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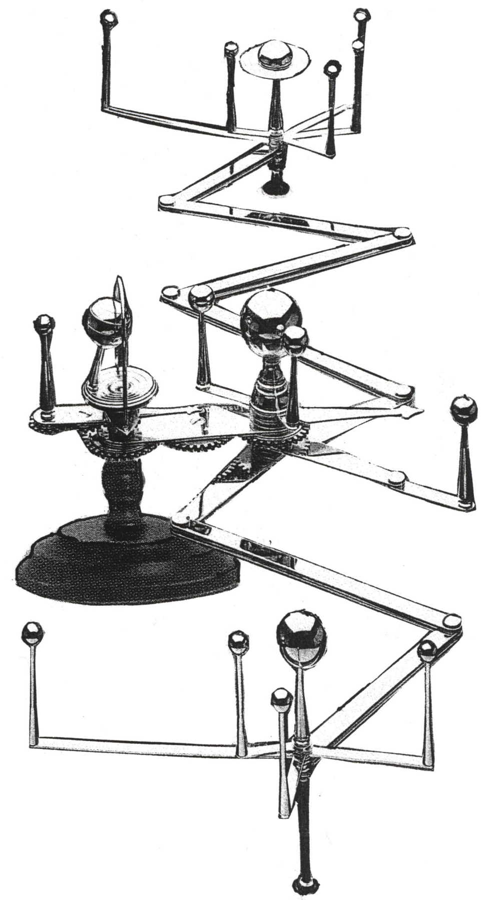
SPRING 2006



RENEWED ITEMS

The following items have been unavailable for some time and are now available again.

Vital Questions by Philip Stott. (Second edition) Tackles just how flimsy the evidence is for such well-established ideas as the Big Bang, Relativity, and evolution. 155 pages. $19

Where in the Universe Are We? by Philip Stott. DVD video. This is the same video we sold in VHS format some years back, but now reissued in DVD format. $25

Problems in Astronomy by Philip Stott. VHS video $15

Foreign orders, please read pricing policies
on the back cover of this issue.

Subscriptions to the *Biblical Astronomer* are $15 per year ($25 outside the USA). Membership is $20 per year, ($30 outside the USA) and members are allowed a 15% discount on all materials published by the Biblical Astronomer. Offerings to make possible additional publishing and research projects are gratefully accepted. Foreign orders please send either cash or cheques drawn on a United States bank. Credit cards are acceptable only on the Internet through PayPal's secure payment service. The product list, including items not listed in this issue, is at http://www.geocentricity.com/geoshop/index.html.

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Front Cover: Prof. James Hanson has modified this picture of an 18th century orrery to depict a geocentric orrery. The earth is at left center, and the sun to the right of it. The moon is at extreme left. Mercury is in front of the sun, Venus between the sun and the earth, Mars is at extreme right, Jupiter is in the foreground, and Saturn is in the background. Four of Jupiter's satellites are shown, as are five of Saturn's.

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READERS' FORUM

$E = m c^2$ Before Einstein

The *Biblical Astronomer* (and other sources, e.g., Alfred O'Rahilly, etc.) have stated that the famous $E=mc^2$ equation antedates Einstein. The formula is reportedly found in papers by Maxwell and Heaviside. Of course, mentioning this inconvenient fact draws down the wrath of the pro-Einstein crowd, who dispute its truthfulness and/or relevance. Interestingly, another precursor to Einstein is mentioned in passing in a most interesting place.

The Fourth Edition of Halliday & Resnick's well-known undergraduate physics textbook, *Fundamentals of Physics*, reports that J. J. Thomson preceded Einstein. Exercise 54E on page 735 reads as follows: "A decade before Einstein published his theory of relativity, J. J. Thomson proposed that the electron might be made up of small parts and that its mass is due to the electrical interaction of the parts. Furthermore, he suggested that the energy equals mc^2."

Einsteiniacs belittle all predecessors to their secular saint (e.g., those who discovered $E=mc^2$ prior to Einstein, or those like Poincare who anticipated relativity theory ahead of Einstein). How, then, did this "heretical" concession creep into a mainstream physics textbook? And how long will it take before it is purged? Only time will tell. World-famous atheist philosopher Antony Flew recently recanted his atheism on scientific grounds, appealing to the Socratic edict to "follow the evidence, wherever it leads." Let's hope such bursts of illumination don't remain as rare as they evidently have been.

Martin G. Selbrede

Hebrews 9:23, Pattern for the Universe?

Concerning Fibonacci numbers, this verse may also show proof of geocentricity. Your article and Willson's article both had the word "pattern." The word "pattern" is used in Hebrews 9:23 saying, "It was therefore necessary that the patterns of things in the heavens should be purified with these; but the heavenly things themselves with better sacrifices than these."

Just a thought: "things" are the planets. The pattern of the planets in heaven indicates a stationary earth. This is proof of geocentricity. "Sacrifices" refers back to Daniel 8:10-13 where the "daily sacrifice" was the firmament revolving around a stationary earth which was cast away. The truth was cast away. This pattern of the stationary earth with all the planets then restores the "daily sacrifice," the revolving firmament. The truth is always "better!"

Yours truly,
Gordon

Reply

My understanding of Hebrews 9:23 is that the tabernacle was a pattern of things in the third heaven, at the throne of God, pertaining to our redemption and remission of sins. The earthly type, that is the tabernacle and later the temple, had to be purified and the sacrifices were a type of that purification which was performed by Jesus' sacrifice on the cross and now his ministry in the heavenly tabernacle of v. 24.

Being in the third heaven, it is not a partaker of the rotation of the universe daily about the earth. And if so, the daily sacrifice cannot be a type of the rotation of the universe, neither place of sacrifice being subject to the daily rotation.

Thus Daniel 8:10-13 cannot possibly refer to either the rotation of the earth or cosmos. The host against the daily sacrifice was an entourage of false priests who followed Antiochus. Today the host against the daily sacrifice is the wafer of the catholic mass, which is called the host. Note that Matthew 24:15 looks to a further fulfillment, later than that of Antiochus, and later than the defilement of A.D. 70 when the temple was no longer holy unto the Lord, the sacrifice having passed to the heavenly tabernacle of Hebrews 9 with the ascension of Jesus some 37 years earlier. (His ministry started on the Day of Atonement, with his baptism by John in A.D. 30.) The Jews used to consult the urim and the thummim after each Day of Atonement sacrifice to see if the sacrifice had been acceptable unto God. From A.D. 30 through the destruction of the temple, for forty years, the response was: "No!" So, even though a vulgar sacrifice was made to desecrate the temple in A.D. 70, it could not have been defiled in the sense Jesus meant and we look for a future fulfillment. As for the truth referred to in Daniel, I think it is the word of God: "Thy word is truth," (John 17:17) and "I am the way, the truth and the life" (John 14:6).

Since 10 and 12 are key numbers in the tabernacle but are not in the Fibonnacci sequence (1, 2, 3, 5, 8, 13,...), I don't see how the pattern of Moses' tabernacle, referred to in Hebrews 9:23, can refer to the pattern of the planets. Especially not given that it is a model of something in the third heaven while the planets reside in the second.

