

Astronomical **Glossary** of **Terms**

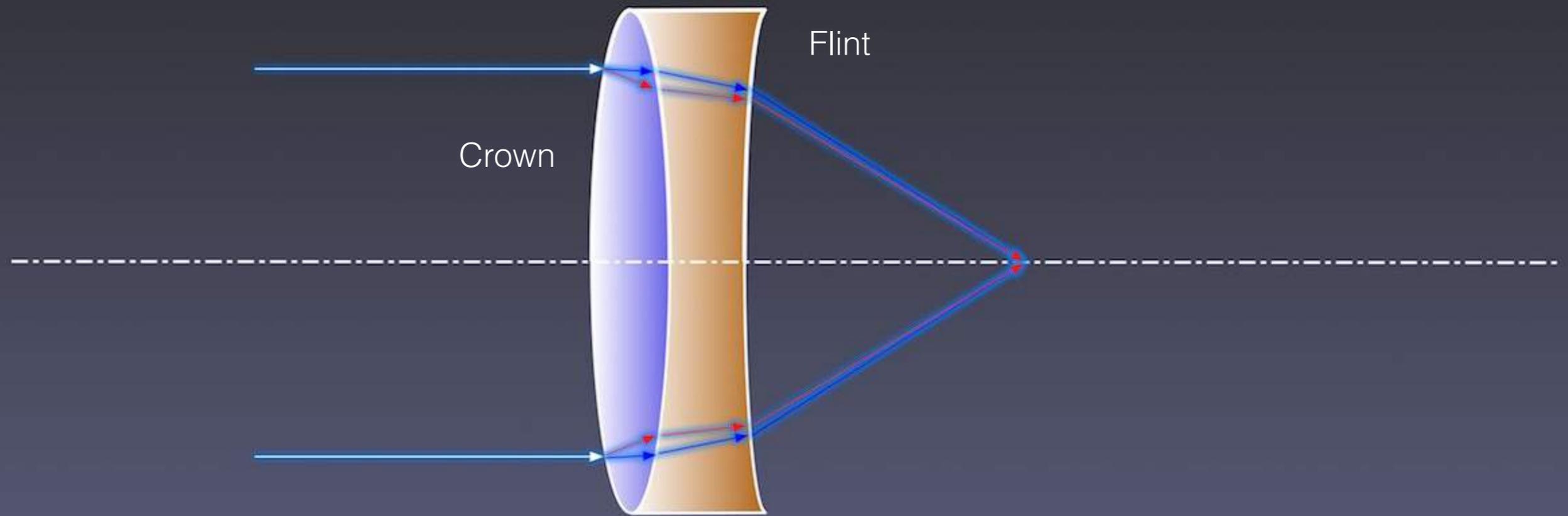
Updated November 2019



Glossary of Astronomical Terms

Welcome to this revised edition of our **astronomical glossary**. This version is based on an earlier body of work dating back to around 1993, and which has been updated on numerous occasions since then.

And one word of caution. Some of the terms are a bit silly, frankly. I make no apology for those.



Achromatic Doublet

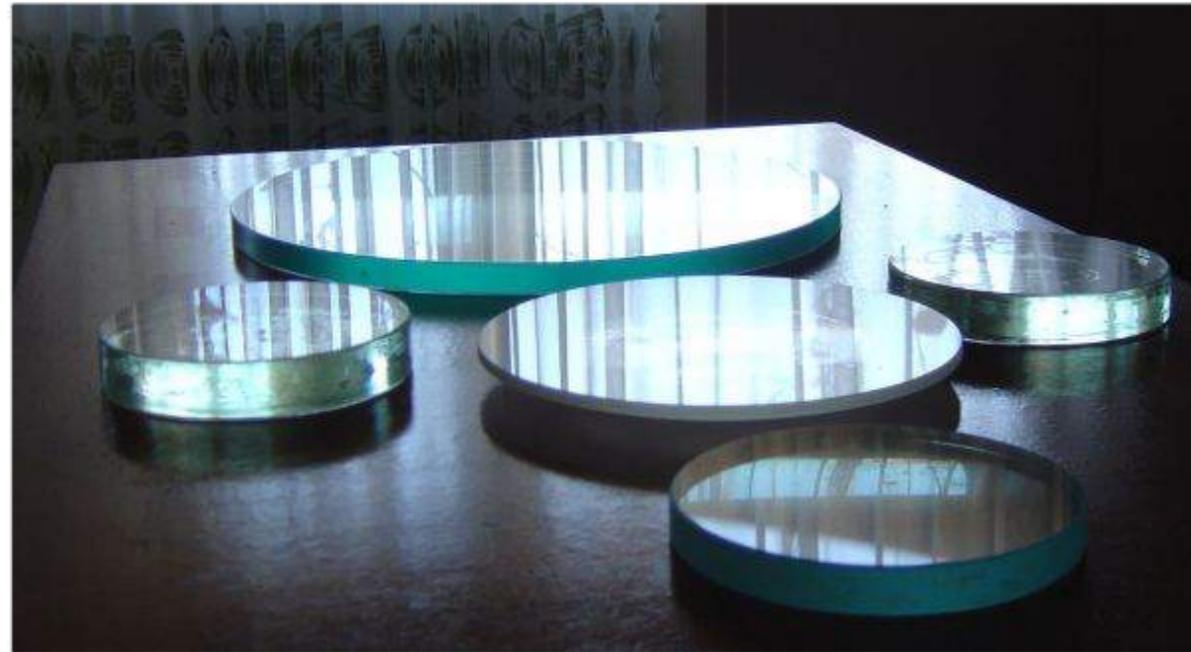
- Two **lenses** of **different refractive index cemented** together such that the different **refractive indices** cancel out **effects** of **chromatic aberration**

• Angular Diameter

The apparent size of an object in the sky, or the distance between two objects, measured as an angle.

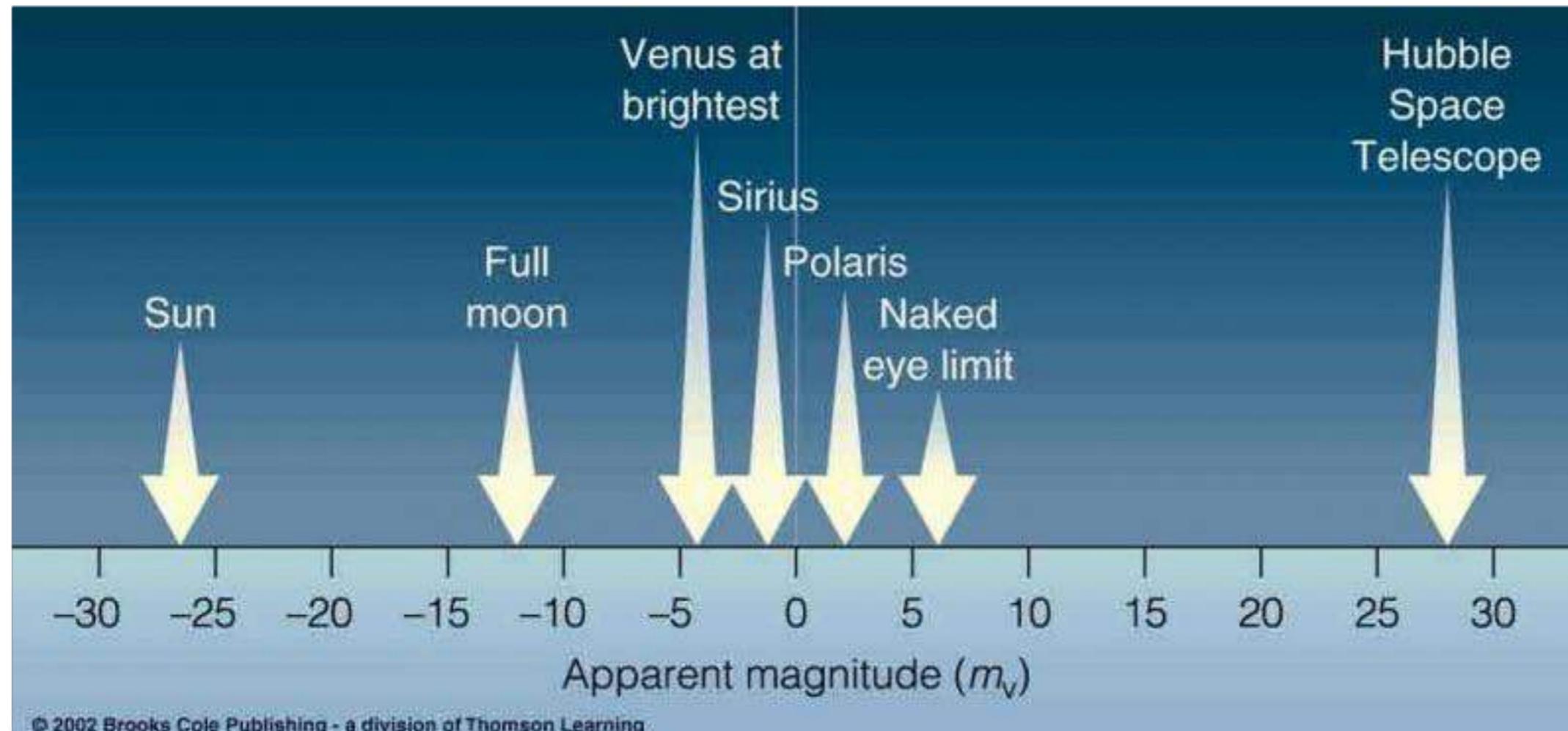
Your index finger held at arm's length spans about 1° , your fist about 10° .





• Aperture

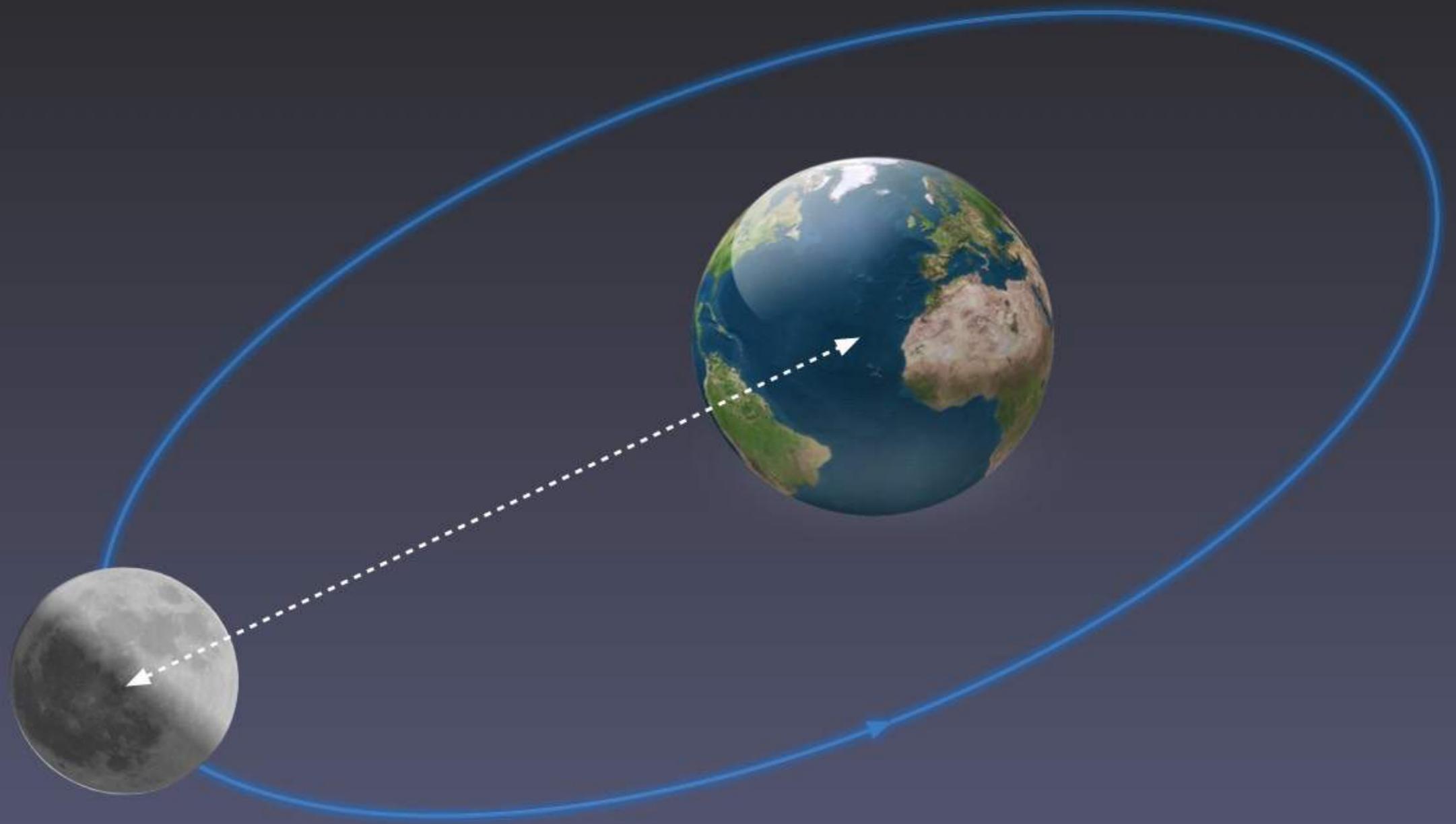
The **diameter** of a **telescope's** main **lens** or **mirror** — and the scope's most important attribute. As a rule of thumb, a **telescope's maximum useful magnification** is **50 times** its **aperture** in inches - or twice its aperture in millimetres...



• Apparent Magnitude

A measure of the brightness of a star or other astronomical object as seen from the Earth's location.

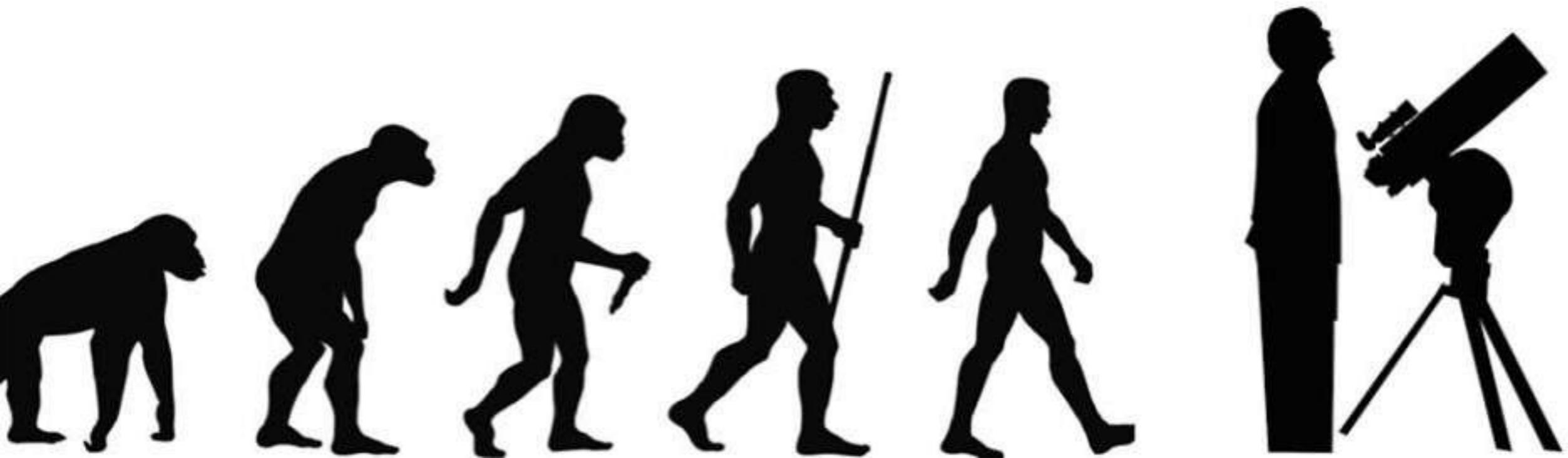
See **Magnitude**



Apogee = Furthest away

Apogee

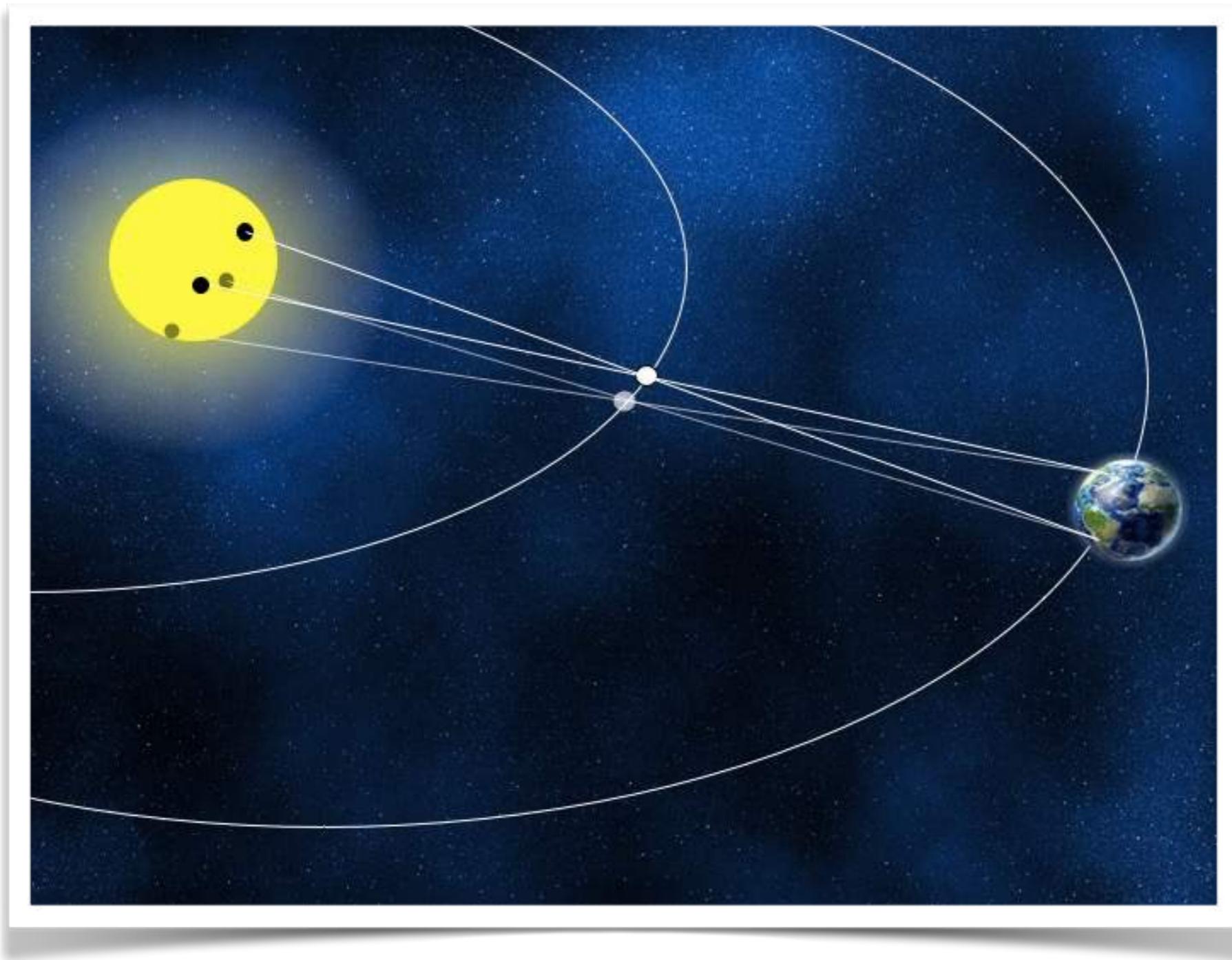
A point in a planet or moon's orbit when it is furthest from its parent body...



• **Astronomer / Astronomy**

An **Astronomer** is a highly evolved **being** of astonishing intellect and incredible perception. They are incredibly generous too.

Astronomy is the most noble of all the **sciences** and simply opening a book on **astronomy** elevates the reader to a higher state of existence. It has been **scientifically proven** that **astronomers** have more luck **romantically** than any other type of **scientist**. They are the Rock Gods of the 21st Century.



• **Astronomical Unit**

A common unit of measure in astronomy. It is defined as the average distance from Earth to the Sun, which is slightly less than 93 million miles, or 149.6 million km.

• Asterism

Any **prominent star pattern** that isn't a whole **constellation**, such as the **Cygnus** or **Ursa Major**



The famous “W” **asterism** from the constellation **Cassiopeia**...

Binoculars



Often overlooked, binoculars are probably the best tool for getting started in astronomy. If you wear glasses, ask for a pair with decent eye relief...

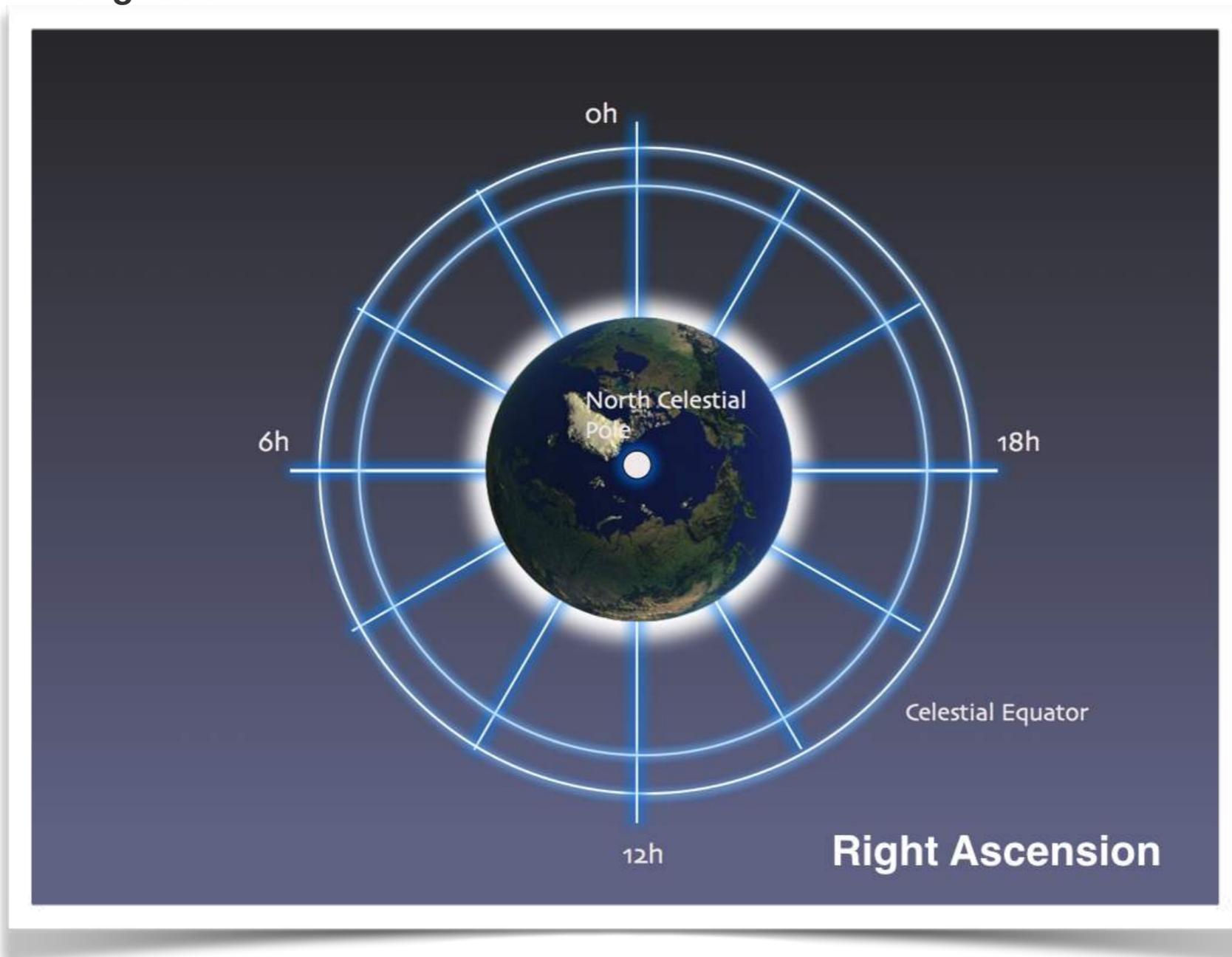
Black Hole



A hypothetical region of the Universe where gravity is so strong that time has no meaning, space is curved in on itself and light no longer travels in straight lines. A bit like Milton Keynes.

