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Evidence for an Earth-Centered Universe

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Abstract

Three lines of cosmological evidence which indicate that earth is at, or very near, the center of the universe, are surveyed: (1) The apparent, linear arrangement of some galaxies, which on a large scale vaguely resembles a 3-D spoked-wheel with the galaxies in linear spoke-like arrays pointing towards the earth at the hub. These "spokes" have been known since the 1970s (but not talked much about) and have been given the intriguing name "fingers of God" by the astronomical community. (2) The linear arrangement of gamma ray bursts and galaxies such that, again, there is a linear alignment with Earth at the hub. (3) The large-scale patterns embedded in the cosmic microwave background radiation which are correlated with the orientation of the earth, and with the earth-sun orbital plane. Some non-earth-centered interpretations of these observations are critiqued.

Keywords

Cosmology, Fingers of God, Gamma ray burst (GRB), Cosmic microwave background (CMB) radiation

Introduction

The first chapter of the Bible informs us that earth is a special place in all of creation. God created the earth on the very first day of Creation week. The expanse, the future abode for the sun, moon and stars, wasn't formed until the second day. The sun, moon and stars themselves weren't formed until the fourth day; they were set in the expanse, and their God-ordained purpose was to serve as lights for the earth and to mark time for the inhabitants of the earth. Thus, Genesis and other parts of the Bible, indicate that earth is God's central focus when we consider the creation of the "universe" (universe= earth, expanse, and the inhabitants of the expanse). It is a logical deduction then that earth might hold a special place in the universe—even at or near the center of it.

Among secular cosmologists, however, the notion that the earth might have a special position in the universe is taboo, because, knowingly or unknowingly, they have adopted a philosophy which says that earth must not hold a special position in the universe. Consequently, all their cosmological theories begin with the assumption that the earth occupies no special place in the universe. This dogma is known as the "Copernican principle."

In the last 15 years or so creationists have begun building cosmologies grounded in biblical narrative (most notably, Humphreys, 1994). Instead of adopting anti-biblical starting assumptions, these cosmologies start with the biblical implication that earth is at, or very near, the center of the universe. There are a variety of possibilities when considering an "earth-centric" universe. Broadly, they are: (1) The historical geocentric concept, that the earth is stationary, and the sun and universe revolve around it. (2) The heliocentric possibility—popular in the early part of the twentieth century—that the sun is at or near the center of the universe. (3) A galactocentric possibility that the Milky Way is at or near the center of the universe. All permutations of these possibilities put earth in a special place in the universe—at, or near its center—and could, therefore, be considered earth-centric; especially given that the standard alternative idea is that earth holds no special place in the universe, or even that the universe doesn't have a center.

In the past several years, many new lines of evidence have come to light which seem to be indicating that earth is at, or near, the center of the observable universe. This paper will explore three of these evidences. Because an earth-centered universe runs so completely counter to the Copernican paradigm that pervades all of modern cosmology, secular cosmologists reflexively try to develop explanations for these observations which don't involve earth being at or near the center of the universe. Some of these alternative explanations will be examined to see whether they stand up to scrutiny.

Humphreys (2002) has previously discussed evidence that earth is at or near the center of the universe. The purpose of this paper is to introduce some of the new lines of evidence for an earth-centered universe to the creationist community.

The "Fingers of God" are all Pointing at Earth

In the early 1970s, astronomers first became aware that large groups of galaxies were aligned with earth in a remarkable way. They were finding groupings of galaxies which were clustered together into long narrow lines that all pointed directly at earth. These javelin shaped assemblages of galaxies pointing at earth, or "fingers of God" as they came to be known, were crying out that earth was at a very special place in the universe—in fact the entire universe was pointing at us.

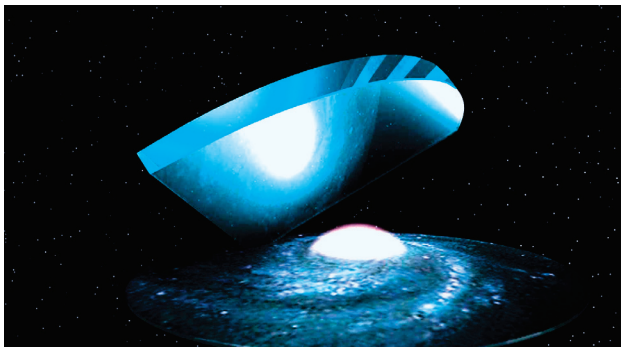

Figure 1. Graphic depiction of how galaxy surveys scan a portion of the universe. This "pie slice" is collapsed into just two dimensions in the other diagrams in this paper. (Credit: 2dFGRS Team)

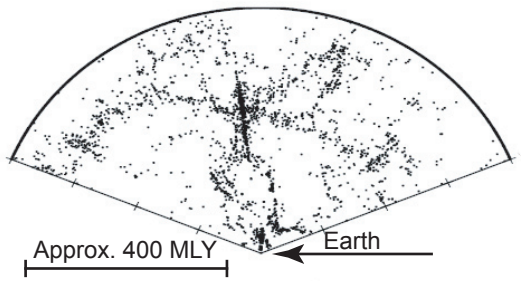

Figure 2. Fingers of God in the Coma galaxy cluster (MLY=Million Light Years) (after West, 1997)

Figure 1 depicts how galaxy surveys are generally conducted. In the figure, earth resides in the outer region of the Milky Way galaxy. A telescope scans a pie-shaped region of a limited thickness (the reach of the scan is much further than depicted in the figure). The locations of the galaxies can then be mapped in two dimensions by collapsing the pie-shaped wedge in the thin dimension. Such a two dimensional map, showing examples of fingers of God in the coma cluster of galaxies, is shown in Figure 2. Each black dot in Figure 2 represents a galaxy (with maybe 100 billion stars in it), and earth is located right at the apex (point) of the pie-shaped wedge. The wedge would be 12° thick in the dimension going into the page, but has been collapsed in thickness so that the placement of the galaxies is shown in just two dimensions. Note the prominent heavy javelin shaped dark line near the center of the wedge which is pointing directly at earth. There are many less prominent fingers of God in this diagram, some as small as just two galaxies close to each other and aligned towards earth. Figure 3 shows a different and larger piece of the sky with more sensitive detection of galaxies so we can get a better feel for the number and average size of the larger fingers of God. The left frame of Figure 4 shows all the galaxies in a particular slice of the sky; the right frame shows the same area of sky as the first, but all the galaxies which are not part of a finger of God have been removed by an objective computer algorithm. On face value then, these fingers of God are telling us that earth occupies a special position in the universe.

Because the idea that earth holds a special place in the universe is anathema to modern cosmologists, a different explanation for the fingers of God had to be found. J. C. Jackson appears to be the first astronomer to discuss the fingers of God (Jackson, 1972). Observe how Jackson breaks the news to the astronomical community that the earth's non-special position in the universe might be threatened:

> The galaxies appear to fall into long chains or cigar-shaped configurations, all pointing at the earth. Unless one is prepared to assign to the earth a very special place in the universe, one must conclude that D is not a good distance indicator, and that in reality the galaxies exist in roughly spherical configurations whose internal velocity dispersions are several times that which would be observed if these systems were expanding with the universe (Jackson, 1972).

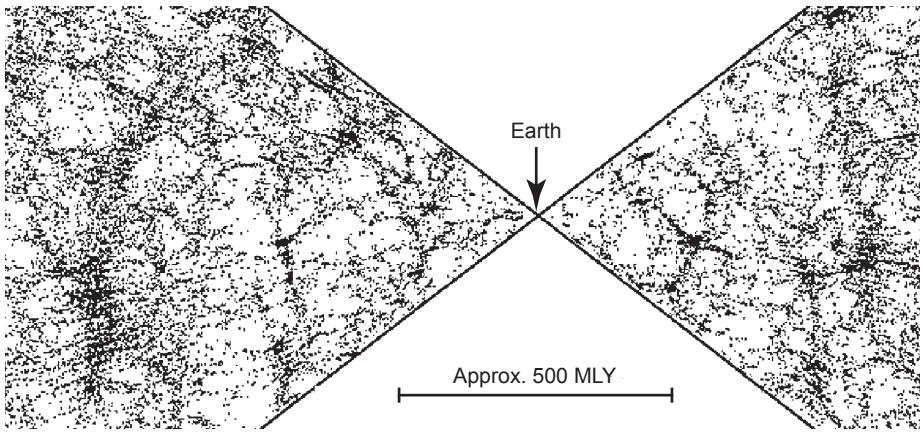

Figure 3. Fingers of God in the SLOAN Survey data. Each dot is a galaxy; the streaks pointing toward earth at the center are all fingers of God. (MLY=Million Light Years) (Credit: 2dFGRS Team)

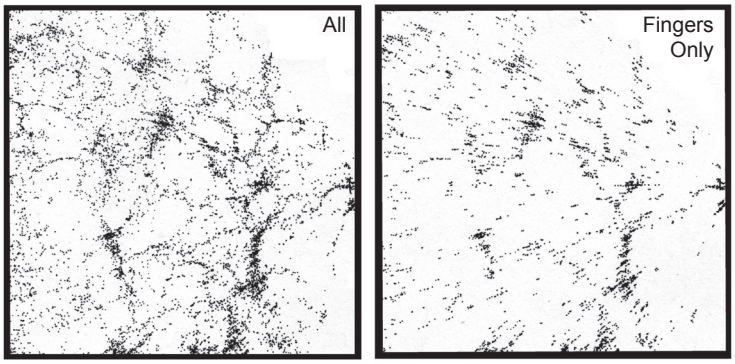

Figure 4. All galaxies are shown in the left panel, only the fingers of God remain in the right panel (after Tegmark et al., 2004).