Sincerely,
Gerard Bouw

THE DISTANCE SCALE OF THE UNIVERSE

How Distances to Stars are measured

Gerardus D. Bouw

Introduction

Among geocentrists there is no universal agreement on the size of the universe. Geocentrists fall into two broad categories: those who believe in a large universe, billions of light years in diameter, and those who believe in a small universe less than or about 12,000 light years in diameter. Large universe advocates believe that the modern distance scale, now said to be 12 billion light years in radius, may be in error by a factor of two or more, thus the distance scale may range from 5 to 20 billion light years in radius. Indeed, some phenomena, such as galaxy cluster rotation, appear to have an age between 30 to 100 billion years. How these figures are arrived at is the subject of this paper.

The distance scale of the Solar System

When we use the term "Solar System," we use it in much the same way as heliocentrists, meaning that the planets orbit the sun, but with one notable exception: that the earth is not a planet and thus not counted as a planet. We assume that the daily rotation of the firmament introduces vibrations or vortices to account for all motions.

The distances to the planets, comets, and asteroids are measured in astronomical units, AU. One AU is equal to 92,955,640 miles (149,597,893 ± 5 kilometers). The universe carries the sun around the earth in an elliptical path, so the astronomical unit is defined as half of the closest distance the sun comes to earth plus the furthest the sun goes from the earth. This distance is usually referred to as the semi-major axis (SMA), half of the widest part of the ellipse. The earth-sun's SMA is 1.0 by definition. For comparison, the SMA for Mercury is 0.387099 AU. Multiply that number by the above value of your choice for the astronomical unit to get the result in miles or kilometers. The length of Pluto's semi-major axis is 39.44.

In the past, the distances to the planets had to be measured using the parallax of the sun and then applying Newton's and Kepler's laws. The parallax of the sun was difficult to determine accurately since the only base-line we had was the diameter of the sun. In the 1960s, however, astronomers could bounce radar signals off the planets. The signal would travel to the planet and some of the signal would echo back to earth. The time between sending the beam and receiving the echo could be measured. Half that time, multiplied by the speed of light would give the distance to the planet. In the case of the moon we can use the more accurate method of laser ranging, bouncing laser signals from the reflectors astronauts left on the moon. As a result, the distance to the moon can be measured to within two inches (four centimeters). These days, having sent spacecraft to other planets, particularly those placed in orbit about said planet, we can measure a planet's distance by sending a command to the spacecraft and awaiting its response to reach earth. This is as accurate as radar ranging. These techniques enable us to determine the mean distance of the sun from the earth to one part in thirty million.

Parallax

Point your finger upwards and place it a half yard before your eyes. Close your right eye and note the position of your finger against the background of the room. Now close the left eye and open the right. Note that your finger appears to have shifted to the left against the background. This effect is called *parallax*. From simple trigonometry, if you know the distance between your eyes and could measure the angles from the left eye to your finger and from the right eye to your finger, you can compute the distance from the bridge of your nose to your finger.

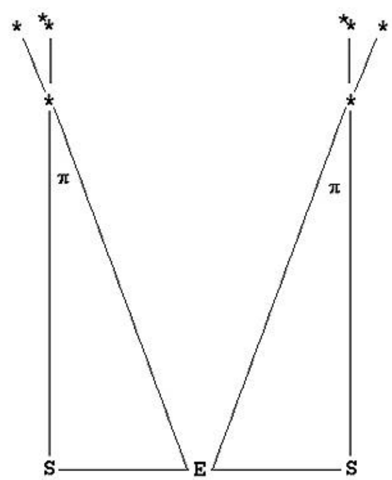


Fig. 1: Geocentric parallax

Now let us adapt the above illustration to the heliocentric parallax explanation. Hold up your finger as before, and close the right eye. Move your head right to left and back again in a smooth motion. Note that your finger seems to move left to right and back again against the background. This is what nearby stars appear to do against background stars.

Now for the geocentric explanation. Again, close your right eye, but instead of moving your head right to left, move your finger left to right and back again. With a little practice, you can trace your finger over the exact path that it followed when you moved your head. The former describes the heliocentric movement while the latter describes the geocentric movement. In both models, the stars and sun move together. That is, the stars follow the sun even as the planets follow the sun. It is technically more correct to say that the sun follows the universe in its yearly vibration, which just "happens" to be centered on the earth.

To further develop the geocentric case, consider the left triangle of Figure 1 on the previous page. Here **S** represents the sun, **E** the earth, and p the parallax angle. The star at the top of the triangle is the star whose distance is being measured, the foreground star. The double star directly above and in line with it is the background star used as a reference star, more distant from the sun and earth. The star at the end of the line running from the earth through the foreground star is the location where the foreground star appears compared to the background pair. Let us assume that the left triangle represents the position of the sun and stars in January. As seen from earth, the foreground star seems to be to the left of the background double star. Six months later, in June, the situation is described by the triangle on the right. This time the foreground star appears to the right of the background double star.

It is important to realize that this is not a rotation. The right triangle is not the left triangle flipped over, that is, as seen twelve hours later. If it were, the upper star of the double would also appear to the right of its lower companion. It appears to the left in June because the stars accompanied the sun in its yearly motion the right. Six months later, the situation is back to the January figure at left.

An illustration of the annual motion is in order. Take a pencil and align it along one of the "horizontal" lines of text on this page. While keeping the pencil horizontal, move it so that the point and the eraser end both trace out a circle about two inches in diameter. Any text on the pencil stays parallel to the lines of text. This is very different from trying to rotate the point of your pencil about the same two-inch circle.

In 1838, Friedrich Wilhelm Bessel (1784-1846) was working at the Königsberg Observatory, Prussia. In that year he measured the first parallax for a star. The star was 61 Cygni, an average naked-eye star in the constellation Cygnus the swan. Bessel measured a parallax value of 0".310 ± 0".02. For comparison, the modern value is 0".292 ± 0".004. (The symbol " means second of arc. One second of arc is 1/3600th of a degree. It is a small angle, sixty times smaller than can be seen by the naked eye.) Since stellar parallaxes are published in seconds of arc, astronomers find it convenient to measure distances in units corresponding to a second of arc instead of light years. Thus the distance to a star that would have a parallax of 1" is 3.261 light years (l.y.). That distance is called a *parsec*, or pc, standing for a parallax second (of arc). It is the distance at which one astronomical unit subtends one second of arc. Thus the distance to 61 Cygni, in parsecs, is 1/0".292 = 3.42 parsecs or 11.2 light years. Until the General Theory of Relativity came about, stellar parallax was the crowning "proof" put forth for the heliocentric, Copernican model.

Parallaxes work up to about 30 parsecs, roughly 100 light years. Beyond that, the uncertainty in their measurement renders them useless. Some modern techniques claim to be twice as accurate and thus good to 200 light years, but the claim has yet to be independently verified.

The parallax method has the advantage that we need not know anything about the physics of the stars themselves. If, for instance, we know the intrinsic luminosity of stars (how much energy a star puts out per second), we can determine its distance by measuring how much energy we receive. This we can do because the energy we receive decreases as the inverse square of the distance ($1/D^2$). However, stars do not all have the same intrinsic luminosity. By its independence from luminosity, parallax avoids the problem of having to know a star's intrinsic luminosity.