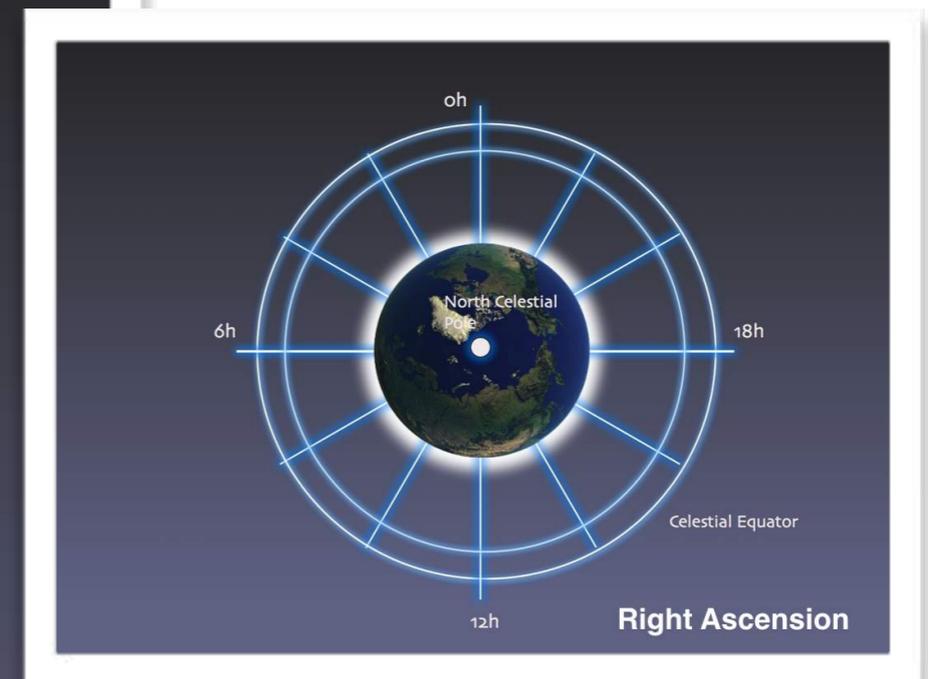
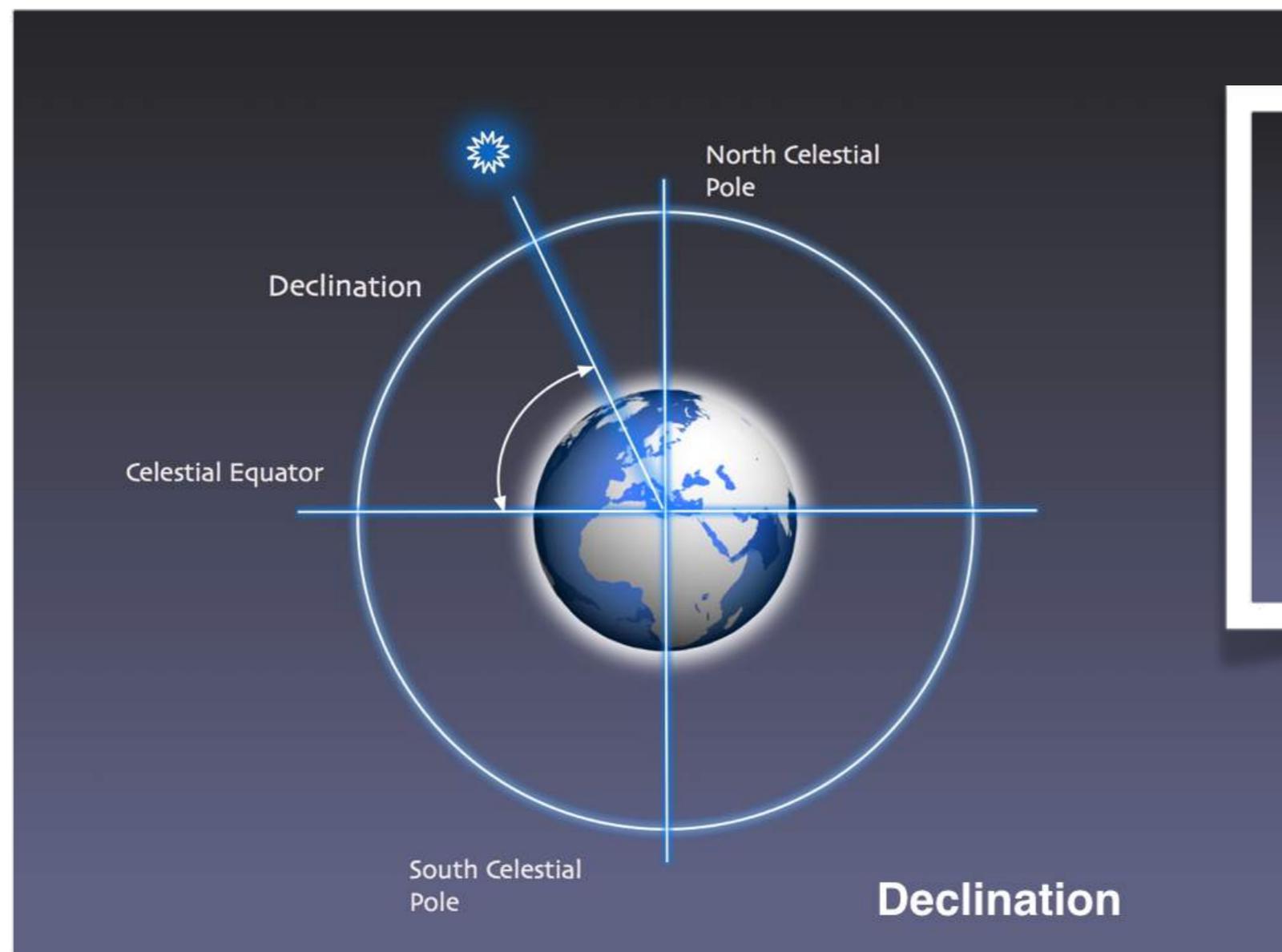
Celestial Coordinates

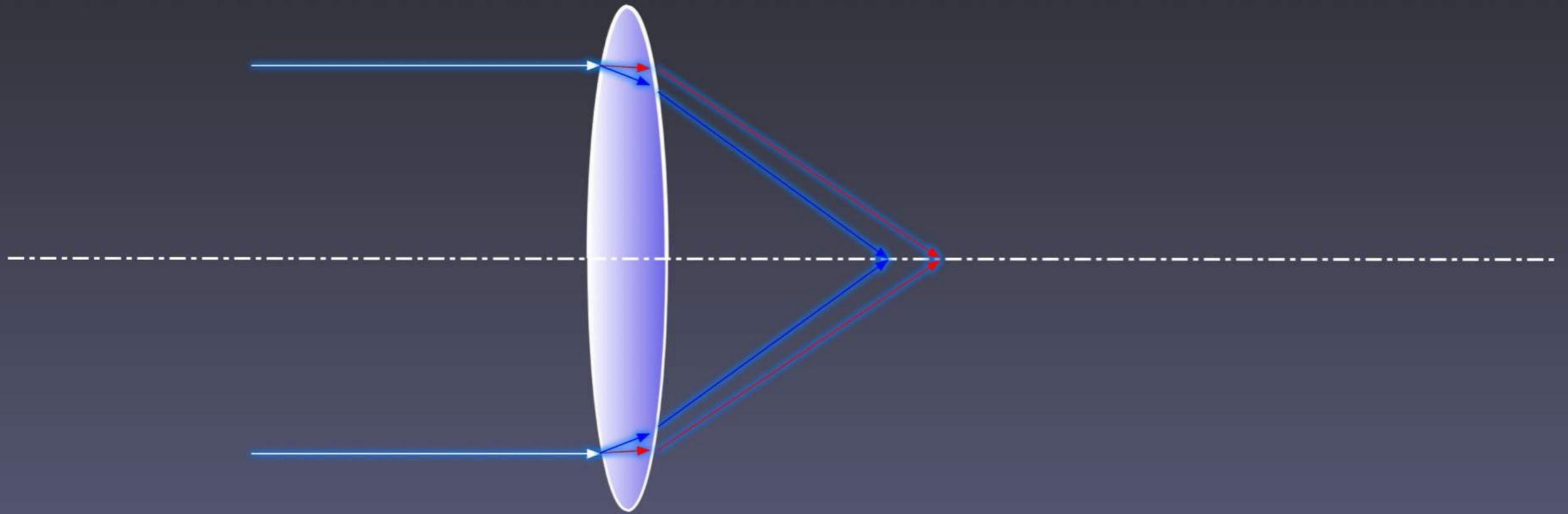
- A **grid system** for locating things in the sky. It's **anchored** to the **celestial poles** (directly above Earth's north and south poles) and the **celestial equator** - directly above Earth's equator
- **Declination** and **Right Ascension** are the **celestial equivalents** of **latitude** and **longitude**



Celestial Coordinates

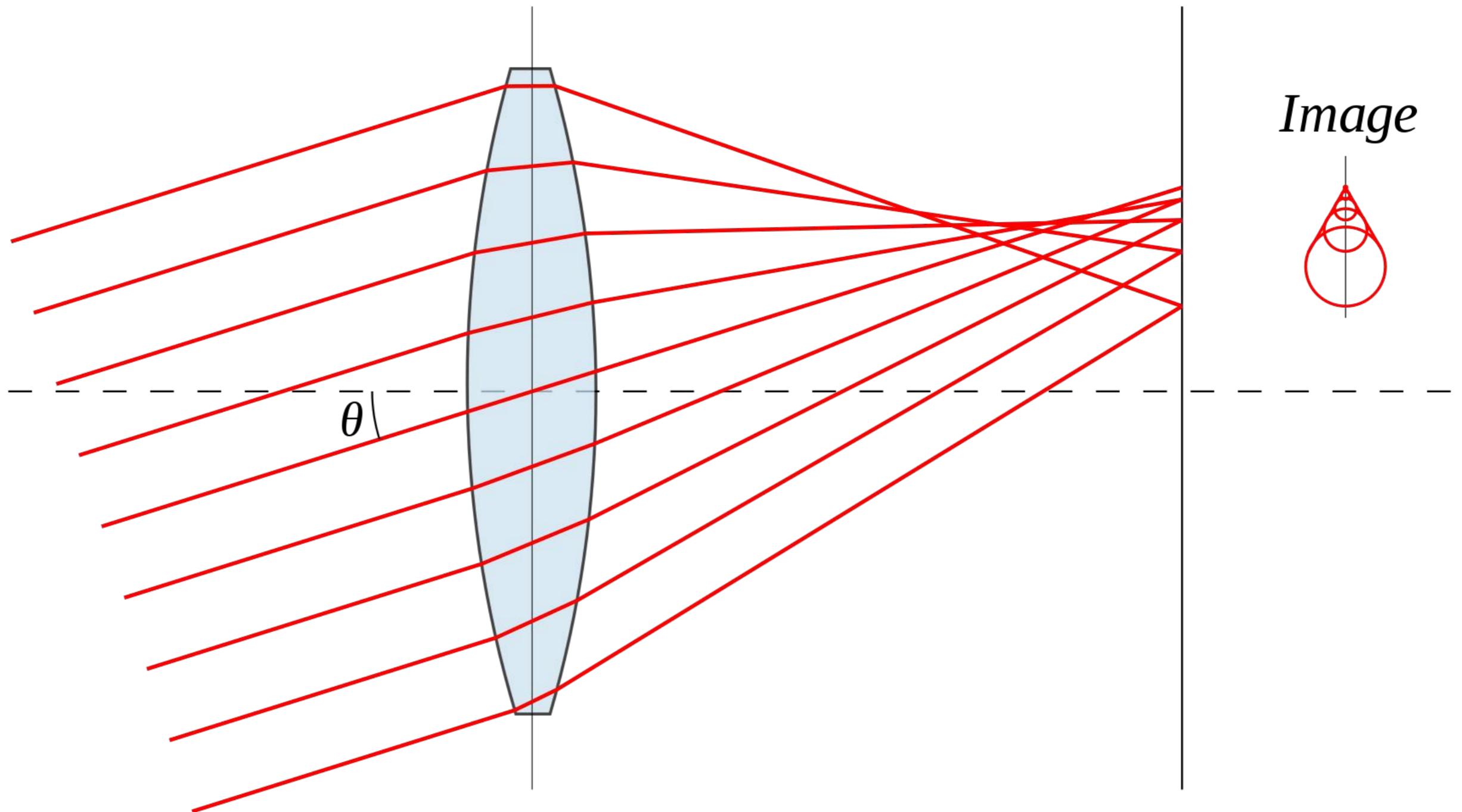
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Chromatic Aberration

- **An optical defect** which occurs because light of different wavelengths is refracted by different amounts.
- The result is that images have *false colour*



Coma :

An optical defect where off-axis images are smeared out across the image plane. Often found in binoculars purchased from non-specialist optical instrument suppliers such as Lidl.



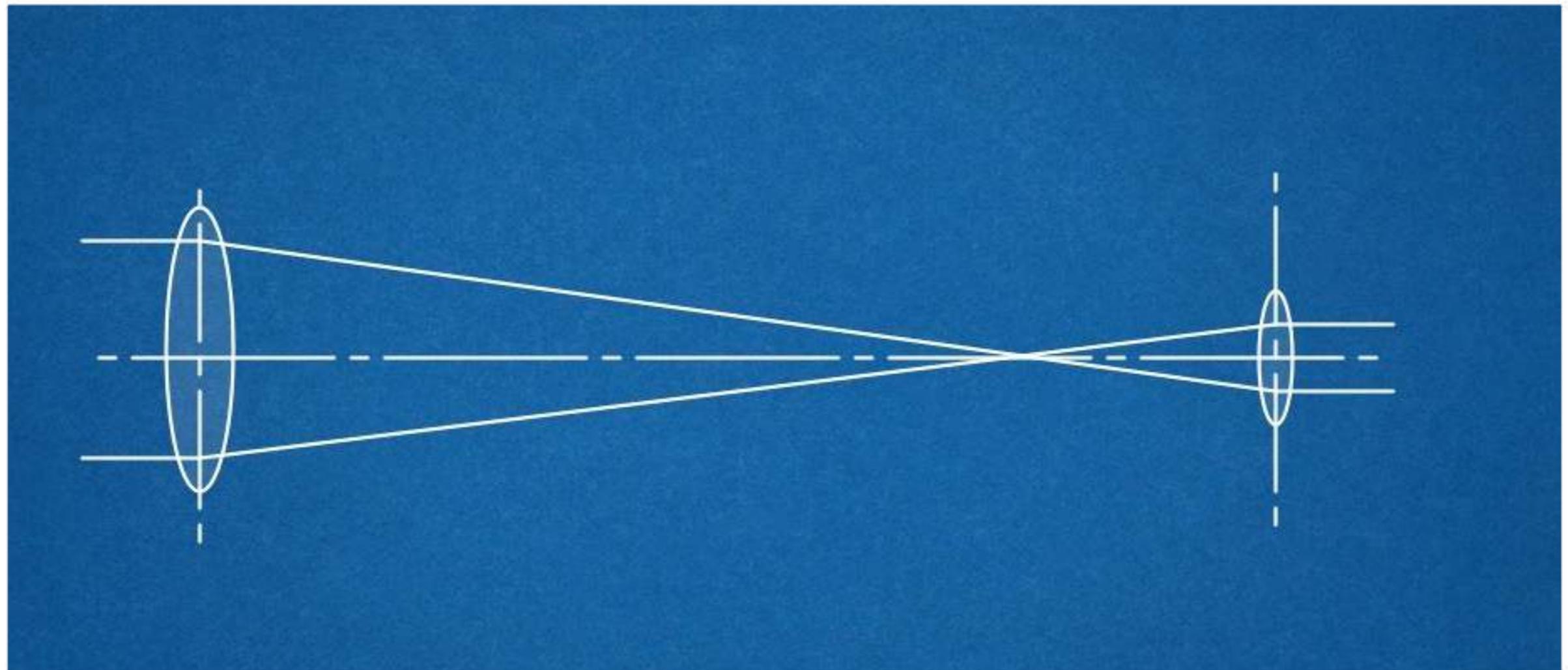
Counterweight

Of a **Telescope**: that part of the **instrument** which, when **incorrectly** aligned or **secured**, serves to **remind** the astronomer that **gravity** is a **cruel mistress** and that a **broken** toe hurts like **nothing** on **Earth**, especially at **three o'clock** in the **morning**.



Circumpolar

Denotes an object near a celestial pole that never dips below the horizon as Earth rotates and thus does not rise or set.



Collimation

Aligning the optical elements of a telescope so that they all point in the proper direction.

Most **reflectors** and compound **telescopes** require occasional **collimation** in order to produce the best possible images.

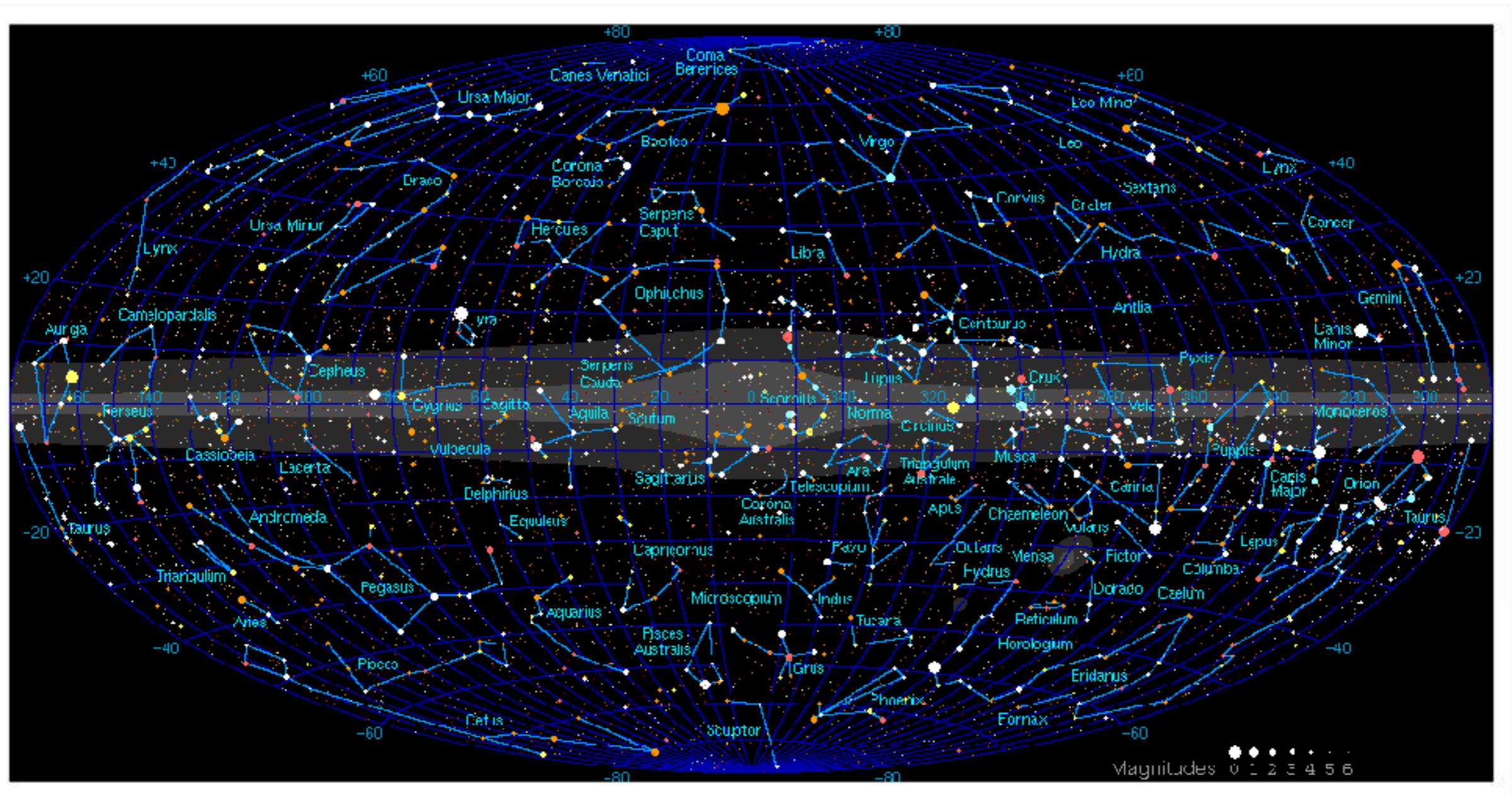


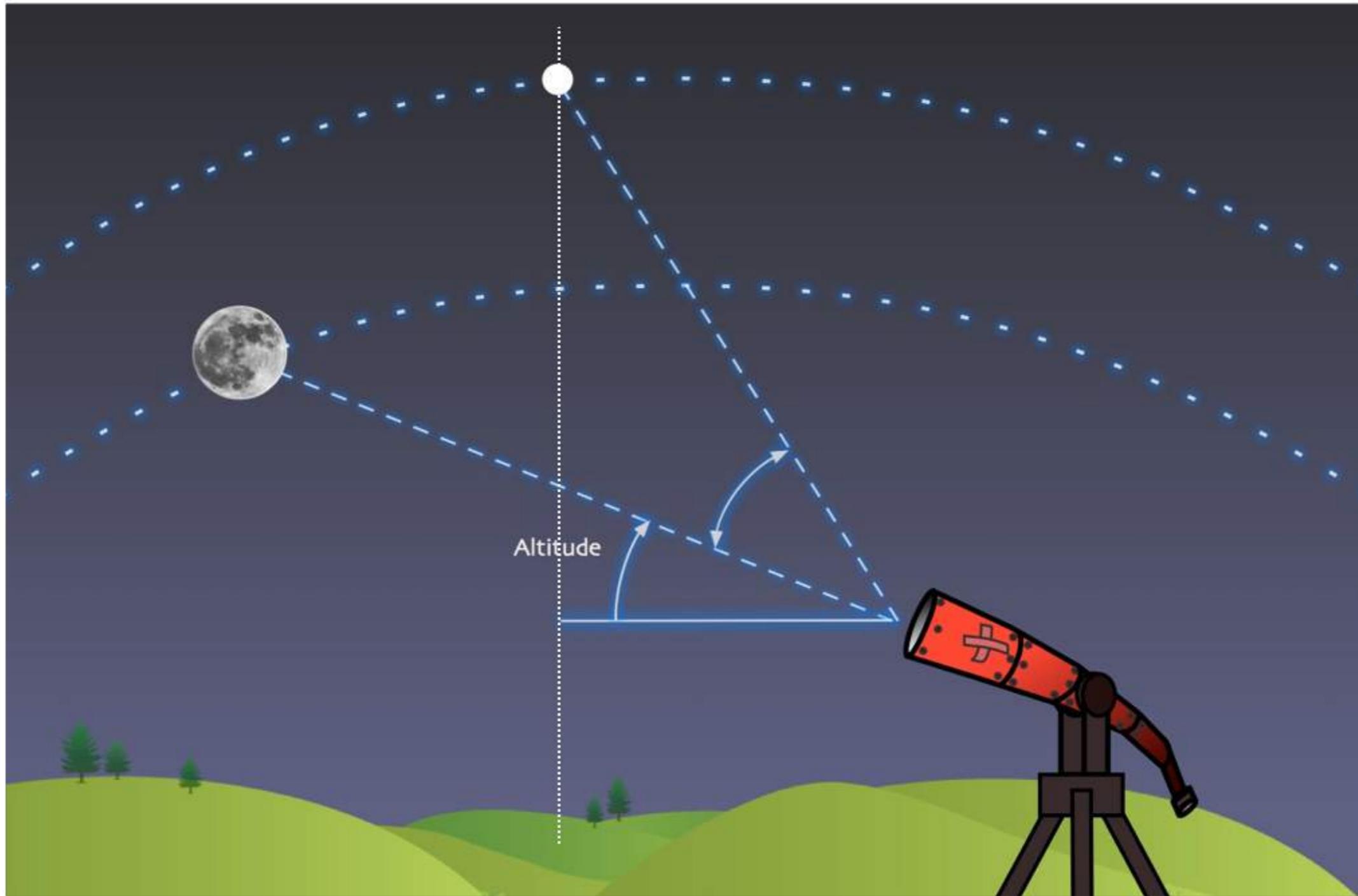
• **Conjunction**

When the Moon or a planet appears especially close either to another planet or to a bright star.