In the above quote, notice how Jackson immediately offers the astronomical community a way to avoid the obvious indication that earth occupies a special position in the universe. It is this explanation of the fingers of God which the astronomical community still holds today. It is instructive to note that Jackson didn't offer any evidence that his alternative explanation was a better interpretation of the data than the obvious interpretation, nor did he present any analysis of his proposed alternative hypothesis so that its plausibility could be judged. In fact, I have not been able to find any numerical analysis purporting to show that Jackson's mechanism is capable of producing the structures we see. Apparently the only thing needed for its wide-spread acceptance in the astronomical community is that it keeps earth in a non-special place. So let us examine this explanation of the fingers of God that Jackson has offered.

Are the Fingers of God an Illusion?

What Jackson proposed was that the fingers of God are an illusion caused by assigning the wrong position to the galaxies which comprise them due to a red-shift distortion: The expansion of the universe is thought to stretch out space. As a result, light waves traveling through space are stretched out along with space so that light's wavelength is lengthened by the time it reaches us, and we perceive the light as redder than it was when it started its journey toward us. (It should be noted that Halton Arp and others have suggested that a galaxy's redshift is a property that is intrinsic to a galaxy, and is not, therefore, an indicator of its distance or speed with respect to earth. Without taking a position on this dispute, this paper presumes the conventional interpretation—that redshift is an indicator of distance and/or radial velocity with respect to the observer.) This redshift, which is due to the presumed expansion of the universe, is called "cosmic redshift." The cosmic redshift of a galaxy is thought to reflect the distance a galaxy is away from us. In addition to a cosmic redshift, a galaxy can have a redshift due to its "peculiar velocity," which is a motion that a galaxy has through the universe that is independent of its "motion" due to cosmic expansion. Redshift due to peculiar velocity is indistinguishable from redshift due to cosmic expansion. Under standard evolutionary assumptions about the history of the universe, the only known way for a galaxy to acquire a peculiar velocity is by gravitational interaction. So two galaxies fairly close together would be drawn towards each other through mutual gravitation, or a galaxy might be drawn towards a nearby cluster of galaxies. Any peculiar motion that a galaxy has along the line of sight from the galaxy to earth will add redshift to the cosmic redshift if the motion is away from earth. If the peculiar motion of the galaxy is towards earth, then it will subtract redshift from the cosmic redshift of the galaxy. These additions/subtractions of extra redshift due to peculiar velocity will cause a distortion in the determination of a galaxy's distance from earth. (See Figure 5 for a simplified graphical explanation of this redshift distortion due to peculiar velocity.) Next we'll see how conventional cosmologists imagine that this redshift distortion effect can explain the fingers of God:

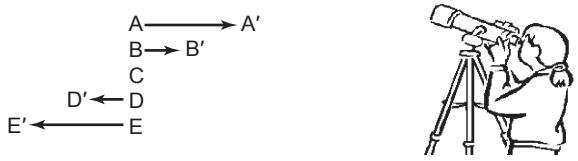

Figure 5. Schematic explanation of redshift distortion—A, B, C, D, E represent the actual positions of five galaxies, however, A is moving toward the observer much faster than B, and E is moving away from the observer much faster than D. C has no peculiar velocity along the line of sight to the observer. Not knowing about A's peculiar velocity, the observer will calculate that A is at position A', and B at position B', and so forth. The observer will correctly calculate the position of C, because C has no peculiar velocity along the line of sight to the observer.

Figure 6 is a schematic representation of the kinds of distortion that would take place under a in-fall peculiar velocity scenario. The upper panel shows how the peculiar velocities of galaxies falling towards an area of high gravitational potential will distort the shape of the cluster. The circles in the left column of the left panel represent galaxies at the same distance from the center of a high density region. The galaxies are all being drawn by gravity so that they are falling in towards the center. The shapes in the right column show how the redshift distortion affects the perceived positions of the galaxies by an observer far below the circles. The concentric circles at the top left are the real positions of the galaxies at the various

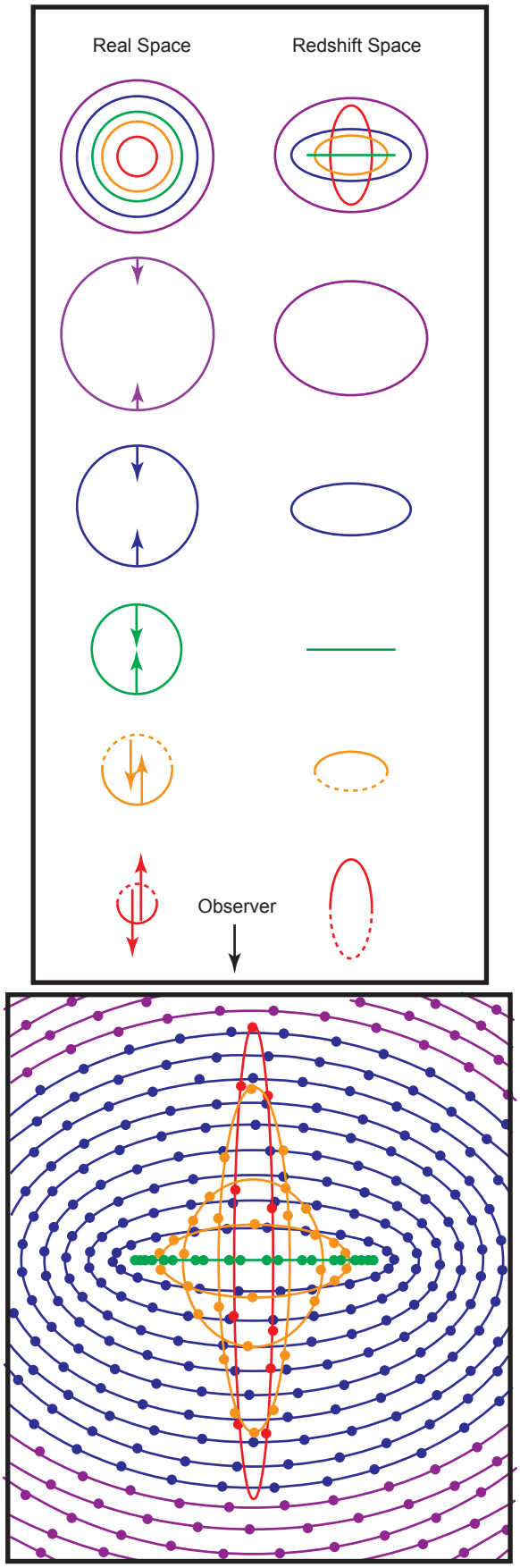

Figure 6. Schematic of redshift distortion (after Hamilton, 1998).

different radii from the center. The series of circles and ovals at the top right shows how an observer far below the bottom of the diagram would perceive the positions of these galaxies because of the peculiar velocity redshift distortion effect. The individual series of circles in the columns below the concentric set shows how the positions of galaxies at each radius are distorted. The purple circle on the left shows the real position of galaxies fairly far away from center that are just beginning to slowly fall towards the center. The purple oval on the right shows how an observer far below would perceive the positions of the same galaxies. The positions would be squashed slightly along the line of sight towards the observer. As the galaxies fall further they pick up speed and the squashing effect is more prominent so that the circles closer to the center are more flattened along the line of sight (blue circle). At a particular distance from the center (represented by the green circle), the squashing effect causes all the galaxies to have the same apparent redshift so they would appear to all be in a line perpendicular to the line of sight. Closer than this radius the distortion is so great that galaxies on the far side of the center will appear to be on this side (the orange circle). Even closer in (the red circle), the distortion stretches out the perceived positions along the line of sight producing the fingers of God effect. The lower panel of Figure 6 shows again how this distortion would affect the perceived positions of galaxies uniformly distributed, but falling in towards a high density region. (The lower panel of Figure 6 will be discussed more later.)

