



NEWS! From the NAVAL OBSERVATORY

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U.S. Naval Observatory Press Release

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FOR IMMEDIATE RELEASE

How far away are our stellar neighbors? USNO releases the URAT Parallax Catalog

In April 2016 the United States Naval Observatory (USNO) released a catalog of distances to over 112 thousand stars, the USNO Parallax Catalog (UPC), using ground-based observations performed with the USNO Robotic Astrometric Telescope (URAT). It is the largest such catalog since the release of the European Space Agency (ESA) Hipparcos mission Catalog in 1997.

The brightest stars in the night sky are not always the nearest in space because the intrinsic brightness of stars varies over a huge range. Some stars are only 1/1000 as bright as our Sun, others thousands of times brighter. Many of the bright stars we can see with the naked eye are far away, luminous, giant stars. So how do we know the distance to the stars?

If you hold a finger in front of your face and alternately watch it with one eye, then the other, your finger appears to be shifting in front of the more distant background. The exact same thing happens when observing a nearby star as the Earth moves around our Sun: a nearby star seems to move slightly with respect to most other stars in the same field of view which are further away. The small angle the star appears to move is called the parallactic angle, and after performing reductions of such observations astronomers end up with a trigonometric parallax, which is the most direct measurement of a star's distance based on geometry and the known size of Earth's orbit around the Sun, without the need of any other assumptions or physical models. A star with a parallax of one arcsecond would be located at a distance of one parsec (pc) or 3.26 light-years from the solar system.

All stars in our Milky Way galaxy are moving. Most stars circle around the galactic center in various orbits. As seen from our perspective on Earth we therefore see small "proper motions" of other stars. In the past general all-sky surveys were utilized to identify stars which appear to have relatively fast proper motions, thus suspected to be nearby. These stars were then targeted one-by-one to find parallactic motion in order to derive a distance. Such centuries-long work culminated with the 1995 release of the Yale General Catalogue of Trigonometric Parallaxes, listing the distances to almost 16 thousand stars.

The ESA Hipparcos Catalogue contains almost 120 thousand stars with very precise positions, proper motions and parallaxes measured by a dedicated satellite mission. It is complete over the entire sky, but it is limited to relatively bright stars and many entries do not reveal a significant parallax, just giving a "this star is too far away to be measured" result.

The new UPC is based on 3 years of observing at the Naval Observatory Flagstaff Station (NOFS) in Arizona using the wide-field URAT astrograph. It has a much fainter magnitude limit than Hipparcos, observing stars as faint as magnitude 17, and covers over 1/2 of the sky north of -13 degrees declination. No pre-selection of candidates based on proper motions were made. A total of over 200 million stars were observed, most of them too far away for a reliable parallax result. USNO astronomers Charlie Finch and Norbert Zacharias found trigonometric parallaxes for over 58 thousand previously known nearby stars and made the first trigonometric parallax measures of 53,500 newly discovered nearby stars with an average precision of about 4 milli-arcseconds. This angle corresponds to just over 1/1000 of an inch as seen from a mile away. The closest star discovery in UPC is about 25 light years away, which astronomers call "nearby" although this is still over 1.5 million times the distance between Earth and Sun.

The UPC is published by the Centre de Données Astronomiques (CDS) in Strasbourg, France and its mirror sites around the world as catalog I/333.

Even more stellar distance measures are expected soon from the PanSTARRS project which uses a much larger telescope than the USNO astrograph, and by about 2018 the first parallax results are expected from the European Gaia space mission.

See also:

<http://arxiv.org/abs/1603.05674> (Astronomical Journal paper in press, describing the data, reductions, and results for stars within 40 parsec)

<http://vizier.u-strasbg.fr/cgi-bin/VizieR?-source=I/333>