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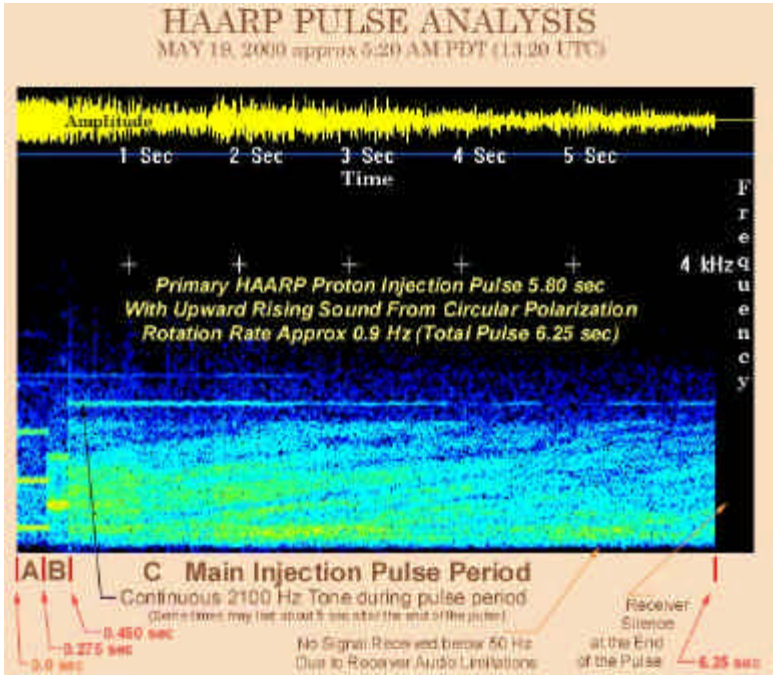

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THE
BIBLICAL ASTRONOMER

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EDITORIAL

It's renewal time for most of you reading this, and we hope you do renew. The price is up a little this year, mostly because of a jump in postage. The murders at the World Trade Center have also cut into the voluntary contributions. We will have more to say on that below and at the end of this issue, but first we'll look at the contents of this issue.

HAARP

This issue is devoted to the High Altitude Auroral Research Project. In the past the *Biblical Astronomer* has debunked myths of astronomical significance. Most particularly we looked at whether or not NASA went to the moon and showed that there is no evidence to say that they didn't. We also looked at the face on Mars and concluded that there, too, there is no basis to think that ancient aliens or antediluvian men made it to let us know they were there or to teach us.

This time we look at a project of military significance which, because of the secrecy surrounding it has become a source of myths almost a fabulous as the mysterious but just as real Area 51 at Groom Lake, Nevada. We present two articles on HAARP, both by people familiar with the people and events surrounding the project. The first article, by Dr. Rosalie Bertell, presents the history leading up to the project. The second is a compilation of views and accounts by different authors and contributors. It looks also at what side effects we may encounter, even catastrophic ones, but these have been considered before in previous issues of the *Biblical Astronomer*.

Cepheid variables and the distance scale

In this issue we continue our review of the cosmic distance scale. The article on page 130 reviews some of the earlier work and shows the difficulty with a pure geocentric model. Since Scripture doesn't say that we are at the center of the firmament, just that we are immobile, it follows that there is no requirement that a central earth be adhered to. Of course, we remember what the mathematician Fourier showed more than a hundred years ago, given enough cyclical arguments, everything can be explained.

Having introduced the Color-magnitude diagram in the previous installment, we now look at the upper half of that diagram, the brightest stars, and therefore those visible the furthest out, and note that some change their brightness from day to day in a way that is quite regular. These are taken as "standard candles," taking the distance determina-

tion out to neighboring galaxies and galaxy clusters. Key to this distance determination step are the Magellanic Clouds, reported to Europe by the explorer Ferdinand Magellan who noted them during his circumnavigation of the earth. The clouds are two hazy patches, looking for all the world like pieces thrown off the Milky Way, and are themselves irregular galaxies, satellites of the Milky Way. Regardless of whether one believes the universe is large or small, these objects are ten times as far away as their size. And, indeed, the uncertainty in their distance is comparable to their thickness.

A new option for copies of the *Biblical Astronomer*

The new subscription rate is $15 per year in the United States, $20 outside the USA. Membership is $20 per year in the USA, $25 outside the USA. Starting with the next issue, electronic delivery becomes an option. Since this will save on postage, the savings will be passed on to our readers. Currently it costs about $1.35 to mail an issue in the US, and at least $2.80 elsewhere since the US Postal Service has obliterated A-O Surface class.

We are thus offering a uniform subscription rate of $10 for anyone, anywhere in the world, who subscribes to the electronic version of the *Biblical Astronomer*. Membership will then be a flat $20 regardless of geographical location. The issue will arrive via e-mail attachment (separate file, not embedded) as an Adobe PDF document or set of documents (that would be one per article in the issue).

Beside the financial savings, there is anther benefit from subscribing to the electronic format. Many of the illustrations are color photographs. These will be reproduced in color. Presently, color work adds $1 per paper side to an issue. A full-color edition could cost $9 per issue. Currently we can only afford that for a cover, and then only a few times per year. We hope many will take advantage of this.

For a complete description of the new items offered for sale and new payment options, please turn to page 138.

Reminder: most readers will have to renew with this issue. Please take a moment to do so now.

Background of the HAARP Project

Rosalie Bertell, Ph.D., GNSH

Military interest in space became intense during and after World War II because of the introduction of rocket science, the companion to nuclear technology. The early versions include the buzz bomb and guided missiles. They were thought of as potential carriers of both nuclear and conventional bombs.