Convergent point method

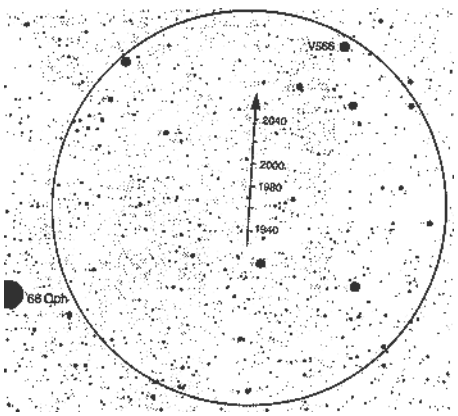


Fig. 2: The proper motion (motion of a star against background stars) of Barnard's Star from about 1930 to 2050. The arrow starts at the star's position in 1916 and ends where it will be about 2060. The circle is one degree in diameter, twice the apparent diameter of the full moon. Some geocentrists, ignorant of astronomy, claim that proper motions are too small to be measured. This, the fifth closest star to earth, was detected in 1916 and has since moved about half of an apparent lunar diameter, about the width of a quarter moon.

The convergent point method for determining stellar distances also avoids the luminosity problem. The method does not work for individual stars, but it can be useful for clusters of stars. It is used in the range between 30 and 200 pc (up to 650 l.y.)

We can see stars moving in the sky against the backdrop of more distant stars. That is called *proper motion* (Fig. 2).

The proper motion is indicative of a motion perpendicular to the line of sight. The speed and direction combine to a quantity called the transverse velocity.

Proper motion should not be confused with parallax. With parallax motion, the star traces out an elliptical path against the background stars. If an observer on the star could see the sun and the earth, he should see the earth "orbiting" the sun. The shape and size of the orbit he would see is the same as the parallax of the star as seen from earth. The observer on the star should see the earth orbiting the sun because the entire cosmos, including the observer and his star, accompanies the sun in its yearly cycle about the earth.

If we know how far away the star is, then from its proper motion we can compute the speed that it is moving across the line of sight. That is called the transverse velocity and is denoted by v_t in figure 3. The star's light shows us how fast the star is moving away from us or towards us (v_r in figure 3). That we know from the Doppler effect, which we experience as a drop in pitch of the sound of a horn that passes by. It turns out that transverse velocity also introduces a Doppler effect called the *transverse Doppler effect*, but it is far too small to be useful for stellar use. The transverse Doppler effect is of the order v^2/c^2, whereas the standard Doppler effect depends on v/c.

Consider Figure 3. The sun is represented by the traditional symbol for the sun, ⊙, d is the distance to the star, which is moving to the upper right along the thick arrow. The transverse motion is labeled with v_t, and the radial velocity by v_r. From earth, in the course of time, we see the star move through an angle q, from which we can derive the angular velocity, w, which is called the proper motion of the star. The two things we can measure are the proper motion and the radial velocity. These are not sufficient to give us either the transverse velocity or the distance. We need to know one to solve for the other. In essence, we need to know the distance in order to find the distance, so the diagram alone is not too useful.

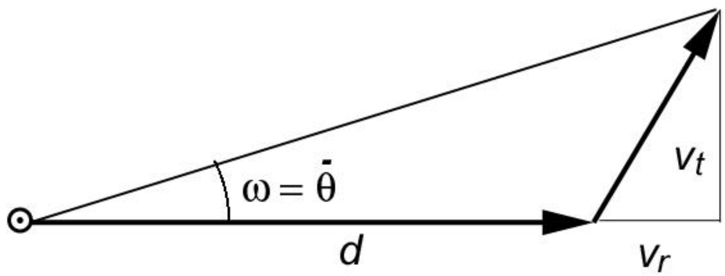


Fig. 3: The motion of a star through space as seen from earth. ω represents the proper motion of the star.

If, however, we observe a cluster of stars, the picture changes. In a cluster of stars, all the stars are moving in the same general direction, parallel to one another. Their motions converge to a point, just as do railroad tracks. This tells us their direction and enables us to find their distance as follows:

$$d = (v_t/v_r) \times (v_r/\omega) = \tan q \times (v_r/\omega).$$

For the Hyades, in Figure 4 below, the distance works out to 46 pc.

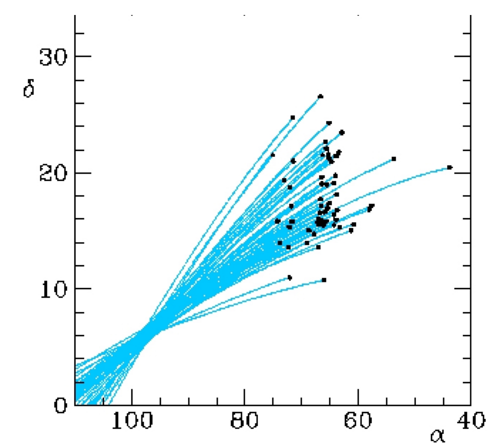
Though this method is not useful for determining the distance to individual stars, it is useful in solving the luminosity problem mentioned above. We can readily measure the apparent magnitudes of the stars in the cluster. Since we know their distance, we can convert the apparent magnitude to the absolute magnitude, the luminosity, for each star. The star's absolute magnitude is the magnitude a star would have as seen from earth at a distance of ten parsecs. This represents the total amount of energy, the luminosity that the star emits. This serves as a checkpoint for methods that depend on knowing a star's luminosity.

Luminosity and distance

Let us represent the absolute luminosity of a star by L_A ergs/sec. (For the sun, $L_\odot = 3.826 \times 10^{33}$ ergs per second, which is 5×10^{25} horsepower.) Then the power P observed by a receiver at a distance d from the star is related to L by

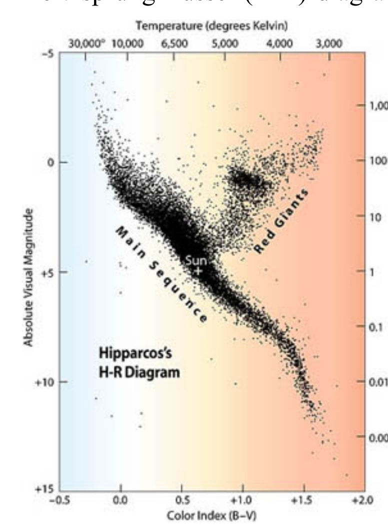
$$P = 1/(4\pi d^2)\, L \text{ ergs/sec.}$$

Fig. 4: The vertex or convergent point for all stars in the Hyades with a parallax greater than 0".010. Although the lines are extended beyond the meeting point, the cluster will just fade away in the distance at the meeting point which is at about 97 degrees in right ascension and 6 degrees north.



We can measure *P*, but we need to find *L* to get the distance, *d*.

All of the Hyades stars are about the same distance from us. The cluster's stars have a variety of spectral types (colors or surface temperatures). Comparing these stellar spectra all at the same distance, we find that the spectral types are associated with stars of different intrinsic luminosities. The spectra have been grouped into categories. Starting with the highest luminosity to lowest, these groups are O, B, A, F, G, K, M, R, N, S, which astronomers memorize with the sentence, "Oh, be a fine girl, kiss me right now, sweetheart." Types O and B are the bluest, the hottest, and S, the reddest, is the coolest. If stars are classified as normal, they fall along a band called the Main Sequence in the Hertzsprung-Russel (H-R) diagram. An H-R diagram plots the abso-



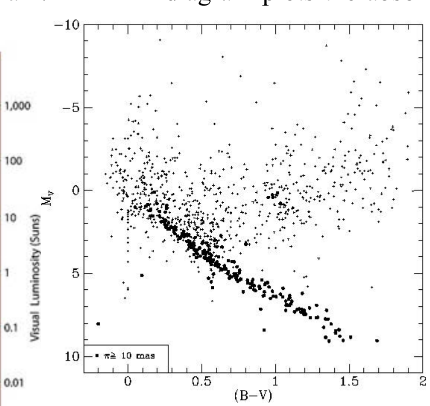


Fig. 5: At left shows the color-magnitude diagram determined by the Hipparcos satellite. **Fig. 6:** Above, the Hyades CM diagram.

lute magnitude vertically and the spectral class horizontally.

