The notion of parallax can be intuitively explored by observing one's outstretched index finger, at arm's length, with first one eye and then the other. It will be seen that the finger seems to change position compared with background objects. Parallax is the effect of the changed point of view of the observer (which could be an artificial satellite) on the observation of an object. This notion has an essential role in astronomy, where parallax is the angle subtended by a given distance:

• the radius of the Earth, in the case of Solar System objects ('diurnal parallax');

• the semi-major axis of the Earth's orbit, i.e. one Astronomical Unit (AU), in the case of objects outside the Solar System ('annual parallax').

The nearer the object in question, the greater the apparent shift in position due to the displacement of the observer. The longest available baseline for the measurement of astronomical distances is the diameter of the Earth's orbit (2 AU), some 300 million kilometers. The distance at which the angular separation of the Earth and the Sun equals one second of arc is called a parsec, a unit of distance used in astronomy. One parsec equals 3.26 light years.

Before the launch of Hipparcos, parallaxes were known for about 8,000 stars only. Some years after the end of its mission, the high precision Hipparcos Catalog was published in 1997 containing parallaxes for almost 120,000 stars, to an accuracy of the order of one millisecond of arc; distances could be determined out to about 1,600 light years. The distances of 20,000 stars were determined to better than 10 percent and for 50,000 stars to better than 20 percent. A lower precision Tycho Catalog containing data for more than a million stars was published at the same time, while the enhanced Tycho 2 Catalog of over 2.5 million stars was published in 2000.

The European Space Agency's Gaia mission, due for launch in March 2013, will conduct a census of a thousand million stars in our Galaxy. This amounts to about 1 percent of the galactic stellar population. Monitoring each of its target stars about 70 times over a five-year period, Gaia will precisely chart their positions, distances, movements, and changes in brightness. Relying on the proven techniques of the Hipparcos mission, Gaia will repeatedly measure the

positions of all objects down to magnitude 20 (about 400,000 times fainter than can be seen with the naked eye). Onboard object detection will ensure that variable stars, supernovae, other transient celestial events and minor planets will all be detected and cataloged to this faint limit For all objects brighter than magnitude 15 (4,000 times fainter than the naked eye limit), Gaia will measure their positions to an accuracy of 24 microarcseconds. This is comparable to measuring the diameter of a human hair at a distance of 1,000 km. It will allow the nearest stars to have their distances measured to the extraordinary precision of 0.001 percent Even stars near the galactic centre, almost 30,000 light years away, will have their distances measured to within an accuracy of 20 percent.