

## 1.3: Scale of the Cosmos

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Perhaps you have heard the phrase that a large number is **astronomical**. Astronomical comes from the fact that the size of the Universe is so big, it is often hard to comprehend. Even distances between the planets and the Sun in our own Solar System are numbers we are not custom to using. To understand the scale of the Cosmos, we will start with several examples in our Solar System. First, the distance between the Earth and Moon is about 230,000 miles. The closest distance between Earth and Mars is about 32,000,000 miles. The distance between the Earth and Sun is about 93,000,000 miles. The distance between Mercury – the closest planet to the Sun – and the Sun is about 36,000,000 miles. The distance between Neptune – the farthest planet from the Sun – and the Sun is about 2,797,770,000 miles. It is often useful to make a scale model of large systems. Some cities, museums, and parks will create a scale Solar System, based on something like 1 foot equals 1 million miles.

To simplify *distance* in our Solar System, astronomers use the Astronomical Unit (1 AU), which equals 93,000,000 miles or the average distance from Earth to the Sun.

As for other numbers, these are the diameters of three Solar System bodies. First, our Earth's diameter is just less than 8,000 miles. Jupiter's diameter – the largest planet in our Solar System – is around 88,000 miles. And the Sun's diameter is about 850,000 miles.

The idea here is *not* to memorize size and distance; rather, it is to appreciate the grand scale of the Universe within which we live.

Going beyond our Solar System, the closest star is Proxima Centauri, part of the Alpha Centauri triple star system. It is about 24,340,000,000,000 miles (that is 24 trillion, 340 billion miles) away or about 270,000 times more distant than Earth to the Sun. And that is the closest star beyond our Sun. Because of these great distances, astronomers will use another measure: the distance light travels in one year, or the light year. This sounds like a time measure, but it is not.

Light travels 186,000 miles in one second, or  $2.99 \times 10^8$  meters per second. That is 5,869,713,600,000 miles in a year. So the Sun is about 8 light minutes from Earth and Proxima Centauri about 4.24 light years distant.

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