Today, colors of stars determined by photometric measurements have replaced the spectral classes, which were assigned by inspection. The colors generally used are blue and violet (B and V) and their difference (B-V) is plotted. When that is done, the H-R diagram is more properly called a color-magnitude diagram. Figure 5 shows the color-magnitude diagram determined from the stars observed by the Hipparcos satellite, and Figure 6 shows that of the Hyades, with the stars used in Figure 4 shown as large filled circles.

When the H-R or color-magnitude diagrams from many clusters are combined, they join along the main sequence to form a structure called the zero age main sequence (ZAMS) because astronomers as-

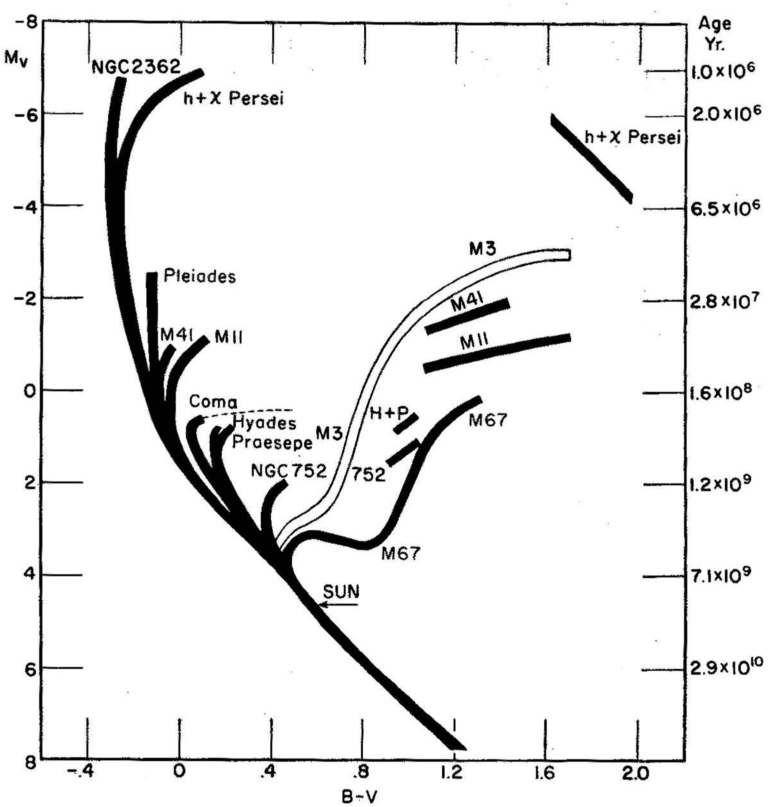


Figure 7: Zero-age fitting of H-R diagrams from various clusters of stars.

sume that all stars start along that line and move upwards and to the right of it as they age. By fitting a cluster's H-R diagram to the ZAMS we can come up with a reasonably close estimate of its distance.

Figure 7, on the previous page, is such a composite H-R diagram of several clusters. The Hyades in that figure does not match what is shown in Figure 6 because Figure 7 is older and presumably corrected of "aging" effects. (The field of stellar "evolution" has nothing much to do with evolution. Technically, it deals with the aging of individual stars.) The bands shown there are deceptively narrow but serve the purpose of showing the alignments. By finding a star's spectral class or color on the horizontal axis of the diagram, we can read off the absolute magnitude on the vertical axis; and so we can find its distance.

The luminosity method works up to 350,000 light years.

Cepheids and other variable stars

Based on the Hyades, the color-magnitude diagrams reveal some interesting things about stars. Of interest here are certain variable stars, stars that vary in brightness over time, that are found only in narrow regions of the color-magnitude diagram. This means that their luminosity can be ascertained with relatively little error. As mentioned earlier, that means their distances can be determined, provided we know the amount of light absorbed by the intervening interstellar medium. The most prominent of these are the Cepheid variables, which provide a "standard candle" out to about 4 Mpc. Cepheids are named after the first star so identified, Delta in the constellation of Cephus (Figure 10). The most famous of the Cepheid variables is Polaris, the North Star.

Fig. 8: Henrietta Leavitt

In 1907, astronomer Henrietta Leavitt (cf. Figure 8) of Harvard Observatory found a relationship between the period of Cepheid variables (the time from maximum brightness to the next maximum) and their luminosities. Plotting the luminosity as a function of the logarithm of the period measured in days, one finds a straight line. The longer the period, the brighter the star.

Indeed, there are two types of Cepheids, denoted in Figure 9 as Type I and Type II. Also on the figure is a third type of variable stars, RR-Lyrae variables, which can also serve as a standard candle; but they are fainter and so do not have the distance range of classical Cepheids. RR-Lyrae stars do serve as a check on the Cepheid distance measurements where these overlap.

Cepheids are close enough to us (Polaris is roughly 440 l.y. from us) to have their distances determined by one or more of the distance determinations presented earlier. Furthermore, stars of similar behavior can be observed in galaxies too distant for other methods to work. (To that end, the satellites of the Milky Way, called the Magellanic Clouds, provide their own color-magnitude diagrams.) If we assume that these stars are similar to the ones in the Milky Way, we can use them as distance determinants, too. Astronomers argue about the validity of that assumption, but there is no solid evidence that invalidates the assumption that these stars, too, are Cepheids.

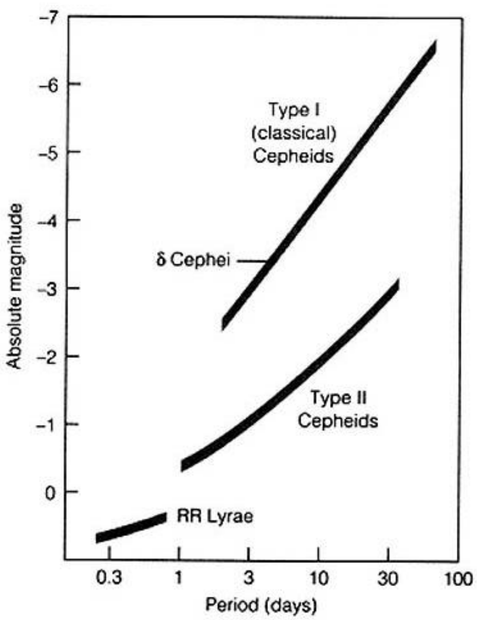


Fig. 9: The period-luminosity diagram for the pulsating variable stars, Types I & II Cepheids and the fainter RR Lyrae stars.

