.
- **Update from MPC** — fresh comet elements from the Minor Planet Center and asteroid elements from JPL. The date of the last fetch is shown underneath.

Tapping a comet on the chart gives its distance from the Sun and from the Earth, phase angle, estimated diameter, orbital elements, period and epoch.

9. Events

The **Events** tab lists eclipses, oppositions and conjunctions, solstices and equinoxes, meteor maxima, close approaches of the Moon and planets, and occultations.

- **Period** — what is next, the next 7 days, 30, 90 or 180 days, 1, 5 or 10 years. “What is next” looks up to 90 days ahead and shows **the next event only**.
- **Direction** — upcoming, past, or both (fixed to upcoming for “what is next”).
- **Kind** — one at a time:
  - **All astronomical events** — eclipses, oppositions, conjunctions and stations, the solstices and equinoxes, the Moon’s phases, perigee and apogee, the meteor maxima.
  - **Occultations** — the Moon passing in front of a star, with immersion or emersion, dark or bright limb, and the star’s magnitude.
  - **Naked-eye satellites** — visible passes of the ISS, the CSS and the Starlink trains.
  - **Eclipses** — with local circumstances (magnitude and times for your site). The last three list only what can actually be observed from your site — above the horizon and in a dark enough sky. Where nothing qualifies, the tab says how many fell in daylight or below the horizon. “All astronomical events” is not filtered.
- 🔍 **Search** starts the scan. While it runs the button reads “⏳ searching 12s — press to stop” and pressing it does stop; the list below is dimmed so that the previous answer is not mistaken for this one.
- Tap a row and **the chart jumps to that moment**; the panel closes so the chart is in front of you.

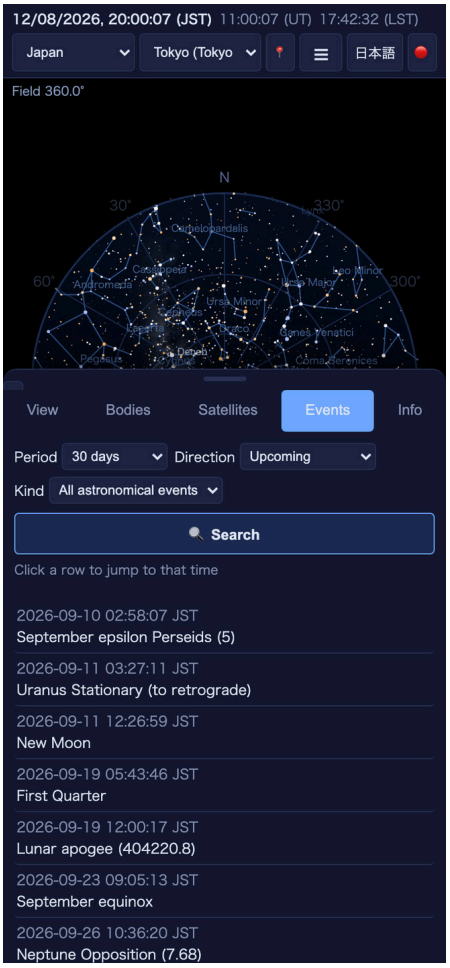

Figure 12. The Events tab

10. The Info tab

- **The sky for the date and place you have chosen** — sunset and sunrise, the beginning and end of twilight, the dark window, moonrise, moonset and lunar age, the transits of the Sun and Moon, the traditional lunisolar date and solar term, and local sidereal time. The heading names them both — “Tokyo — 22 August 2026” — and moving the clock to another date changes the table with it.
- **Selected object** — the position and rise/set times of whatever you last tapped on the chart.
- **Credits and sources** — every catalogue, ephemeris, image and library the app uses, with its source, its licence and the date it was last checked. It follows the language setting.

