

# ASTRONOMY UNITS

## MEASURING THE COSMOS

Astronomers use special units to measure the vast distances and enormous sizes in space. Here are some of the most important astronomical units.

### ASTRONOMICAL UNIT (AU)

The average distance from the Earth to the Sun.



1 AU = 149,597,870.7 km  
 ≈ 8.317 light-minutes

#### USED TO MEASURE

Distances within our solar system (planets, asteroids, comets).

### LIGHT-YEAR (ly)

The distance light travels in one year in a vacuum.



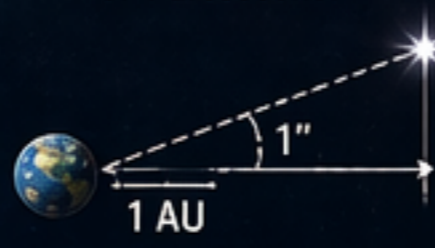
1 ly =  $9.4607 \times 10^{12}$  km  
 ≈ 63,241 AU

#### USED TO MEASURE

Distances to stars and galaxies.

### PARSEC (pc)

The distance at which 1 AU subtends an angle of 1 arcsecond.



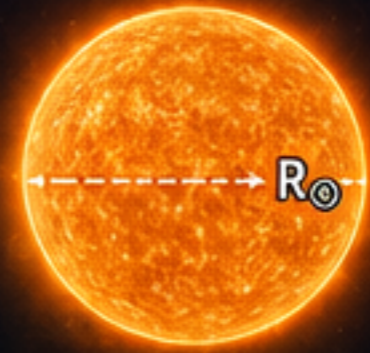
1 pc =  $3.0857 \times 10^{13}$  km  
 ≈ 3.262 ly

#### USED TO MEASURE

Stellar distances using parallax.

### SOLAR RADIUS (R<sub>☉</sub>)

The radius of the Sun.



1 R<sub>☉</sub> = 695,700 km  
 ≈ 0.00465 AU

#### USED TO MEASURE

Sizes of stars.

### SOLAR MASS (M<sub>☉</sub>)

The mass of the Sun.



1 M<sub>☉</sub> =  $1.9885 \times 10^{30}$  kg

#### USED TO MEASURE

Masses of stars, planets, and other objects.

## SCALE COMPARISONS

EARTH



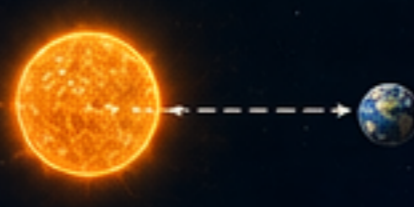
12,742 km (diameter)

SUN



1 R<sub>☉</sub>  
695,700 km

EARTH-SUN



1 AU  
149,597,870.7 km

NEAREST STAR (Proxima Centauri)



4.24 ly (1.30 pc)

CENTER OF MILKY WAY



26,000 ly (≈ 8,000 pc)

ANDROMEDA GALAXY



2.54 million ly (≈ 780,000 pc)

FROM SMALL TO COSMIC

km

Planets  
Moons

AU

Solar System (1-100 AU)

ly

Stars (1-1,000 ly)

pc

Star Clusters (1-10,000 pc)

kpc

Galaxies (1-1,000 kpc)

Mly

Universe (> 1 million ly)

### UNIT RELATIONSHIPS

- 1 ly =  $9.4607 \times 10^{12}$  km
- 1 pc =  $3.0857 \times 10^{13}$  km = 3.262 ly
- 1 AU =  $1.495978707 \times 10^8$  km
- 1 pc = 206,265 AU
- 1 ly = 63,241 AU
- 1 R<sub>☉</sub> = 0.00465 AU
- 1 M<sub>☉</sub> =  $1.9885 \times 10^{30}$  kg
- Mass of Earth =  $3.003 \times 10^{24}$  kg =  $3.003 \times 10^{-6}$  M<sub>☉</sub>

### HOW PARSEC WORKS

If you observe a star from Earth, then observe it again 6 months later from the opposite side of Earth's orbit, the star appears to shift slightly against background stars.

That tiny angle (parallax) tells us the distance.



### REAL-WORLD EXAMPLES

- Jupiter orbits the Sun at ≈ 5.2 AU
- The nearest star (Proxima Centauri) is ≈ 4.24 light-years away
- The Milky Way is about 100,000 light-years across
- Andromeda Galaxy is ≈ 2.54 million light-years from us

### VISUALIZING THE COSMIC SCALE



The universe is not only stranger than we imagine, it is stranger than we can imagine."  
 — J.B.S. Haldane

**unitconversion.tools**  
 MEASURE • CONVERT • UNDERSTAND

Keep Exploring.  
 Every number is a step further into the cosmos.

