

Understanding the Origin of
Earth's "Nightlights"

STARS AND THEIR PURPOSE



Werner Gitt

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I

CAN THE STARS BE COUNTED?

People have always been fascinated by the stars, and many have tried to count them. When God promised Abraham that he would have innumerable descendants, He drew a striking comparison: “Look up at the heavens and count the stars — if indeed you can count them.” Then He said to him, “So shall your offspring be” (Gen. 15:5). Stars up to the sixth → magnitude¹ are visible to the naked eye. The total number of individual stars visible in both the northern and the southern → celestial hemispheres is about 6,000. On a clear night, one can thus see at most 3,000 stars at the same time. Is that it? With the advent of telescopes many previously unknown stars were discovered. Galileo (1564–1642) was probably the first person to do that, using his homemade telescope. In his famous work *Sidereus nuncius* (1610), he wrote:

It is really astounding to be able to add an innumerable number of fixed stars to the large number which we have been

aware of up to now. These others which have never before been seen, have now become visible and comprise a tenfold increase in the number of stars.

Galileo saw a tenfold increase in the number of visible stars, that is, up to 30,000. From 1852 to 1859, F.W. Årgelander completed his survey and counted 324,198 stars up to the 9th magnitude. The number of stars was once more increased by a factor of ten. The largest earth-bound telescopes, using photographic plates and long exposure times, have made three billion stars visible in each hemisphere (celestial hemisphere), most of which belong to the local Milky Way galaxy. Each half of the → celestial sphere comprises an area equal to 100,000 full moons as seen from earth. It follows that about 30,000 stars occupy an area equal to the full moon. The total number of stars which Galileo could see can today be observed in an area no larger than the apparent size of the moon! Is this the upper limit?

The local Milky Way galaxy has been found to contain 200 billion stars — what an astounding result! If somebody could count three stars per second, then, after 100 years, he would have counted only five percent of this number. Our galaxy comprises not only an unimaginable host of stars, but the size of this bright starry band in the sky is also astounding. Its diameter is said to be 100,000 light-years. Astronomical distances are too large to be measured in miles or kilometers, so light-years are used instead. One light-year is the distance that a light ray travels in one year. At a speed of 300,000 km per second, it amounts to 9.46 trillion kilometers. The total mass of all the stars in the Milky Way amounts to 200 billion times the mass of the sun, which is 2×10^{27} tons, or 333,000 times the mass of the earth. Can we really grasp these large masses and those immense sizes and distances?

And is this the only galaxy? No, with the naked eye we can see three more, namely the two Clouds of Magellan near the southern celestial pole, and the Andromeda galaxy in the constellation of the same name

(designated M31 in Messier's catalogue,² or NGC 224 in the *New General Catalogue of Nebulae and Clusters of Stars*). Andromeda was recognized as a galaxy consisting of individual stars as late as 1923, by means of the 2.5 m mirror telescope at Mt. Wilson. This galaxy is thought to be 2.25 million light-years from us.³ Its total light emission is equal to 2,500 million times that of the sun. However, at this distance stars having the same luminosity as the sun can no longer be proved to exist by the use of optical telescopes. The Andromeda galaxy is the most distant object in the universe that can be seen by the naked eye, except for the occasional supernova.

Numerous other galaxies were discovered by means of the prolonged exposure of photographic plates. According to currently available data, there are 100 million galaxies with stellar magnitudes of up to 21. The actual number could be appreciably larger, because only galaxies up to apparent magnitude 23 lying within a distance of a few billion light-years can be observed. Furthermore, small galaxies are difficult to detect. Probably the world's best telescope is that of the European Organization for Astronomical Research (ESO), located in Chile. The faintest galaxies that can be detected on a photographic plate appear 1,600 million times less bright than stars that can just be seen by the naked eye. A glowing cigar on the moon will have the same apparent brightness on earth as the faintest observable galaxy. Attempts to count even the farthest and the faintest galaxies are continuing. To this end, charge coupled devices (CCDs) are directed at a particular spot in the sky for up to six hours. This process is repeated with different filters to obtain information about the colors of the light emitted by the galaxies. J.A. Tyson of Bell Laboratories and P. Seitzer of National Optical Observatories have succeeded in detecting galaxies up to stellar magnitude 27, covering between 70 and 80 percent of the area of the celestial sphere.

The total number of galaxies discovered thus far is probably in the region of several hundred billion, and it may even amount to a few trillion.