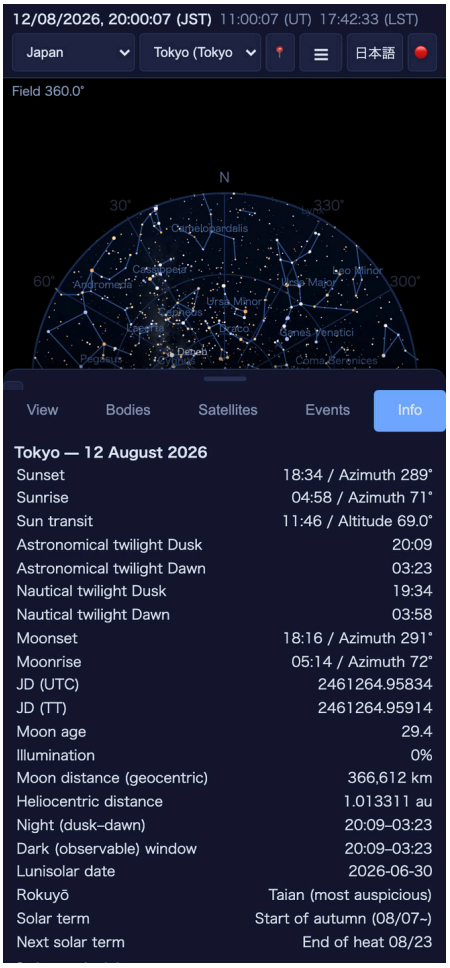

Figure 13. The Info tab, “Tonight’s sky”

11. The Pro features

These five things are added to the free Astrarium. There, satellites are the space stations only, and there is no aurora forecast and no deep-sky catalogue.

11.1 Satellites

The **Satellites** tab, or the **Satellites** button on the quick bar.

1. Press **Download / update TLEs** first (this needs a connection). Within two hours of a fetch it answers “up to date” rather than asking again. Several groups are fetched at once, so the wait is the slowest one, not the sum. The elapsed seconds are shown while it runs; with no answer after 25 seconds (60 for Starlink) it stops and says so. Starlink is about 1.7 MB and more than ten thousand objects, and propagating them takes another ten seconds or so.

   About the interval. CelesTrak asks callers not to fetch the same group more than once every two hours — that is how often the elements change.

Fetching harder returns errors, and persisting gets the address blocked. Astrarium Pro records the time of each fetch and, within two hours, answers from what it already has. That is not thrift; it is how the block is avoided.

2. Switch on **Show on chart** and the satellites start moving across the sky.
3. Choose the groups to show.

Group	What is in it
Space stations	The ISS and Tiangong
Brightest (visual)	The satellites bright enough to see
Science	Research and observation satellites
Starlink	The Starlink constellation
Weather	Meteorological satellites

- **Magnitude limit** — 4 by default, which is roughly what the eye can do.
- **Sunlit only** — show only satellites out of the Earth's shadow, that is, the ones actually visible.
- Tapping a satellite gives its range, height, apparent magnitude and how old its elements are. **Next visible passes** lists the passes for the next five days.
- Above ×600 playback the satellites are paused: the propagation cannot keep up.

Finding a satellite

Search by any part of the name. Nicknames work too — "Hinode", "XRISM", "Daichi", "Himawari", "Michibiki" are translated to the catalogue name.

- Press a name and **that satellite is selected**: its coming passes and its **current position** (azimuth and altitude, sub-satellite point, height in km, whether it is sunlit) are shown. Even when there is no visible pass for weeks, where it is right now is still answered.
- **With the horizon view on screen, the selected satellite is brought to the centre** and kept there, so a pass that crosses the sky in minutes is not lost. Panning the chart by hand lets go of it.
- Geostationary satellites (Himawari and the like) are outside the pass prediction. The catalogue entry and NORAD number are shown, with a note.
- **+** adds it to "My list" for next time.

Projections

The **Projection** menu at the top of the tab shows the same satellites four ways.