So, the conventional explanation is that the fingers of God are a phenomenon produced by galaxy clusters. Gravitational fields are strongest near the center of large clusters of galaxies, and a galaxy falling into a galaxy cluster will achieve its maximum speed at the center of the cluster. Some of these falling galaxies near the center of the cluster will be oriented such that most of their motion is along our line of sight to the cluster, so the redshift distortion described above will cause us to think that these galaxies are stretched out along our line of sight, and in this way the fingers of God illusion is produced. Also, galaxies orbiting a cluster core at high speeds contribute to the fingers of God effect.

In the literature, the fingers of God are always discussed within the context of galaxy clusters—the standard explanation described above only applies in the context of a galaxy cluster. It is postulated that most galaxies in a cluster are relaxed (or "viralized")—that is, they have been members of the cluster for a long time and are moving slowly with respect to the cluster in general, and therefore their redshift reflects their true position (or approximately so). However, new galaxies falling into the cluster (due

to gravitational attraction) from large distances—especially those falling quickly directly into the core of the cluster and which are very near the core and thus have obtained the highest velocities—these new speedy members of the cluster have the highest distorted redshifts. These highest distorted redshifts comprise the galaxies near the ends of the javelin-shaped fingers of God.

So, we have at least two possible interpretations of the data: (1) the galaxies really are stretched out in linear clusters pointing towards earth; or (2) the galaxies are in spherical clusters but appear elongated towards earth due to peculiar velocities along the line of sight. Which interpretation fits the data better? There are many reasons to think that the "illusion" interpretation is incorrect:

The length of the fingers of God can vary greatly. Under the conventional distortion interpretation, the longer the fingers, the higher the speeds of the galaxies near the center of the galaxy cluster. The speeds needed are a significant fraction of the speed of light. Remember that old-age cosmologists only have gravity as an explanation for peculiar velocities, so, under an old universe scenario, it would take a very strong gravitational field to accelerate the in-falling galaxies to the required speeds (and to retain them within the cluster if they happen to get trapped in an orbit by the cluster). Such gravitational fields can only be caused by sufficient amounts of mass in the galaxy clusters. The problem is that the mass of the galaxy clusters, based on the visible amount of mass, is not large enough to cause these kinds of velocities. This discrepancy in mass causes the astronomical community to postulate that the cluster must consist of a large amount of "dark matter" (for example, see Scoccimarro, 2004). Dark matter then becomes a fudge factor that can be invoked whenever observations don't fit theory. Astronomers can, and do, postulate that all the missing mass needed to account for the peculiar velocities is in the form of dark matter that we can't see. (Although, apparently, even dark matter can't save the day under standard inflation models, for example, Peebles, 1987, p. 210) However, invoking dark matter to explain the fingers of God still leaves many unsolved problems:

While fingers of God are often found running through clusters of galaxies or parts of clusters of galaxies, this is not always so. Look again at Figures 2 and 4; there are several small fingers of God that don't appear to be associated with larger clusters at all. What then produces the gravity field which is large enough to cause these fingers of God? If one is going to invoke dark matter to cause the illusion, then why hasn't this large dark matter gravity field attracted many more of the nearby galaxies to it to build a bigger cluster? It must surely be tugging greatly on them if it has enough mass to create this illusion.

And while there are many fingers of God present where there doesn't seem to be enough mass to support them, conversely there are many large concentrations of mass which should be capable of causing fingers of God, which don't. Look at the region around the Perseus-Pisces cluster in Figure 7, the fingers of God appear to be distributed more or less randomly, not just concentrated in denser areas of the cluster.

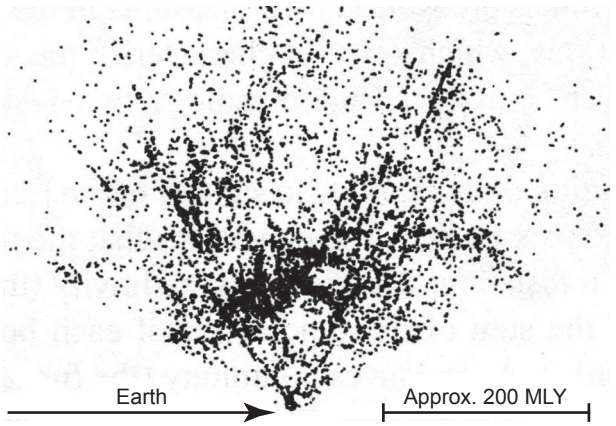

Figure 7. Perseus-Pisces Cluster fingers of God (MLY=Million Light Years) (after Luo, Vishniac, & Martel, 1996).

The distribution of galaxies along the length of the fingers of God is not correct. Galaxies should be falling into the cluster from all different directions, but only the component of their velocity which is directed towards us along our line of sight, or directed away from us along our line of sight will contribute to the illusion. Because of the geometries involved, the galaxy density at the ends of the fingers of God should be greater than those regions close to the middle. In other words, the fingers of God should contain more galaxies per unit length as you go away from the center of the finger of God. Figure 8 shows why this is so: There is no preferred direction for a galaxy to be entering (or orbiting) a galaxy cluster, so let us consider galaxies approaching a cluster from the same distance with the same speed but from different directions. A galaxy at position 1 has a large velocity which is directed straight at the observer. The redshift distortion will cause the observer (O) to think that 1 is at position 1′. Now consider a galaxy at position 2 which has a velocity directed towards 2″. Only that portion of the velocity which is directed toward O will contribute to the redshift distortion. O will perceive 2 to be at 2′ and so on for galaxies 3, 4, 5, 6, 7, 8 and 9. If the distance of the galaxies from the cluster core (the core should be much larger than indicated) is a negligible distance for O (that is, these galaxies are all close to the cluster core) then

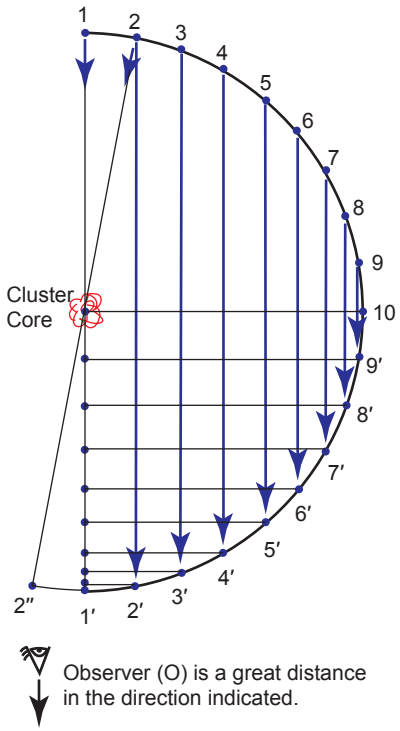

Figure 8. Geometric effects should cause the fingers of God to have more galaxies per unit length near the ends of the fingers (see explanation in the text). However the fingers of God that we observe do not show this effect.

for the purposes of this illustration we will consider only the positions of the galaxies along a single line of sight to O, and we will project 2′–9′ and 10 along the thin lines onto the line of sight going through the cluster core (the line between 1 and 1′). The projected position of 7′ is half way between 1′ and the cluster core. We find then that seven galaxies are in the portion of the finger of God from 1′ to 7′, and only three galaxies are between 7′ and the core. In this way we see the geometric effect that should cause the outer portions of the fingers of God to have a greater density per unit length of the finger of God than the inner portions do. Yet we don't see this effect in the real fingers of God.

If the fingers of God do not represent the real positions of galaxies but are an illusion caused by peculiar velocities, then there are certain structures which we should observe but don't. The right panel of Figure 6 shows how the redshift distortion effect is thought to affect the perceived positions of galaxies. The galaxies at the same rather distant radius (purple) appear squashed slightly along the line of sight. The closer to the center we get the larger the squashing effect until at the green radius all the galaxies would appear to lie on a line perpendicular to the line of sight. Galaxies closer in than this, like the orange galaxies, have their true and apparent positions reversed; and finally, the galaxies closest to the center (red) are very stretched out along the line of sight. Notice that the density of galaxies in the green line perpendicular to the line of sight is much greater than the density of galaxies which make up the finger of God, because there are more galaxies which contribute to the feature. This perpendicular linear feature, then, should be more prominent than the finger of God effect; but we do not find this perpendicular feature in any of the observed fingers of God. Look again at Figures 2, 3, 4, and 7, no perpendicular linear feature is seen dividing the fingers of God.

The fingers of God also appear to be far too narrow for the standard explanation; they should be much thicker toward the middle because of the more abundant galaxies which are a little further away from the center and which aren't as distorted in redshift position (like the orange galaxies). Likewise, there should be a big bulge in the center of the fingers of God which is the viralized part of the host cluster, but we often find fingers of God which are essentially isolated and not associated with a cluster (again, see the small isolated fingers of God in Figures 2 and 4).