One of the most startling astronomical discoveries is that galaxies occur in clusters, which can be extremely large. The average diameter of such a cluster is about three million light-years. The best-known cluster, consisting of 2,500 galaxies, is Virgo, at an average distance of 70 million light-years from earth. Its diameter is 130,000 light-years, and E. Holmberg estimates that its total mass is equal to 790 billion suns. In contrast to Virgo, the Hercules cluster is relatively small, consisting of 300 galaxies. The cluster to which the Milky Way belongs is called the → “Local Group.”

Why are galaxies clustered together? Obviously the Creator grouped them in clusters, so that even the most distant reaches of the universe can proclaim His glory. At such a vast distance, the light of a single galaxy is too dim to be detected on earth, but a cluster can be observed. The words of the Psalmist, “Like your name, O God, your praise reaches to the ends of the earth” (Ps. 48:10), are also valid for the most distant points of the universe, as is clear from known astronomical facts.

Today, the total number of stars in the observable universe is estimated to be 10^{24} (10 followed by 24 zeroes). Nobody knows the actual number. We read in one of the apocryphal books:

We have seen only a few of His works, the Lord Himself having made all things — and having given wisdom to devout men (Sira 43:36–37).⁴

What does the Bible say about the number of stars? Jeremiah writes: “. . . as countless as the stars of the sky and as measureless as the sand on the seashore” (Jer. 33:22). At that time, when scientists were convinced that there were only about 3,000 stars, Jeremiah wrote that nobody would be able to count the stars. Let us consider an imaginary dialogue between Jeremiah (J) and a well-known astronomer (A) of that day (the seventh century before Christ):

A: Jeremiah, you write about the number of stars as if you knew what you were saying. My colleagues and I have studied

astronomy for a long time and daily concern ourselves with the stars. Our researches have made astronomy the most advanced science. Even kings appreciate and respect our findings.

J: You may have discovered many things, but you are mistaken about the number of stars.

A: How do you know that? You have not studied astronomy, not even for a single semester. So do not speak about matters which you do not understand!

J: Yes, of course my studies were in a totally different field. But I still maintain that nobody is able to count the stars, because they total such a large number, similar to the number of grains of sand on the beach.

A: We have recently completed a survey of the number of stars in the sky, employing our younger colleagues whose vision is sharp and unimpaired. They did not miss any stars, and their count was 3,000. Revise your biblical text; it has been disproved by our scientific findings.

J: I still maintain that I have written the truth. I am no expert, but I know Him who created the stars. He has told me and I believe Him.

It is noteworthy that only now in the 20th century we can fully appreciate the astronomical import of biblical affirmations. It behooves us to trust biblical pronouncements in other cases as well. Let us now try to visualize the above-mentioned number of stars. No human being lives long enough to count such a large number, so we use a computer, one of the fastest ones available.⁵ It can do ten billion calculations in one second, which is extremely fast! But even at this great speed, it would require 30 million years of non-stop counting stars, and indeed, no computer could last as long as that. God has foretold the result of such an endeavor through His prophet Jeremiah in the above quoted Scripture.

Isaiah tells us that God's thoughts and ways are far higher than ours (Isa. 55:8–9). Not only are His thoughts higher than ours, they are also much faster. He can count the stars! He has done exactly that; He even gave each one a name: "He determines the number of the stars and calls them each by name" (Ps. 147:4). The very next verse emphasizes His greatness: "Great is our Lord and mighty in power; his understanding has no limit." This is also proclaimed by Isaiah:

Lift your eyes and look to the heavens: Who created all these?
He who brings out the starry host one by one, and calls
them each by name. Because of his great power and mighty
strength, not one of them is missing (Isa. 40:26).

Johann Hey (1789–1854) wrote the following song full of wisdom:

Do you know how many stars shine in the night?
Do you know how many clouds float in the sky?
Not a single star or cloud escapes God's sight.
He has counted all of them, need we ask why?

The Creator takes note of each and every star, without the use of a computer or a telescope, and in one second. For Him anything is possible! Yet He is also concerned about each and every human being. This is clearly expressed in Psalm 8:3-4:

When I consider your heavens, the work of your fingers,
the moon and the stars, which you have set in place, what is
man that you are mindful of him, the son of man that you
care for him?

In contrast, other world views paint a dreary and dismal picture. F.M. Wuketits, for example, writes [W6, p. 40]: "The universe is as deaf to our lamentations as to our exuberant expressions of joy. Nobody out there in the infinite reaches of the cosmos will be sad when a certain species concludes its process of self-extinction. I am sorry, but this is the only conclusion I could publish about the evolution of

thought.” Similarly false is Kant’s conclusion that the immeasurably large universe destroys our importance. If he had believed some of the verses of Psalm 8, he would have reached quite a different conclusion about our position in this vast universe.

