UNIVERSITY
LOWBROW
ASTRONOMERS

NEWSLETTER

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Finding the Distance to Stars

by Brian McGraw

Modern astronomy is making greater advances than ever before in its history. New discoveries are greatly advancing knowledge of the heavens as greater distances to astronomical objects become known, and the size of the universe becomes more apparent. There is some dispute among astronomers, however, as to the true size of the universe. Recent uncertainties in the famed Hubble constant have caused many astronomers to return to the basics in determining accurate distances to the nearer stars; distances on which the Hubble Constant is based. This article will decribe one such method of finding stellar distances known as trigonometric parallax.

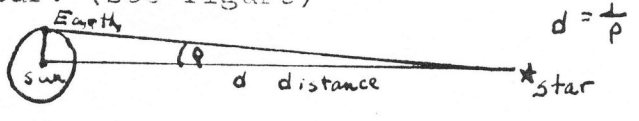
Trigonometric parallax is based on Earth's orbit around the sun. As the earth travels in its orbit, stars closest to the sun appear to move due to the changing perspective. More distant stars also appear to move, but their motion can hardly be detected. This apparant motion is called parallax. Astronomers can measure this motion in nearer stars and use trigonometry to determine their distance.

The first step is to take a series of photograghs of a star whose distance is desired. Photographs are taken six months apart when the Earth is at opposite ends in its orbit to give the greatest effect of parallax. These photos are taken over a period of years or more.

Next, astronomers choose four stars near the target to serve as reference stars from which to measure the target star's position. Astronomers then use a device called a measuring engine to magnify and measure the microscopic star images on the photographic plates. This process is repeated many times for each plate to eliminate as many stars as possible.

These measurements are then reduced, through a series of calculations, to a set of equations describing the position of the star with respect to a standard reference frame. Many factors must be entered into these calculations such as allowance for proper motion, discrepencies in the Earth's orbit, errors in observation, and errors in measurement.

Once these equations have been solved they can be applied to find the parallax of the star. The parallax is the angle in arc seconds between the Earth and the Sun at the star. Then simple trigonometry is applied to find the distance of the star. (see figure)



I have not gone into very much detail as to how these calculations are carried out because it would take much more space than is available here. Instead, I have tried to give a general idea of how trigometric parallax is used to find the distance to a star.

There is much dispute over values obtained for stellar distances these days mainly because of the errors involved in this type of claculation. Modern technology is bringing us closer to finding the actual distances to the stars, and we may soon know how big the universe really is.

WHAT'S UP

A Calendar of Astronomical & Space-related Events for Ann Arbor

10/16/81 - 11/13/81

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OCTOBER

16 Notice Antares 1.9 degrees below brilliant Venus in the southwest after sunset.

17 Saturday. With the moon just after full, this is not a good weekend for nonplanetary observing.

18 Mercury moves into morning sky, but too close to sun until about the 25th.

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20 Mars and Regulus only 1.6 degrees apart. A pretty conjunction, rising about 3:15 a.m. and visible the next few nights.
Moon at last quarter.
Orionid meteors, normally the third best shower of the year, peak at the wrong time of day and are washed out by the moon, as well. Best time to watch: from 2 a.m. 'til morning twilight.

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23 Friday. Moonrise 4:30 a.m. E.D.T. tomorrow morning.
Astrofest with Jim Loudon, "Saturn: The Discoveries of Voyager 2", with films, slides, audiotapes.

24 Saturday. Moonrise 5:30 a.m. E.D.T. tomorrow morning.

25 Last Sunday in October. Change clocks back 1 hour, from Daylight-Savings Time to Standard Time.

26 During twilight this <u>morning</u>, Saturn, Mercury, and the sliver of the crescent moon cluster in the southeast. Binoculars might show you Jupiter, too, below the others and somewhat lost in the glare of the "approaching" sun.

27 Moon new.
Meeting of the Ann Arbor Space Advocates. More info: Perry Clark, 482-7929.

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30 Friday. Moon sets about 7:30 p.m. E.S.T.

31 Saturday. Moon sets about 8:15 p.m. E.S.T.

NOVEMBER

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3 Mercury is at a fairly good greatest western elongation, and visible in the predawn sky.

4 Tentative launch date for STS-2, and the second flight of space shuttle orbiter Columbia.

5 Moon at first quarter.

6 Friday. Moon sets about 1:45 a.m. tomorrow morning.
Mercury passes 1.2 degrees north of Jupiter in predawn sky.

7 Saturday. Moon sets about 3:00 tomorrow morning.

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NOVEMBER

11 Moon full.
Venus at greatest elongation east, 47 degrees from the sun. However, it is not that far from the horizon at the best time to view it (around the end of twilight). Other elongations have been better, for example the last evening elongation, in 1980.

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13 Friday. November meeting of the University Lowbrow Astronomers, 7:30 p.m., room to be announced.

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WANTED: Someone to make up a crossword puzzle along astronomical lines for the November newsletter. See/Call Brian McGraw (662-1917) or Jim Cypser (995-0204) if you'd like to help.