Rocket technology and nuclear weapon technology developed simultaneously between 1945 and 1963. During this time of intensive atmospheric nuclear testing, explosions at various levels above and below the surface of the earth were attempted. Some of the now familiar descriptions of the earth's protective atmosphere, such as the existence of the Van Allen belts, were based on information gained through stratospheric and ionospheric experimentation.

The earth's atmosphere consists of the troposphere, from sea level to about 16 km above the earth's surface; the stratosphere (which contains the ozone level) which extends from about the 16 to 48 km above the earth; and the ionosphere which extends from 48 km to over 50,000 km above the surface of the earth.

The earth's protective atmosphere or "skin" extends beyond 3,200 km above sea level to the large magnetic fields, called the Van Allen Belts, which can capture the charged particles sprayed through the cosmos by the solar and galactic winds. These belts were discovered in 1958 during the first weeks of the operation of America's first satellite, Explorer I. They appear to contain charged particles trapped in the earth's gravity and magnetic fields. Primary galactic cosmic rays enter the solar system from interstellar space, and are made up of protons with energies above 100 MeV, extending up to astronomically high energies. They make up about 100 percent of the high-energy rays. Solar rays are generally of lower energy, below 20 MeV (which is still high energy in earth terms). These high-energy particles are affected by the earth's magnetic field and by geomagnetic latitude (distance above or below the geomagnetic equator). The flux density of low energy protons at the top of the atmosphere is normally greater at the poles than at the equator. The density also varies with solar activity, being at a minimum when solar flares are at a minimum.

The Van Allen belts capture charged particles (protons, electrons and alpha particles) and these spiral along the magnetic force lines toward the polar regions where the force lines converge. They are re-

flected back and forth between the magnetic force lines near the poles. The lower Van Allen Belt is about 7700 km above the earth's surface, and the outer Van Allen Belt is about 51,500 km above the surface. According to the Encyclopedia Britannica, the Van Allen belts are most intense along the equator, and effectively absent over the poles. They dip to 400 km over the South Atlantic Ocean, and are about 1,000 km high over the Central Pacific Ocean. In the lower Van Allen Belt, the proton intensity is about 20,000 particles with energy above 30 MeV per second per square centimeter. Electrons reach a maximum energy of 1 MeV, and their intensity has a maximum of 100 million per second per square centimeter. In the outer Belt, proton energy averages only 1 MeV. For comparison, most charged particles discharged in a nuclear explosion range between 0.3 and 3 MeV, while diagnostic medical X-ray has peak voltage around 0.5 MeV.

Project Argus (1958)

Between August and September 1958, the US Navy exploded three fission type nuclear bombs 480 km above the South Atlantic Ocean, in the part of the lower Van Allen Belt closest to the earth's surface. In addition, two hydrogen bombs were detonated 160 km over Johnston Island in the Pacific. The military called this "the biggest scientific experiment ever undertaken." It was designed by the US Department of Defense and the US Atomic Energy Commission, under the code name Project Argus. The purpose appears to be to assess the impact of high altitude nuclear explosions on radio transmission and radar operations because of the electromagnetic pulse (EMP), and to increase understanding of the geomagnetic field and the behavior of the charged particles in it.

This gigantic experiment created new (inner) magnetic radiation belts encompassing almost the whole earth, and injected sufficient electrons and other energetic particles into the ionosphere to cause worldwide effects. The electrons traveled back and forth along magnetic force lines, causing an artificial "aurora" when striking the atmosphere near the North Pole.

The US Military planned to create a "telecommunications shield" in the ionosphere, reported in 13-20 August 1961, *Keesings Historisch Archief* (K.H.A.). This shield would be created "in the ionosphere at 3,000 km height, by bringing into orbit 350,000 million copper needles, each 2-4 cm long [total weight 16 kg], forming a belt 10 km thick and 40 km wide, the needles spaced about 100 m apart." This was designed to replace the ionosphere "because telecommunications are impaired by magnetic storms and solar flares." The US planned to add to the num-

ber of copper needles if the experiment proved to be successful. This plan was strongly opposed by the International Union of Astronomers.

Project Starfish (1962)

On July 9, 1962, the US began a further series of experiments with the ionosphere. From their description: "one kiloton device, at a height of 60 km and one megaton and one multi-megaton, at several hundred kilometers height" (K.H.A., 29 June 1962). These tests seriously disturbed the lower Van Allen Belt, substantially altering its shape and intensity. "In this experiment the inner Van Allen Belt will be practically destroyed for a period of time; particles from the Belt will be transported to the atmosphere. It is anticipated that the earth's magnetic field will be disturbed over long distances for several hours, preventing radio communication. The explosion in the inner radiation belt will create an artificial dome of polar light that will be visible from Los Angeles" (K.H.A. 11 May, 1962). A Fijian Sailor, present at this nuclear explosion, told me that the whole sky was on fire and he thought it would be the end of the world. This was the experiment which called forth the strong protest of the Queen's Astronomer, Sir Martin Ryle, in the UK.

"The ionosphere [according to the understanding at that time], that part of the atmosphere between 65 and 80 km and 280-320 km height, will be disrupted by mechanical forces caused by the pressure wave following the explosion. At the same time, large quantities of ionizing radiation will be released, further ionizing the gaseous components of the atmosphere at this height. This ionization effect is strengthened by the radiation from the fission products.... The lower Van Allen Belt, consisting of charged particles that move along the geomagnetic field lines... will similarly be disrupted. As a result of the explosion, this field will be locally destroyed, while countless new electrons will be introduced into the lower belt" (K.H.A. 11 May, 1962). "On 19 July ... NASA announced that as a consequence of the high altitude nuclear test of July 9, a new radiation belt had been formed, stretching from a height of about 400 km to 1600 km; it can be seen as a temporary extension of the lower Van Allen Belt" (K.H.A. 5 August, 1962).