• Constellation

- A distinctive pattern of stars used informally to organise a part of the sky.
- 88 official constellations - define sections of the sky rather than collections of specific stars.





• Culmination

The **moment** when a **celestial object crosses** the **meridian** and is thus at its **highest** above the **horizon**

Dark Matter

A substance which is thought to make up around 75% of the matter in the Universe although it might not. Dark Matter represents one of the biggest conundrums in modern astrophysics for the following reasons:

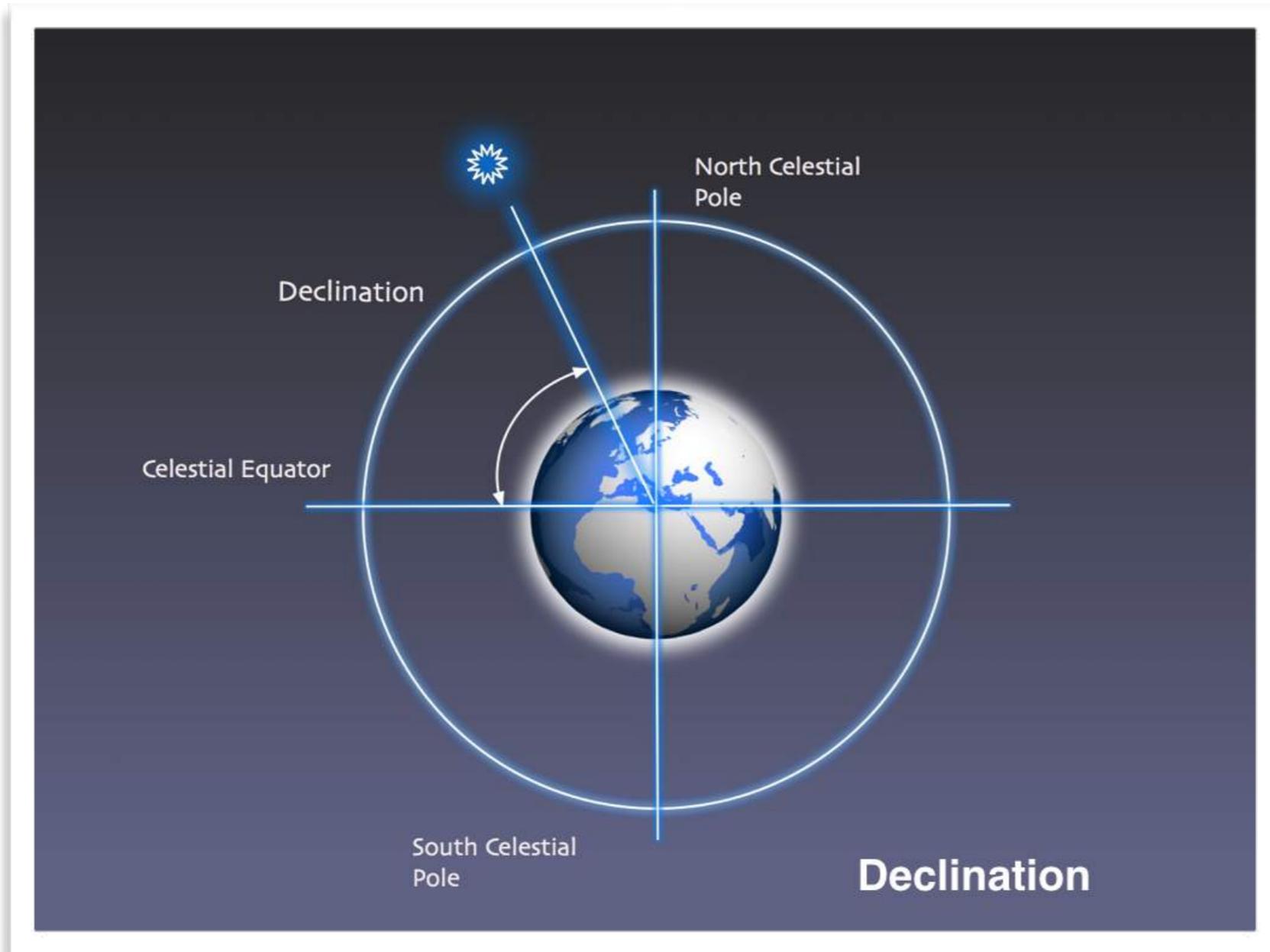
1. Nobody knows what **Dark Matter** is
2. Nobody can agree on what **Dark Matter** might be
3. Nobody has actually found any **Dark Matter**

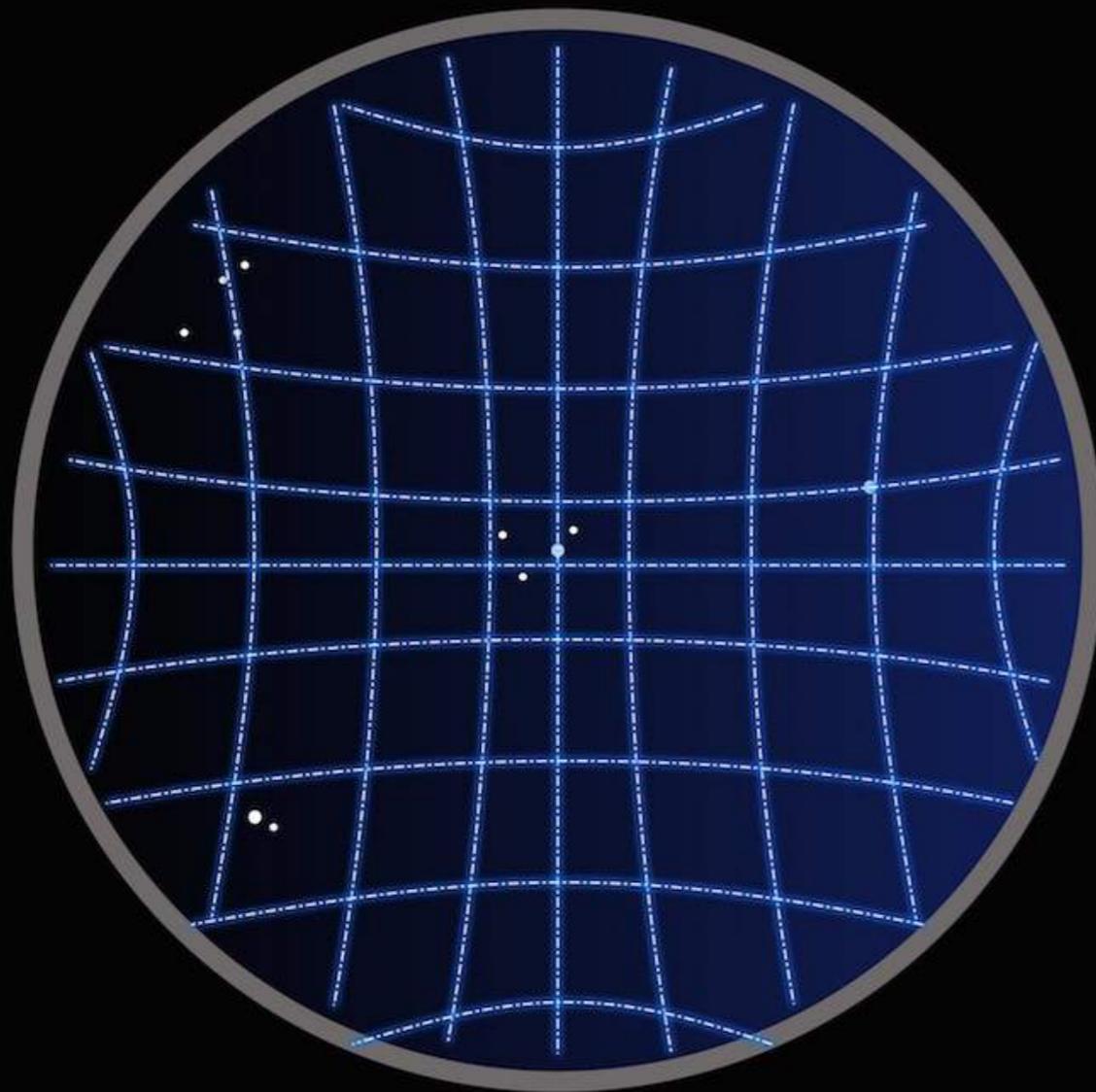
Many astronomers don't think **Dark Matter** exists at all. Most think that it's just a mistake in the maths.

Dark Matter astronomers have lost more friends and relatives because of their **Dark Matter** heresy than at any time since the days of the **Phlogiston** theory.

- **Declination (Dec.)**

Celestial equivalent of latitude - denoting how far in **degrees** an **object** lies north or south of **celestial equator**





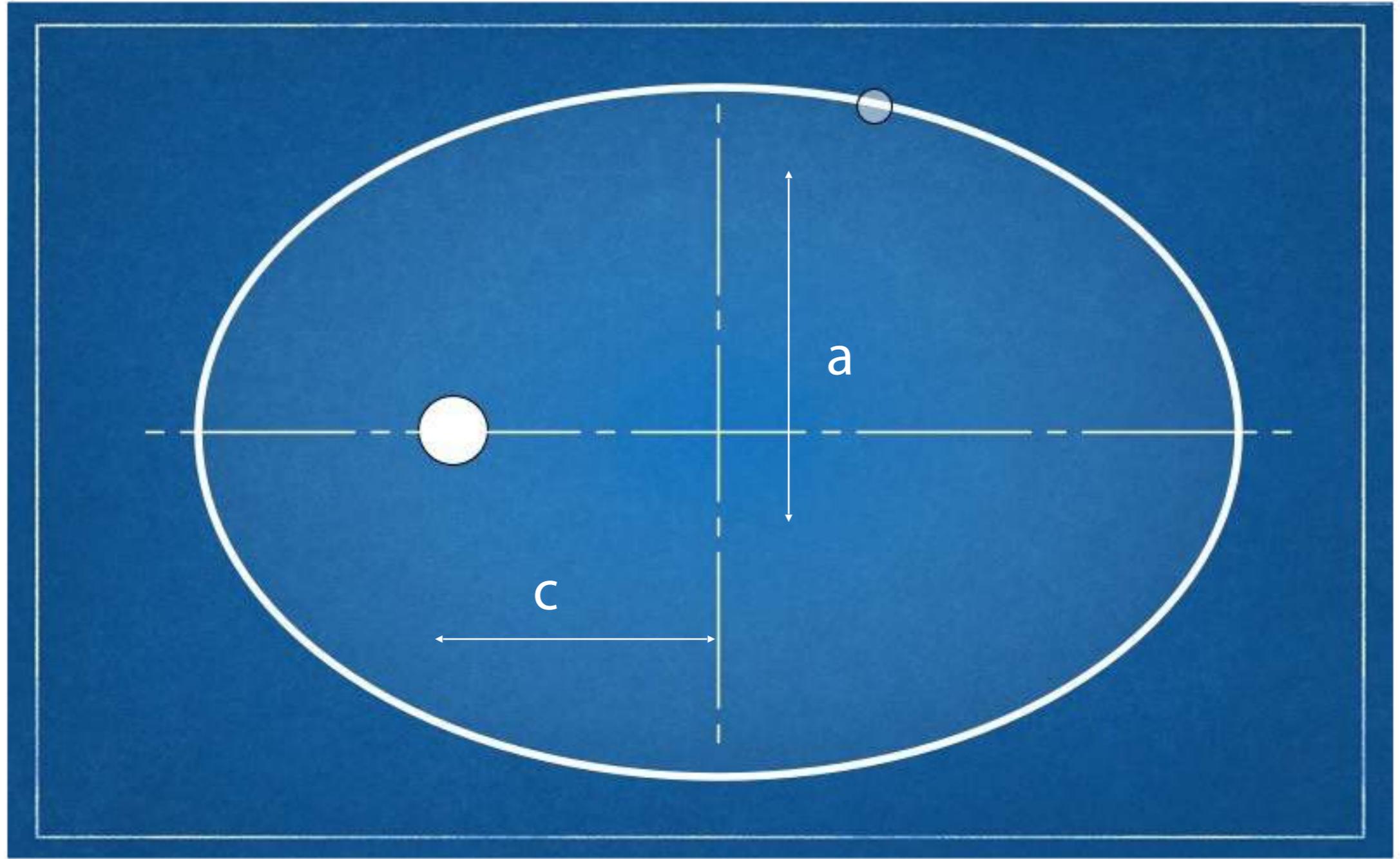
Pin cushion distortion



Barrel distortion

Distortion

- **Optical effect** where the final images in the eyepiece are pulled out of position by defects in the optical elements.



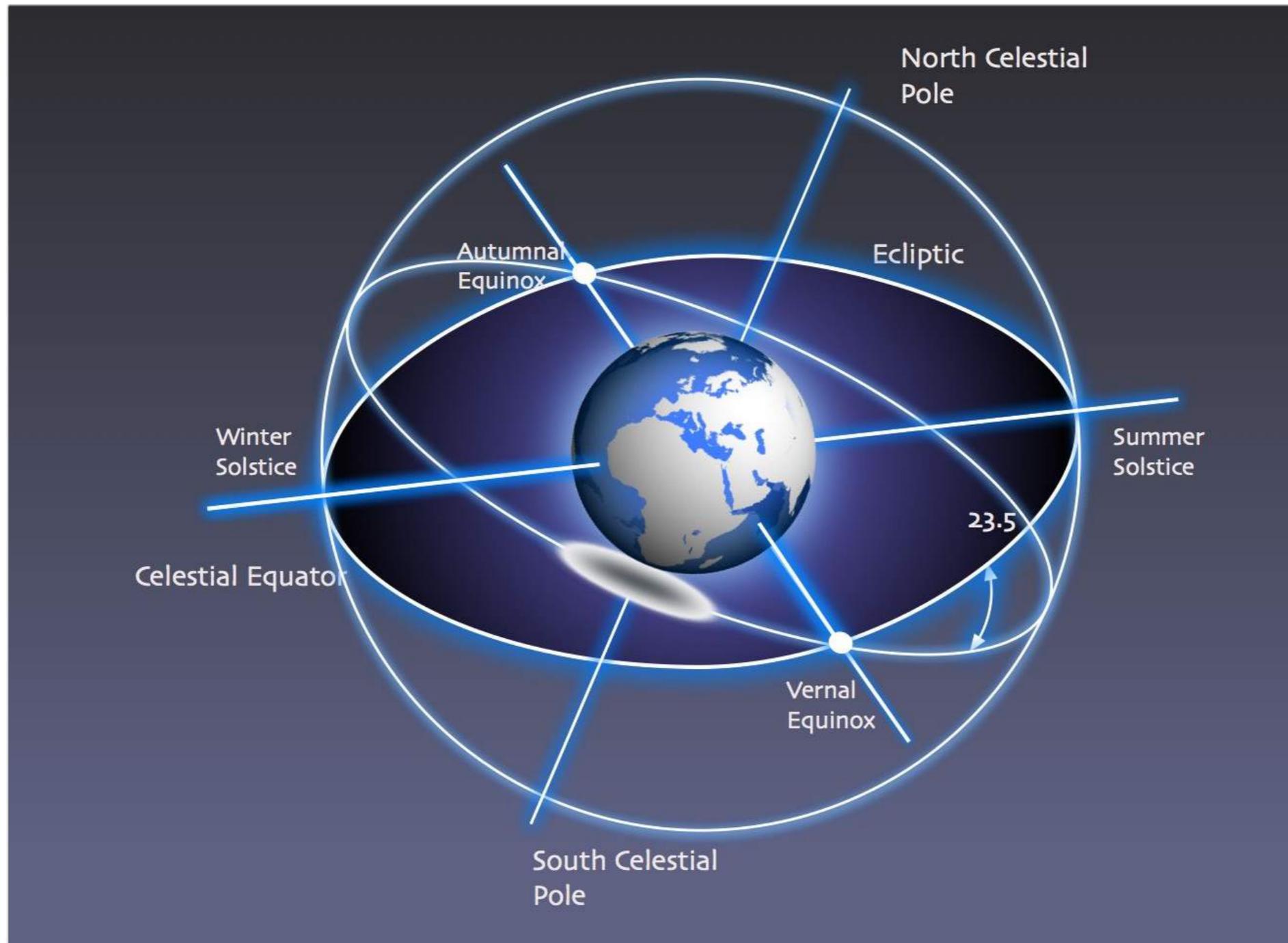
Eccentricity (e) = $\frac{c}{a}$

Hard sums...



• Ecliptic

- The **path** among the **stars** traced by the **Sun** throughout the **year**.
- **Moon** and **planets** never stray far from ecliptic.

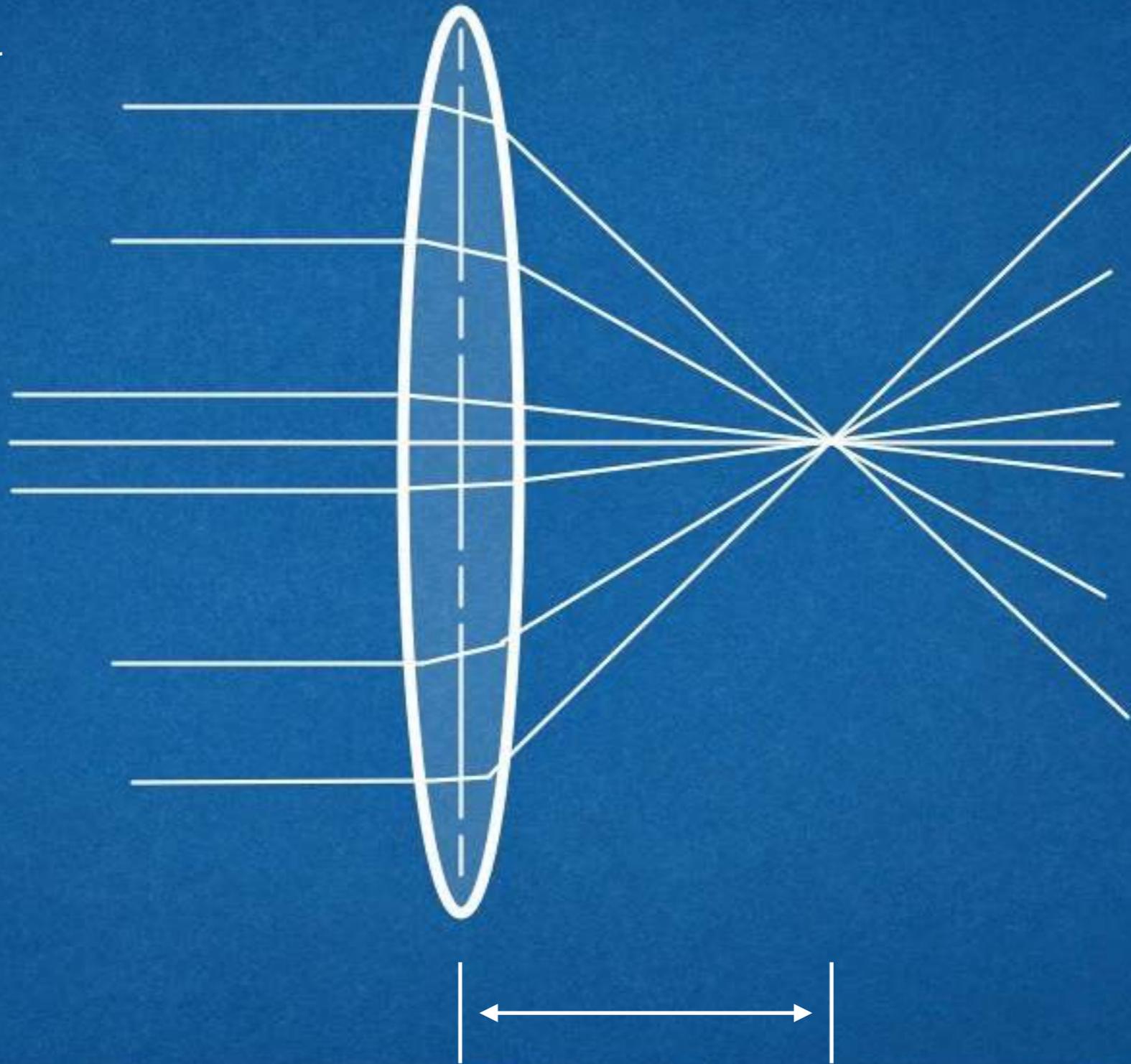


• Equinox

The two times each year, near March 20th and September 22nd, when the Sun is directly overhead at noon as seen from Earth's equator. On an equinox date, day and night are of equal length.