Projection	What you see
All-sky	On the zenith-centred chart
Horizon	On the chart as you would look up at it
World map	Equirectangular, with the ground track behind and ahead
Globe	Orthographic Earth, with the day/night terminator

The map and the globe carry **national borders** (the land ones) as well as the coastline.

On the map and the globe the names are **placed so that they do not overlap** (where there is no room, the dot is drawn without a name). Selecting a satellite brings up a card with its **country and flag**, its height and speed, and its next visible pass.

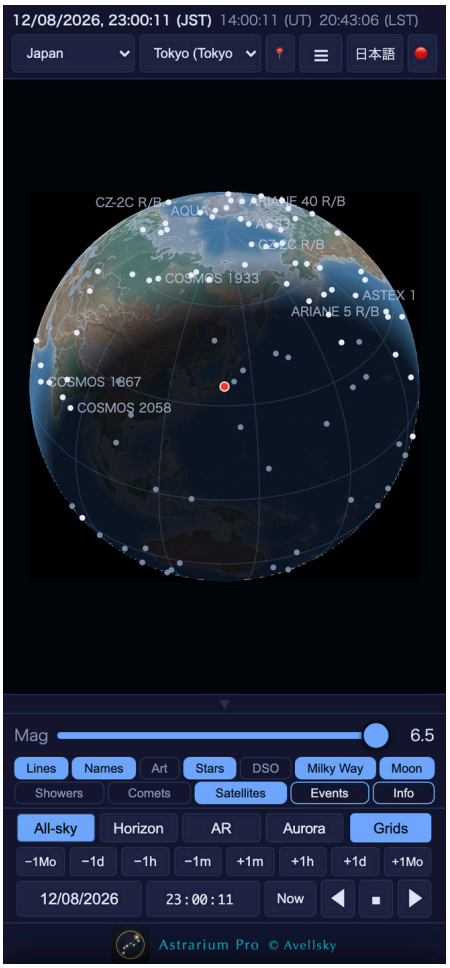

Figure 14. Satellites on the globe

11.2 AR

Press **AR** on the time bar and the chart is drawn over the rear camera image. Hold the device up and the constellations line up with the sky in front of you. The

first time, iOS asks for camera and motion permission.

The control panel at the bottom has four rows.

Row	What is on it
1	**Field of view** and **bearing** sliders, and night mode
2	What to draw: stars / constellation lines / names / art / landmarks / Milky Way / Sun / Moon and planets / alt-azimuth / RA-Dec / equator / ecliptic
3	The **magnitude** slider
4	Date and time, **Now**, **Reset**, the direction you are pointing, the four **shutter** buttons (twilight, Moon, stars, aurora) and **Leave AR**

- A button brightens when it is on, so what is being drawn is visible at a glance.
- The **bearing** slider corrects the chart when the compass is off. **Reset** throws the correction away and follows the sensor again.
- **Shutter** composites the camera image and the chart into one picture. The four buttons are exposure settings — the darker the subject, the longer. Keep a little of the landscape in frame, or turn the alt-azimuth grid on, and the direction is still readable afterwards.
- **Leave AR** puts back the display settings you had before AR started.