As explained in the *Encyclopedia Britannica*: "... Starfish made a much wider belt [than Project Argus] that extends from low altitude out past L=3 [i.e. three earth radiuses or about 13,000 km above the surface of the earth]." Later in 1962, the USSR undertook similar planetary experiments, creating three new radiation belts between 7,000 and 13,000 km above the earth. According to the Encyclopedia, the elec-

tron fluxes in the lower Van Allen Belt have changed markedly since the 1962 high-altitude nuclear explosions by the US and USSR, never returning to their former state. According to American scientists, it could take many hundreds of years for the Van Allen Belts to destabilize at their normal levels. (Research done by: Nigel Harle, *Borderland Archives*, Cortenbachstraat 32, 6136 CH Sittard, Netherlands.)

SPS: Solar Power Satellite Project (1968)

In 1968 the US military proposed Solar Powered Satellites in geostationary orbit some 40,000 km above the earth, which would intercept solar radiation using solar cells on satellites and transmit it via a microwave beam to receiving antennas, called rectennas, on earth. The US Congress mandated the Department of Energy and NASA to prepare an Environmental Impact Assessment on this project, to be completed by June 1980, and costing $25 Million. This project was designed to construct 60 Solar Powered Satellites over a thirty year period at a cost between $500 and $800 thousand million (in 1968 dollars), providing 100 percent of the US energy needs in the year 2025 at a cost of $3,000 per kW. At that time, the project cost was two to three times larger than the whole Department of Energy budget, and the projected cost of the electricity was well above the cost of most conventional energy sources. The rectenna sites on earth were expected to take up to 145 square kilometers of land, and would preclude habitation by any humans, animals or even vegetation. Each satellite was to be the size of Manhattan Island.

Saturn V Rocket (1975)

Due to a malfunction, a Saturn V Rocket burned unusually high in the atmosphere, above 300 km. This burn produced “a large ionospheric hole” (Mendillo, M. Et al., *Science*, pp. 187, 343, 1975). The disturbance reduced the total electron content more than 60% over an area 1,000 km in radius, and lasted for several hours. It prevented all telecommunications over a large area of the Atlantic Ocean. The phenomenon was apparently caused by a reaction between the exhaust gases and ionospheric oxygen ions. The reaction emitted a 6300Å airglow. Between 1975 and 1981 NASA and the US Military began to design ways to test this new phenomena through deliberate experimentation with the ionosphere.

SPS Military Implications (1978)

Early review of the Solar Powered Satellite Project began in around 1978, and I was on the review panel. Although this was proposed as an energy program, it had significant military implications. One of the most significant, first pointed out by Michael J. Ozeroff, was the possibility of developing a satellite-borne beam weapon for anti-ballistic missile (ABM) use. The satellites were to be in geosynchronous orbits, each providing an excellent vantagepoint from which an entire hemisphere can be surveyed continuously. It was speculated that a high-energy laser beam could function as a thermal weapon to disable or destroy enemy missiles. There was some discussion of electron weapon beams, through the use of a laser beam to preheat a path for the following electron beam.

The SPS was also described as a psychological and anti-personnel weapon, which could be directed toward an enemy. If the main microwave beam was redirected away from its rectenna, toward enemy personnel, it could use an infrared radiation wavelength (invisible) as an anti-personnel weapon. It might also be possible to transmit enough energy to ignite combustible materials. Laser beam power relays could be made from the SPS satellite to other satellites or platforms, for example aircraft, for military purposes. One application could be a laser-powered turbofan engine, which would receive the laser beam directly in its combustion chamber, producing the required high temperature gas for its cruising operation. This would allow unlimited on-station cruise time. As a psychological weapon, the SPS was capable of causing general panic

The SPS would be able to transmit power to remote military operations anywhere needed on earth. The manned platform of the SPS would provide surveillance and early warning capability, and ELF linkage to submarines. It would also provide the capability of jamming enemy communications. The potential for jamming and creating communications is significant. The SPS was also capable of causing physical changes in the ionosphere

President Carter approved the SPS Project and gave it a go-ahead, in spite of the reservation which many reviewers, myself included, expressed. Fortunately, it was so expensive, exceeding the entire Department of Energy budget, that funding was denied by the Congress. I approached the United Nations Committee on Disarmament on this project, but was told that as long as the program was called Solar Energy by the United States, it could not be considered a weapons project. The same project resurfaced in the US under President Reagan. He moved it to the much larger budget of the Department of Defense

and called it Star Wars. Since this is more recent history, I will not discuss the debate which raged over this phase of the plan.

By 1978, it was apparent to the US Military that communications in a nuclear hostile environment would not be possible using traditional methods of radio and television technology (*Jane's Military Communications* 1978). By 1982, GTE Sylvania (Needham Heights, Massachusetts) had developed a command control electronic sub-system for the US Air Force's Ground Launch Cruise Missiles (GLCM) that would enable military commanders to monitor and control the missile prior to launch both in hostile and non-hostile environments. The system contains six radio subsystems, created with visible light using a dark beam (not visible[1]) and is resistant to the disruptions experienced by radio and television. Dark beams contribute to the formation of energetic plasma in the atmosphere. This plasma can become visible as smog or fog. Some has a different charge than the sun's energy, and accumulates in places where the sun's energy is absent, like the polar regions in the winter [sic]. When the polar spring occurs, the sun appears and repels this plasma, contributing to holes in the ozone layer. This military system is called: Ground Wave Emergency Network (GWEN). (See *The SECOMII Communication System*, by Wayne Olsen, SAND 78- 0391, Sandia Laboratories, Albuquerque, New Mexico, April 1978.) This innovative emergency radio system was apparently never implemented in Europe, and exists only in North America.