The Hubble constant

In 1929 Edwin Hubble published a paper entitled, "A Relation Between Distance and Radial Velocity Among the Extra-Galactic Nebulae." Figure 11 reproduces the plot of the galaxies he observed in 1929. Those galaxies were close enough that at least one of the above distance measurements was possible, Cepheids, in particular. The Figure shows the radial velocity, measured from the red shift of their spectra and the distance Hubble determined. Hubble fit a straight line through the data and the formula for his line is:

$$v = H_0 d.$$

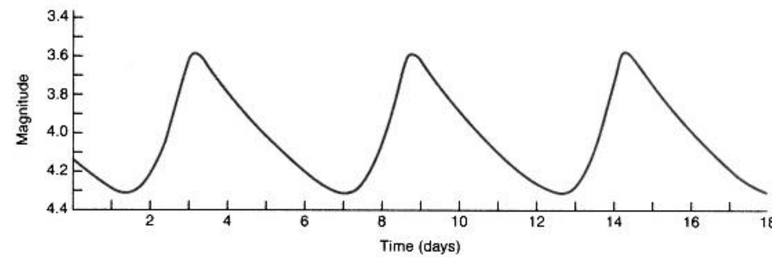


Fig. 10: Showing the change in Delta Cepheii's brightness over a period of 18 days. Magnitude 5 is about the limit that the naked eye can see. (The lower the value of M, the brighter the star).

This formula is known as Hubble's law. Here v is the red shift converted to the velocity of the galaxy away from the earth, d is the distance, and H_0 is the slope of the line, now called Hubble's constant. There is quite a bit of scatter in the diagram. In clusters of galaxies, the scatter among its members is roughly plus or minus 150 miles per second (250 km/sec). The greatest scatter in the distance estimate in the figure is 500,000 parsecs

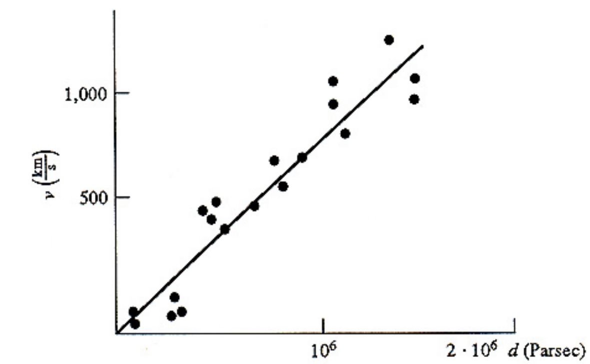


Fig. 11: Hubble's original 1929 plot of radial velocity versus distance for nearby galaxies.

Today, it is no longer believed that Hubble's constant is constant. In the big bang model, the expansion rate of the universe decreases in time, which would show itself in the diagram as a curvature tending to bend the line to the horizontal axis. Also in the modern view, some volumes of the universe may expand faster than others, so that the best the Figure can say is that near us, this is the expansion rate observed right now. Still, the measurement of H_0 is one of the most important, not to say hotly contested, experiment in cosmology today.

To refine the values, astronomers introduced a fudge factor h. Currently, h ranges somewhere between 0.4 and 1, which means that it is known up to a factor of 2. H_0 is derived from h as follows:

$$H_0 = h \times 100 \text{ km s}^{-1} \text{ Mpc}^{-1}$$

The Mpc stands for megaparsec, which is 3.086×10^{19} km. The rightmost factor is read as "one hundred kilometers per second per megaparsec." The idea is that the inverse of H_0 is the presumed age of the universe, assuming a constant or near constant expansion rate. That resulting "age" expressed with the fudge factor is:

$$1/H_0 = 9.780 \times 10^9 \text{ yr } h^{-1}.$$

Unfortunately for astronomy, the measurements of H_0 range from 30 to 125, giving h a range of 0.3 to 1.25, which gives an "age" between 7.824×10^9 and 32.60×10^9 years. If you look at Hubble's original diagram (Fig. 11), the reader will note that his slope gives a value for H_0 of about 700 km/sec/Mpc, which gives an "age" of 1.397×10^9 years, roughly 10% of the alleged age of the universe and a quarter of the alleged age of the earth. Part of the problem with Hubble's analysis, however, is that he did not include the blue-shifted galaxies. That makes it statistically irrelevant.

Summary

We have reviewed the basic steps that go into making up the modern cosmic distance scale. The steps start with the distance determinations of the solar system and spread out from there through nearby galaxies. These are by no means the only techniques used. Others build up the distance scale beyond the local galaxies: Type Ia Supernovae and brightest cluster galaxies are examples of those. The age of the universe seems inexorably linked to its size in modern thought, but that is not required. Except for zero age main sequence fitting, none of the above methods depend on the "ages" of stars. Below is a list of distance determinations that we have not considered in this paper. These determinations overlap as well as extend the methods described above.

Secular parallax	Largest H II region diameters
Statistical parallax	Surface brightness fluctuations
Kinematic distance	Type Ia Supernovae
Expansion parallax (e.g., SNR)	Tully-Fisher relation
Light echo distance	Faber-Jackson relation
Spectroscopic visual binaries	Brightest cluster galaxies
Spectroscopic eclipsing binaries	Gravitational lens time delay
Baade-Wesselink method	Sunyaev-Zeldovich effect
Expanding photosphere method	Interstellar extinction
Spectroscopic parallax	Mass-Luminosity function
Planetary nebulae luminosity function	Brightest stars

It is hoped that this paper will provide some food for thought to those who want to dismiss the distance scale as a hoax or treat it as irrelevant or trivial and lacking in evidence.

QUOTABLE QUOTES

Don't be concerned about your dying, go on living well.
—Catherine Booth, wife of the Salvation Army founder

The world wants to be deceived
—Sebastian Brant, 1494

Nothing could be more obvious than that the earth is stable and unmoving, and that we are the center of the universe. Modern Western science takes its beginning from the denial of this commonsense axiom. This denial, the birth and the prototype of science's sovereign paradoxes, would be our invitation to an infinite invisible world. Just as Knowledge was what led Adam and Eve to discover their nakedness and put on their clothing, so the guilty knowledge of this simple paradox—that the earth was not as central or immobile as it seemed—would lead man to discover the nakedness of his senses. Common sense, the foundation of everyday life, could no longer serve for the governance of the world. When "scientific" knowledge, the sophisticated product of complicated instruments and subtle calculations, proved unimpeachable truths, things were no longer what they seemed.
—Boorstin, *The Discoverers*, p. 294.

ERRATUM

In the Winter 2003 issue of the *Biblical Astronomer*[1] we presented a quote that read:

> But this implies that the earth was somehow a preferred object; only with respect to the earth would the speed of light be as predicted by Maxwell's equations. This was tantamount to assuming that the earth is the central body of the universe.

It was erroneously attributed to D. C. Gencel, from a text entitled *Physics: Principles with Applications*.

Several months ago, Robert Sungenis asked about the reference. He was unable to find anything like it under the name Gencel. A quick search of the Internet confirmed this and led to the correct name, D. C. *Giancoli*.

Normally, that would have been the end of it and this erratum would already be way too long, but Mr. Sungenis followed through on the correct reference and found a story behind it. He reported:

> Giancoli has had six editions of *Physics: Principles with Applications*. The first edition was in 1980, and it is that edition that has the quote in question. Subsequently, either Giancoli or the editors took out the quote, in later editions. I have the fourth and fifth editions (1995 and 1998) and the quote is missing.
>
> Thus, in the 1980 edition, Giancoli writes regarding Michelson and Morley:
>
>> But they found no significant fringe shift whatever! They set their apparatus at various orientations. They made observations day and night, so that they would be at various orientations with respect to the sun. They tried at different seasons of the year (the Earth at different locations due to its orbit around the Sun). Never did they observe a significant fringe shift.
>>
>> This "null" result was one of the great puzzles of physics at the end of the nineteenth century. One possibility was that...*v* would be zero and no fringe shift would be expected. But this implies that the earth is somehow a preferred object; only with respect to the earth would the speed of light be *c* as predicted by Maxwell's equations. This is tantamount to

[1] "On the Michelson-Morley Experiment," *B. A.* **13**(103):11.