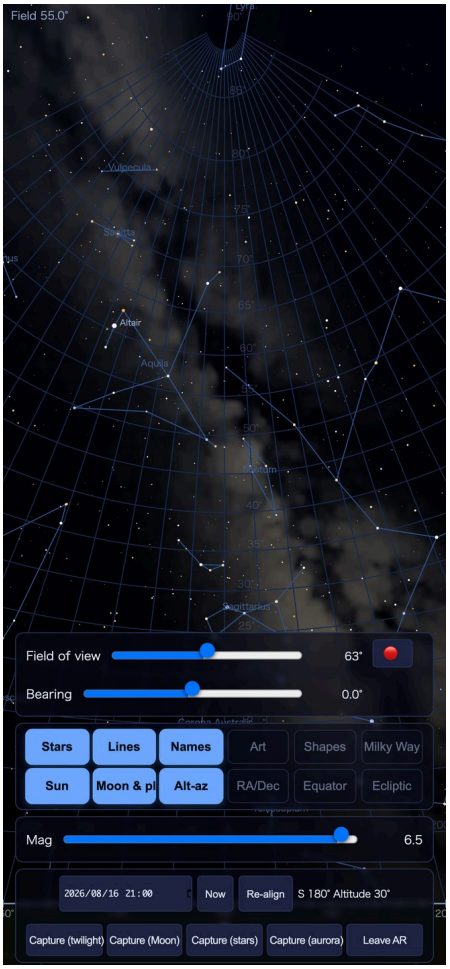

Figure 15. AR: the chart drawn over the camera image

11.3 Aurora forecast

Aurora on the time bar, or ≡ → **Aurora**.

- **Forecast the aurora** fetches NASA DONKI: the solar-wind arrival prediction (the ENLIL model) and the recent geomagnetic storms (observed Kp). Needs a connection.
- The **geomagnetic latitude** of your site is given first, with the Kp at which the aurora would clear your horizon.
- **Draw in the sky** puts the auroral oval on the chart (all-sky, horizon) or on the globe.
- The **Kp** slider lets you see what a stronger storm would look like.

How it is drawn: the oval is placed by a dipole approximation of the geomagnetic field, and the height of the emission (green 557.7 nm at 100 km at the bottom, red 630 nm at 400 km at the top) decides how far above your horizon it reaches. **A low-latitude aurora is red because only the high red emission clears the horizon** — that is geometry, not a special case.

On the globe, NOAA's **OVATION** nowcast (the probability of aurora, from measured solar wind) is laid over it in colour. It is valid for about an hour either side, so moving the clock returns to the model's oval.

Below the panel are **Watching and photographing** and **How the aurora works** (mechanism, colour, the solar wind, the magnetosphere, space weather), each with links to its source.

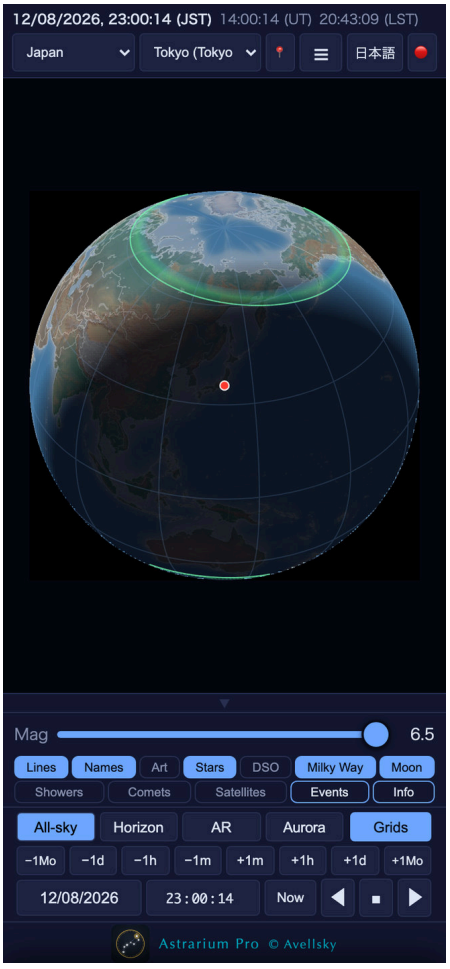

Figure 16. The aurora forecast, with the oval on the globe

11.4 The deep-sky catalogue

≡ → **Info** → **Deep-sky catalogue** downloads an extra catalogue that takes the chart to much fainter objects. It works as soon as the download finishes — no restart. The same place removes it again.

11.5 Two more kinds of event

The Events tab holds two more kinds (the range and direction are the same as in the free version).

- **Exoplanet transits** — the transits observable from your site.