Orbit Maneuvering System (1981)

Part of the plan to build the SPS space platforms was the demand for reusable space shuttles, since they could not afford to keep discarding rockets. The NASA Spacelab 3 Mission of the Space Shuttle made, in 1981, "a series of passes over a network of five ground based observatories" in order to study what happened to the ionosphere when the Shuttle injected gases into it from the Orbit Maneuvering System (OMS). They discovered that they could "induce ionospheric holes" and began to experiment with holes made in the daytime or at night over Millstone, Connecticut, and Arecibo, Puerto Rico. They experimented with the effects of "artificially induced ionospheric depletions

[1] A visible light dark beam seems a contradiction in terms and technically savvy readers may pause at this. However, though I, your editor, know nothing of this kind of dark beam consisting of visible light, I can think of a way to produce it. Consider two laser beams tuned to almost the same wavelength and transmitted 180 degrees out of phase. The resulting beam has no energy and cannot be seen. If the wavelength of each is slightly different at some predetermined distance the beams will become visible. Generally speaking, black light is near ultraviolet, which would explain the plasma reference. [*–Ed.*]

on very low frequency wave lengths, on equatorial plasma instabilities, and on low frequency radio astronomical observations over Roberval, Quebec, Kwajelein, in the Marshall Islands and Hobart, Tasmania" (*Advanced Space Research*, Vo1. 8, No. 1, 1988).

Innovative Shuttle Experiments (1985)

An innovative use of the Space Shuttle to perform space physics experiments in earth orbit was launched, using the OMS injections of gases to "cause a sudden depletion in the local plasma concentration, the creation of a so called ionospheric hole." This artificially induced plasma depletion can then be used to investigate other space phenomena, such as the growth of the plasma instabilities or the modification of radio propagation paths. The 47 second OMS burn of July 29, 1985, produced the largest and most long-lived ionospheric hole to date, dumping some 830 kg of exhaust into the ionosphere at sunset. A 6-second, 68-km OMS release above Connecticut in August 1985, produced an airglow which covered over 400,000 square km.

During the 1980's, rocket launches globally numbered about 500 to 600 a year, peaking at 1500 in 1989. There were many more during the Gulf War. The Shuttle is the largest of the solid fuel rockets, with twin 45-meter boosters. All solid fuel rockets release large amounts of hydrochloric acid in their exhaust, each Shuttle flight injecting about 75 tons of ozone destroying chlorine into the stratosphere. Those launched since 1992 inject even more ozone-destroying chlorine, about 187 tons, into the stratosphere (which contains the ozone layer).

Mighty Oaks (1986)

In April 1986, just before the Chernobyl disaster, the US had a failed hydrogen test at the Nevada Test Site called Mighty Oaks. This test, conducted far underground, consisted of a hydrogen bomb explosion in one chamber, with a leaded steel door to the chamber, two meters thick, closing within milliseconds of the blast. The door was to allow only the first radioactive beam to escape into the "control room" in which expensive instrumentation was located. The radiation was to be captured as a weapon beam. The door failed to close as quickly as planned, causing the radioactive gases and debris to fill the control room, destroying millions of dollars worth of equipment. The experiment was part of a program to develop X-ray and particle beam weapons. The radioactive releases from Mighty Oaks were vented, under a "licensed venting" and were likely responsible for many of the North

American nuclear fallout reports in May 1986, which were attributed to the Chernobyl disaster.

Desert Storm (1991)

According to *Defense News*, April 13-19, 1992, the US deployed an electromagnetic pulse weapon (EMP) in Desert Storm, designed to mimic the flash of electricity from a nuclear bomb. The Sandia National Laboratory had built a 23,000 square meter laboratory on the Kirkland Air Force Base in 1989 to house the Hermes II electron beam generator capable of producing 20 Trillion Watt pulses lasting 20 billionths to 25 billionths of a second. This X-ray simulator is called a Particle Beam Fusion Accelerator. A stream of electrons hitting a metal plate can produce a pulsed X-ray or gamma ray. Hermes II had produced electron beams since 1974. These devises were apparently tested during the Gulf War, although detailed information on them is sparse.

High Frequency Active Auroral Research Program, HAARP (1993)

The HAARP Program is jointly managed by the US Air Force and the US Navy, and is based in Gakona, Alaska. It is designed to "understand, simulate and control ionospheric processes that might alter the performance of communication and surveillance systems." The HAARP system intends to beam 3.6 Gigawatts of effective radiated power of high frequency radio energy into the ionosphere in order to:

- Generate extremely low frequency (ELF) waves for communicating with submerged submarines
- Conduct geophysical probes to identify and characterize natural ionospheric processes so that techniques can be developed to mitigate or control them
- Generate ionospheric lenses to focus large amounts of high frequency energy, thus providing a means of triggering ionospheric processes that potentially could be exploited for Department of Defense purposes,
- Electron acceleration for infrared (IR) and other optical emissions which could be used to control radio wave propagation properties
- Generate geomagnetic field aligned ionization to control the reflection/scattering properties of radio waves,

- Use oblique heating to produce effects on radio wave propagation, thus broadening the potential military applications of ionospheric enhancement technology.

