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How Far Little Star?

The stars above us all seem to be equally just out of arms length but they are really at vastly different distances. Since knowing the distances to stars is only the first step in measuring distances to far flung galaxies, it's important to get that step right. It's one thing to say that Altair, for example, is 17 light years away, but how do they know?

Distances to nearby stars are measured using a basic geometry tool, parallax. Hold your arm out straight with your thumb up. Close one eye and see what your thumb lines up with. Then shut that eye and open the other. Your thumb will appear to have moved. That is parallax.

Astronomers do the same with stars. When the Earth is on one side of the Sun, they measure the angle to the target star against the background of stars. Six months later, when Earth is on the opposite side of the Sun, they measure the angle again. The difference in angle is the parallax. Combining the change in angle with the 300 million km baseline gives the distance to the star.

A star with a parallax of 1 second (1") of arc (1/3600th of a degree) is said to be one parsec (**par**allax **sec**ond) away. This equals 3.26 light years. But if the star is further away, its parallax is smaller. The closest star, Alpha Centauri, has a parallax of only 0.76", or 1.3 parsec or 4.2 light years.

As you might imagine, this makes measurements extremely difficult. The most precise measurements for earth bound telescopes could not go beyond 0.01", or 100 parsecs. But the satellite Hipparcos has measured hundreds of thousands of stars' distances out to 1600 light years and in 2013, the satellite Gaia will extend that out to tens of thousands of light years. It's nice to know how big the neighbourhood is.