> assuming that the earth is the central body of the universe."
> (*Physics: Principles with Applications*, pp. 621, 625).

Here are the fourth and fifth editions:

> But they found no significant fringe shift whatever! They set their apparatus at various orientations. They made observations day and night, so that they would be at various orientations with respect to the sun. They tried at different seasons of the year (the Earth at different locations due to its orbit around the Sun). Never did they observe a significant fringe shift.
>
> This "null" result was one of the great puzzles of physics at the end of the nineteenth century. To explain it was a difficult challenge. One possibility to explain the null result was to apply an idea put forth independently by G. F. Fitzgerald and H. A. Lorentz (in the 1890s) in which they proposed that any length (including the arm of an interferometer) contracts by a factor of $(1-v^2/c^2)^{-2}$ in the direction of motion through the ether.
>
> (*Physics: Principles with Applications*,
> p. 799 in fifth edition and fourth edition p. 749).

There was nothing wrong with the original text, just as there is nothing wrong with the subsequent texts. The only difference is that up through the 1970s, most scientists were quite open to new ideas and possible revival of old ones. In the late '70s, however, the increasing strength of the creationist movement roused the ire of prominent atheists, such as Sagan and Asimov, who turned science into a political (Marxist, Communist, Socialist) issue. The history of the quote reflects the increasing demand on authors in general and scientists in particular to conform to politically correct thought.

Modern Proverbs

You have the right to remain silent. Anything you say will be misquoted and then used against you; anything you didn't say will be counted against you.

The things that come to those who wait are usually the things left by those who got there first.

PANORAMA

Those Mysterious Eclipses of the Sun[1]

An eclipse of the sun was a frightening event to ancient peoples. Some would roll out the drums to scare the devil away from devouring the sun. Others would sacrifice animals, and even people, to keep the monster from devouring the sun.

Today, of course, we know that an eclipse of the sun is when the moon passes between the earth and the sun. Nevertheless, an eclipse of the sun is still a strange and mysterious event. As the land darkens, shadows produce increasingly eerie edges. At totality, birds stop singing and go to their nests, roosters crow as if it were dusk, and cattle start their nighttime activities. Inevitably, after a period lasting from seconds to about eight minutes, the sun reappears and the creatures of earth resume their normal routines.

But the animals of earth are not the only things subject to unusual behavior during the minutes of totality. In the lab, too, some things have been observed to behave differently during the time of totality. Here is a list of anomalous behaviors in the lab.

Allais and the pendulum: In the early 1950s, Maurice Allais observed irregular behavior in torsion pendulums during a total solar eclipse.

Allais finds another strange effect:[2] In 1957 Allais presented evidence that the plane of oscillation of a paraconical pendulum typically varies with time, the variations comprising two main oscillations, one of a period 24 hours and the other of period 24 hours 50 minutes, which is the period of the Moon's motion with respect to an observer on earth. Though this did not involve eclipse observations, the phenomenon detected relates, either directly or indirectly to the eclipses observations.

The Romanian observations of the 1961 eclipse: In 1961, G. T. Jeverdan, G. I. Rusu and V. Antonesco of Jassy University in Ro-

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[1] Based in part on "Pendulums, radioactive decay, and solar eclipses," *Science Frontiers*, no. 161, p. 2, Sept-Oct., 2005. Sourcebook Project, Box 107, Glen Arm, MD 21057. Annual subscription: $8.00.

[2] Allais, M., 1957. *Comptes Rendus*, **245**:1875.

mania presented observations confirming Allais' original result. They observed the total solar eclipse of 15 February 1961.[3]

If one knows the length of the pendulum, and can measure its period accurately, the gravitational force (acceleration) can be determined. When Jevadan's team did so, they found that it increased by 1.76 cm/sec^2 and then decreased back to normal during the hour centered on the eclipse. Whereas Allais' experiment showed a twisting in the plane of the pendulum, Allais apparently did not check on the period itself. Nevertheless, the twist that Allais observed is consistent with a change in the force of the earth's gravity.

Radioactive decay:[4] Polonium-210 and Cobalt-60 are short-lived isotopes with half-lives measured in seconds. Now Gary C. Vezzoli has reported an unexpected result of an experiment conducted in Kansas, located directly on the other side of the earth from a total solar eclipse. That eclipse was the one on 4 December, 2002.

Vezzoli reports measuring a dip in the radioactive decay of the two aforementioned radioactive elements at stations in Massachusetts (for Po-210) and Kansas (for Co-60).

The phenomenon is attributed to a partial blocking by the moon and the full diameter of the earth of the flow of solar particles impinging on the U.S. stations. The implication is that solar particles affect radioactive decay rates. *That has serious consequences for radioactive dating methods, which are alleged to be the strongest support for evolution.*

The Epicycles Myth

It is often claimed that the Copernican system had far fewer epicycles than did the Ptolemaic. Some claim that there are tens to a hundred fewer epicycles in the Copernican system than in the Ptolemaic. Anti-geocentrists use this claim to argue that Occam's razor should favor the Copernican heliocentric model. They are wrong on both counts.

Astrophysicist and history of astronomy expert Owen Gingerich of Harvard University has weighed in on the argument. He reports, "Copernicus has small epicyclets for each of the planets, except two for Mercury and for the earth and for the moon. There are additional motions, which in the earlier sense would call for additional circles, but he never depicts

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[3] Jeverdan, G.T., G. I. Rusu and V. Antonesco, 1961. "Experiments using the Foucault Pendulum during the solar eclipse of 15 February, 1961," Reprinted in Winter 1991, in the *Biblical Astronomer* **1**(55):18.

[4] Vezzoli, G. C., 2005. "Radioactive decay of Po-210 and Co-60…," *Infinite Energy*, no. 61:48.

them that way. Ptolemy has large epicycles for six planets, an extra for Mercury, and two for the moon. He has a special device called the equant for each of these, and that is replaced by Copernicus with the small epicyclet. But essentially Copernicus gets rid of the large epicycles by letting the single circle (the orbit of the earth) act as a replacement for each of the planets. Hence he has achieved a great simplification and unification."[5] According to Copernicus himself, in his *Commentariolus* published a year or so before his *Revolutionibus*, his model required a total of 34 circles. He exulted that so few were necessary to account for the complicated motions of the heavenly bodies. This exultation has been mistakenly assumed to result from how well his model simplified an intransigent Ptolemaic model.

Elsewhere, Dr. Gingerich wrote of this: "…the entire calculational procedure for the *Alfonsine Tables* [tables predicting the position of planets using the Ptolemaic model] depends on a clever approximation invented by Ptolemy to handle a single epicycle on an eccentric circle. …Copernicus must have realized that with his small epicyclets he actually had more circles than the Ptolemaic computational scheme used in the *Alfonsine Tables* or for the Stoeffler ephemeredes."[6] Thus not only is the epicycles claim greatly overblown, but also Occam's razor, in a computational sense, supports Ptolemy, not Copernicus.