Poker Flat Rocket Launch (1968 to Present)

The Poker Flat Research Range is located about 50 km North of Fairbanks, Alaska, and it was established in 1968. It is operated by the Geophysical Institute with the University of Alaska Fairbanks, under NASA contract. About 250 major rocket launches have taken place from this site, and in 1994, a 16-meter long rocket was launched to help NASA "understand chemical reactions in the atmosphere associated with global climate change." Similar experiments, but using Chemical Release Modules (CRM), have been launched from Churchill, Manitoba. In 1980, Brian Whelan's "Project Waterhole" disrupted an aurora borealis, bringing it to a temporary halt. In February 1983, the chemical released into the ionosphere caused an aurora borealis over Churchill. In March 1989, two Black Brant X and two Nike Orion rockets were launched over Canada, releasing barium at high altitudes and creating artificial clouds. These Churchill artificial clouds were observed from as far away as Los Alamos, New Mexico.

The US Navy has also been carrying on High Power Auroral Stimulation (HIPAS) research in Alaska. Through a series of wires and a 15-meter antenna, they have beamed high intensity signals into the upper atmosphere, generating a controlled disturbance in the ionosphere. As early as 1992, the Navy talked of creating 10-kilometer long antennas in the sky to generate extremely low frequency (ELF) waves needed for communicating with submarines. Another purpose of these experiments is to study the Aurora Borealis, called by some an outdoor plasma lab for studying the principles of fusion. Shuttle flights are now able to generate auroras with an electron beam. On November 10, 1991, and aurora borealis appeared in the Texas sky for the first time ever recorded, and it was seen by people as far away as Ohio and Utah, Nebraska and Missouri. The sky contained "Christmas colors" and various scientists were quick to blame it on solar activity. However, when pressed most would admit that the ionosphere must have been weakened at the time, so that the electrically charged particle hitting the earth's atmosphere created the highly visible light called airglow. These charged particles are normally pulled northwards by the earth's magnetic forces, to the magnetic north pole. The Northern Lights, as the aurora borealis is called, normally occurs in the vortex at the pole where the energetic particles, directed by the magnetic force lines, are directed.

Conclusions

It would be rash to assume that HAARP is an isolated experiment which would not be expanded. It is related to fifty years of intensive and increasingly destructive programs to understand and control the upper atmosphere.

It would be rash not to associate HAARP with the space laboratory construction which is separately being planned by the United States. HAARP is an integral part of a long history of space research and development of a deliberate military nature.

The military implications of combining these projects is alarming.

Basic to this project is control of communications, both disruption and reliability in hostile environments. The power wielded by such control is obvious.

The ability of the HAARP / Spacelab / rocket combination to deliver very large amount of energy, comparable to a nuclear bomb, anywhere on earth via laser and particle beams, are frightening.

The project is likely to be "sold" to the public as a space shield against incoming weapons, or, for the more gullible, a devise for repairing the ozone layer.

Further References:

C. L. Herzenberg, *Physics and Society*, April 1994.

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W. Kofinan and C. Lathuillere, *Geophysical Research Letters*, Vol. 14, No. 11, pp. 1158-1161, November 1987. (Includes French experiments at EISCAT).

G. Metz and F. W. Perkins. "Ionospheric Modification Theory: Past Present and Future," *Radio Science*, Vo1. 9, No. 11, pp. 885-888, November 1974.

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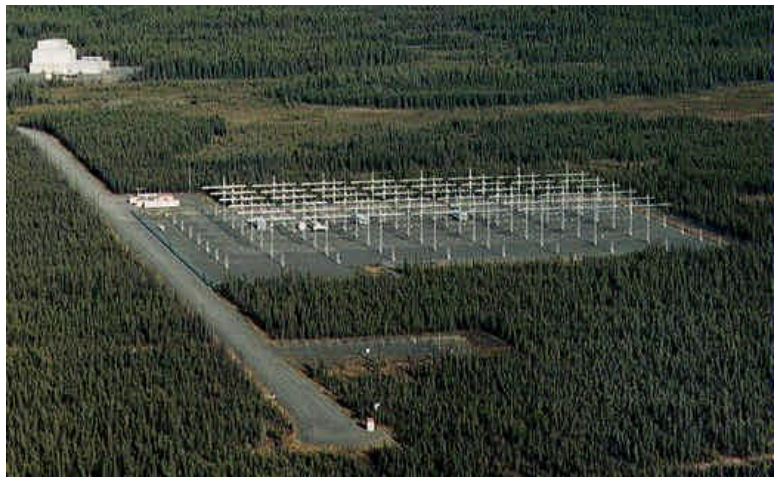
What is HAARP?[2]



Above is an aerial view of the 48-antenna HAARP array. At top left is the Power Generation Building and Future Operations Center, to the left of the 48-Element HF Antenna Array is the Temporary Operations Center and the small structure at the bottom end of the runway is the Aircraft Alert Radar. The clearing above it is the Temporary Radiometer Pad.

HAARP is an acronym that stands for High-Frequency Active Auroral Research Program. It is a research program jointly operated for the U.S. government by the Navy, Air Force, and several universities. HAARP is one of several ionospheric heaters in the world. Others currently working or planned include HISCAT of the International Radio Observatory, Sweden (350 MegaWatts); EISCAT at Tromsö, Norway (48 MW); SURA operated by the Radiophysical Research Institute, at Nizhny Novgorod, Russia (20 MW); the valley-turned-to-radio-receiver dish at Arecibo, Puerto Rico (20 MW); and HIPAS, the High Power Auroral Stimulation Observatory of the UCLA's Plasma Physics Lab at Fairbanks Alaska (17 MW). Little is heard of those others. Ionospheric heating causes the ionosphere to better reflect radio waves.