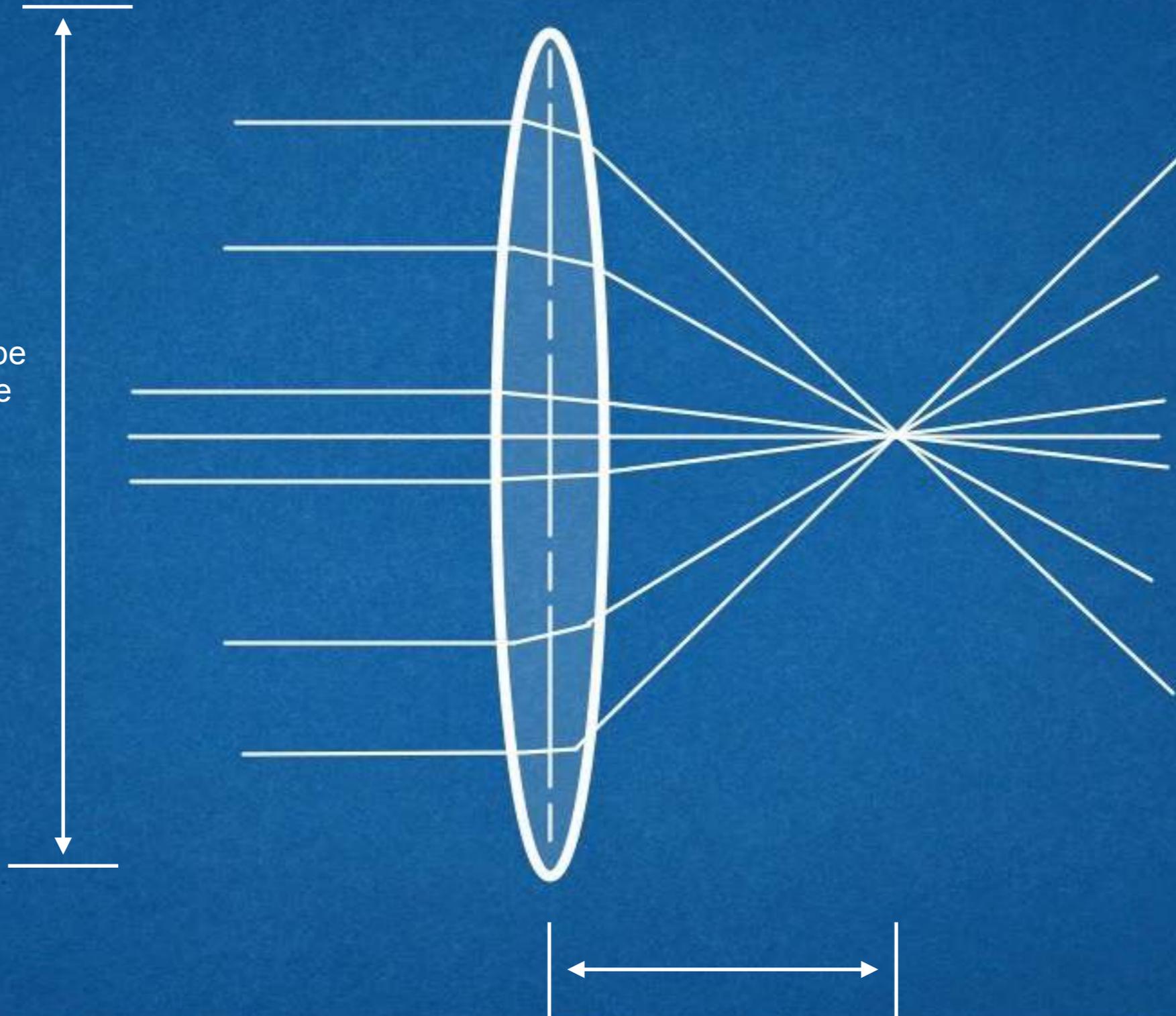
- **Focal Length**

The distance from a mirror or lens to the image that it forms. In most telescopes the focal length is roughly equal to the length of the tube. Some telescopes use extra lenses and/or mirrors to create a long effective focal length in a short tube.



- **Focal Ratio (f/number)**

A lens or mirror's focal length divided by its aperture. For instance, a telescope with an 80-mm-wide lens and a 400-mm focal length has a focal ratio of f/5.





Galaxies

The Sombrero Hat Galaxy

A collection of stars, planets and other bodies grouped together and gravitationally bound.

Galilean Moons

The Four **Moons** of **Jupiter** discovered by Italian Astronomer **Galileo Galilee**

- Ganymede
- Callisto
- Europa
- Io



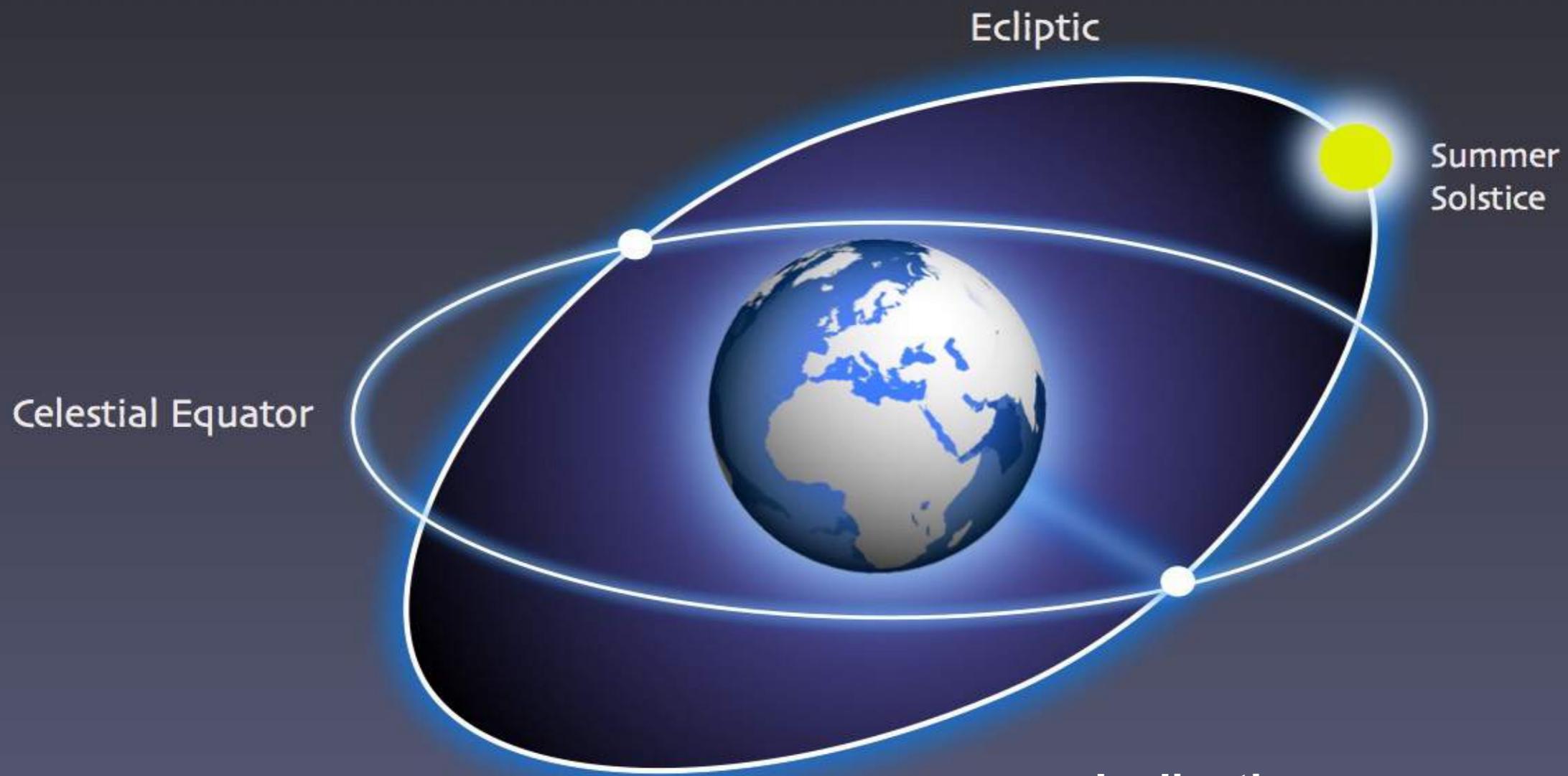
Globular Cluster

A type of **star cluster** which greatly annoys **astronomers** because we don't know:

- Where they **come from**
- How they **old** are
- How **many** stars make up a **globular cluster**
- Why they **stay together**
- Why they don't **fly apart**



Like I said, annoying...



- **Inclination**

The angle between the plane of an orbit and a reference plane.

For example, NASA satellites typically have orbits inclined 28° to Earth's equator.

1 AU

10 AU

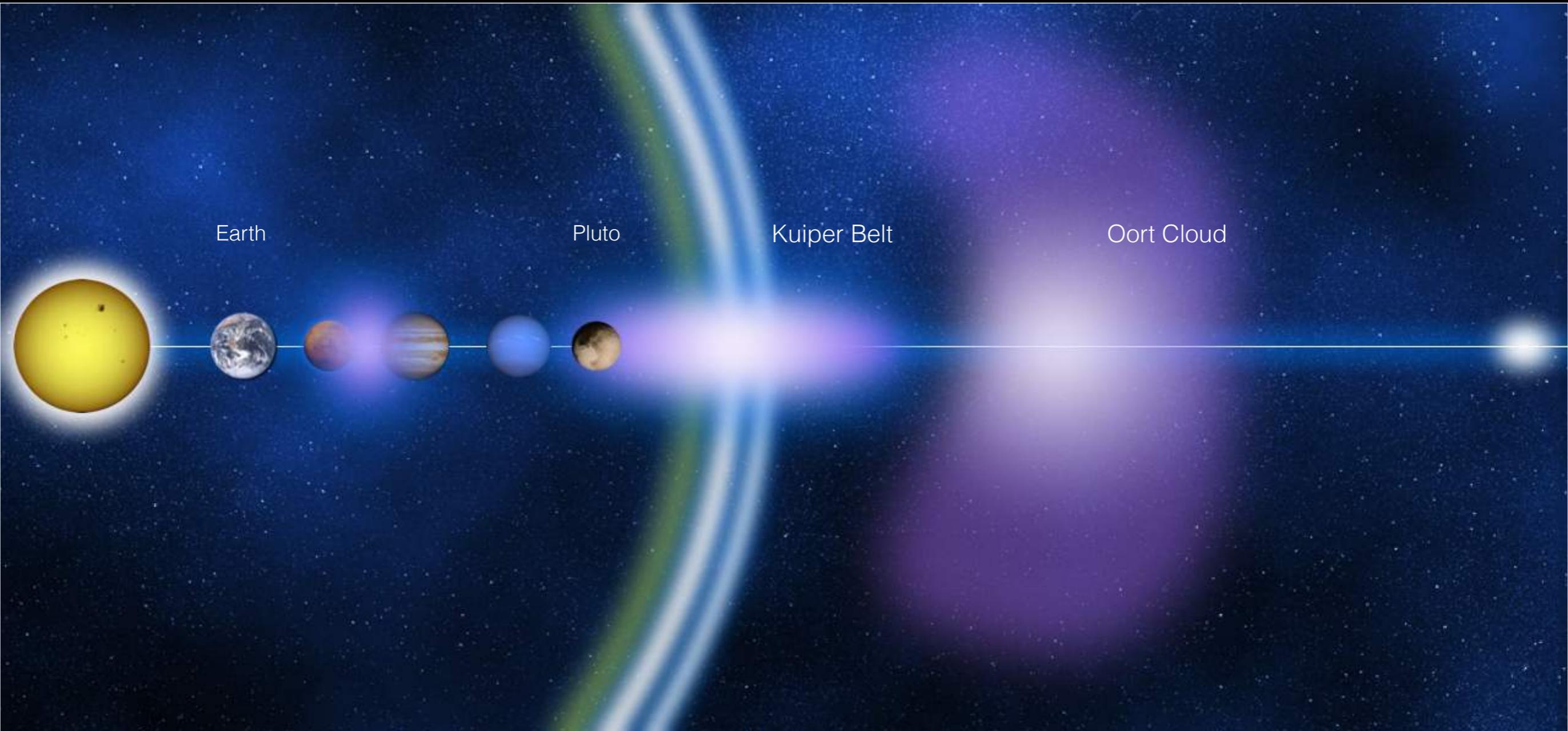
100 AU

1000 AU

10000 AU

100000 AU

1000000 AU



Earth

Pluto

Kuiper Belt

Oort Cloud

Kuiper Belt

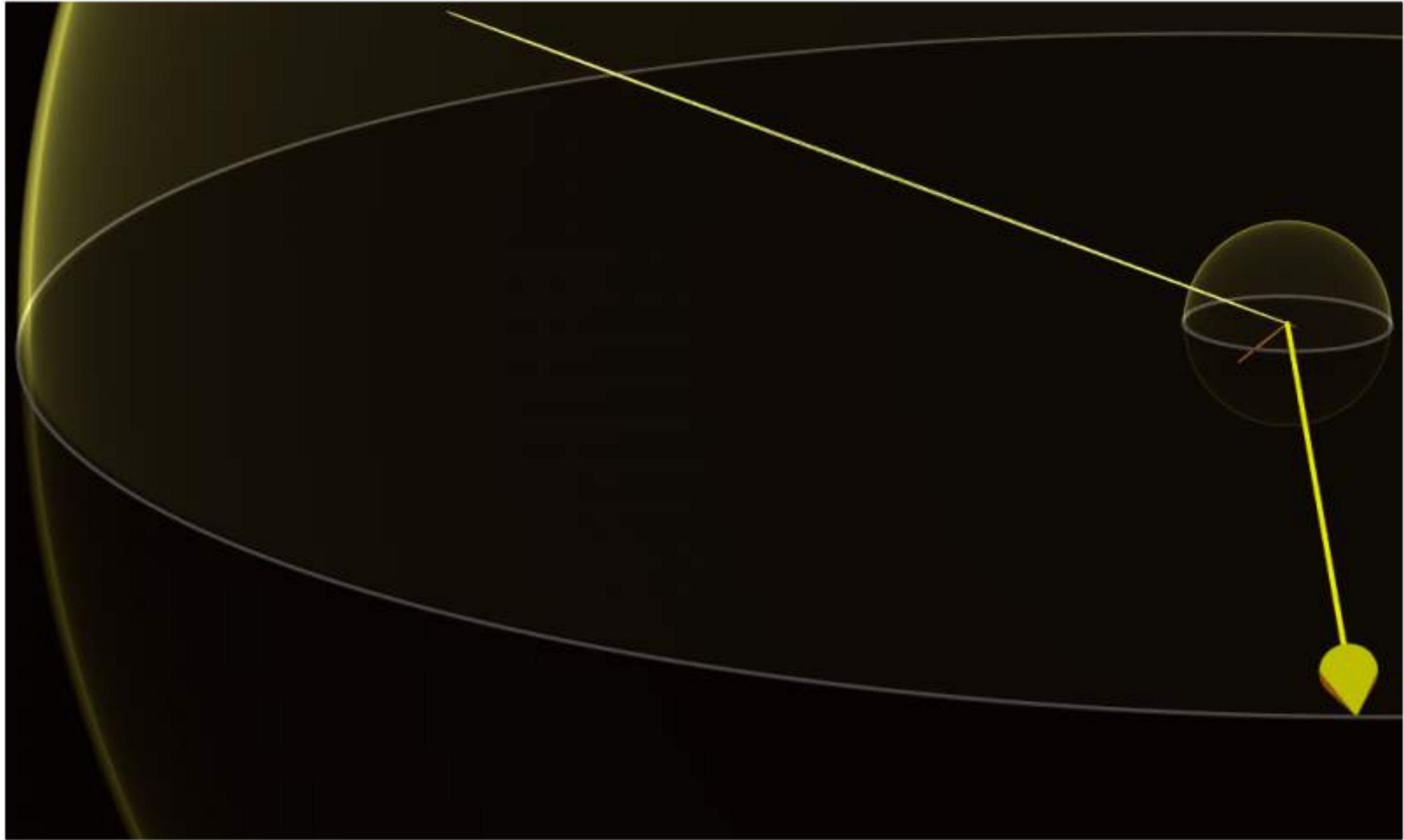
A collection of objects which generally lie beyond the orbit of Pluto. Thought to be left over from the formation of the solar system. Composition largely rocks and big lumps of ice.



Libration

A slight tipping and tilting of the Moon from week to week that brings various features along the limb into better view. The main causes are two aspects of the Moon's orbit: its elliptical shape and inclination to the ecliptic.

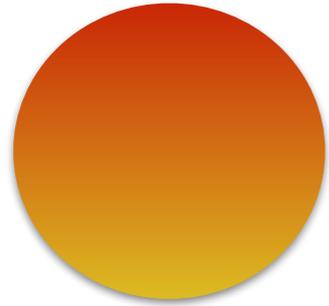
Lunar **Libration**



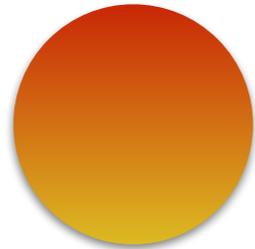
- **Light-year**

Imperial : Distance that a photon moving at about 186,000 miles per second travels in one year - about 6 trillion miles...

Metric : Distance that a photon moving at about 3×10^8 meters per second travels in one year - about 10^{15} metres



1st Magnitude



2nd Magnitude



3rd Magnitude



4th Magnitude



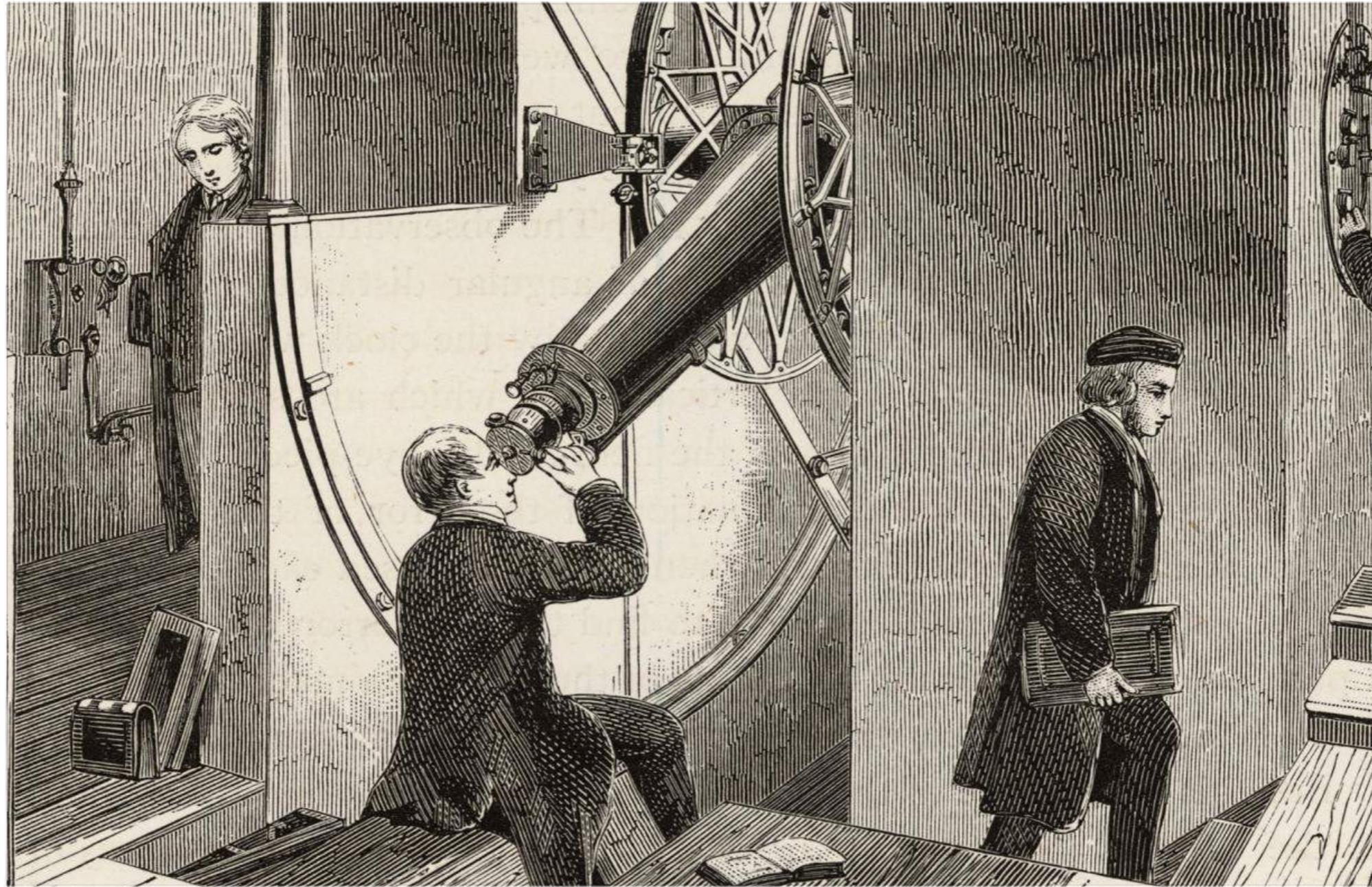
5th Magnitude



6th Magnitude

• **Magnitude**

A number denoting the brightness of a star or other celestial object. The higher the magnitude, the fainter the object. For example, a 1st-magnitude star is 100 times brighter than a 6th-magnitude star.



• Meridian

The imaginary north-south line that passes directly overhead (through the zenith).