Occam's razor is too easy to abuse. As mentioned above, when used against geocentricity in the Copernican affair, it is argued that Copernicus' model required fewer epicycles and is therefore superior, by Occam's razor. Certainly the phases of Venus demolished the crystalline spheres concept, but the Ptolemaic model is easily adjusted to accommodate that fly in the ointment, and that is essentially what Tycho Brahe did in his model, which has the orbits of the planets centered on the sun, and the sun moving on an epicycle centered on the earth. Copernicus, on the other hand, had the center of the solar system at the center of the earth's orbit, not the sun.

When Occam's razor is applied to the Copernican and Tychonic models, there is no significant difference. At the time, the evidence favored Tycho because his model predicted no parallax, whereas Copernicus's model did. Despite that, however, Copernicus won the day. How does that square with Occam's razor? It doesn't. Tycho's was the simplest explanation meeting all the observations at the time. It is as the Scripture says of Occam's razor in Proverbs 1:22:

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[5] Gingerich, Owen, 2006. Private e-mail communication.
[6] Gingerich, Owen, 2004. *The Book Nobody Read*, (NYC: Penguin Books), p. 58.

> How long, ye simple ones, will ye love simplicity? and the scorners delight in their scorning, and fools hate knowledge?

Constant Concern

Every two or three years, researchers resurrect the question, "Are the fundamental constants really constant?" Fundamental constants are items such as the speed of light, the gravitational constant, Planck's constant, Boltzman's constant, and the fine structure constant. So far, most of the research on the constancy of constants has come from cosmology, but a report published in the April 21, 2006 *Physical Review Letters* is based on supercooled hydrogen molecules. The constant investigated therein is the ratio, the mass of a proton to the mass of an electron. A research team from the Netherlands, Russia, and France report that the change in the mass ratio of the two particles may have changed by two thousandths of one percent in the past "twelve billion years." The evidence appeared in light-absorption patterns of hydrogen molecules.

In related research, a team of Russians and French researchers made very precise measurements of radiation emanating from two quasars 2 billion l.y. distant. They focused on wavelengths absorbed by clouds of hydrogen molecules in space. The measurements were compared to ones made in the laboratory of the Free University of Amsterdam. Because the wavelengths that hydrogen molecules absorb depend on the ratio of the proton to electron masses, the results suggest that the ratio, m, has changed. If the value of m has changed, and if the fine structure constant has changed, as reported in 2001, then this provides some support for the theory that the speed of light was considerably faster in the past. Although one part in 50,000 does not seem like a lot, especially when the speed of light's decrease was almost all in the creation week, the speed of light's decrease must obey the first law of thermodynamics, namely that energy must be conserved. Thus, since $E = mc^2$, a decrease in c means that m must increase. That the speed of light's rate of decrease is itself decreasing is what the European team may, (and I must emphasize *may*,) have found.

Dr. Henry Morris, RIP

On 25 February, Dr. Henry Morris, founder of the Institute for Creation Research and shining light of the Creationist movement, went home to be with his Lord and Saviour, Jesus Christ. Though never a geocentrist, public pressure did force him to take a stance. His choice was to disavow any connection between creationism and geocentricity. He was 87.

Earthquakes and Geocentricity[1]

James N. Hanson & Gerardus D. Bouw

A number of critics of geocentricity and others with genuine concern have raised the question of how sudden changes in the length of the day can come about. The heliocentric approach is that, given an event such as an earthquake, large snowfall, or something else which may redistribute the mass of the earth, the resulting change in the distribution of the earth's mass changes the angular velocity (speed of rotation) of the earth. Hence, the uplift of a mountain or the raising of a shovel full of earth should increase the length of the day. Their respective lowering would decrease the length of the day.

The underlying principle of physics, which is said to account for this, is called the conservation of angular momentum. Basically, the angular momentum, ***L***, can be stated as the cross-product of an object's moment of inertia, ***I***, and its angular velocity, *w* (its rotational speed in, say, degrees per second), i.e.:

$$\boldsymbol{L} = \boldsymbol{I} \times w.$$

For a coordinate system fixed on the center of mass of a body, the moment of inertia, ***I***, is a property which depends on the object's density distribution, $D(\boldsymbol{r})$, (where ***r*** is the distance from the center) and a characteristic area (r^2); i.e.,

$$\boldsymbol{I} = \int D(\boldsymbol{r})\, r^2 \, \mathrm{d}V$$

Conservation of angular momentum simply means that if the moment of inertia is changed (e.g. by a redistribution of matter), that then the angular velocity, *w*, must also change so as to keep the angular momentum, ***L***, constant. We see this principle in examples around us every day. A figure skater starts to twirl. As she pulls her arms and legs in closer to her body, she spins faster and faster. Upon moving them out again her angular velocity decreases and she is seen to rotate more slowly.

Now those who ask the question of how geocentricity deals with such an effect may have oversimplified the matter. I could turn the question around and ask the same of the heliocentrist. The usual first attempt at a heliocentric explanation would go as follows:

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[1] Reprinted from *The Bulletin of the Tychonian Society*, no. 42, pgs. 16-20, January 1987.

Let I_0 be the moment of inertia of the body (we shall use the earth as an example) without the "movable" mass such as a mountain or a shovel full of dirt. Our "movable" object has a mass, *m*, and is rigidly lifted (i.e., not thrown) up a distance, *h*. Furthermore, let ω_0 be the original angular velocity of the earth and ω is the new angular velocity after the mass has been hoisted above the earth. Let *R* be the radius of the earth; then the conservation of momentum would dictate that

$$(I_0 + m(h + R)^2)\ \omega = (I_0 + m(0 + R)^2)\ \omega_0$$

so that

$$\omega = \omega_0[(I_0 + mR^2)/(I_0 + m(h + R)^2)].$$

Now we must also consider the conservation of energy. That is, the energy levels of the two cases must be the same. Since the kinetic energy (energy of motion), *T*, is

$$T = \omega L/2 = 0.5\ \omega I \omega$$

or

$$T = (1/2)\ I\ \omega^2$$

then

$$0.5\ (I_0 + m(h + R)^2)\ \omega^2 = 0.5\ (I_0 + m(0 + R)^2)\ \omega^2$$

which means that

$$\omega^2 = \omega_0^2\ [(I_0 + mR^2)\ /\ (I_0 + m(h + R)^2)].$$

Dividing the energy conservation case by the momentum conservation case yields

$$\omega = \omega_0$$

which typically means that ω=ω_0=0 if the other changes are real (that is, the uplift of the mass, etc.).

One is tempted to say: "See, the earth does not rotate," but that is not necessarily what is indicated by this result. What is indicated is that the analysis in the heliocentric frame is not as simple as the questioner assumes when claiming that: "Changes in the earth's angular velocity in response to earthquakes, etc. are readily accounted for by the conservation of angular momentum" and thus, by implication, claiming that the heliocentric view leads to a simple solution (or to a solution at all) whereas the geocentric view does not. Evidently none of those who pose the problem to geocentrists has ever attempted a solution in either model, let alone both; so the challenge does not hold much weight.

Actually, the question stems from two factors. The first is an over-simplified view of geocentricity and the second is an inflated view of heliocentrism. The latter is evidenced because of the mistaken belief that heliocentrism is the only geometry (and that is all it is, geometry) capable of modeling "reality," whereas the former error, the over-simplified view of geocentricity, is reflected in the fact that the questioner assumes that Biblical geocentricity requires an absolutely immobile earth. We will deal with these in turn.

