

A tour of the universe



Astronomy — The oldest science



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Astronomy — The oldest science (cont.)



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- Arose from a need to develop agricultural calendars.
- Sun, Moon, and stars move in the night sky.
- “Wandering stars”



Mayan El Caracol observatory,
Chichen Itza (906 AD)

Movement of Sun



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- Sun moves in the sky.
- Rises in the east, sets in the west
- Length of a day — time from sun to start and end on the meridian (highest point)
- 24 hours
- Sun also moves throughout the year.
- Higher in the summer, lower in the winter.



Movement of Moon



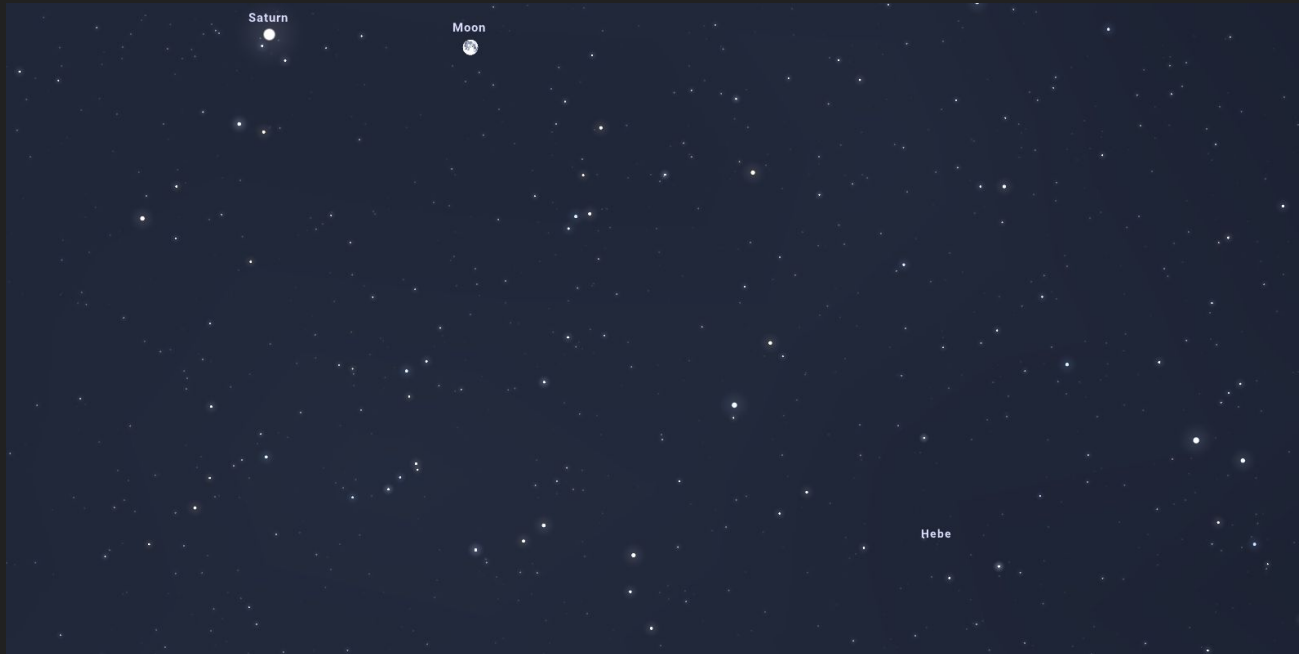
6 September 2025, 1:00 AM

Movement of Moon



7 September 2025, 1:00 AM

Movement of Moon