We are not cosmic outcasts (F. Nietzsche: “Kosmische Eckensteher”), neither are we “gypsies at the edge of the universe” [J. Monod, M1, p. 151]. On the contrary, we are beloved by our Father in heaven, through Jesus Christ.

Heinz Kaminski (1921–), for many years the director of the Bochum Observatory, was once asked what his thoughts were when he first pointed his telescope at the moon, the planets, and the Milky Way. Was he also looking for the solution of the puzzle like Einstein? He gave the following revealing answer [H7, p. 106–107]:

We will not find the solution of the puzzle out there in the universe, but in ourselves. This gigantic “something” enters our brain through the pupils, where it begins to grow. What a fantastic event. Astronomers have reduced man to an atomic nothing; he was continuously dragged out and left to stand alone like a worm at seventeen billion light-years. He is overwhelmed by the enormous stars and vast distances. To himself he appears tiny and insignificant. Clever people have forgotten that this puny human being occupies an important place in the eye of the Creator, as can be read in the Bible. When God had created the earth, He found that something was lacking; there was nobody who could appreciate His works and acknowledge His might. Then He created man and gave him some crumbs of the greatness of His own Spirit. And these crumbs enable us to grasp something of the logistics of the entire system. If we did not carry this creative spark, we would not have been able to analyze the laws of the universe nor understand their effects.

The universe in its immensity was especially created for us humans so that we could see and appreciate the glory and the power of God.

He is so great that it required no more effort to create ten stars than one, or one thousand, or even 10^{25} . He did not exert himself, neither did He perspire. His creative words were sufficient: “For he spoke, and it came to be; he commanded, and it stood firm” (Ps. 33:9).

Endnotes

1. Star magnitude: The apparent brightness of stars as seen from earth. The scale of magnitudes does not reflect the actual sizes of the stars. The Greek astronomer Hipparchus (about 190 B.C. to 125 B.C.) divided the visible stars into six brightness groups, the first magnitude being the brightest, and the sixth those which are barely visible. With the advent of telescopes, the scale was extended. This is discussed more fully in appendix A3 (key word: “star magnitude”).
2. Star catalogue: The first printed catalogues of nebulae were published in the middle of the 18th century. These were systematically organized lists of star groupings like the Milky Way, and also gaseous nebulae like the one in Orion. In 1755, N. de la Caille published a list of 42 nebulae, and C. Messier’s (1730–1817) catalogue of 103 objects appeared in 1780 and 1781. It is still known under his name. Later, another astronomer, F.W. Herschel (1738–1822), compiled a list of 2,500 nebulae. The *New General Catalogue of Nebulae and Clusters of Stars* (NGC) appeared in 1888, compiled by the Danish astronomer J. Dreyer (1852–1926). During the period 1990 to 1992, the first catalogue of x-ray stars (with 60,000 stars) was compiled by the German x-ray satellite ROSAT.
3. Astronomical distances: Radar and laser techniques can be employed for measuring the distances in the solar system. Greater distances require the use of parallax, the apparent displacement of an object against the distant background when the observer moves in a direction perpendicular to the line of sight. The distance of certain stars, known as cepheid variables, can be estimated by their period of variability and their apparent brightness. For distances greater than ten million light-years, estimates are based on the red-shift phenomenon. It should be noted that the measurement of very large distances in particular is subject to great uncertainty, both because of the limited accuracy of the measurements, and the supposed meaning of the red shift. One should be very careful with the red shift. The displacement found in star spectra is not interpreted according

to the Doppler effect but according to the expansion of the universe, so that the calculated distances depend strongly on the cosmological model (“big bang”) and on the value of the Hubble constant. As a result of this uncertainty, only the measured value, z , of the red shift (the displacement factor) is often given, and not the estimated distance, which depends on calculations based on the preferred model. Because no other data is available, this book employs the published distances, with the reservation that they are not really dependable.

4. Sira, or “Ecclesiasticus” in *The Jerusalem Bible*: This is one of the apocryphal Old Testament books (Greek: *apókryphos* = concealed, secret, not genuine). Such books are not regarded as the words of God and have not been included with the canonical books of the Bible [G5, p 127–129]. Martin Luther characterized these books as not part of Holy Scripture, but useful and profitable to read. Such quotations are sometimes pertinent to our theme.
5. Computer: One of the fastest computers is the series C-90 CRAY C916/16. It has 16 processors and its speed is approximately 10 GFLOPS (10 Giga FLOPS). FLOPS indicate the number of Floating Point Operations Per Second; 10 Giga FLOPS means that ten billion arithmetical calculations like addition and multiplication can be done in one second. At present, super computers last about five years, and the above-mentioned CRAY computer could only count 1.5 thousand millionth percent of the number of stars in five years.