In the very near future (and the data may be available now) there should be a way to rather definitively settle the question about whether the fingers of God represent the real-space position of galaxies, or whether they are a redshift illusion caused by peculiar velocities. There are other distance measures, not based on redshift, which are used for determining the radial distance to galaxies. One of the more trusted methods is the Tully-Fisher method (Tully & Fisher, 1977)). Surveys, like the 2MASS Tully-Fisher survey (2MTF), which use the Tully-Fisher method to determine radial distance, are being carried out and should soon have enough data so that we can determine if the fingers of God are still apparent using this method. If so, then the hypothesis that the fingers of God are due to peculiar motion will be falsified.

There is already an anecdotal indication that the Tully-Fisher data will show fingers of God:

> On the other hand, from work based on the Tully-Fisher (TF) Relation, which allows the distance to an individual spiral galaxy to be given with an accuracy of ~0.4 mag, there is consistent evidence that Virgo late types are distributed in a prolate cloud, or filament, stretching—nearly along our line of sight—from the cluster backwards to the so-called "W cloud" at twice Virgo's distance. Probably this is part of a very long filament that is running way back to the "Great Wall" at the distance of the Coma cluster. On the near side of Virgo it might even be connected with the "Coma-Sculptor cloud" that is running through us, that is, includes the local group. (Murdin, 2001, p. 5)

We will have to wait for survey confirmation before we know if the above result is typical or a fluke.

Gamma Ray Bursts and Galaxies also Point at Earth

About once per day, on average, earth is zapped by a short-duration blast of gamma-rays, usually lasting 0.1 to 100 seconds. These rays originate from every direction in the sky, with no preferred origination direction. Although these gamma ray bursts (GRBs) have been known since the 60s, it wasn't until the Italian x-ray satellite BeppoSAX, launched in 1997, that "afterglows" from GRBs were discovered and redshift measurements could be made (and distances to GRBs calculated). The "afterglows" are residual radiation emitted from the source area of the GRB that lingers on, sometimes for many days, long after the gamma rays are no longer being detected. The residual afterglow can consist of x-rays, radio waves, and optical light. According to redshift measurements, GRBs originate at great distances from earth—several billion light years (BLYs) to 13 BLYs.

A strange discovery related to GRBs was reported in September of 2006 (Prochter, Prochaska, Chen, Bloom, Dessauges-Zavadsky, & Foley, 2006, pp. L93–L96). Prochter et. al. showed that usually there is at least one galaxy which is in the sightline to the GRBs. In other words, galaxies and GRBs tend to be arranged in a line which points back to earth (see Figure 9). This alignment is not simply the consequence of there being so many galaxies in the universe. Prochter et. al. compared how often galaxies occur between earth and GRBs to how often galaxies occur between earth and quasars (Quasi-Stellar Objects or QSOs) most of which are also thought to be extremely distant objects. They found that galaxies

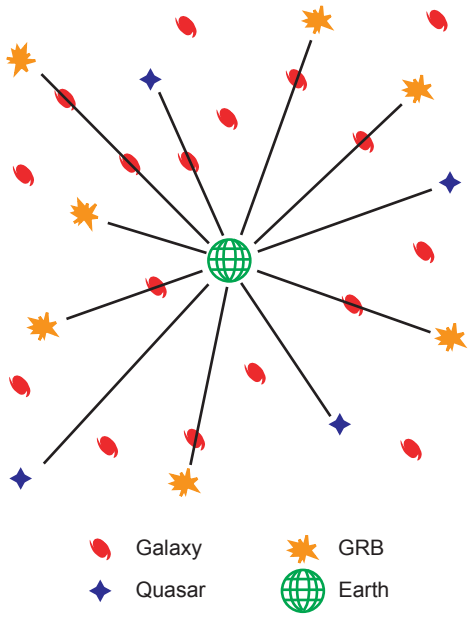

Figure 9. Galaxies are usually found along the line of sight to GRBs but are not found along the line of sight to quasars nearly as often. (Drawing is not to scale.)

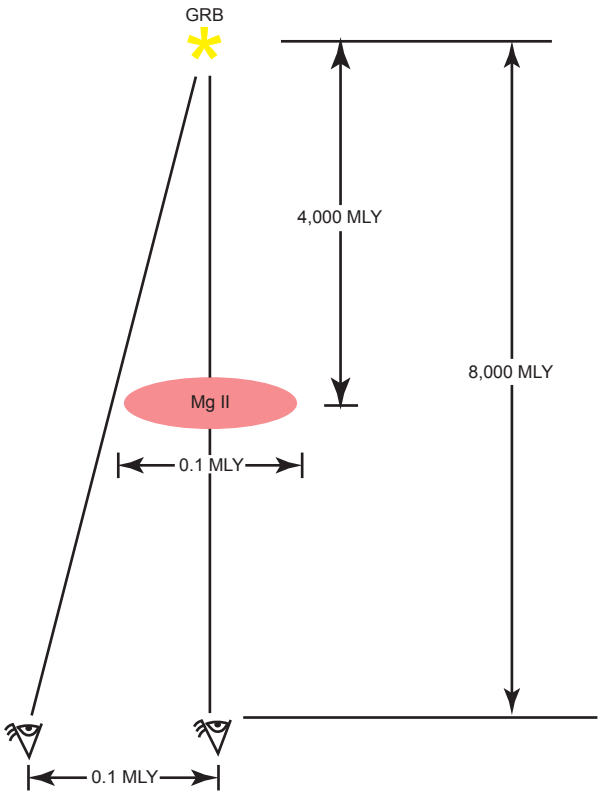

Figure 10. The alignment between GRBs, galaxies, and earth would be destroyed if earth were in a slightly different position. (MYL=Million Light Years). (Drawing is not to scale.)

are found in the sightlines to GRBs four times more often than they are found in the sightlines to quasars. Statistics indicate that this imbalance in sightline galaxy frequency is not just a fluke with greater than 99.9% confidence. The authors refer to this finding as "astonishing." Such an observation would seem to indicate that the earth occupies a special place in the universe. Figure 10 shows how if earth were shifted slightly from its current position then this linear alignment of the earth, galaxies and GRBs would be destroyed. For example, a typical distance to a GRB may be 8 billion light years. If we take the Milky Way as an average sized galaxy of 100,000 light years in diameter, then the alignment with the earth, galaxy and GRB would vanish for an average sized galaxy at half the distance to the average GRB, if the earth were moved just 100,000 light years perpendicular to the line of sight. Even with these rough numbers, we can surmise with some confidence that an observer in any galaxy other than the Milky Way would not see the same special alignment of GRBs and galaxies.

This finding has been very worrisome to astronomers, and they would very much like to find an explanation that doesn't involve the earth being in a special place. Four potential explanations have been offered, the first three were discussed by Prochter et. al. in the same paper that they report their findings

and were shown to be unlikely. Porciani, Viel, and Lilly (2007) in a more recent paper also addresses all the proposed explanations and find they don't stand up to scrutiny.

The first hypothesized explanation is that dust in galaxies could be obscuring many faint quasars. If true, then this leaves open the possibility that there may be many more quasars than we have previously detected, and these quasars would all have galaxies along their sightlines to earth, and therefore the alignment of galaxies with GBRs would no longer be anomalous. The problem with this potential explanation is that all indications are that galactic dust does not have enough obscuration power and is therefore unlikely to obscure enough quasars to make up the large difference in sightline galaxy-occurrence frequency (the frequency for quasars was based on a very large sample of 50,000 quasars).

The second possible explanation is that we are getting false indications of galaxies in the sightlines to GRBs. The presence of a galaxy in the sightline of GRB is initially indicated by the presence of MgII as determined by the absorption of radiation in the MgII part of the spectrum. The hypothesis is that the MgII absorption is intrinsic to the GRB itself and not due to an intervening galaxy. The simplest rebuttal of this hypothesis is to look to see if there are visible galaxies in the positions indicated by the MgII absorbers. This has been done for many other strong MgII absorbers investigated as part of other studies and the galaxies have been able to be verified in almost every case.

The third possible explanation is that the GRBs are being gravitationally lensed (and magnified) by the galaxies along the sightline so that they are more easily detected and therefore are more often seen to be associated with an intervening galaxy. For this to be a viable explanation, GRBs would have to somehow be more subject to lensing than quasars, but there is no rationale for such a suggestion. In addition, there are none of the normal indicators that lensing is occurring with these GRBs (multiple images, arcs, etc.).

A fourth proposal has recently been put forth by Frank et al. (2007). It requires that the MgII absorbers be much smaller, on the order of the size of the quasar emitting region. Pontzen, Hewett, Carswell, and Wild (2007) show that the possibility of the MgII absorbers being small enough can be ruled out through several lines of evidence.