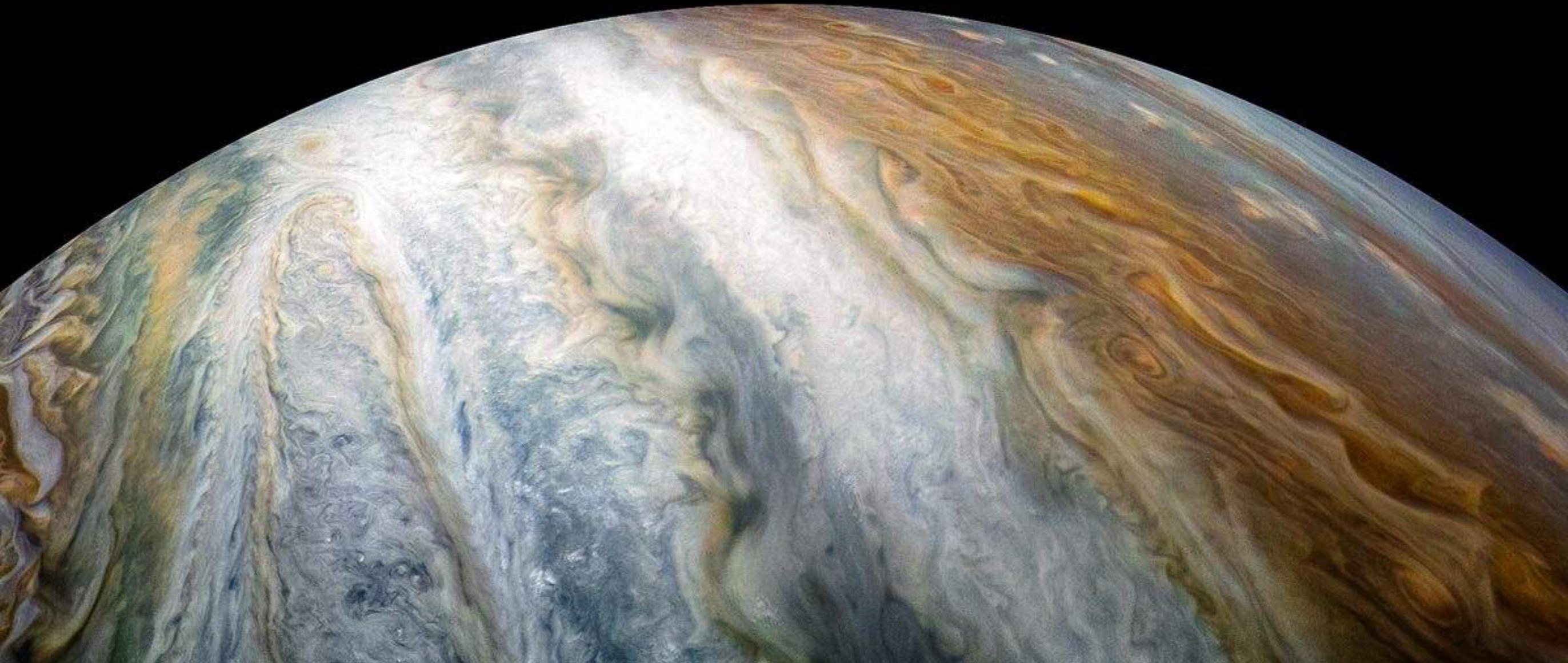


Messier Objects

An entry in a catalogue of 103 star clusters, nebulas, and galaxies compiled by French comet hunter Charles **Messier** (mess-YAY) between 1758 and 1782. The modern-day Messier catalogue contains 109 objects.

Moon

A **moon** is **defined** to be a celestial body that makes an orbit around a planet,

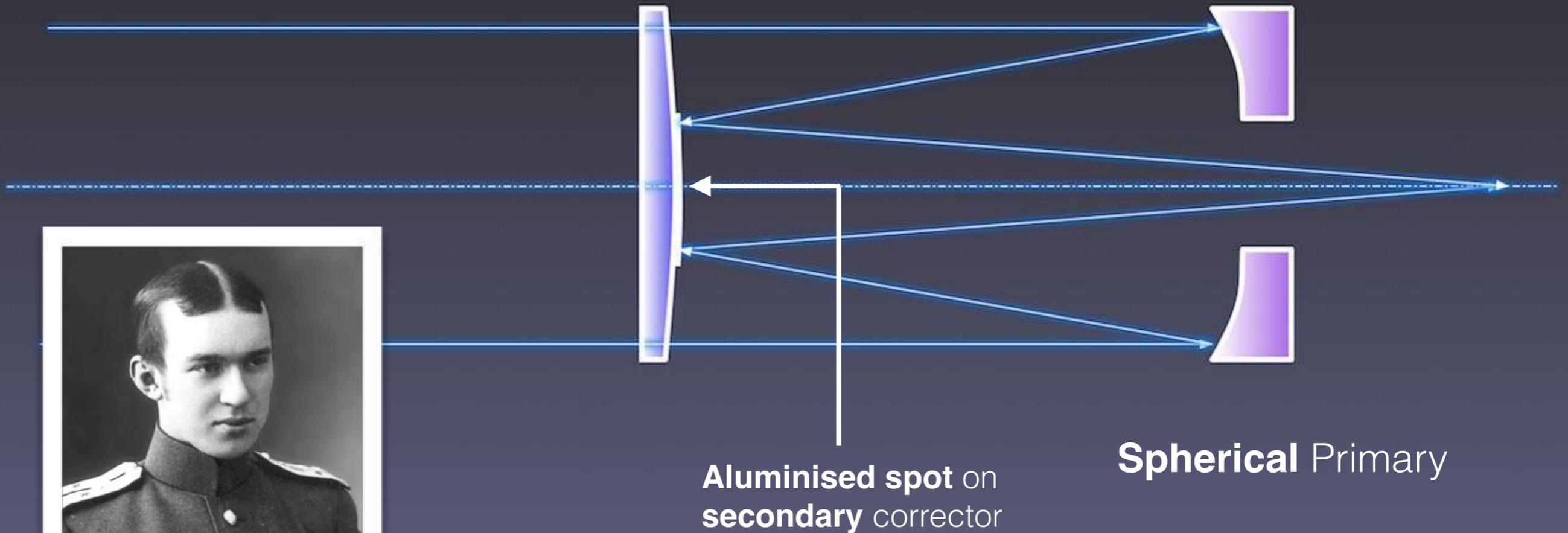


- **Nadir**

The point in the sky that's directly beneath you.



Spherical Corrector



Maksutov Telescope

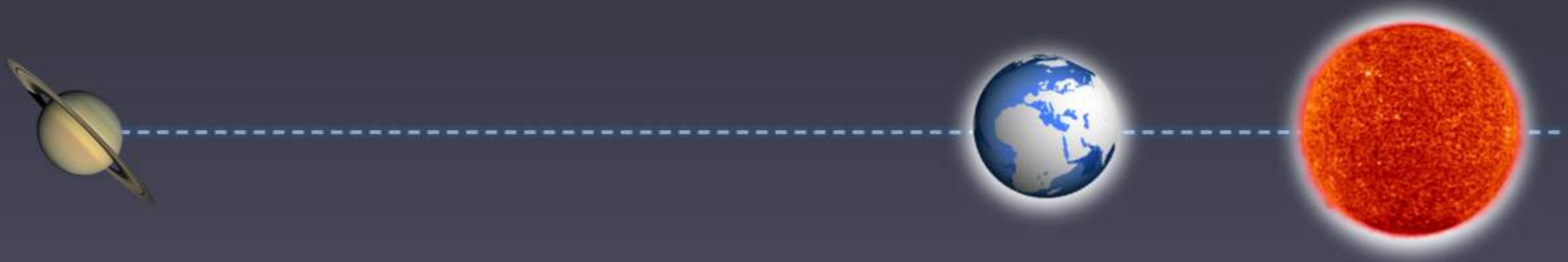
- Telescope design featuring a **Spherical corrector** and a **Spherical** primary
- Most semi-pro telescopes these days are **Maksutov**
- **Designed** by a **Russian** Military Officer, Dmitry Dmitrievich **Maksutov**



- **Objective**

A telescope's main light-gathering lens or mirror.





• Opposition

When a planet or asteroid is opposite the Sun in the sky. At such times the object is visible all night — rising at sunset and setting at sunrise.



• Occultation

When the Moon or a planet passes directly in front of a more distant planet or star. A grazing occultation occurs if the background body is never completely hidden from the observer.



Lunar Occultation

1 AU

10 AU

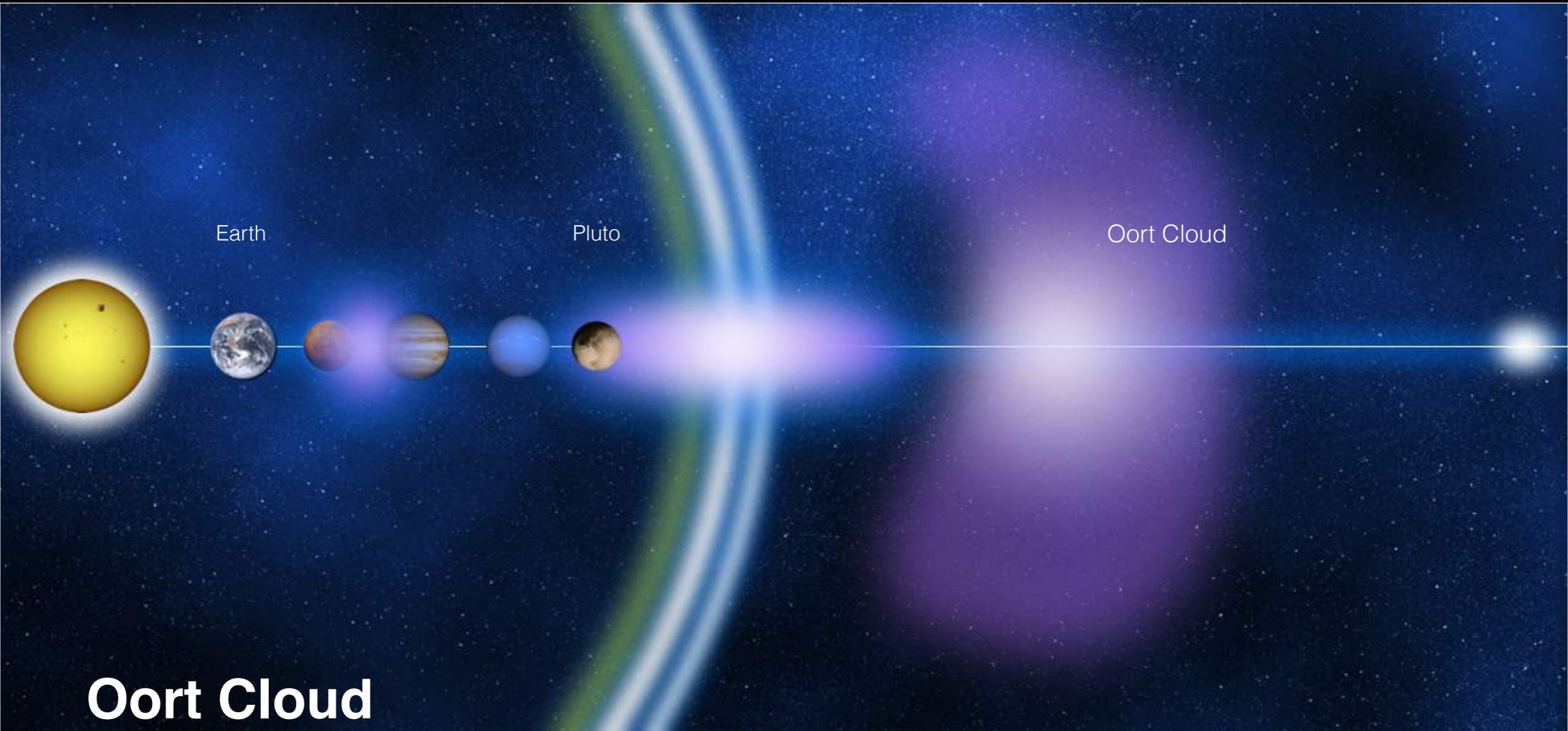
100 AU

1000 AU

10000 AU

100000 AU

1000000 AU



Earth

Pluto

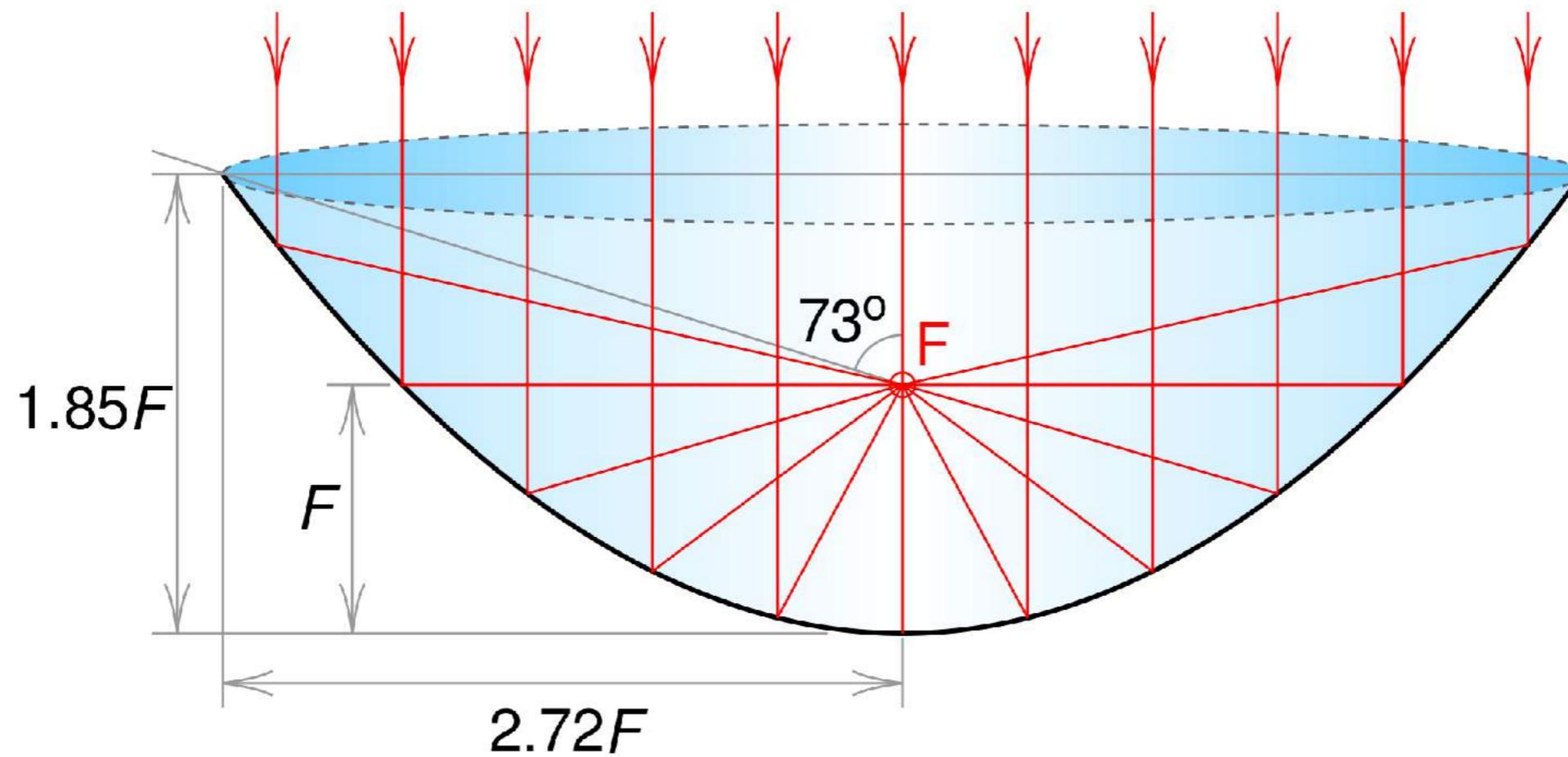
Oort Cloud

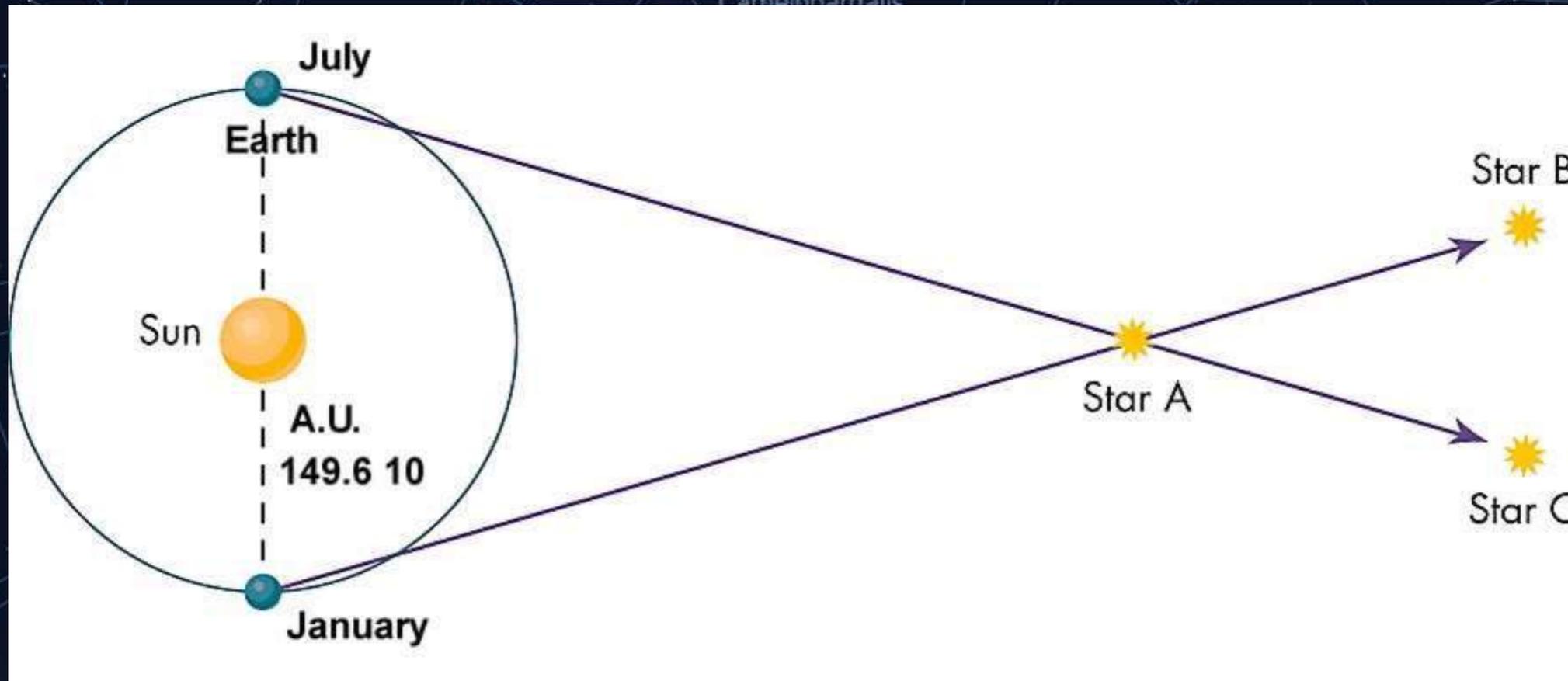
Oort Cloud

A cloud of objects which generally lie beyond the Kuiper Belt and which is thought to extend roughly about half way to the nearest star system. Thought to be left over from the formation of the solar system. Composition largely rocks, big lumps of ice, KitKat wrappers and lumps of Pork Pie.

Parabola:

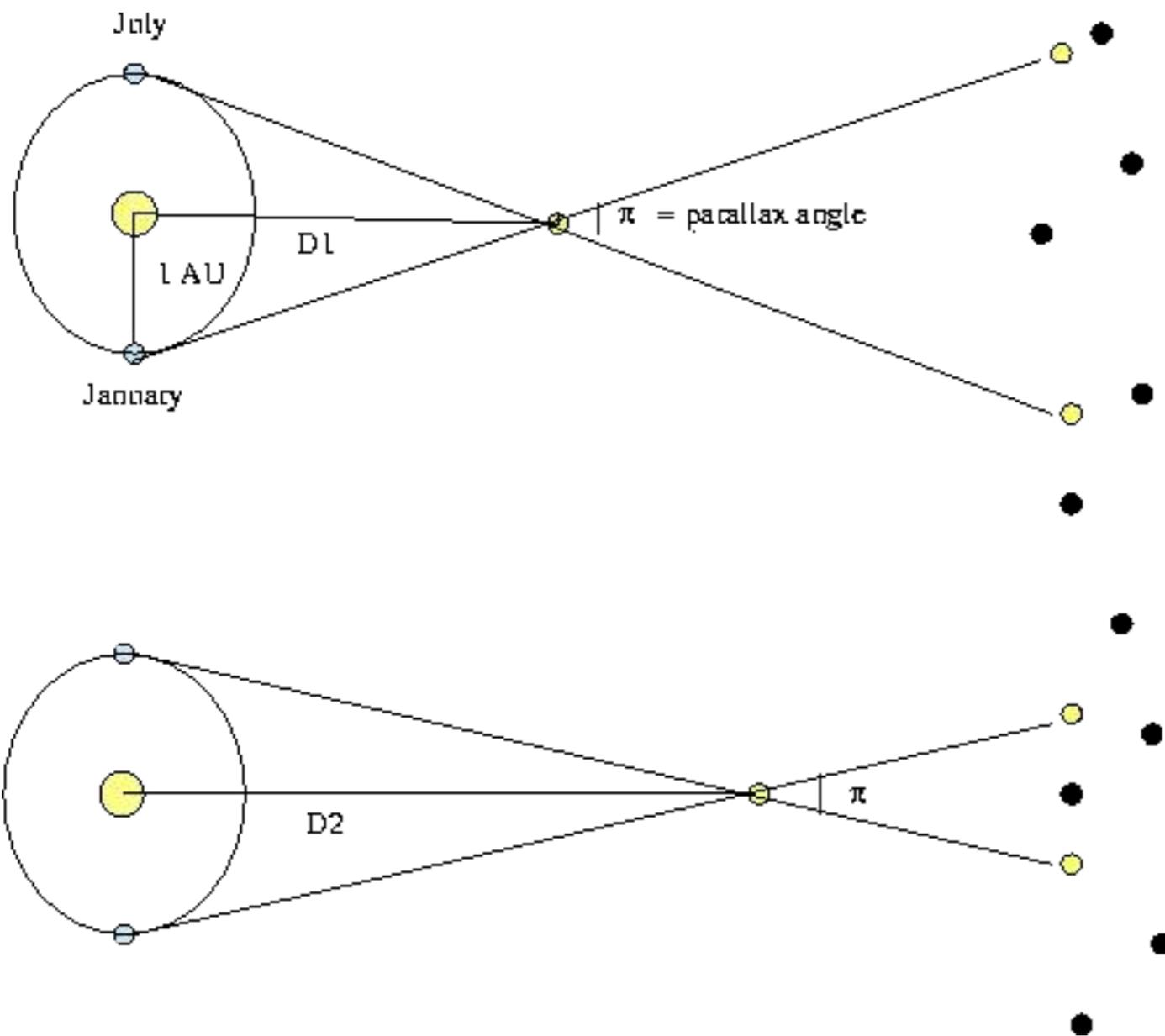
The shape of a telescope mirror...