8 September 2025, 1:00 AM

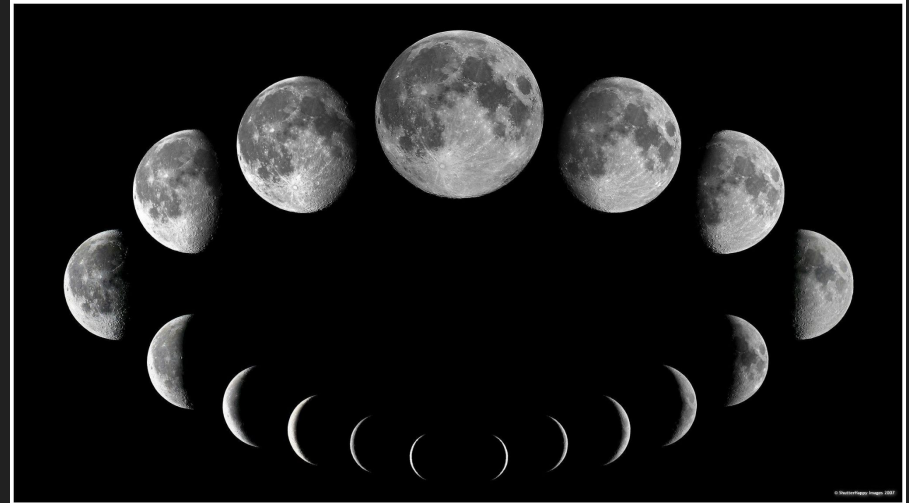
Lunar Cycle



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- Lunar cycle — 29.5 days.
- Month = Moon
- First calendars used the lunar cycle to measure the calendar year, “lunar calendar.”
- 1 lunar year = 354.37 days
- Many civilizations developed corrections to match lunar calendars with solar year.



Movement of stars



26 August 2025, 9:00 PM

Movement of stars



2 September 2025, 9:00 PM

Movement of stars



9 September 2025, 9:00 PM

Wandering stars

- Certain “stars” did not follow the same paths as background stars — called the “wandering stars.”
- Remarkably bright stars.
- 7 were known, including the Sun and the Moon.



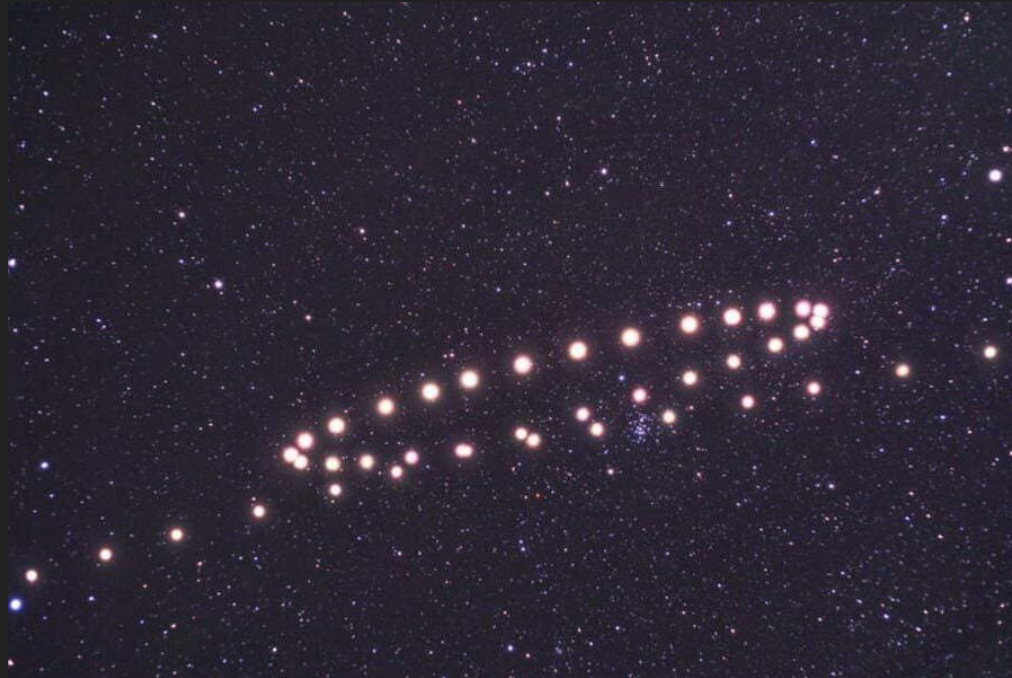
Mars is named after the Roman god of war, for its red color. Arabic mirrīkh comes from the word for fire.