At this time it appears that the alignment of galaxies, GRBs, and earth, is real. Why should there be such an alignment in an earth-centered universe? It is just speculation, but one possibility might be along these lines: many verses in the Old Testament indicate that God has stretched out the heavens. This stretching could have taken place during the making of the expanse on day two, or it could have been afterwards. If the "stretching" was in such a fashion that earth was at the center, and the stretching took place in the region between the earth and the "edge of the universe" (wherever that may be) then it is possible that the expanse contains something similar to stretch marks or faults, or inhomogeneities of some kind, which are linear in structure and which are oriented radially towards, and away from, earth. It would be as if you took a piece of cloth and stretched it between your hands. When the cloth gets tight, ridges running parallel to the direction of stretching will form. Such cosmic "ridges" might explain the fingers of God phenomenon as well as other linear arrangements of cosmological phenomenon which point towards earth.

Cosmic Microwave Background (CMB) Radiation is Correlated with the Solar System and Earth

Unlike the gamma rays that zap the earth with short duration bursts from random points in the sky, the earth is continuously bathed by microwaves which come at earth from all directions. The majority of these microwaves have wavelengths that range from about 1 mm to about 20 cm with the maximum intensity at about 2 mm. For comparison, the microwaves produced by a microwave oven are about 12 cm. This microwave background radiation was first detected in 1964 but during the last 15 years or so has been studied intensely by satellite and balloon borne detectors. Big bang cosmologists are interested in this Cosmic Microwave Background (CMB) radiation because, based on big bang theory, they believe the microwaves were generated near the beginning of the universe and are just now reaching us from the edge of the visible universe. Consequently, they believe the CMB can illuminate some of the conditions in the early universe and can therefore help with the testing and forming of theories about the universe's beginning. If these microwaves really are reaching us from the "edge" of the universe, then they must surely contain "information" that will be helpful in discerning methods God may have used in creating the universe.

The spectrum of these microwaves (that is, the intensity of the microwaves at all the various wavelengths) is what is expected from a blackbody at 2.725° Kelvin (that is ~−454° F). This temperate is practically the same no matter which direction we look, but not exactly the same, there are tiny differences (±0.0001° C) in the temperature depending on which direction we look. It is these small differences in the temperature of the CMB that are of interest to cosmologists—they use various techniques to study, in a statistical way, the patterns of these variations in temperature.

The latest satellite used to study the CMB is known as the Wilkinson Microwave Anisotropy Probe (WMAP) and was launched in 2001. The WMAP, like its predecessor satellite COBE (Cosmic Background Explorer) were designed to produce full-sky maps of the CMB. Figure 11 is a full-sky map of the CMB temperature fluctuations (in the same way that the oval shaped map of the earth in the inset depicts the whole surface of the earth, the oval map of the CMB depicts the whole sky). Unlike COBE, which was a satellite in earth orbit, WMAP detects microwaves from the L2 Lagrange position—see Figure 12. WMAP has detectors on board which detect five different specific wavelengths of microwaves: K-Band (23 GHz), Ka-Band (33 GHz), Q-Band (41 GHz), V-Band (61 GHz), W-Band (94 GHz). Not all of the microwaves detected by WMAP were generated deep in space however, there are several known sources of microwaves occurring in the "foreground," the Milky Way being the largest source of foreground microwaves. Figure 13 shows maps of the microwave universe as seen by the five different wavelength WMAP detectors. The red band running across the middle of each image is the Milky Way. Notice that the Milky Way does not affect the W-band map as much as it does of the K-band Map. These differences in the maps and the different spectral characteristics of the foreground radiation enable researchers to remove as much of the foreground as possible from the WMAP data. That is how they can produce a "cleaned" map like that seen in Figure 11 where the effect of the Milky Way has been removed (details of the removal process are in Hinshaw et al., 2007). As mentioned previously, there are other areas of the sky which are sources of foreground contamination as shown in Figure 14. For certain types of data analysis there are areas of the sky (mostly including the highest intensity parts of the Milky Way) which must be "cut out" or "masked" due to the uncertainty involved in the clean-up of the most heavily contaminated areas. Many researchers have studied what the effects of using different sky-cuts have on the various analyses of the data to gain an understanding of how much error is introduced into the analysis by the sky-cuts.

Data collected from the WMAP have been made public by the WMAP team of scientists through two separate data releases so far. The first release, in 2003, contained the data collected during the first year of WMAP's mission and was accompanied by a suite of 18 papers that described every aspect of the satellite, mission, data collection, and processing. The second data release (data available for download at http://lambda.gsfc.nasa.gov/product/) was in 2006 and contained the data that had been collected during the combined first three years of WMAP. The second data release was also accompanied by a smaller suite of papers from the WMAP team (Hinshaw et al., 2007; Jarosik et al., 2007; Page et al., 2007; Spergel et al., 2007) giving all the details of the collection of the data, known sources of error, how the data has been processed to correct for biases and to remove foreground radiation, noise, etc., as well as some analysis of the data. The second data release and suite of papers are considered the best because the additional two years of data allowed the team to better characterize and correct errors and biases in the satellite data. The CMB temperature data described in Hinshaw et al. (2007) are the focus of the rest of this paper.

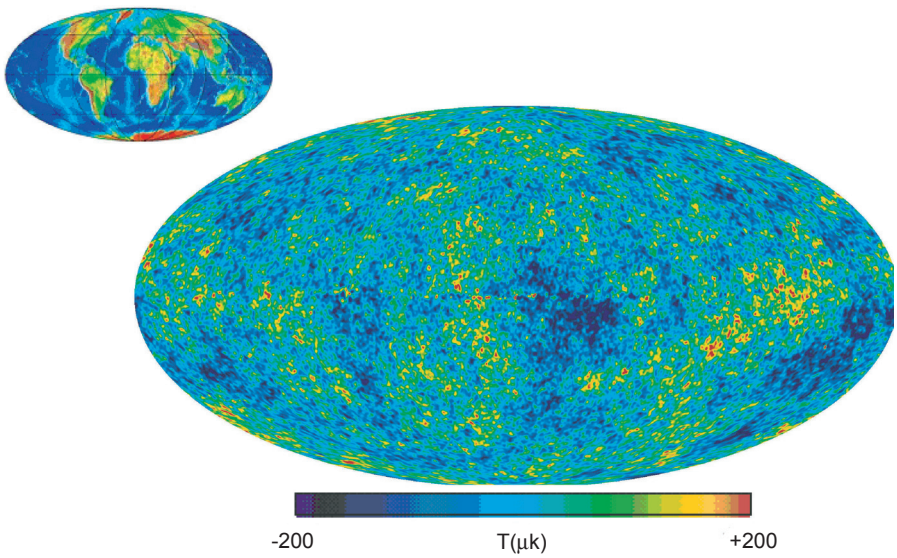

Figure 11. WMAP LILC Map. The large oval shows the tiny fluctuations in temperature in the CMB. The oval depicts the entire sky in the same way that the oval map of earth depicts the entire surface of the earth. The scale indicates temperature differences in micro-Kelvin. (Credit: WMAP Science Team.)

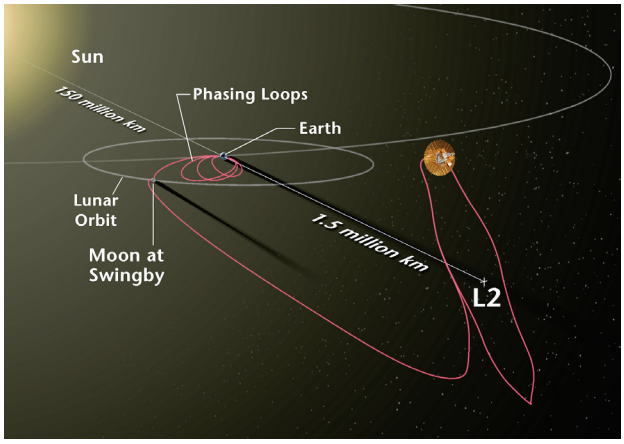

Figure 12. COBE used an earth orbit to map the CMB sky. WMAP orbits the L2 Lagrange point—an excellent location from which to map the CMB sky. (Credit: NASA/WMAP Science Team.)

Researchers investigating the Cosmic Microwave Background radiation (CMB) have, in the last several years, uncovered some surprising patterns in temperature variations of the CMB that have perplexed them greatly and threaten to undermine the very foundations of big bang theory. Unless these patterns are very small probability flukes, or some other explanation for the patterns is found, then these patterns are incompatible with big bang/inflation theory and they tie the earth and solar system to the largest scale structure of the universe. Strident atheist and Director of the Center for Education and Research in Cosmology and Astrophysics, at Case Western Reserve University, Lawrence M. Krauss, recently gave a talk at a conference he organized in which he commented on the implications of this finding. The quote from his talk below is startling enough, but when you consider some of the cosmological heavyweights attending the conference: Stephen Hawking, Alan Guth, Jim Peebles, and Kip Thorne; you realize how remarkable his comments are. Here is a quote from Krauss' talk:

> But when you look at [the]CMB map, you also see that the structure that is observed, is in fact, in a weird way, correlated with the plane of the earth around the sun. Is this Copernicus coming back to haunt us? That's crazy. We're looking out at the whole universe. There's no way there should be a correlation of structure with our motion of the earth around the sun—the plane of the earth around the sun—the ecliptic. That would say we are truly the center of the universe.
>
> The new results are either telling us that all of science is wrong and we're the center of the universe, or maybe the data is [s]imply incorrect, or maybe it's telling us there's something weird about the microwave background results and that maybe, maybe there's something wrong with our theories on the larger scales. And of course as a theorist I'm certainly hoping it's the latter, because I want theory to be wrong, not right, because if it's wrong there's still work left for the rest of us. (Krauss, 2006, last two paragraphs).