Of all the alternative geometries dealing with the earth at the center of a rotating universe, the best and most comprehensive is found in a paper by Barbour and Bertotti.[2] They assume that the universe can be characterized by a particular energy equation called a Lagrangian (a simplifying assumption widely used in mechanics) and that the Lagrangian is of the form

$$L = T - L(r,v)$$

where $L(r,v)$ is the potential energy term which is to be taken as the sum of the contributions by all the particles in the universe to the potential energy of a body. T is the kinetic energy, r is the distance between contributing body and our test body, and v is their relative velocity. Solving the Lagrangian yields the usual ("heliocentric") force law, including the so-called inertial terms. That is,

$$F = ma + \text{“inertial terms”}$$

where a is acceleration. More completely,

$$\boldsymbol{F} = m\boldsymbol{a} - mw \times (w \times \boldsymbol{r}) - 2mw \times \boldsymbol{v} + m\boldsymbol{r} \times \mathrm{d}w/\mathrm{dt}.$$

The point is that Barbour and Bertotti derived these terms from what could be interpreted as a geocentric perspective (Machian). Hence the heliocentric geometry is not necessary and is certainly not unique in being able to "solve" the equations of motion for the sun, moon, planets, and stars. Now it may be argued that ω in particular is a constant of integration and may thus have an arbitrary value, in particular, a 24-hour period for the universe.

As for the simplistic view of geocentricity which is evidenced in the question of how earthquakes can change the length of the day in geocentricity, let it be noted that the Bible does allow the earth some motions. Earthquakes are allowed. Motions in earth's foundations are

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[2] 1 J. B. Barbour and B. Bertotti, 1977. "Gravity and Inertia in a Machian Framework," Il Nuovo Cimento 38(1):1-27.

allowed. The earth will "flee away" at its end, and motions pertaining to that time are quite explicit in Isaiah 24. Psalm 104:5 is conditional when it states that:

> Who laid the foundations of the earth, that it *should* not be removed for ever (emphasis added).

There are only two motions that are not allowed the earth in Scripture. The first of these two "motions" is rotation with a period of one day (Joshua 10:13, Ecclesiastes 1:5, etc.) The second "motion" not allowed is revolution with a period of one year. This is more subtle in the Bible, having to do with whether or not the sun is to rule the night by having the night in orbit (with the earth) about it. Job 26:7 is another proof text for a non-orbiting earth. Also see more indirect references such as Psalm 19:1-6, etc. But Biblical geocentricity does not require an absolutely immobile earth. The earth may well be gravitationally pushed or pulled or shaken by the sun, moon, planets, and universe, much as in the heliocentric model. It may even rotate very slowly or even experience changes in rotation relative to the starry firmament; but it cannot, Biblically, have a rotation period of 24 hours nor a revolutionary period of one year.

So it is that earthquakes could cause the drag which the rotating universe has on the surface of the earth to be slightly asymmetric and so induce a slow spin on the earth, or even accelerate the spin rate. Such asymmetry could be exacerbated by uplifts or landfalls, or even snowfall. These phenomena would convert comparatively slight amounts of the universe's potential energy into kinetic energy of the earth via the conservation of energy law, a law which is at least as valid in geocentricity as in heliocentrism.

All that, however, is not to say that the earth must exhibit such second-order motions. In fact, Job 26:7 might dictate to the contrary. The universe itself could be exhibiting the changes in period and in position about the earth. Because of that, one could envision the following scenario: Say that God wishes to cause an earthquake in the Sodom of the U.S.A. (San Francisco?). All that he would have to do is to "tap" the firmament on just the right spot (flaw?). The resulting change in the angular velocity of the firmament would propagate to the earth in about 10^{-44} second and the earthquake would commence. As the firmament would "resonate" with the "tap," it would take time for the material superimposed on the firmament to come into equilibrium. That time is characteristic of the scale and density of the material. In fact, that time would be characterized by the "speed of sound" through the affected medium.

Thus the question reduces down to one of causality. Is it the strain and stresses in the rocks of the earth that cause the earthquake (heliocentric view) or is it a condition (curse?) where the strains and stresses are imposed from outside the universe (geocentric view)? And that brings us to the question of first cause, but that we'll leave to the philosophers to ponder. We would like to remind them, though, that wave equations (equations of state or Schröedinger equations) for these kinds of problems (and earthquakes do involve waves) have no solution unless a wave comes in from "infinity" before the event (such as a quake) and then radiates from the source after "focusing" or undergoing a state transformation at the source or event. That is,

$$A \sin \omega t, \text{ where } t \geq 0$$

in particular is no solution to the problem; it must be

$$\mathrm{A} \sin \omega \mathrm{t}, \quad -\infty = t = +\infty$$

by the constraints placed on such equations of state by boundary conditions and continuity.

We have seen that the heliocentric solution to the question of why the length of the day seems to change with earthquakes, snowfall, etc. is not as simple as its proponents might wish to make it out to be. The geocentric solution can take at least two forms: one being due to a change in perspective as to the cause of the earthquake, and the second alternative being to show that the generalized force equation, when derived from a geocentric perspective, exhibits the usual Newtonian force definition, including the so-called inertial terms — the Eulerian, Coriolis, and centrifugal. This has already been demonstrated in the paper by Barbour and Bertotti.

QUOTABLE QUOTE

As the "Higher Critics" attacked the authenticity and accuracy of the Scriptures, the Theologians bent to accommodate the "naturalistic" interpretation of God's word. When the "Scientists" swept the Creation account into the dustbin of mythology, the Theologians found "allegorical meaning" in the words. And when the Philosophers rationalized away the "absolutes" of righteousness and negated the "concept" of sin, the Theologians embraced "situational morality" and "cultural diversity."

—ICR *Back to Genesis* article
June 2001

CREDO

The Biblical Astronomer was founded in 1971 as the Tychonian Society. It is based on the premise that the only absolutely trustworthy information about the origin and purpose of all that exists and happens is given by God, our Creator and Redeemer, in his infallible, preserved word, the Holy Bible commonly called the King James Bible. All scientific endeavor which does not accept this revelation from on high without any reservations, literary, philosophical or whatever, we reject as already condemned in its unfounded first assumptions.

We believe that the creation was completed in six twenty-four hour days and that the world is not older than about six thousand years. We maintain that the Bible teaches us of an earth that neither rotates daily nor revolves yearly about the sun; that it is at rest with respect to the throne of him who called it into existence; and that hence it is absolutely at rest in the universe.

We affirm that no man is righteous and so all are in need of salvation, which is the free gift of God, given by the grace of God, and not to be obtained through any merit or works of our own. We affirm that salvation is available only through faith in the shed blood and finished work of our risen LORD and saviour, Jesus Christ.

Lastly, the reason why we deem a return to a geocentric astronomy a first apologetic necessity is that its rejection at the beginning of our Modern Age constitutes one very important, if not the most important, cause of the historical development of Bible criticism, now resulting in an increasingly anti-Christian world in which atheistic existentialism preaches a life that is really meaningless.

If you agree with the above, please consider becoming a member. Membership dues are $20 per year. Members receive a 15% discount on all items offered for sale by the *Biblical Astronomer*.

To the law and to the testimony: if they speak not according to this word, it is because there is no light in them.

– Isaiah 8:20

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