Because of its unusual nature and its high secrecy, many people wonder about just what HAARP is and does. Most ideas are wild

[2] This article draws heavily from the *Brother Jonathan Gazette* referenced on the inside cover of this issue.

speculations, built on fear, uncertainty and doubt. The most fantastic speculation is one that started as a joke-fax to the Joint Chiefs of Staff. The fax claimed that an accidental shutdown of a HAARP transmitter created a rift in the space-time continuum. The rift allowed several reptilian creatures from another dimension to invade upstate New York. Another extreme myth is that HAARP is a sinister mind-control experiment. In this article we'll look at the nature of the project, what really goes on—as recounted by researchers knowledgeable about the project and its technology.

The HAARP transmitter is located near Gakona, Alaska, about 180 miles northeast of Anchorage. That location is directly under the place where the ionosphere intersects the magnetosphere. The original 48 antennae (pictured above) have been upgraded to 180 covering 33 acres. According to the Department of Defense (DOD), the antennas transmit 3.6 megawatts of power, roughly one-tenth the power of the Voice of America shortwave radio station, but unofficial figures place the power at up to a hundred times that. People with short-wave radios can listen to the HAARP signal. When it broadcasts, it may be heard either at 3.39 or at 6.99 MHz, though the transmitter can be tuned to broadcast at any frequency between 2.8 and 10 MHz. Because of its remoteness, the signal may only be heard at night. Lately, when broadcasting, each signal lasts about six and a quarter seconds and is followed by a quiet period ranging from fifteen to thirty seconds before starting over.

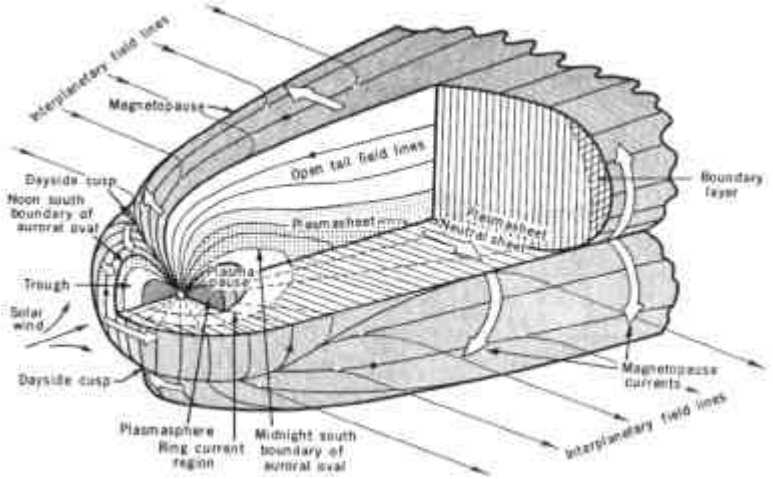
Each of the transmission antennae sits on a 72-foot (24 m) high tower, spaced 80 feet (26 m) from its neighbors, forming a rectangular grid as seen in the above photo. Each tower has two antennae. One is tuned to transmit between 2.8 and 7 MHz and the other from 7 to 10 MHz. A ground screen raised 15 feet (5 m) above the ground acts as a mirror. Under it are 30 transmitter shelters. According to the DOD, each shelter contains six pairs of 10-kilowatt transmitters, feeding 3600 kW to the antenna farm. The signal is sent straight up, heating a pocket of air about 30 miles (50 km) in diameter and a few hundred yards (meters) thick some 25 to 500 miles (40-800 km) above the surface of the earth. This delivers up to 0.02 Watt per square foot (0.1 m^2), which is not a lot, but it is certainly enough to influence charged particles. (The DOD likes to make it sound insignificant, but if that were so it would not make for a useful experiment, would it?) Besides, there is more to the antenna than meets the untrained eye. Note the crosspieces. The antennae are made to send circularly polarized signals, but more on that anon.

Before looking at the signal itself, we need one more item of background. Light travels at 186,000 miles per second (300,000

km/sec). Radio waves bouncing off the ionosphere go around the earth about 7.75 times per second, giving a frequency of about 8 Hz. This is called the first Schumann Resonance of the earth. This is well known, but there is another frequency observed which is more mysterious. Called the Alfvén Resonance, its origin is a complete mystery. Its existence implies that there is another path that radio waves can follow which has a round trip path 8 times the circumference of the earth. Alternatively, it may mean there is a medium through which the radio waves travel which is 8 times slower than the speed of light. It might even be a combination of the two.

When radio waves travel through ionized gas they are slowed down to a degree dependent on the "plasma[3] frequency," which is a function of the temperature, density, and the type of ions that make up the plasma. When radio waves travel through the rocks of the earth they, too, are slowed down depending on the density and make-up of the rock. Consequently, there are three theories about the source of the Alfvén Resonance. The first is that the waves go through the ionosphere, the second through the rocks of the earth (lithosphere), and the third has them passing through the magnetosphere.

The lithospheric theory posits that stressed rock in the earth cause piezo-electric signals (caused when a rock is hit or stressed) which radiate from the source primarily at the Alfvén Frequency. That rocks glow prior to an earthquake has been documented.



[3] Plasma is a gas of charged (ionized) particles, which may or may not be hot. Thus the sun emits protons which hit the earth and excite gas molecules in the atmosphere which, in turn, shine as an aurora.

The Magnetosphere

The ionospheric theory of Alfvén waves has received the most research attention. In that theory, waves travel through the thin plasma between the top of the ionosphere and below the magnetosphere several thousand miles above the surface, at a speed much slower than the speed of light. Maser-like (a *maser* is to radio waves what a laser is to light waves) interactions in layers of ions below the magnetosphere are postulated to be the source of the Alfvén Resonance.