- **Variable stars** — predicted maxima and minima of the main variables.

Pressing a row moves the clock to that moment and **marks the target and centres it** on the chart.

12. If something looks wrong

Location does not work
: Settings → Privacy & Security → Location Services, and set Astrarium to “While Using the App”. You can also skip location altogether and type coordinates into the Info tab.

The event list is slow
: Only the first 5- or 10-year scan, which takes a few minutes. It is cached afterwards.

The aurora forecast will not load
: It needs a connection. Without one, the Kp slider still shows what a storm would look like — that part is computed on the device. **No comets appear**
The Comets button shows nothing when no comet is brighter than the limit, and fetching current elements needs a connection.

No meteor rate is shown
: You are more than a day from the maximum, or outside the activity period. The rate is also zero in daylight.

Too few or too many stars
: Move the magnitude-limit slider. To match a real sky, a city is about 4, the suburbs 5-something, and a dark mountain site 6.5.

No satellites appear
: Either the orbital elements (TLEs) have never been downloaded, or playback is faster than ×600. With “Sunlit only” ticked, craft in the Earth’s shadow are hidden.

TLEs will not download, or the address has been blocked
: CelesTrak answers a caller that fetches the same group more often than every two hours with an error, and blocks the **IP address** if it continues. The block is against the connection, not against your device or Apple ID, so:

1. Stop fetching and leave it alone for a while. Astrarium Pro does not touch the network within two hours of a fetch, so ordinary use will not get you blocked.
2. Switching networks (Wi-Fi to mobile data, or the other way) changes the address and often works. On shared Wi-Fi the cause may be someone else on the same connection.
3. If it does not clear, ask CelesTrak (celestrak.org) to lift it.

While blocked, **the elements you have already fetched still work**. They lose accuracy over a few days, but the chart and the pass predictions keep running without a connection.

The event list is slow

Only the first 5- or 10-year scan, which takes a few minutes. It runs in the background and fills in when it finishes; the result is cached, so the next one is immediate.

In AR the chart does not line up with the sky

Steel-framed buildings and cars upset the compass. Step outside and press **Reset**, or correct it by hand with the **bearing** slider.

13. Glossary

Term	Meaning
Magnitude	Brightness; smaller is brighter, and one magnitude is a factor of about 2.5
Azimuth / altitude	Direction round the horizon (north 0°, east 90°) and angle above it
RA / Dec	Coordinates fixed to the sky — the system star catalogues use
Local sidereal time	The right ascension currently on the meridian
Universal Time	Time at longitude 0°
Moon age	Days since new Moon; 0 is new, about 14.8 is full
Illumination	The fraction of the Moon’s disc that is lit
Airmass	Thickness of atmosphere, 1 at the zenith; the larger, the worse the seeing
ZHR	Meteors per hour with the radiant overhead and a 6.5-magnitude sky
Radiant	The point the meteors of a shower appear to come from
TLE	A satellite’s orbital elements; they go stale in a few days and need refreshing
Kp	The index of geomagnetic disturbance (0–9); the higher it is, the further the auroral oval reaches towards the equator

Term	Meaning
Geomagnetic latitude	Latitude measured from the geomagnetic pole — what the aurora actually follows

14. Credits and contact

Every source Astrarium Pro computes from is listed in the app under **Info** → **Credits and sources**. The principal ones are:

- Planetary ephemeris: JPL DE421
- Stars: Yale Bright Star Catalogue, Tycho-2
- Deep sky: the Messier and Caldwell catalogues; photographs from Wikimedia Commons (freely licensed images only)
- Satellites: Celestrak (TLEs), SGP4/SDP4
- Space weather: NASA DONKI (solar wind, geomagnetic storms), NOAA SWPC OVATION (aurora probability)
- Comets and asteroids: Minor Planet Center, JPL Small-Body Database
- Earth orientation: IERS finals2000A

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