Standard big bang theory combined with inflation theory is predicated on the notion that the universe is homogeneous (that is, large volumes of the universe are all the same—they have basically the same contents) and isotropic (that is, no matter which direction we look in, the universe has the same properties). Therefore, when researchers were investigating the statistical properties and the distribution of the temperature fluctuations of the CMB they expected these fluctuations to reflect a Gaussian randomness which would be consistent with homogeneity and

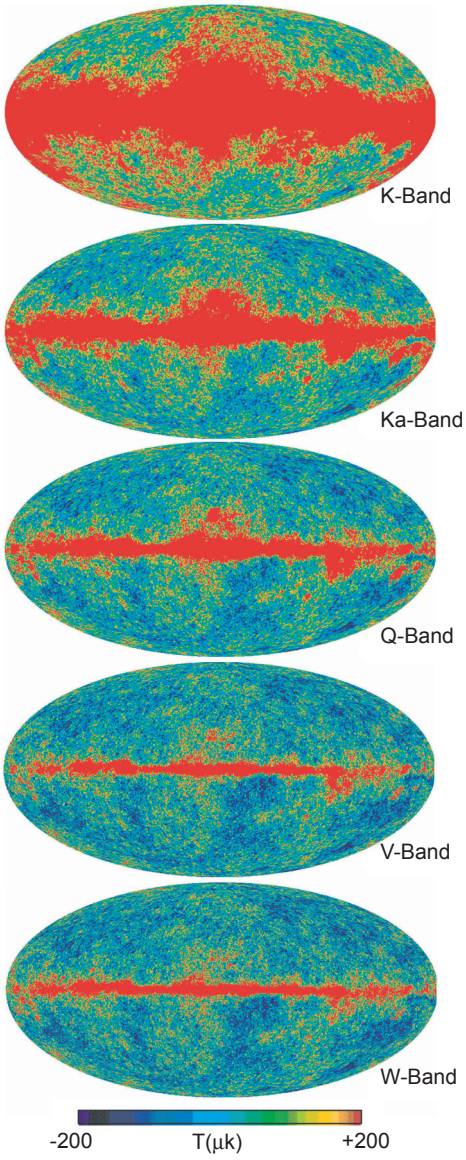

Figure 13. CMB Maps of the 5 different wavelengths of microwave that WMAP measures. The scale indicates temperature differences in micro-Kelvin. (Credit: WMAP Science Team.)

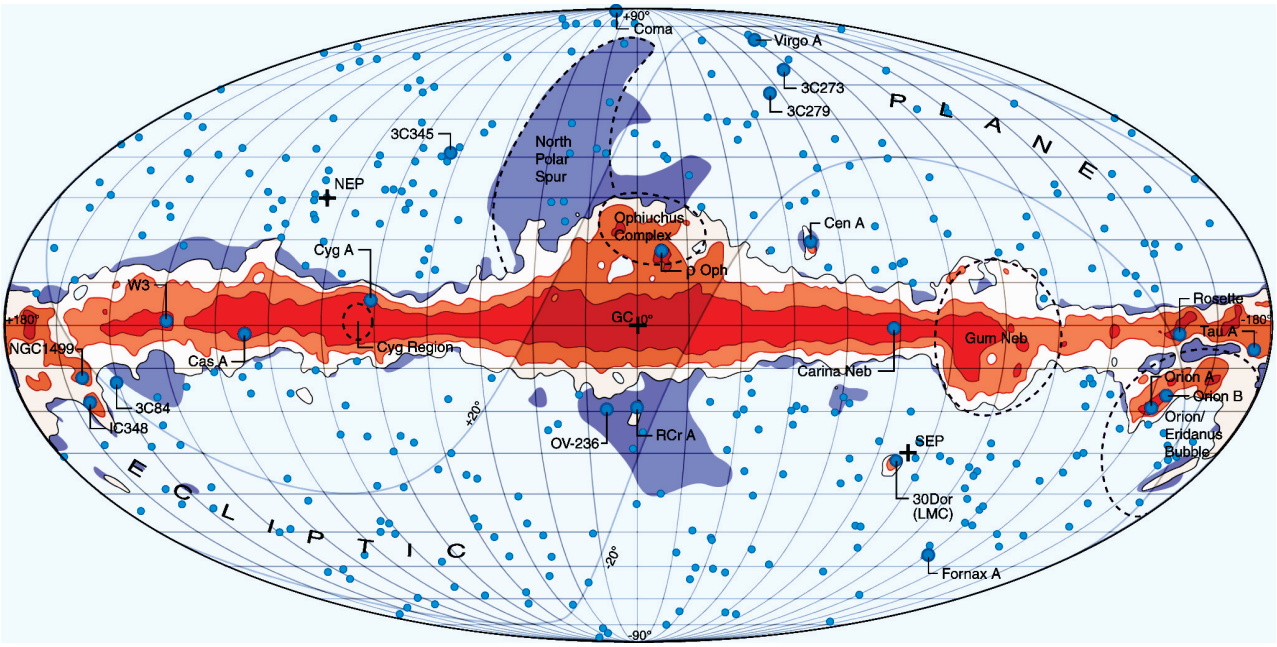

Figure 14. Different sources of microwave contamination in the sky. The galaxy plane is oriented across the center of the oval. Blue dots are point sources of microwave contamination. (Credit: WMAP Science Team).

isotropy. What they have found, however, are patterns and alignments which appear to negate the assumptions of isotropy.

Peculiarities of the CMB—The Dipole

If one were to divide the sky in half using an imaginary plane which passes through the center of the earth, one could then average the CMB temperature in each of the sky hemispheres on either side of the plane and compare the temperatures. One could then repeat this procedure with the plane oriented in any direction. It turns out that the plane orientation which produces the greatest difference in the average temperature of each hemisphere (so in essence we are finding the warmest half of the CMB sky and the coolest half of the CMB sky), is almost exactly perpendicular to the ecliptic plane of the solar system (the plane that the sun, earth, and planets exist in and move in), and the plane passes almost exactly through the summer and winter solstice points on earth's orbit (the points in earth's orbit where the north pole is closest to the sun and the furthest away from the sun). This also means that the line connecting the middle of the warmer hemisphere and the middle of the cooler hemisphere runs almost exactly through the spring and fall equinoxes—the points in earth's orbit where the whole earth gets equal hours of light and dark during a day. This difference between the hot hemisphere and the cold hemisphere is much larger than would be expected if the warm and cool spots of the CMB sky were randomly distributed. See Figure 15 for a diagrammatic depiction of the above correlations.

It should be noted that the ecliptic is peculiar to the solar system so that almost all other hypothetical randomly oriented planetary systems would not

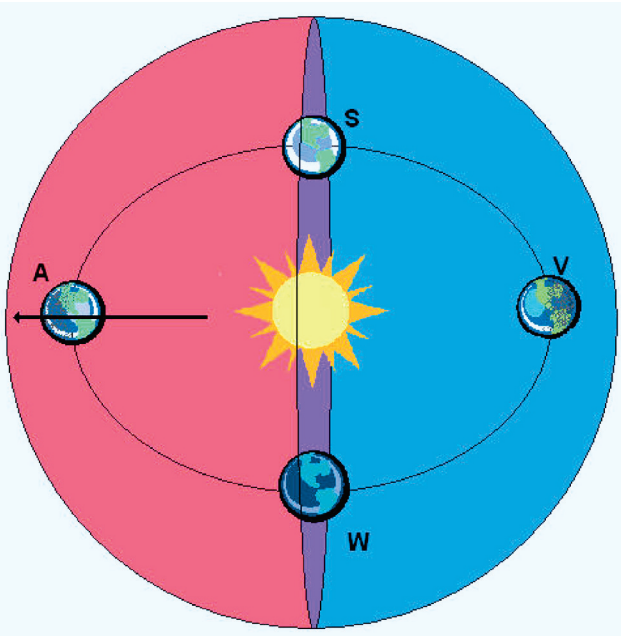

Figure 15. The ecliptic (the plane that the earth and sun exist in) coincides with the plane that divides the most temperature variable half of the sky and the least temperature variable half of the sky. The quadrupole/ octopole plane cuts through the summer (S) and winter (W) solstice like the plane shown intersecting the ecliptic plane above. The axis of the dipole (the dipole divides the sky into a warmer half and a cooler half) comes very near to the spring (vernal—V) and fall (autumnal—A) equinox. Earth lies at the intersection of all three of these major CMB defined features.

perceive a unique correlation between a dipole plane and their ecliptic. In addition, the equinoxes and solstices are peculiar to earth because they are defined by earth's tilted axis. This means that no other planet in the solar system has a unique alignment of the dipole plane with special points in its orbit. Also, if earth's axis were oriented in most any other direction this special alignment would be destroyed. Because earth's axis has wobble associated with it called the precession (with a period of ~26,000 years), from an old earth perspective this is one of the small percentages of time during the earth's history that this alignment would occur. This data would seem to be indicating that the solar system and the earth are correlated with the CMB structure in the furthest reaches of the universe. The CMB structure is considered a reflection of the underlying physical structure of the universe.