Wandering stars



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Peculiar path of a wandering star
— “in retrograde”

Wandering stars

- These 7 wandering stars are the origin of the week.
- 4 weeks in one lunar cycle (roughly).



The “morning star” and
crescent moon

Wandering stars

Planet (English)	Planet (Italian)	Day of the week (English)	Day of the week (Italian)
Sun	Sole	Sunday	Domenica
Moon	Luna	Monday	Lunedì
Mars	Marte	Tuesday	Martedì
Mercury	Mercurio	Wednesday	Mercoledì
Jupiter	Giove	Thursday	Giovedì
Venus	Venere	Friday	Venerdì
Saturn	Saturno	Saturday	Sabato



Numbers in Astronomy

- Units that are appropriate for day-to-day life become large on astronomical scales.
- Use scientific notation to easily express large numbers.
 - e.g.) $5,000 \rightarrow 5 \times 10^3$
 - e.g.) $9,000,000,000 \rightarrow 9 \times 10^9$
- Invent new units to deal with astronomical phenomena.
 - e.g.) 86,400 seconds \rightarrow 1 day
 - e.g.) 5,280 feet \rightarrow 1 mile

The universe- Earth



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$6.378 \times 10^6 \text{ m}$



The universe- Earth-Moon system



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$3.85 \times 10^8 \text{ m}$

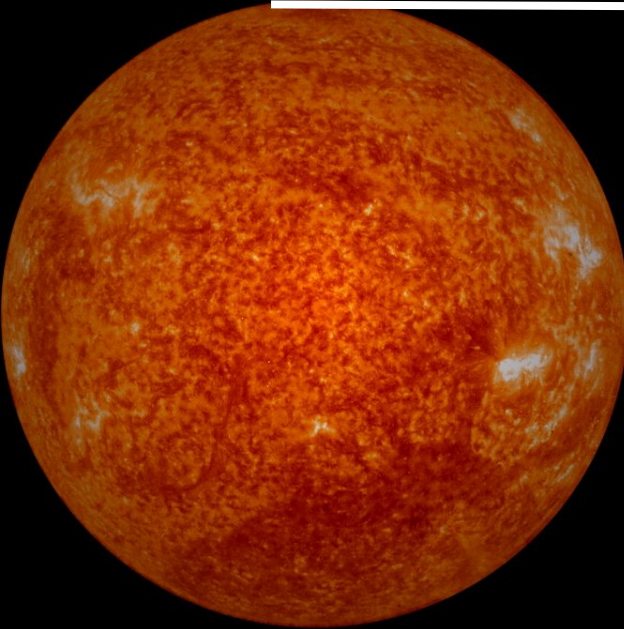


The universe- Solar system



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Mercury
Venus
Earth
Mars

$4.50 \times 10^{12} \text{ m}$
30.07 AU



Jupiter



Saturn



Uranus



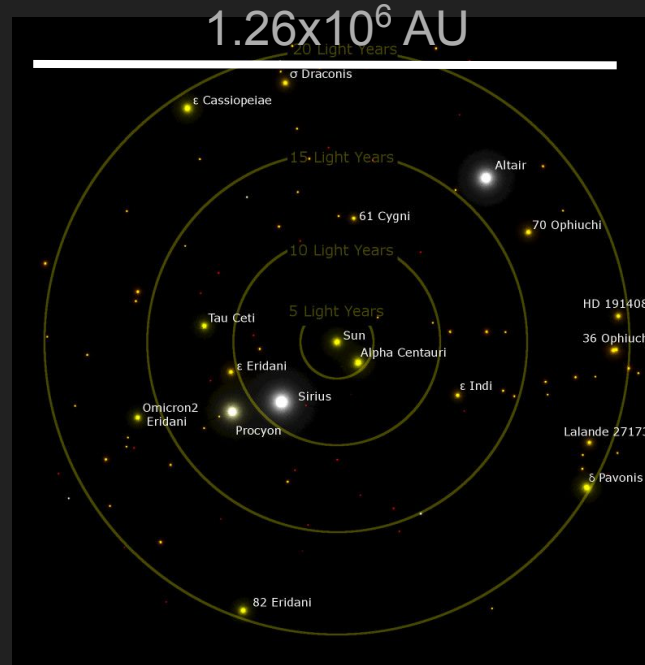
Neptune

The universe- The solar neighborhood



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The universe- Milky Way galaxy