The magnetospheric theory for Alfvén waves posits that waves can travel through the plasma of the magnetosphere itself and just as the electrons are bounced back and forth from north to south magnetic pole, they may be grouped in bunches such that their density rises and falls at a 1 Hz Alfvén rate. Just how this could arise is not clear, but it is possible that the earth's magnetospheric tail (a long cone-shaped region in the figure above on the night-side of earth formed by particles blown away from the sun hitting the day-side of the earth) is the source of the Alfvén waves. A thunderstorm produces aurora-like red and blue streamers called sprites and elves. If the rising streamers radiate electromagnetic waves upward in the direction of the magnetic tail, then the tail itself may act as a "corner reflector" and send the radio waves right back to the thunderstorm which created them, triggering another sprite and so setting up a feedback loop. The loop would last for as long as the thunderstorm is active, with a resonant frequency of 0.9 Hz. The presence of a 0.9 Hz component in the HAARP spectrum is both interesting and informative.

The official version of this classified research facility is that it is to monitor and improve the passing of satellite radio transmissions through the ionosphere, and any other radio signals bounced off it. One proposed line of research couples receivers with a supercomputer to create a cross-sectional scan of the earth, akin to a CAT scan. Presumably, this would allow monitoring of underground nuclear explosions set off in violation of the test ban treaties.

Components of the signal

This section refers to the picture on the front cover of this issue.

The 6.25-second signal constitutes a single pulse of energy. That pulse is a sequence of several phases, each with several components. The first phase lasts for about 0.275 seconds and sends most of its energy in five or six specific frequencies. These lie at roughly 360, 990, 1710, 2370, 2475, and 2970 Hz (cycles per second). Below 1000 Hz the energy density is highest and mostly uniform. Above 1000 Hz and up to about 2100 Hz the energy density is less and also less uniform.

The continuum then drops off up to about 2500 Hz where it goes nearly to zero. The first three, 360, 990, and 1710 Hz are the primary frequencies. The others are presumed to be harmonics of these three, but that does not follow from the spectrum, which your editor measured to come up with those numbers. From 0.275 to 0.450 second, the lines at 360 and 1710 Hz broaden slightly over the first 0.03 second, and then stop abruptly. The 2475 Hz signal persists throughout this phase, though there is a hint that it has broadened a bit. A new tone roughly 100 Hz broad and centered at about 650 Hz starts right at the beginning of the second phase, seems to dip slightly in frequency and then climb back to its original frequency. The second new tone appears to be a harmonic at 1300 Hz except that it starts 0.03 seconds into the phase, right when the 360 and 1710 Hz lines cease. The continuum region of uniform strength ranges from the zero to about 1350 Hz. Above that it is about the same strength as it was during the first phase.

The third phase is the last and the longest. The 2475 Hz line appears to strengthen slightly for the first half second of the third phase and then starts to fade so that it is almost gone 2.6 seconds into the pulse. A new line, at about 2060 Hz starts in this phase and persists throughout it, sometimes lasting about five seconds after the end of the pulse. About the time that the 2475 Hz line fades, though hints of it persist throughout the pulse, the 2060 line also fades a bit and appears to vary in intensity for the rest of the pulse. The remaining second-phase lines end or meld into a broader band, less powerful than the original signal. Several bands below 1300 Hz start and sweep upward during the course of the third phase. Apparently, these bands are accelerating charged particles (ions) sensitive to those frequencies.

There is a component of the spectrum that a short-wave receiver is not designed to show, and that is the existence of any low-frequency waves. That is not a design flaw in the radio, since most people can't hear frequencies much below 50 Hz anyhow. Certainly 1 Hz or less is well below human hearing, although if the signal is loud enough one can "feel" the wave in one's body, or it may feel like a slow moving earthquake or as a rocking motion. A frequency at about 0.9 Hz is a major component of the HAARP pulse, *viz.*, the radio signal is circularly polarized and the time it takes the polarization to sweep around is 1.1 second, that is, its frequency is 0.9 Hz.

Just what is circular polarization? We normally picture a light wave the same way we picture a wave traveling down a rope. Suppose we tie a rope to a tree, then if we move our hand up and down, then the wave we see moves up and down. Likewise, if we move the rope horizontally, that is left and right, then the wave traveling away from us down the rope also lies horizontal. To get circularly polarized waves

on the rope, imagine starting the rope's waves by shaking the rope up and down, then slowly turn the plane in which you are shaking the rope until it's horizontal left-to-right and back. Continue turning the rope until it is in vertical position again, this time going down and up; keep turning until it's back to horizontal right-to-left and then keep rotating until the plane is vertical again, up and down. If the rope was long enough you would see that the plane of the wave twists like a corkscrew or like a twisted streamer. This is circular polarization.

Circular polarization of radio waves is not at all uncommon. For example, all VHF television stations send a circularly polarized signal, one plane for horizontally mounted roof antennas and the vertical component for vertically oriented portable TV antennas.

What the pulse does to the atmosphere

The three phases of the HAARP pulse serve two functions. Phases one and two are a "pre-heat" pulse aimed upward at the ionosphere above the HAARP transmitter. It effectively gets the ions' (charged particles like protons, electrons, and atoms and molecules with one or more electrons knocked off such as ozone, nitrogen, and oxygen) attention. These charged particles start in abundance about 120 miles up from the ground. This is far above the regular atmosphere, which is usually said to extend up to fifteen miles.

Normally the particles in the ionosphere move randomly in all directions. As they move they may collide with other particles and some will recombine with other ions to become neutral atoms such as normal molecular oxygen, nitrogen. These may become part of the atmosphere while others escape into space.

When phases one and two of the HAARP pulse hit the ions, they force them to move back and forth in the plane of the radio wave. The energy of the wave accelerates the ions to near the speed of light. As they gain energy from the radio wave, the ions collide with one another as well as with neutral atoms, which are unaffected by the radio wave, ionizing them. Meanwhile, because of the circular polarization, the charged particles race faster and faster in large circles above the antenna. And wouldn't you know it, but the maximum number of ions will circulate if the rotational rate of the beam is 0.9 Hz.