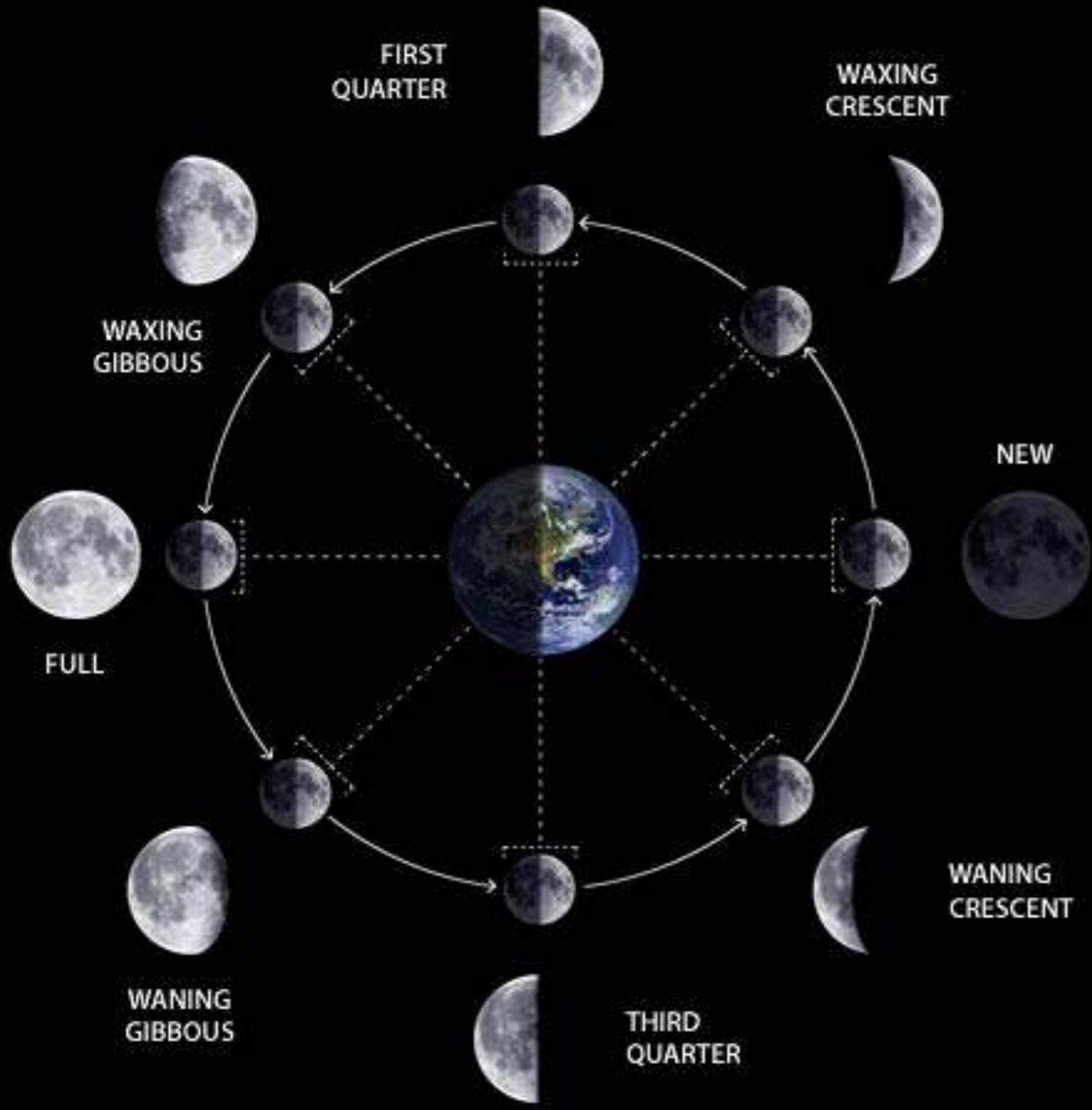
• Parallax

The apparent offset of a foreground object against the background when your perspective changes. At a given instant, the Moon appears among different stars for observers at widely separated locations on Earth. Astronomers directly calculate the distance to a nearby star by measuring its incredibly small positional changes (its parallax) as Earth orbits the Sun.



• Parsec

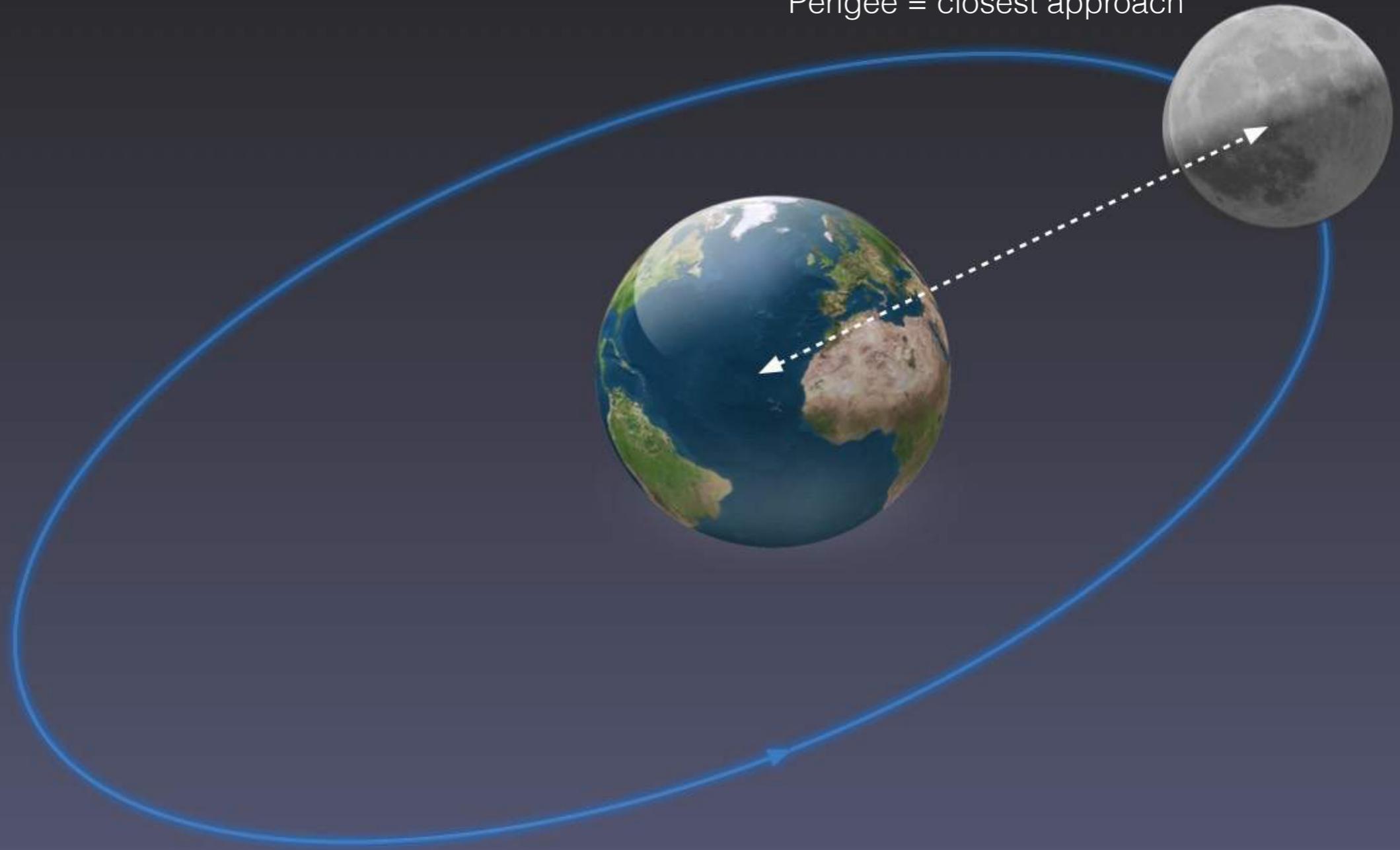
unit of length used to measure the large distances to **astronomical objects** outside the **Solar System**



• Phase

The fraction of the Moon or other body that we see illuminated by sunlight.

Perigee = closest approach



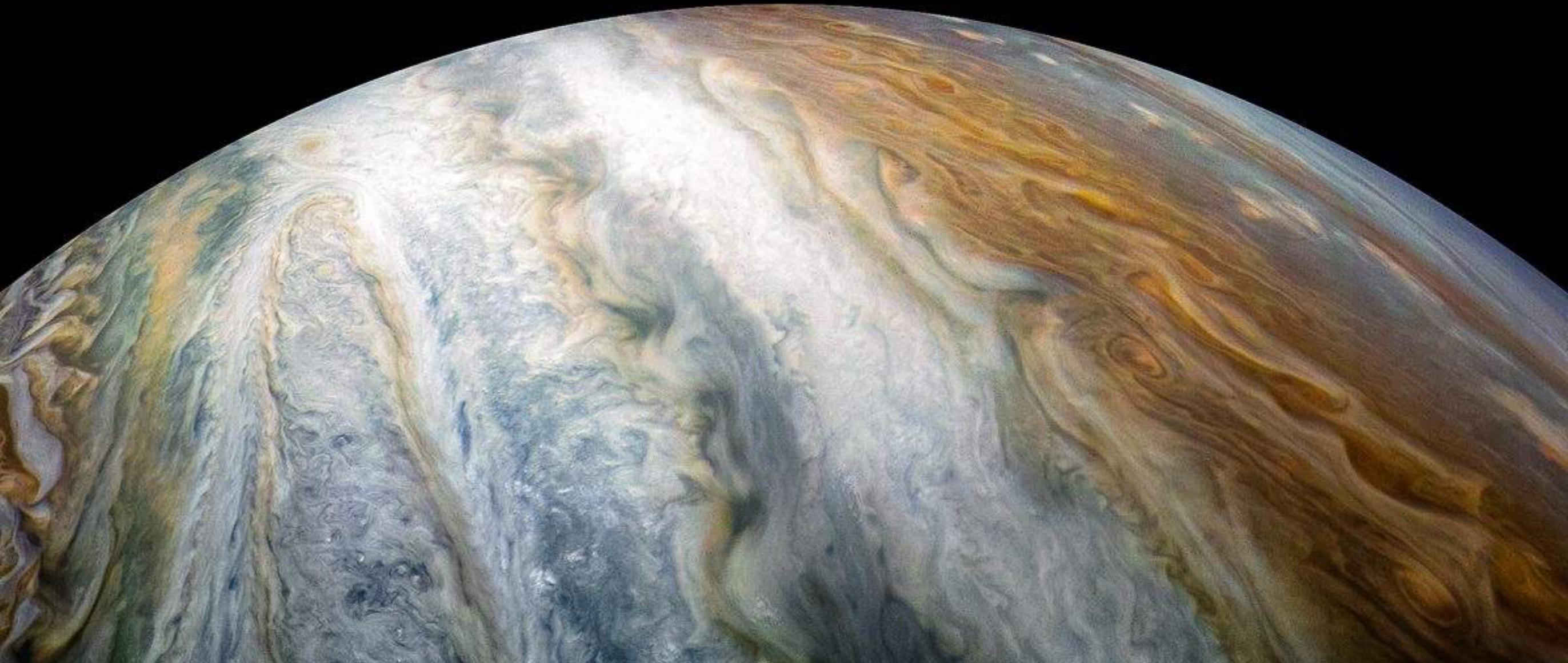
Perigee

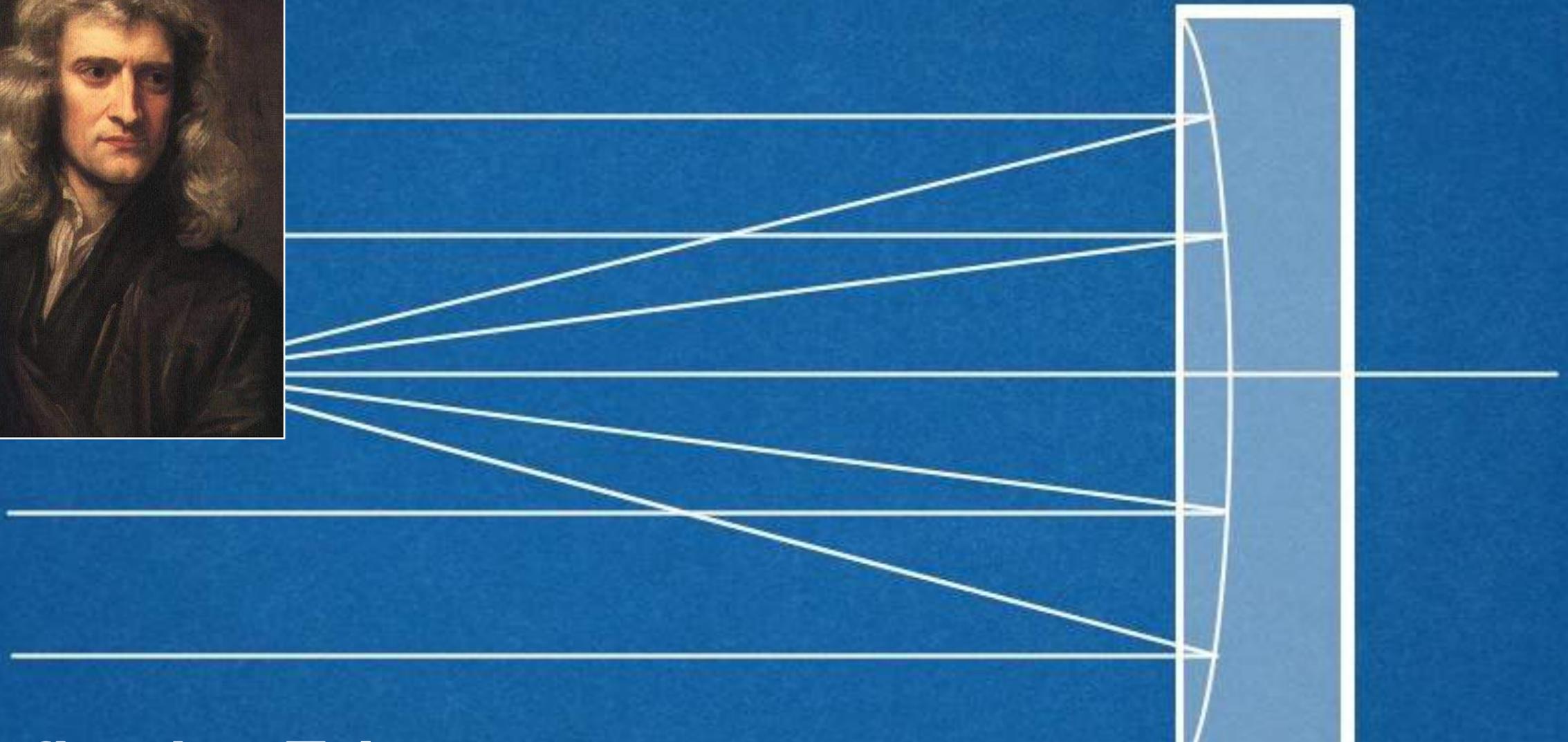
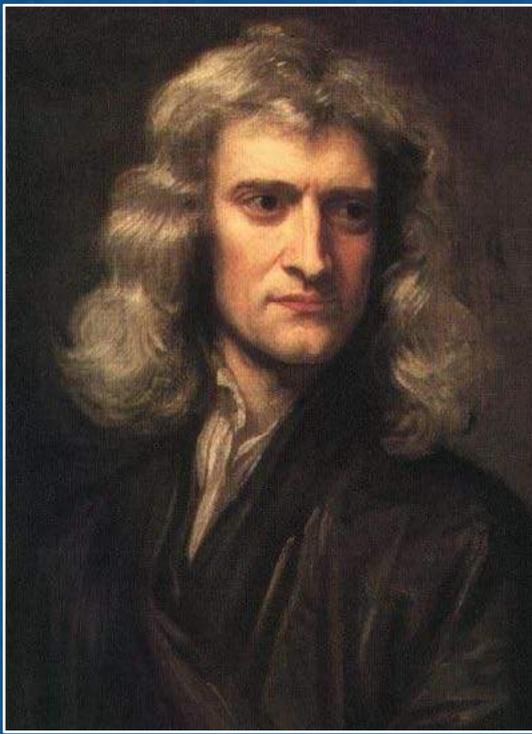
A point in a planet or moon's orbit when it is closest to its parent body...

Planet

The International Astronomical Union (IAU) defined in August 2006 that, in the **Solar System**, a **planet** is a **celestial body** which:

1. is in **orbit** around the **Sun**
2. has sufficient mass to assume **hydrostatic equilibrium** (a nearly round shape)
3. **cleared** the **neighbourhood** around its orbit





• Reflecting Telescope

A telescope that gathers light with a mirror. The Newtonian reflector, designed by Isaac Newton, has a small second mirror mounted diagonally near the front of the tube to divert the light sideways and out to your eye

Whilst the design is commonly attributed to Newton, it's likely that Newton 'borrowed' the design from a Scottish Optician James **Gregory**, although Gregory may have, in turn, 'borrowed' the design from a Venetian Optician, Giovanni Francesco **Sagredo**.

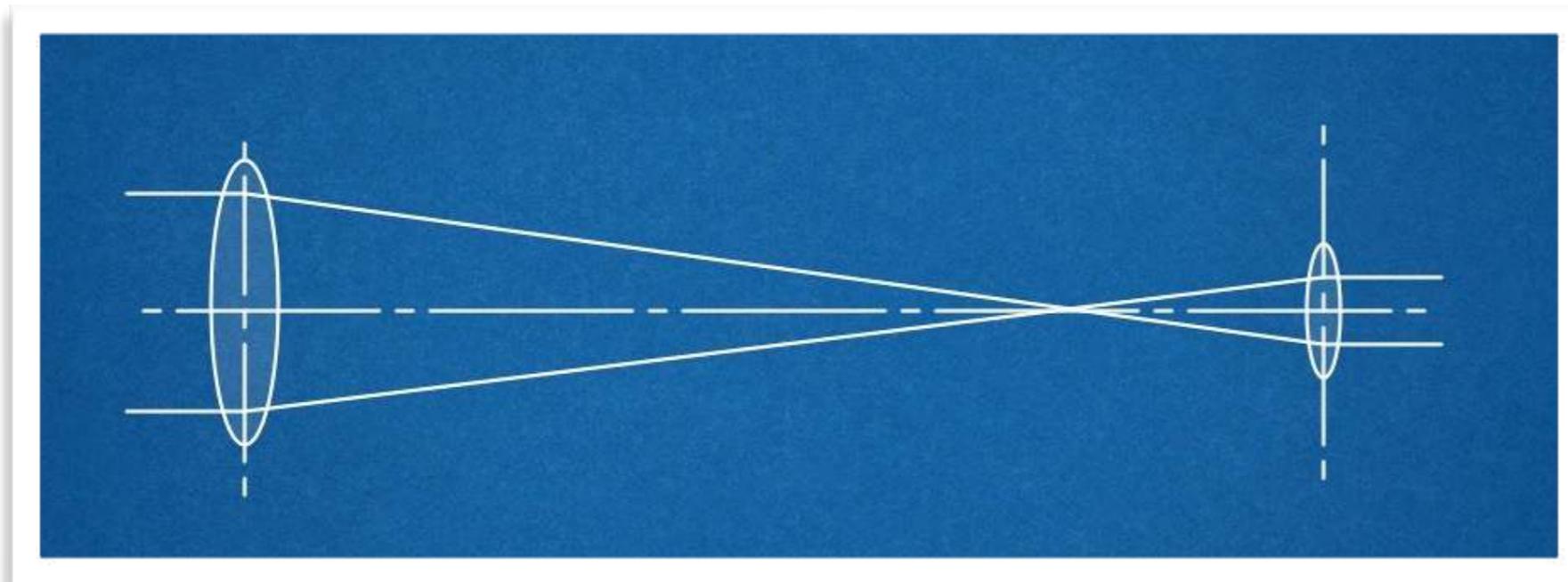


• Refracting Telescope

A telescope that gathers light with a lens.

Many books attribute the design to a Dutch Optician, Johann **Lippershey**, although this is almost certainly wrong. Archeological evidence suggests that the first refracting telescopes were probably invented by the ancient **Babylonian** Astronomers. Optically, these instruments would have been poor, and would have shown dramatic rainbows or “false colours” around stars and planets.

Most modern refractors are achromatic, meaning “free of false colour,” but this design still shows thin violet fringes around the brightest objects. The finest refractors produced today are apochromatic, meaning “beyond achromatic.” They use expensive, exotic kinds of glass to reduce false colour to nearly undetectable levels.





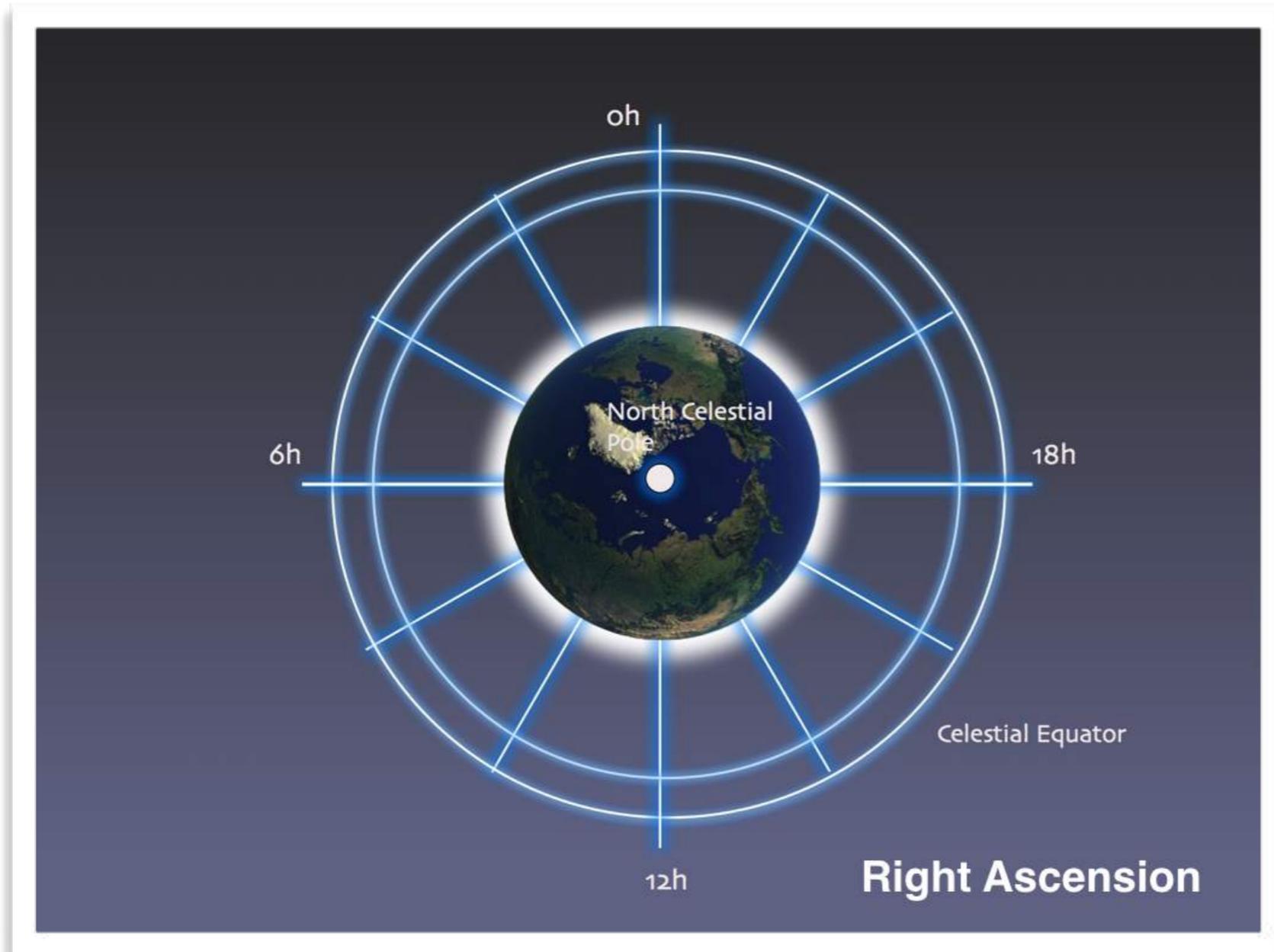
• Retrograde

When an object moves in the reverse sense of “normal” motion.