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8.74×10^4 light years

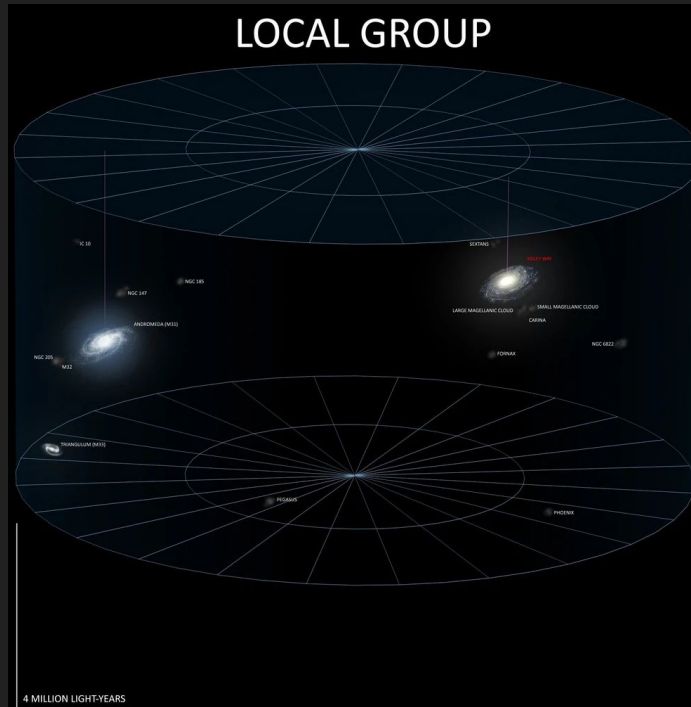
26.8 kiloparsecs

We are here —○



The universe- Local group

1,226 kiloparsecs



The universe- Virgo supercluster



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33 megaparsecs



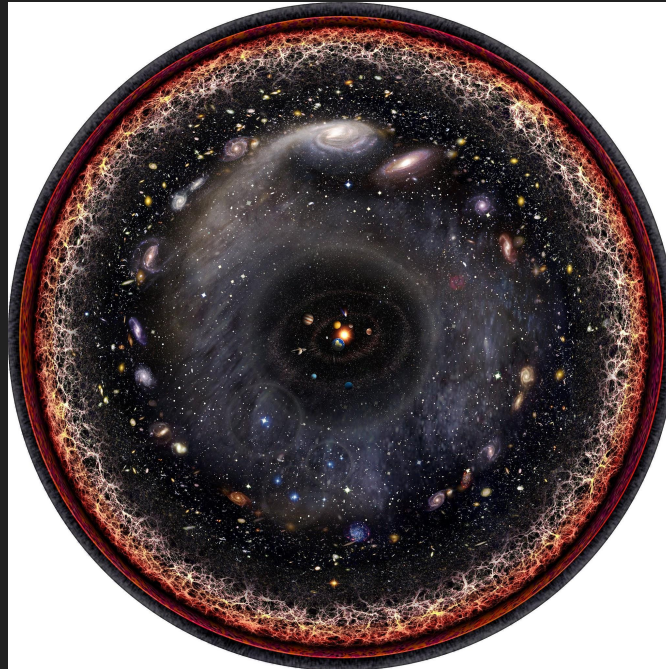
The universe- observable universe



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28.5 gigaparsecs



Poll Everywhere

Poll everywhere

Poll Everywhere



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The Moon, the Earth, the Sun, the Solar
Neighborhood, the Milky Way, the observable
universe

Announcements

- None

Next time

- The Nature of Science