It should also be kept in mind that what may seem like a number of separate coincidences above could be the result of just one coincidence: If there happens to be an abnormally hot spot in the CMB sky that happens to be very near one of the equinoxes, then it will define the center of a warm hemisphere, which will dictate that the dipole plane must be perpendicular to the ecliptic and must pass through the solstices. Essentially this is how conventional cosmologists explain the above correlations—they think the axis of the dipole just happens to align with our equinoxes.

Astronomers believe that not only is the earth orbiting the sun, but that the sun is orbiting the center of the Milky Way galaxy, and the Milky Way has movement within the local group of galaxies which it is a part of, and the local group is being drawn towards other larger superclusters of galaxies. Consequently, they believe that the dipole phenomenon is caused by the solar system's movement through the universe relative to the CMB radiation. So cosmologists interpret the center of the warm hemisphere as the point in the sky that the solar system is moving toward, and the center of the cool hemisphere is the point in the sky that we are moving fastest away from. The CMB in the region we are moving towards is blue-shifted and consequently appears warmer. The CMB radiation coming to us from the region we are moving away from is red-shifted and therefore appears cooler. They believe that it is just a coincidence that the point we are moving towards happens to be in the direction of the autumnal equinox. Because they believe this dipole signature is caused by the solar system's motion, and is not an actual artifact of the cosmic CMB, they subtract it out of their studies of the cosmic CMB.

If earth is at or near the center of the universe then a creationist might hypothesize that the earth and solar system are not careening through the cosmos at high speeds, but rather the CMB dipole has a cosmic origin instead of a local origin. If so, then the various analyses of the CMB data (some of which are discussed below) can be carried out with the dipole effect added back to the data to see what effect it has. But, it is important to realize that whether or not the dipole is due to the solar system's motion relative to the CMB or is of cosmic origin, there is still correlation of the CMB with the earth (via the ecliptic, equinoxes, and solstices) that calls for an explanation. The coincidence explanation might be plausible if it were not for the many other coincidences that tie the large scale structure of the CMB to the earth that we will examine below.

Peculiarities of the CMB—Multipoles

As mentioned above, one of the main motivations that secular cosmologists have for investigating the CMB, is to gain insight about the conditions in the early universe. One main area of interest is how the CMB temperature fluctuates on all size scales, because different origins theories about the universe call for different magnitudes of fluctuations on different size scales. Looking at Figure 11 it is all the small (in angular size) fluctuations that are most obvious, these fluctuations are on the order of about 1 angular degree in size. Much less obvious to the eye, but of more importance for cosmological theories, are the larger scale fluctuations in temperature differences—like the dipole temperature difference that was discussed above.

To evaluate these fluctuations statistically researchers process the temperature data using some advanced mathematical techniques. One type of analysis, involving the use of spherical harmonic multipoles, can be used to produce diagrams which reflect the properties of temperature variations on different scales. For example, the top panel in Figure 16 is a map of the octopole. This map is a visual depiction of properties of the CMB temperature fluctuations, over fairly large areas, using actual WMAP data. Note how the centers of the three large warm spots and the three large cold spots lie on a single plane. This planer alignment is totally unexpected under standard big bang theory which predicts that the hot and cold spots would be randomly distributed about the sky, more like is depicted in the middle panel of Figure 16. The probability that this planer alignment was produced purely by chance is less than 0.1 % (Schwarz, Starkman, Huterer, & Copi, 2004). This observation alone is a problem for standard big bang theory; but the big bang's troubles are compounded greatly by the alignment of the octopole and quadrupole. When we look at the quadrupole (two warm spots and two cold spots) we find that centers of these hot/cold spots lie on the same plane as the octopole (quadrupole is in

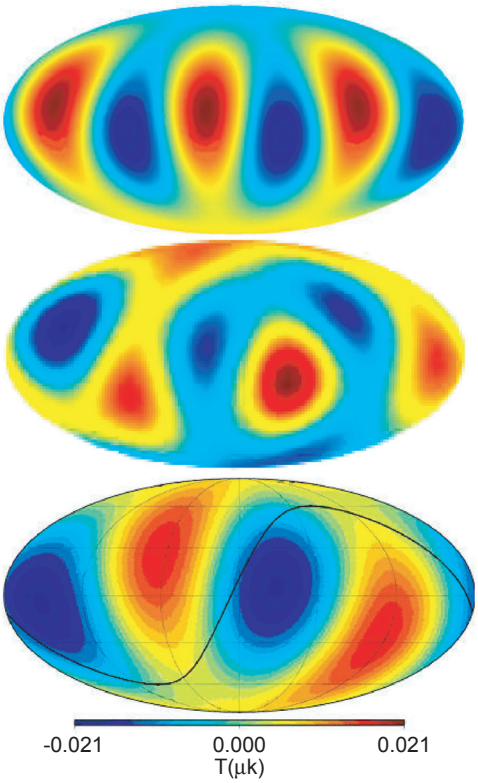

Figure 16. Top—octopole in preferred orientation (after Land & Magueijo, 2005). Middle—what a random octopole might look like (after Gordon, Hu, Huterer, & Crawford, 2005). Bottom—quadrupole in slightly different orientation than top. The dark line is a projection of earth's ecliptic. The scale indicates temperature differences in micro-Kelvin (after Copi, Huterer, Schwarz, & Starkman, 2007).

the bottom panel of Figure 16). Even if we take the planarity of the octopole as a given, that the octopole and quadrupole should both be oriented on the same plane by chance can be rejected at a 99.9% confidence level (Copi, Huterer, Schwarz, & Starkman, 2006).

Not only are we seeing that there is a high degree of structure in the CMB (as opposed to randomness), but we are seeing that this structure is correlated with the earth. The octopole/quadrupole plane is perpendicular to the cosmic CMB dipole axis and the equinox axis to greater than a 99.8% confidence level (Copi et al., 2006)

There are other peculiarities in the quadrupole and octopole that tie them to the solar system. Copi et al. (2006) show a map of the combined octopole and quadrupole. In this map (see Figure 17, and note that the map is centered on the galactic plane instead of the octopole/quadrupole plane like those above) the ecliptic of the solar system exactly splits one of the warm spots and one of the cool spots for over 120° of the sky. Also the warm/cool spots in the southern ecliptic hemisphere are all more intense than the three milder warm/cool spots in the northern hemisphere.

This curious disparity in the temperature variations in the northern ecliptic hemisphere and the southern ecliptic hemisphere (which can be easily seen with the eye in Figure 18) has been investigated by Hansen, Banday, and Gorski (2004). They found that the plane which maximizes the discrepancy between hemispheres in the amount of temperature variation within the hemisphere is very near to the ecliptic plane. This asymmetry is yet another of the many anisotropies that have been found in the CMB and which are shaking the foundations of the big bang. Referring to the many violations of isotropy and non-gaussinity detected by themselves and many other researchers, here is how Hansen, Banday, and Gorski conclude their paper:

> Given the large number of detections with different methods on different sky cuts and frequency channels, it seems inescapable that the WMAP data does indeed contain unexpected properties on large scales. In the absence of compelling evidence for a Galactic or systematic origin for the asymmetry, the intriguing possibility is raised that the cosmological principle of isotropy is violated and that fundamentally new physics on large scales in the universe is required. Further clarification of this scenario awaits further observations from WMAP, and ultimately the forthcoming Planck satellite mission (Hansen, Banday, & Gorski, 2004, p. 665).

Is the WMAP Data Suspect?

As the quotes by Hansen and Krauss above allude to, many cosmologists are hoping that a mundane explanation can be found for these discrepancies between the CMB data and big bang theory. The source of the error, if there is one, must be capable of producing systematic effects because the discrepancies are highly structured and coordinated. The three main suspects are (1) the CMB detecting equipment, (2) the data processing, or (3) sources of non-cosmic microwaves that are contaminating the data.