For example, most bodies in the solar system revolve around the Sun and rotate counterclockwise as seen from above (north of) Earth’s orbit; those that orbit or spin clockwise have retrograde motion.

This term also describes the period when a planet or asteroid appears to backtrack in the sky because of the changing viewing perspective caused by Earth’s orbital motion.

Saturn’s Moons : Phoebe



- **Right Ascension (R.A.)**

The celestial equivalent of longitude, denoting how far (in 15°-wide “hours”) an object lies east of the Sun’s location during the March equinox.

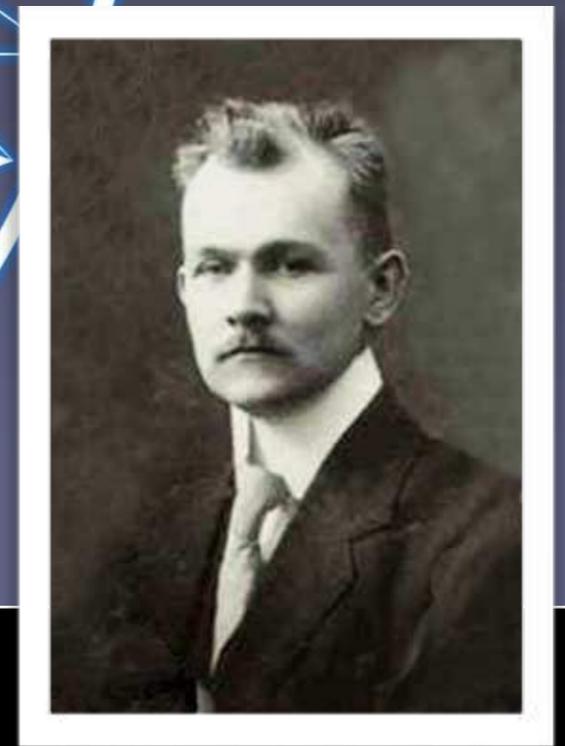
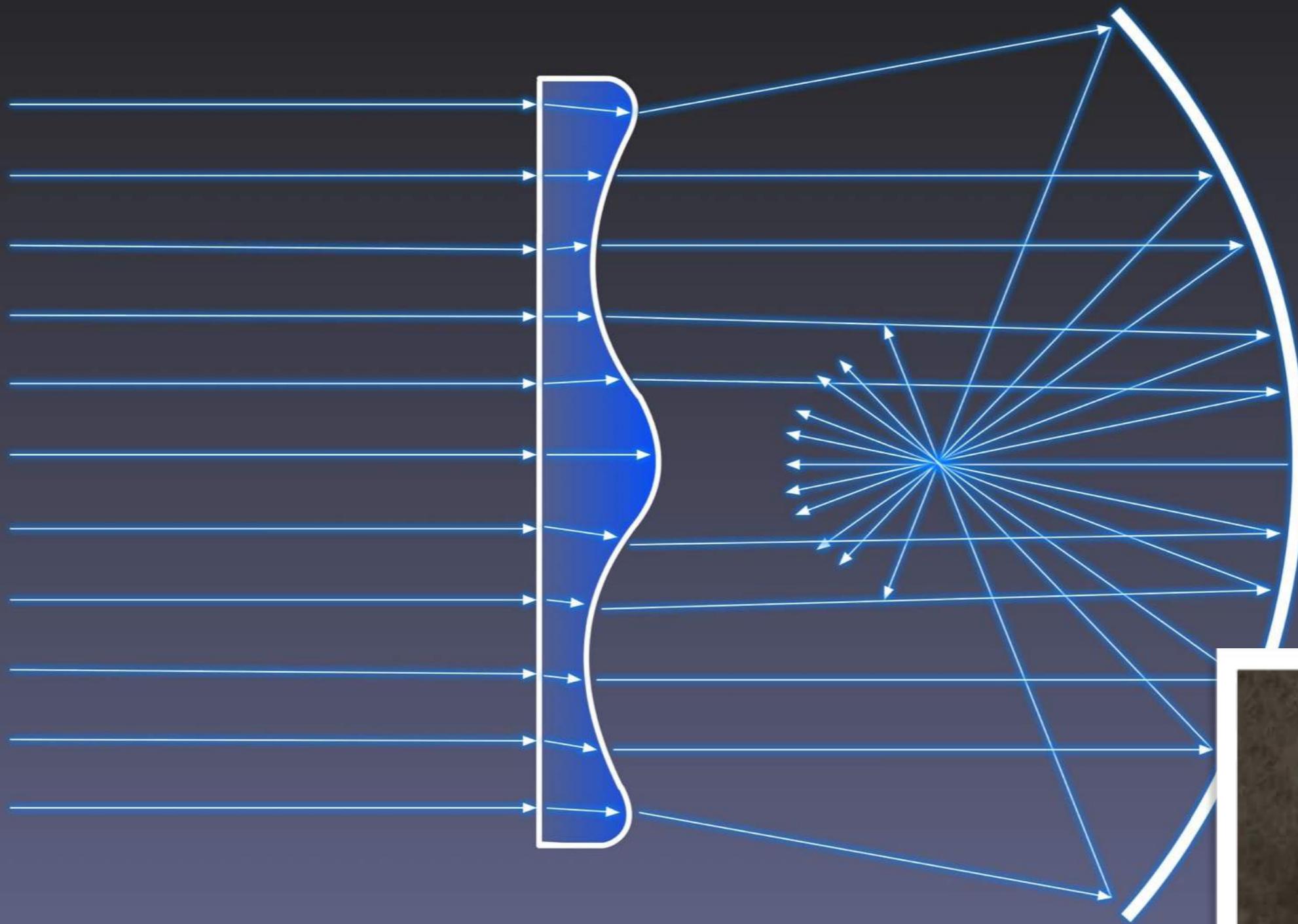


Sagitta

When making telescope optics - the depth of the curve on an optical surface.

It is important to not confuse dimensions when measuring the Sagitta or Sag of a surface. Do not, for instance, confuse thousandths of an inches with millimetres, particularly if you are rough grinding a 6" mirror. If you fail to do so then you will finish up with a very expensive ash tray instead of a telescope mirror.

Right, Tom?



Schmidt Camera

- Invented by Bernhard **Schmidt** in **1931**
- **Designed** to photograph **large areas** of the **sky**

1 AU

10 AU

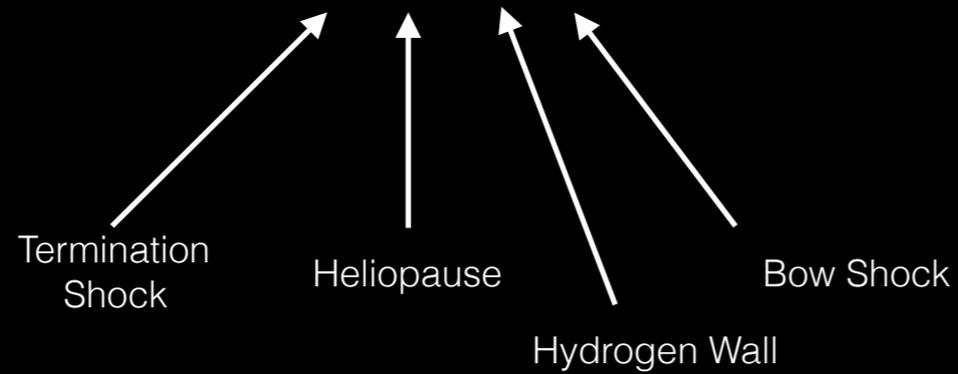
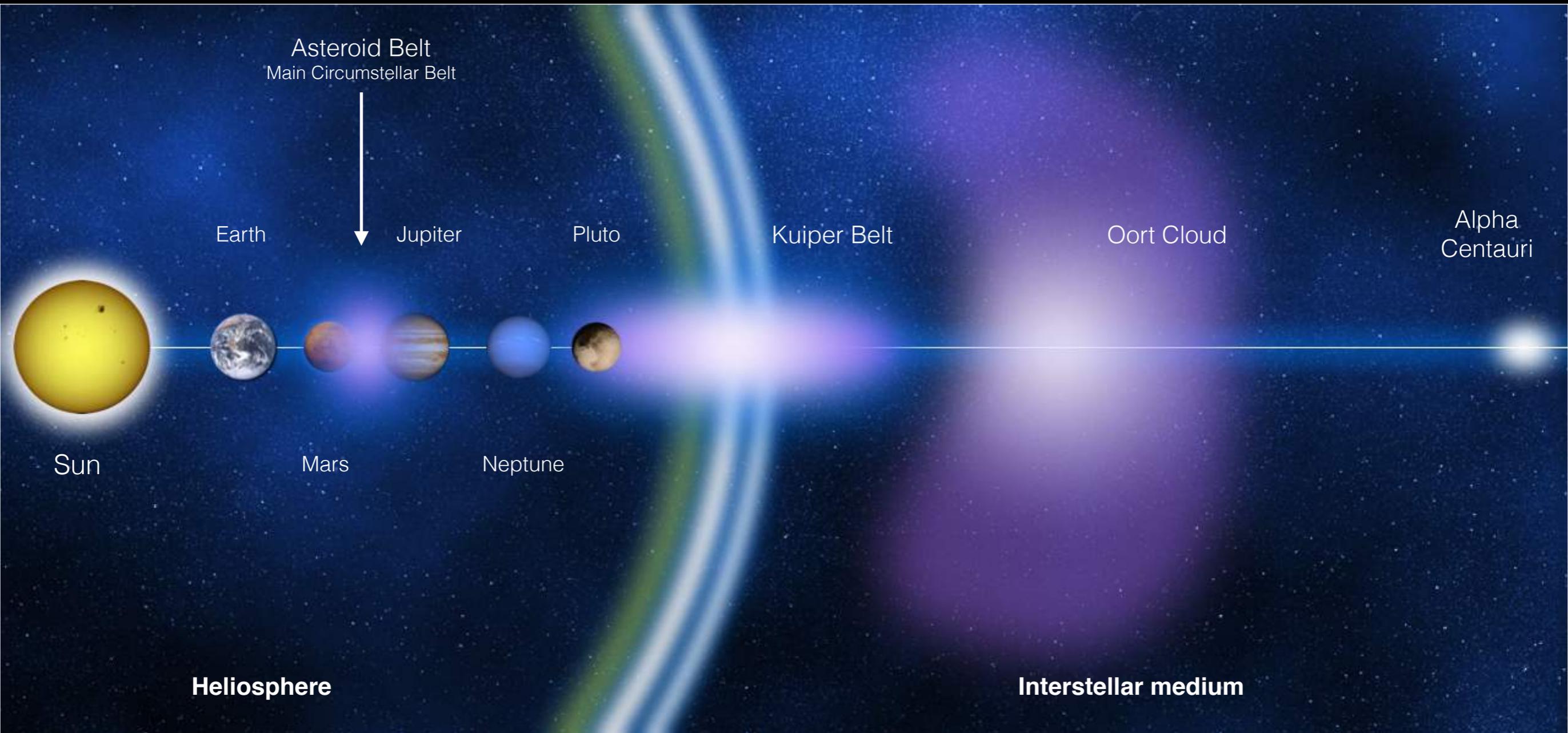
100 AU

1000 AU

10000 AU

100000 AU

1000000 AU

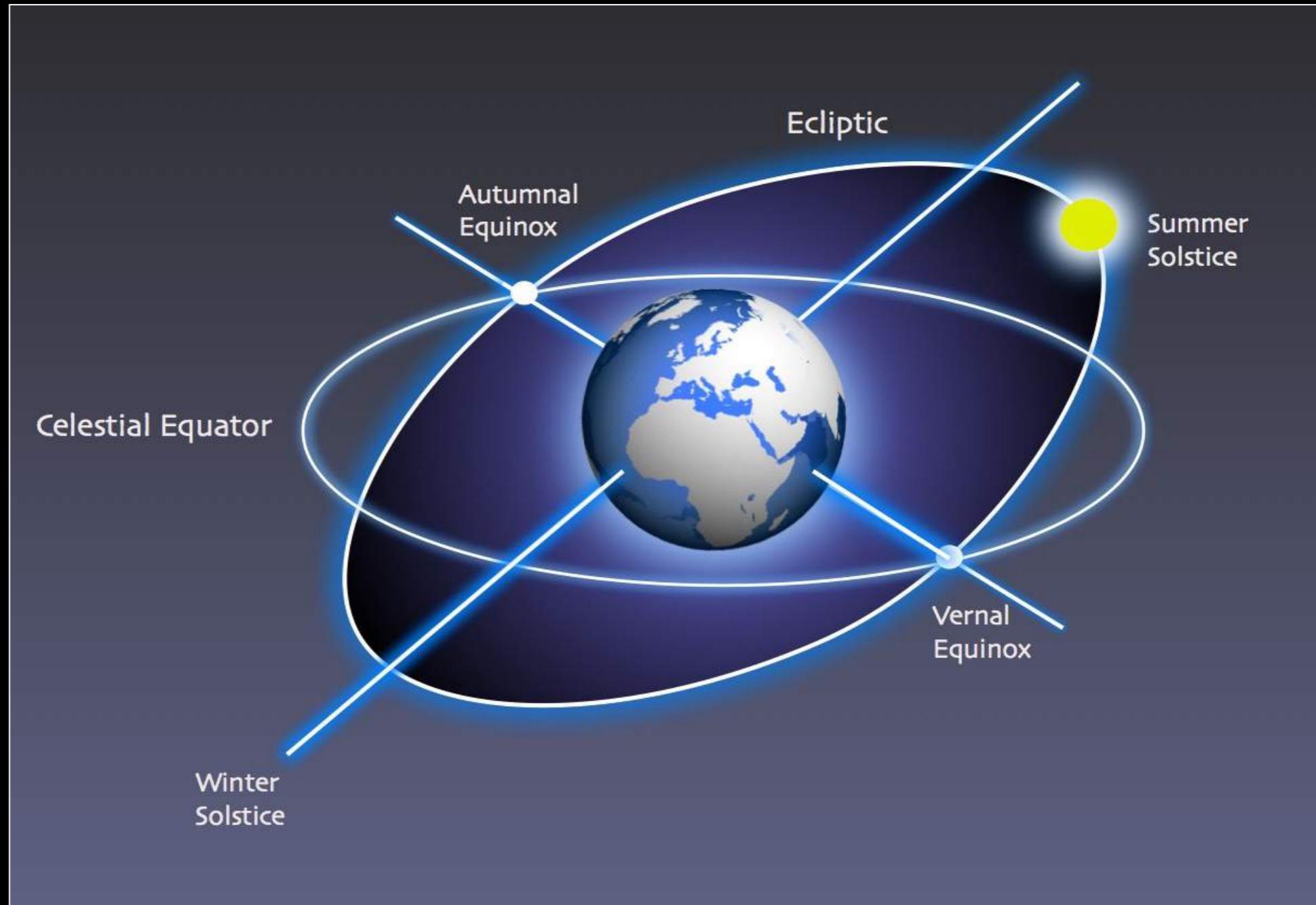


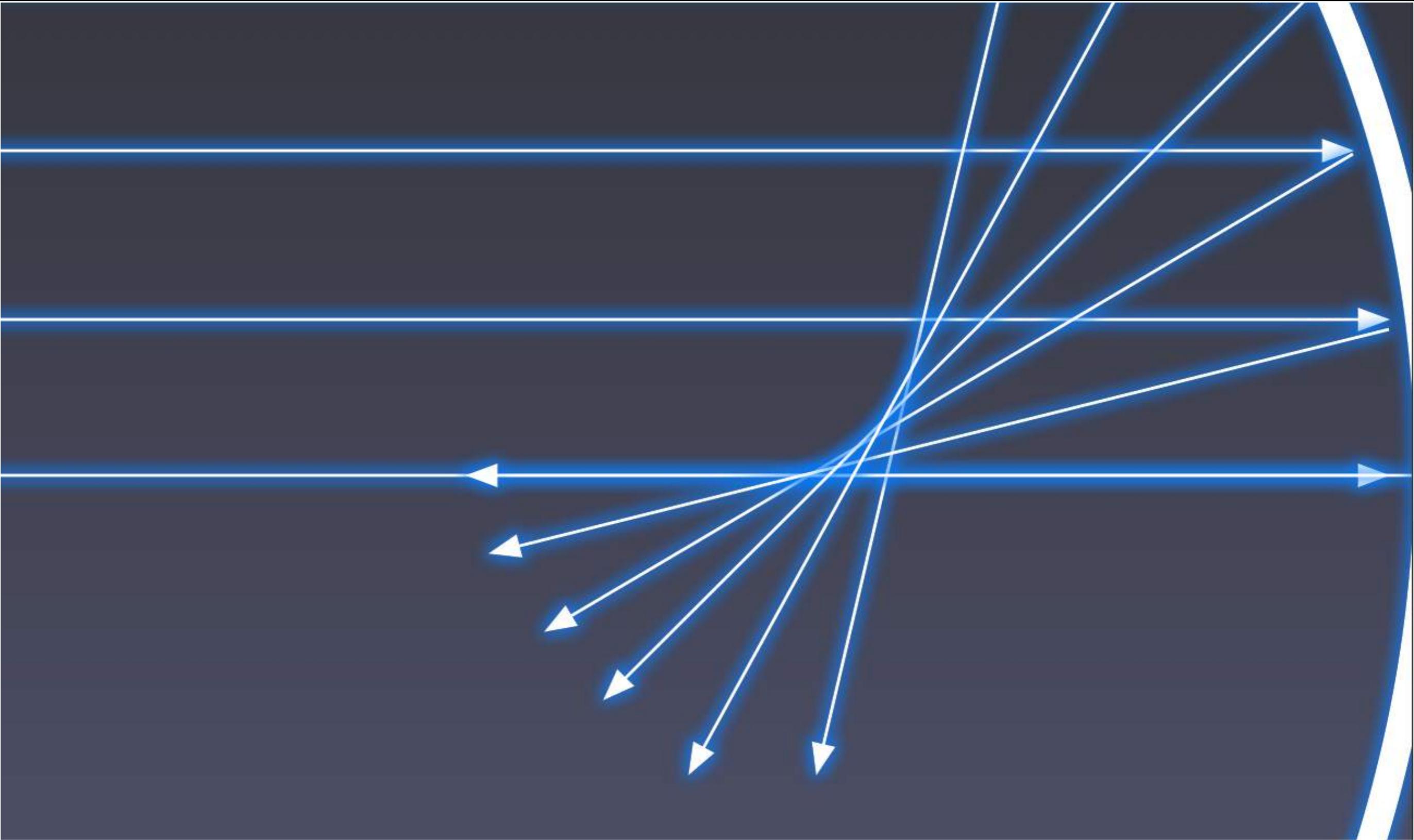
The **Solar** System
Where we live...

• Solstice

The two times each year, around June 20th and December 21st, when the Sun is farthest north or south in the sky. At the summer solstice, the day is longest and the night is shortest, and vice versa at the winter solstice.

Solstice = Sun Still





Spherical Aberration

An **optical defect** where **not** all light rays meet at the **focal point** of a mirror or lens. The result is blurred images.

Stars

The **Sun** (also a star)

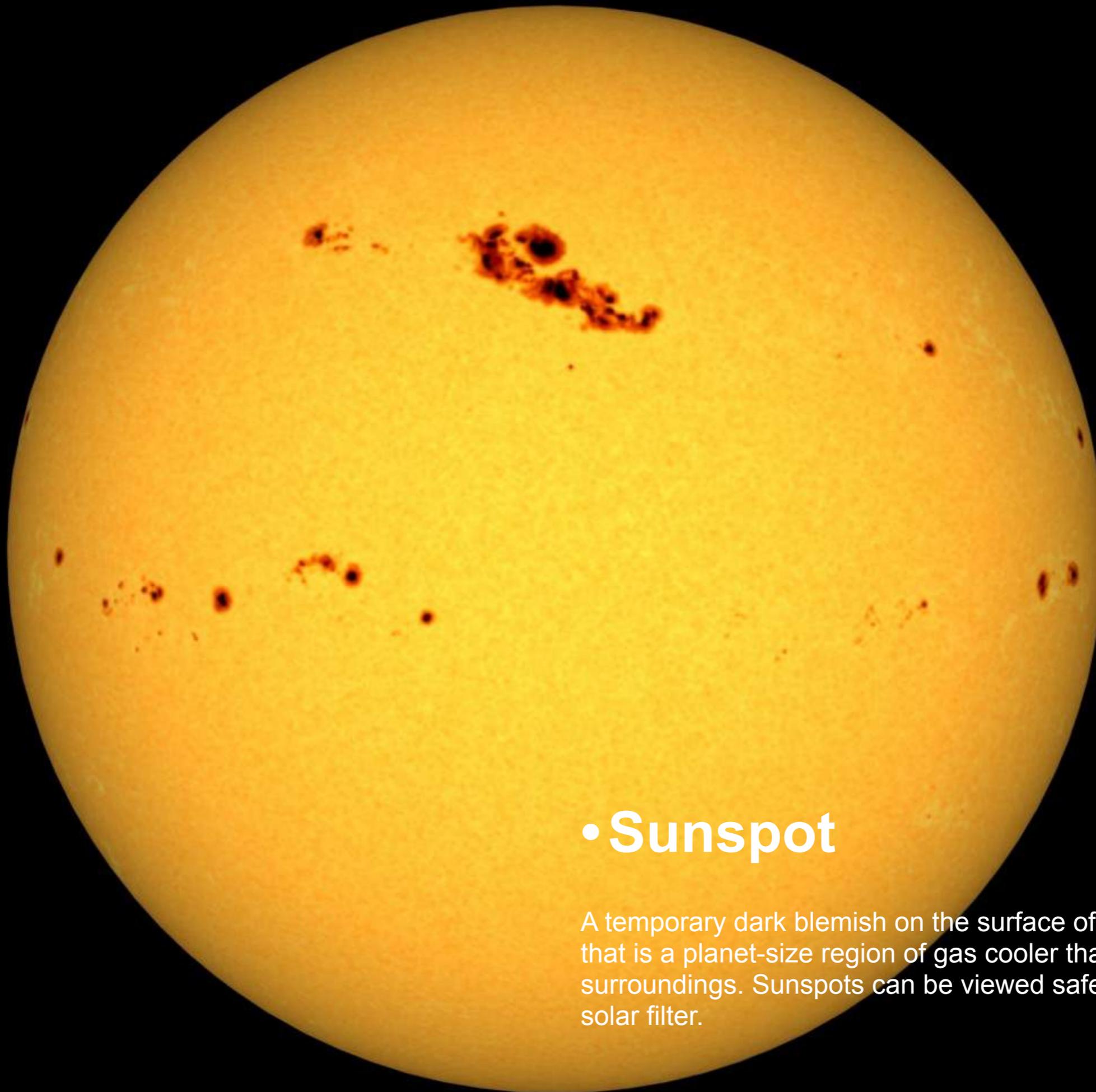


Stars come in many shapes and sizes. Under normal circumstances i.e. how they spend most of their lives, they're just a big ball of gas which has become hot enough to convert its hydrogen into helium by a process called Nuclear Fusion.



