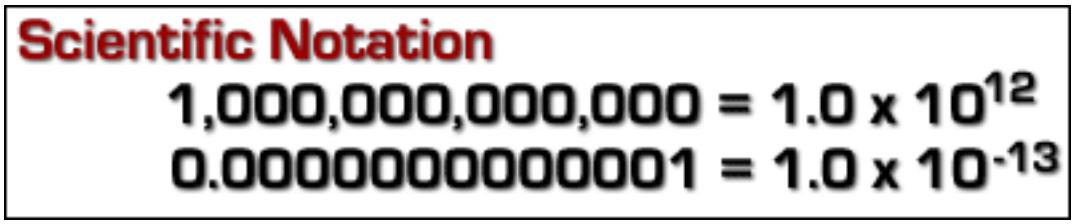
Astronomy for Kids - Big Numbers

What Do All Those Numbers Mean?

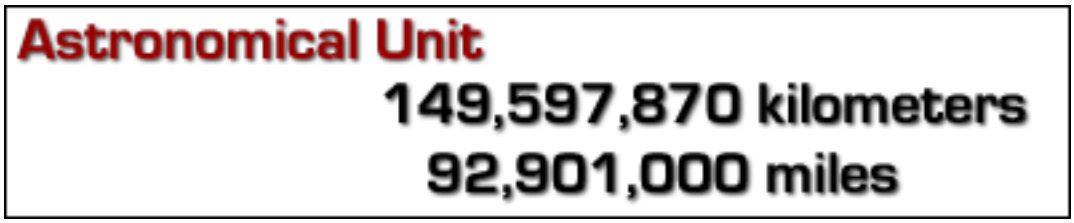
As you learn more and more about astronomy, and science in general, you will come across abbreviations and shorthand that don't seem to make any sense at all. Don't worry, they are just shorthand ways to express some of the really large and small numbers that scientists use every day. Just like everything else, they make sense after you understand them. We are going to take a few minutes and try to explain some of the ones you will come across. In just a little while, you will be able to make sense out of some of the apparently cryptic terms you will come across. It's not that hard.



Scientists are used to working with both very large and very small numbers, like the ones in the image above (the number on top is a trillion). When you have to write very lareg and small numbers all the time, it can get pretty boring to have to write all those zeroes, so scientists have a shorthand method called, appropriately enough, scientific notation. When you first see a number expressed this way, it doesn't make any sense at all. However, if you look at the two numbers we are using as an example, there is a pattern to this puzzle.

The key to this puzzle is the small number at the top right of the "10". This number is called an "exponent" and it tells you how to convert a number expressed in scientific notation to one that you are familiar with. If the exponent is positive, or doesn't have a sign at all, that tells you how many places to move the decimal point to the right. In our top example, if you move the decimal point in the number to the right of the equals sign twelve places over (the exponent is 12), you will get the number to the left of the equals sign.
The bottom number is an example of how to express a very small number. In this example, the exponent (-13) is negative. When the exponent is negative, that tells you how many places to move it to the left. In this example, if you move the decimal point in the number to the right of the equals sign thirteen places to the left, you will get the number to the left of the equals sign.
See, it really isn't that hard once you get the hang of it.

Astronomy for Kids - Big Numbers

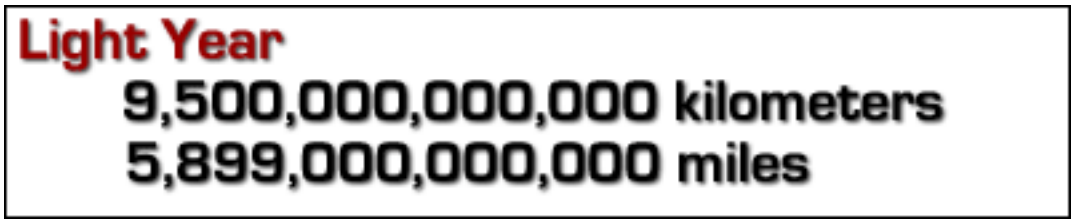


An astronomical unit is a number you will encounter very often as you read about astronomy. It is usually abbreviated "au" and it represents the average distance between the Earth and the Sun. The orbit that Earth follows around the Sun isn't a perfect circle, so the au is the average distance. The au comes in very handy to express an approximation of large distances. For example, it's a whole lot easier to say "10au" than it is to say, or write, 929,010,000 miles.
To give an example of this in our solar system, Saturn's average distance from the Sun 856 million miles. If you express this in astronomical units, it is about 9.5au, which not only tells you how far away Saturn is from the Sun, but it also tells you that the ringed planet is nine and one-half times further away from the Sun than Earth is. It's a very handy shorthand method to get used to.

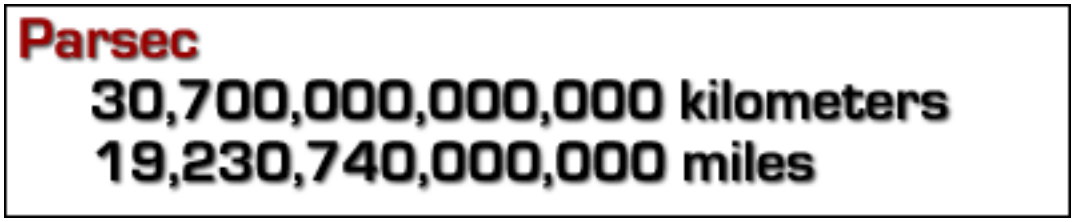
In what seems to be a ever-changing world and Universe, it is nice to find something that is constant. The sped of light is a constant. No matter where you are in the universe, you can always count on the fact that light travels at the very same speed. This is one thing that always remains the same no matter where you are.

Even though it is a constant, it is still an amazing fact. At the speed of light, even large distances become unimportant. For an example, Earth is almost 93 million miles away from the Sun, but light, traveling over 186 miles per second, reaches us in a little over eight minutes. It also makes some of the really large distances, expressed in light years, seem almost beyond understanding.

Astronomy for Kids - Big Numbers



A light year is not a year that has lost weight. Instead, it is the distance that light can travel in a year. At this point, the numbers are beyond our real understanding. Scientists tell us that the largest number we can really comprehend is about one hundred thousand. This is what the crowd is at a very large college football game. It's a number that our minds can understand pretty easily.
When we start talking about a light year, which is almost six trillion miles, our eyes kind of glaze over and the number becomes a concept instead of a real number. This should also give you something to think about when scientists announce that they have dicovered an object in the far reaches of the Universe that is over ten billion light years away. These kinds of distances are almost unimaginable.



A parsec is an abbreviation for "parallax second". Scientists use parsecs when even light years are too small to conveniently express distances. A parsec is 3.26 light years or well over nineteen trillion miles.
A full discussion of parallax is beyond this section, but it generally means how much the apparent position of something changes as you move around. Astronomers have used parallax to measure distances for far away objects for a very long time, and parsec is an abbreviation for one second of arc. Trust me.
If you would like a more thorough explanation of parsec and parallax, you can see Phil Plait's explanation