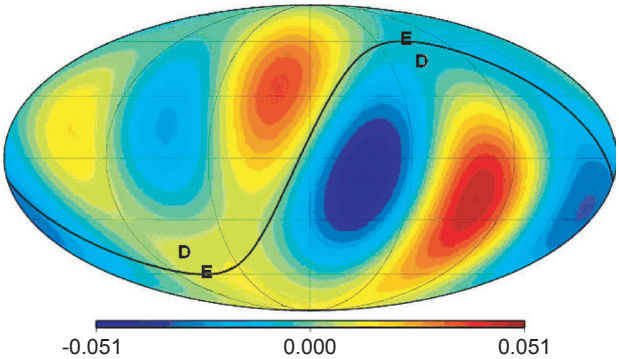

Figure 17. Combined octopole and quadrupole (l=2+3). The black line is the ecliptic; E=Equinox; D=Dipole. The galactic plane runs horizontally through the middle of the map (after Copi, Huterer, Schwarz, & Starkman, 2006).

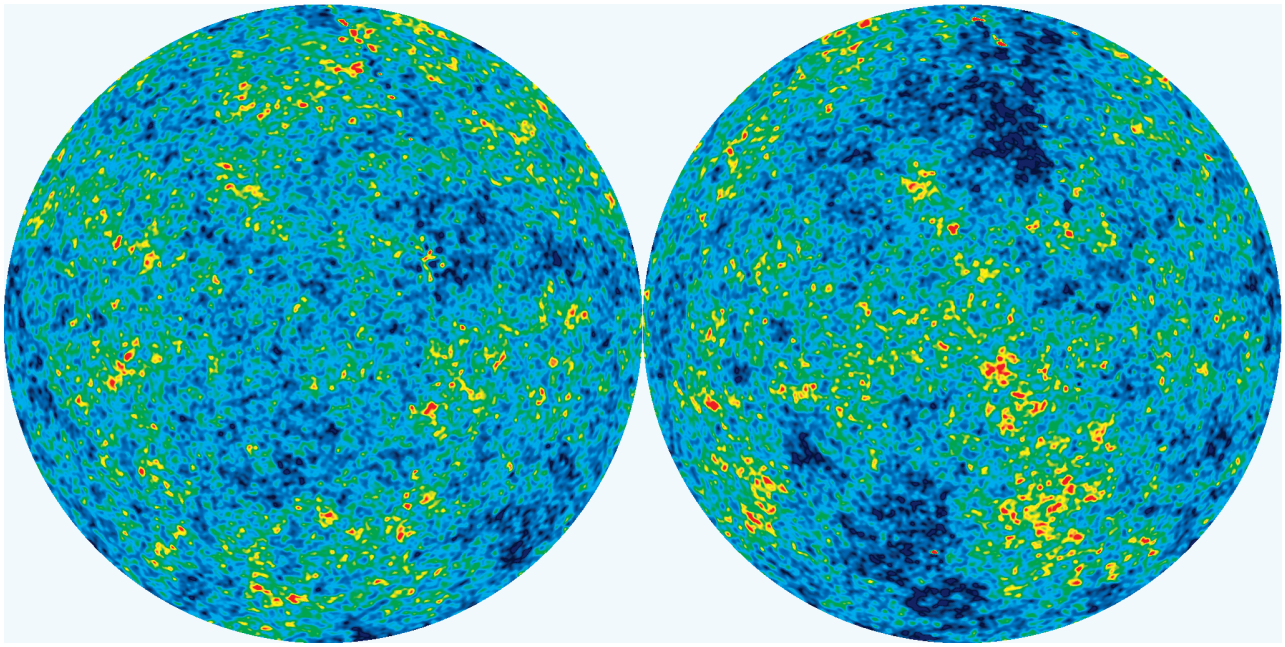

Figure 18. North/south anisotropy in the variation of the CMB temperature fluctuations. Even the eye can see that the temperature variation in the southern ecliptic hemisphere (right circle) is greater that the temperature variation in the northern ecliptic hemisphere (left circle). Detailed statistical studies have shown that there is indeed a significant disparity. Such an anisotropy violates the Copernican Principle and the assumptions of big bang models. (Credit: WMAP Science Team)

The more data generated by WMAP satellite the better the WMAP Team are able to characterize sources of error or bias generated by the WMAP (known instrument effects are documented in Jarosik et al., 2007). However, the corrections to the data made in the latest WMAP data release do not materially change any of the "anomalies" under discussion here, as Copi et al. (2006) have demonstrated. In fact most of correlations of the CMB with the earth and solar system were slightly strengthened between the first data release and the second. There is no realistic prospect that equipment-based data adjustments of the types made so far will be of the right type or magnitude to explain the anomalies. Many of these anomalies were capable of detection by the older COBE satellite and have indeed been found in the COBE data as well. The COBE satellite orbited earth, but WMAP orbits the L2 Lagrange point 1.5 million kilometers from earth. That the features of concern are present in data of two different satellites in different observing orbits is a strong argument against the possibility that the features are an artifact of observational error or bias.

The WMAP team is also very careful about documenting procedures and providing routines for processing the WMAP data. The WMAP data is publicly available (http://lambda.gsfc.nasa.gov/product/) in many different forms including raw data for those that prefer unaltered data. (The official WMAP website, http://map.gsfc.nasa.gov/, has much more interesting, technical and non-technical information about the WMAP program.) Given the enormous significance of the findings and the high level of interest in these results among cosmologists, it seems unlikely that data processing errors are causing these anomalies.

It would appear that the leading candidate in the search for a cause of the CMB anomalies is some unaccounted for microwave contamination. Researchers' attention seems to be continually brought back to the large foreground radiation emitted by the Milky Way, as shown in Figure 13. Certainly there are imperfections in the removal of the Milky Way contamination. Indeed the areas closest to the Milky Way plane are so heavily contaminated that for many types of analysis it has to be masked or artificially reconstructed, because the cleaning of this region is too uncertain. However, there have been many studies conducted to understand how the data of this region affects the anomalies, and the consensus is that these anomalies are not due to galactic emissions or distortions. For example, Copi et al. (2006) took the cleaned maps produced by the WMAP team and then incrementally added and subtracted known foreground contamination (up to 100% foreground) to see how it affected the multipoles. As might be expected, what they found was that the incremental addition of galactic contamination incrementally caused the multipole to correlate with the galaxy, not the ecliptic. They also note that it takes an appreciable amount of foreground contamination before movement in the multiple alignments is noticeable to the eye. They conclude that

ecliptic plane contamination would tend to produce a correlation that is perpendicular to the one actually observed in the CMB data (Copi et al., 2006).

Along these lines though, one area of investigation creationists might look into is the effect of the removal of the dipole. Gordon, Hu, Huterer, and Crawford (2005) may be useful in this regard. Cosmologists, apparently universally, believe that the dipole is due mainly to movement of the Milky Way through space. In other words, they don't believe the dipole signal has a cosmic origin (because their theories say that there shouldn't be any cosmic dipole signal). Creationists are free to speculate that the dipole may be of cosmic origin and therefore shouldn't be subtracted out of the data. It seems likely that removal of the dipole (recall that the poles of the dipole are very near the ecliptic plane) is capable of causing a predominance of power in the temperature fluctuations near the plane which divides the dipole sphere—this is exactly the plane where we are seeing the unusual alignment of the quadrupole and octopole.

Is Earth at the Center of CMB Structure?

We find then that earth occupies a unique point defined by the structure of the CMB. The plane which divides the most temperature-variable half of the sky from the least temperature-variable half of the sky coincides with the ecliptic plane. Perpendicular to this plane is the quadrupole/octopole plane. The intersection of these two planes defines a line. Perpendicular to this line is a line which connects CMB dipole points—the center of the warm half of the sky, and the center of the cooler half of the sky. This places earth at a unique intersection of structure defined by the CMB (see Figure 15). Keeping in mind that the CMB is thought to originate from the furthest edge of the visible universe, this would seem to imply that cosmological structure is correlated with, and possibly centered on, earth.

No doubt all this "anomalous" structure seen in the CMB is an imprint of, and a clue to, the process that produced the CMB, and therefore should be of utmost interest to creationist cosmologists as they develop their biblically-based cosmologies.

Conclusion

It appears that there is now more and stronger evidence for an earth-centered universe than for a standard homogeneous, isotropic, big-bang universe. The astronomical data indicates that the universe is not homogenous, not isotropic, and that earth claims a special place—the center of the universe.

This paper only gives a general overview of the evidence for an earth-centered universe. I encourage other creationists to join the investigation of these evidences (and other evidence for an earth-centered universe) and document them in greater detail. Each of these lines of evidence could probably be the subject of its own paper. Many papers could be written on the CMB data alone—the subject is deep and the literature is voluminous. Hopefully, we will soon see papers published exploring this evidence more fully.

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