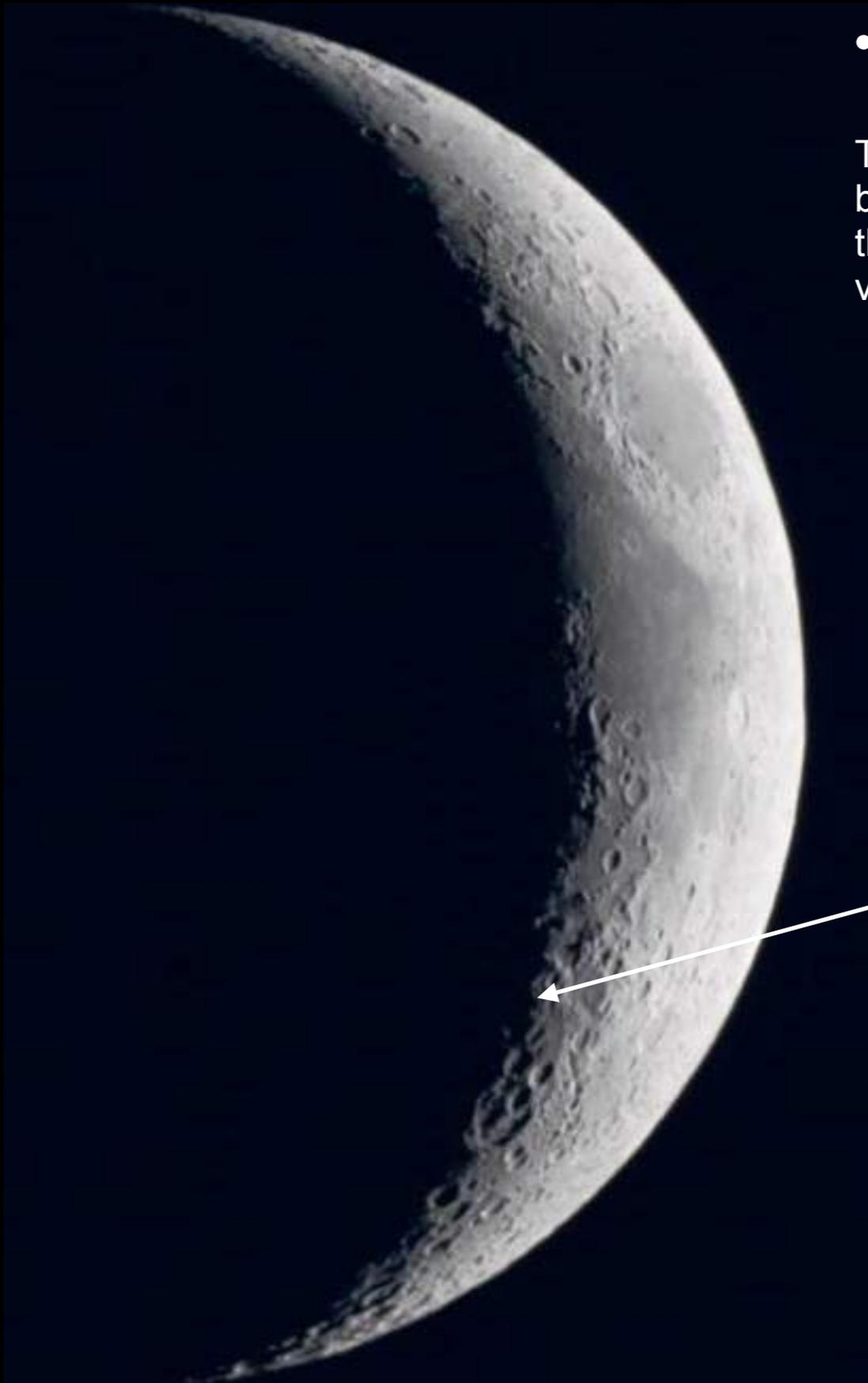
• **Supernova**

A star ending its life in a huge explosion. In comparison, a nova is a star that explosively sheds its outer layers without destroying itself.



• Sunspot

A temporary dark blemish on the surface of the Sun that is a planet-size region of gas cooler than its surroundings. Sunspots can be viewed safely using a solar filter.



- **Terminator**

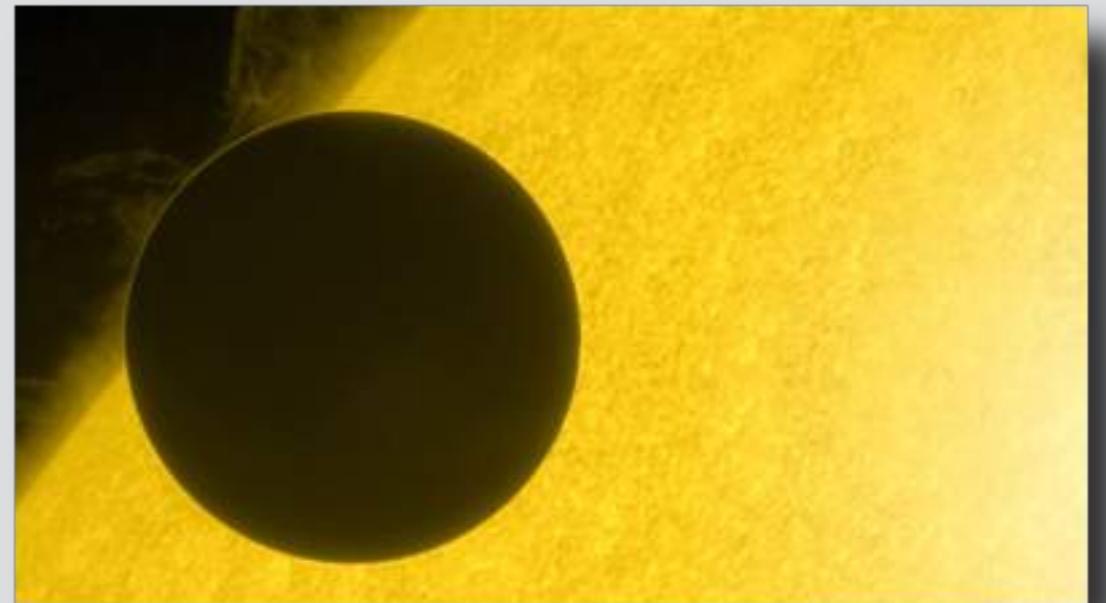
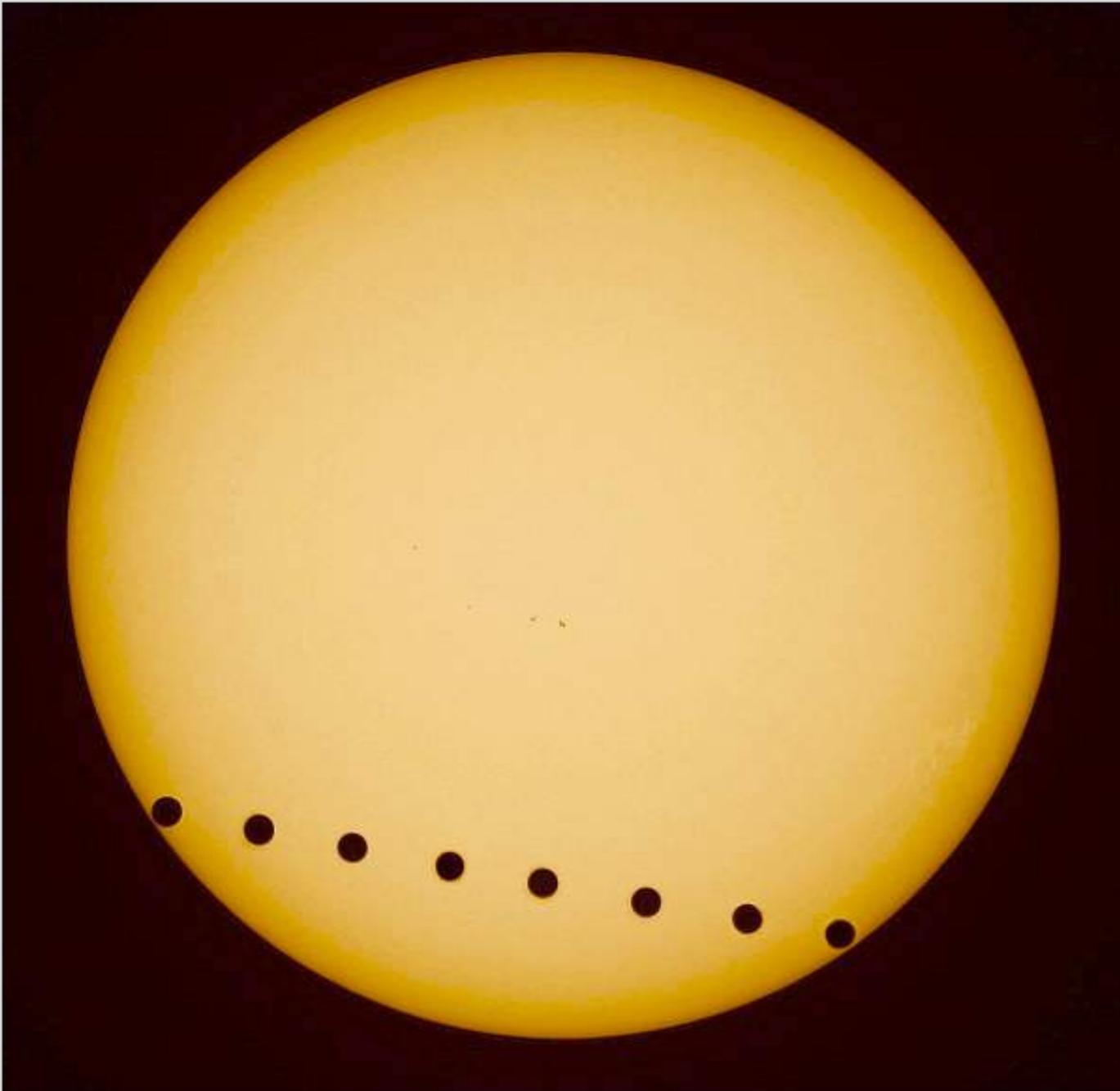
The line on the Moon or a planet that divides the bright, sunlit part from the part in shadow. It's usually the most exciting and detailed region of the Moon to view through a telescope.

Terminator

(I'll be back...)

• Transit

When Mercury or Venus crosses the disk of the Sun, making the planet visible as a black dot in silhouette, or when a moon passes across the face of its parent planet. Transit also refers to the instant when a celestial object crosses the meridian and thus is highest in the sky.





- **Universal Time (UT)**

Greenwich Mean Time, expressed in the 24-hour system.

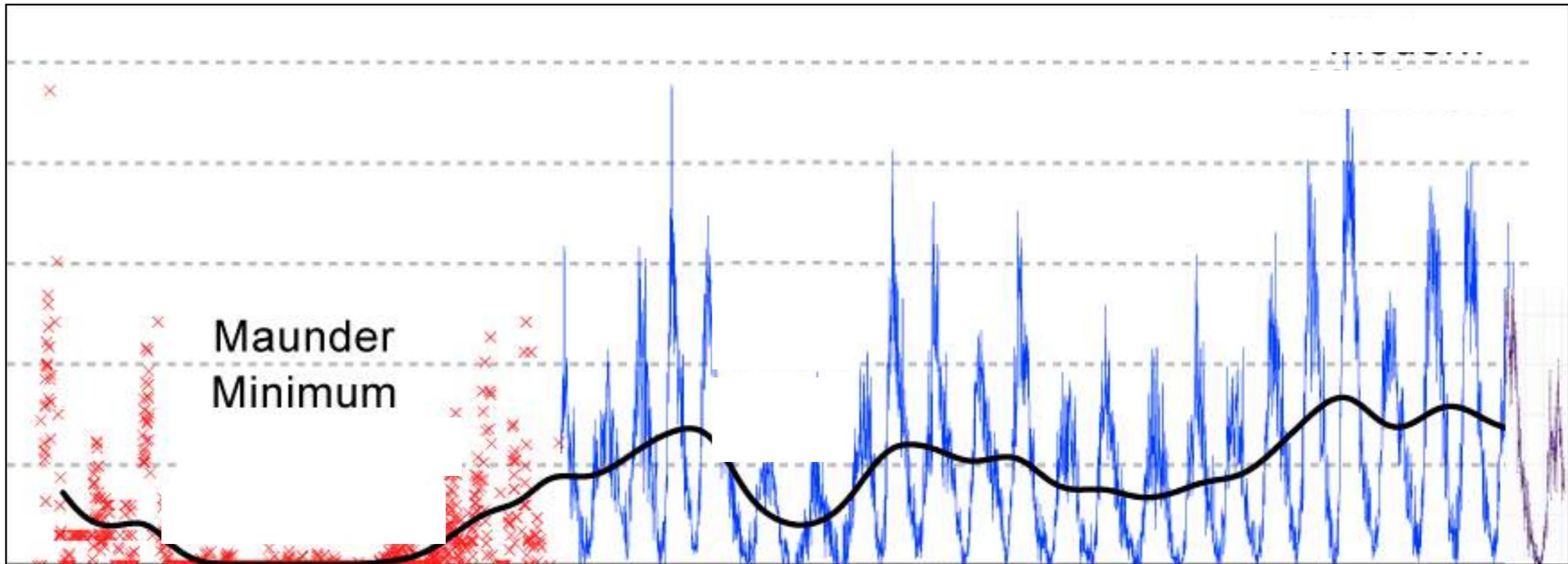
For example, 23:00 UT is 7:00 p.m. Eastern Daylight Time (or 6:00 p.m. Eastern Standard Time).

Astronomers use Universal Time to describe when celestial events happen in a way that is independent of an observer's time zone.

Maunder Minimum

Dalton Minimum

Current Maximum



1650

1700

1750

1800

1850

1900

1950

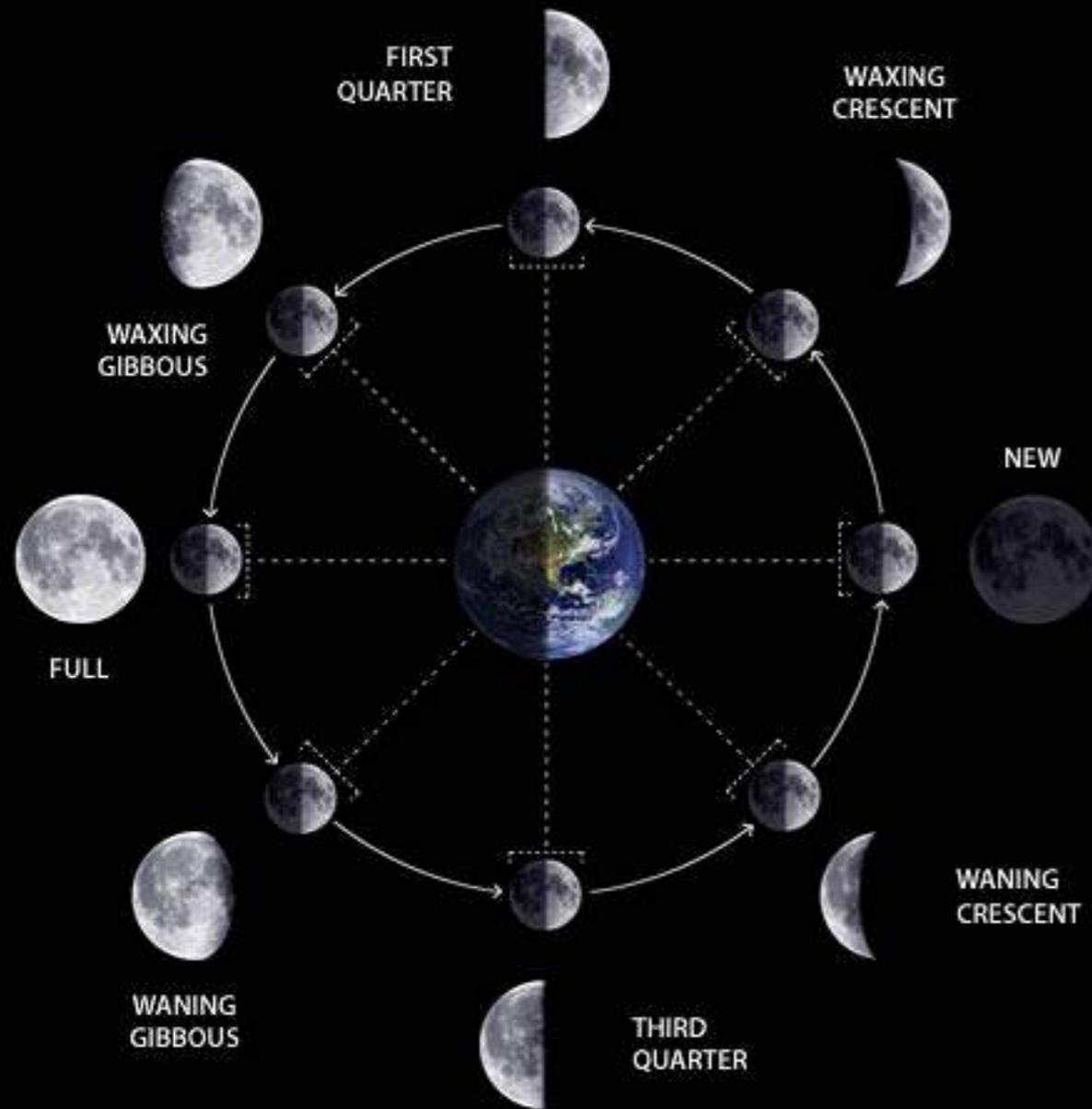
2000

Sunspot Observations



• **Variable Star**

A star whose brightness changes over the course of days, weeks, months, or years.

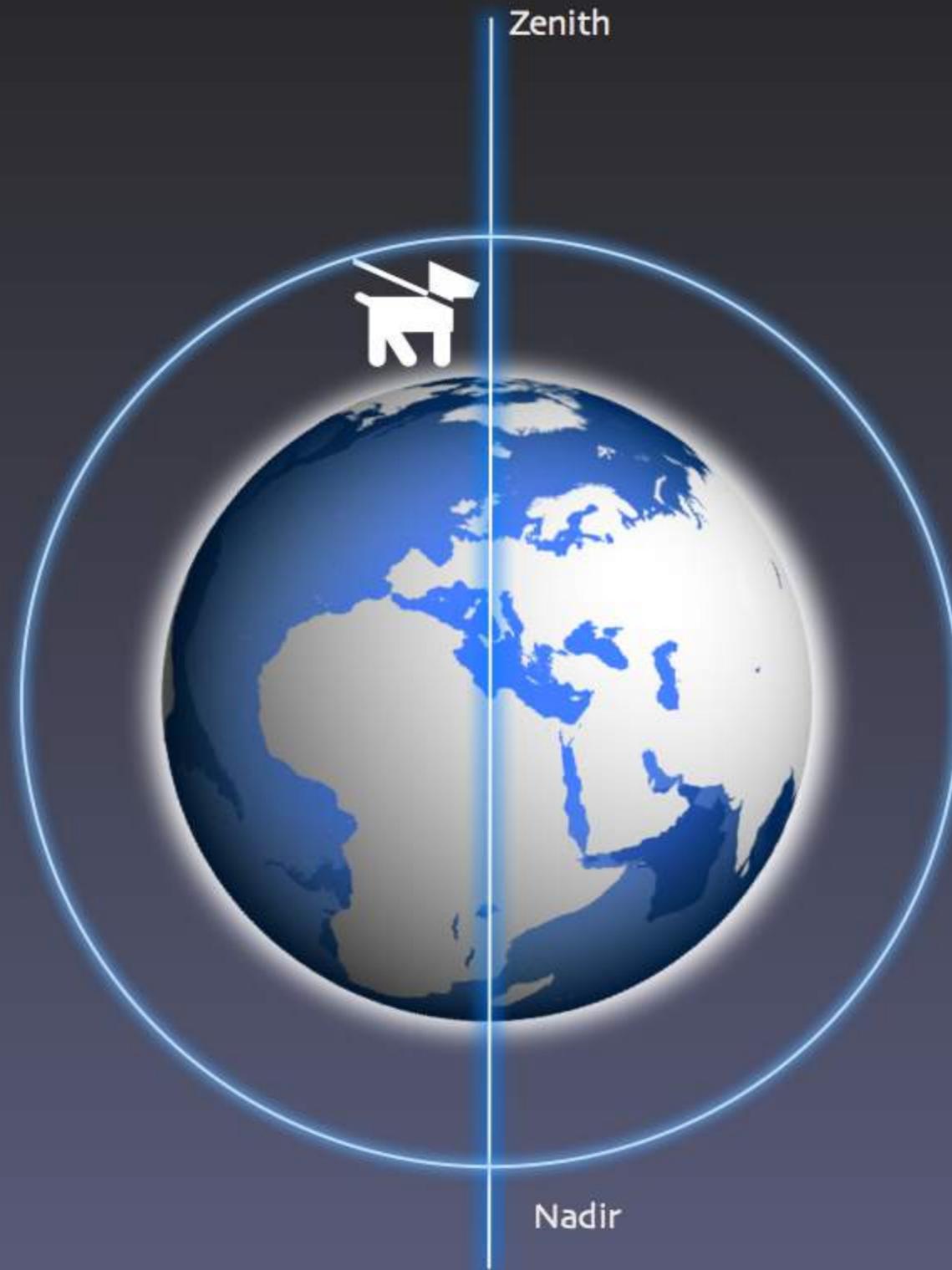


- **Waxing**

The changing illumination of the Moon (or other body) over time. The Moon waxes, growing more illuminated, between its new and full phases, and wanes, becoming less illuminated, between its full and new phases.

- **Waning**

The changing illumination of the Moon (or other body) over time. The Moon waxes, growing more illuminated, between its new and full phases, and wanes, becoming less illuminated, between its full and new phases.



• Zenith

The point in the sky that's directly overhead.

Astronomical **Glossary** of **Terms**

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