By forcing the ions to move in big circles, each becomes a little electromagnet with a north and south magnetic pole. At the latitude of HAARP in Alaska, the earth's magnetic force lines are nearly vertical. That way, by polarizing the beam either clockwise or counterclockwise, the ions circulating at 0.9 Hz will either be attracted to the earth's magnetic north pole or repelled away to the south pole. If the

ions were circulated so as to be attracted to the north pole, then they would spiral downward toward the earth's north magnetic pole, hit the denser upper atmosphere, and produce a very weak aurora; hence the name High-frequency Active Auroral Research Program.

HAARP as a particle gun

The idea that HAARP can be used as a particle gun is officially dismissed as one of the HAARP myths. However, it makes the most sense of all accounts, including the official DOD story.

If the HAARP signal's polarity rotates so the ions circle around with their north poles pointing downward, then they are repelled by the earth's magnetic north pole and are shot out into space along the lines of force of the earth's magnetic field. They spiral up to about 10,000 miles (16,000 km) above the earth's equator and then converge on the south magnetic pole, which they reach less than half a second after departure. Since the lines of force converge at the poles, the field gets stronger, and the ions spiral more tightly across the magnetic field lines. At some point, they sense each other's fields and they flip over so that their north poles now are oriented upwards, away from the south magnetic pole and so they are repelled by the pole. They then turn around and are shot back to the north magnetic pole. The round trip takes less than a second.

When the particles return to the north pole they are again squeezed by the magnetic lines of force and they again flip over as they did at the south pole. If the HAARP signal is ready for it, an extra kick is provided at just the right instant to add additional energy to the ions. This also ionizes additional atoms which are then join the pole-to-pole oscillation. In this way HAARP fires billions of ions into the earth's magnetosphere, where they remain trapped for a long time.

According to the patent of record, filed by Eastlund, (1991, patent number 05038664), HAARP could be used to produce a thick cloud of energetic particles in the magnetosphere. Such a cloud would knock out any electronic controls on, or possibly destroy, any spacecraft that flew through it. About the time that the patent was filed in the late '80s, the chief threat to the United States was the nuclear missile threat from the USSR, and any missile from the Soviets aimed at the US would need to pass through the magnetosphere over the north pole. With the HAARP system in place, no missiles from Russia would reach the United States across the pole.

How HAARP cripples missiles

Most people think of an intercontinental ballistic missile (ICBM) as a bomb that is launched by rocket and then falls on the target when the fuel is spent, but an ICBM is actually a space ship. It uses a booster rocket, and maybe even a second stage, to accelerate to near orbital speed in space until it reaches the target area. Then it must re-enter the atmosphere just as a manned spacecraft. To survive re-entry the missile must have a heat shield to protect the warhead from burning up in the atmosphere, or it must fire retro-rockets. If the missile's computer controls are destroyed while passing through the magnetosphere, the missile will not survive re-entry. There's a good chance the missile's control system will be destroyed before the second stage separates from the booster, thus the missile never even arrives over the target.

HAARP and SDI

In the 1980s President Reagan started the Strategic Defense Initiative (SDI or "Star Wars") program. Heralded by pro-Russian academicians as an impossible foolish venture, a complete waste of talent and money, work started on extending the antiquated 1970s technology. All of that early technology was based on firing particle beams, lasers or anti-ballistic missiles at a target, but with the advent of radar absorbing paint and stealth technology, by the early 1980s it was rendered useless. After all, in order to hit the target with the ballistic technology one has to know where the target is.

The alternative is a shield, a device that need not know the target's location in order to stop it. Insofar as a threat from Russia is concerned, HAARP fits the bill. Since all land-based Soviet missiles would be destroyed soon after launch, the only Soviet defense was to fire missiles from their nuclear submarine force. Such a force is only effective for a first-strike, but there are not enough of them to press home a nuclear attack. So the Soviet Union had to take another tact. In order to buy time and technology, it feigned collapse, and dissolved the union in 1991. Besides buying time, the strategy also gave it additional votes in the United Nations, an organization whose constitution was modeled after that of the Bolshevik Republic and whose charter places all UN military under the command of the USSR, that is, Russia.

Now there is a major shortcoming of SDI's reliance on HAARP. The shield follows the lines of the earth's magnetic field. Near the north and south poles the magnetosphere reaches down almost to the atmosphere, but at lower latitudes, particularly at the equator, the magnetosphere is thousands of miles out in space. Thus, though capable of

stopping a missile from Russia going over the polar region, a missile from China can reach the United States while never coming anywhere near the magnetosphere. Thus HAARP is no defense against Chinese nuclear weapons.

In the late 1950s Mao Tse Tung and Khrushchev signed an agreement that in a war against the United States the Soviets would supply the technology and China would supply the troops. SDI threw a new wrinkle in that plan when it rendered the Russian technology obsolete because of geographical factors. Thus during the 1990s Chinese nuclear technology was expanded with the covert help of the entire Executive and many unscrupulous members of the Legislative and Judicial branches of the United States government, much to the consternation and objection of US military leaders.

About 1995, ionospheric physicists studying particles coming from the sun, noticed that the height of the particles shuttling back and forth from pole to pole was dependent on their velocity. The slower the particles moved, the less they felt the constriction of the lines of force, and the closer they came to reaching the top of the atmosphere. So, whereas at first they came to within several thousand miles before being reflected back to the other pole, the slower ones could come down to about 20 to 50 miles above the surface. This gave additional control over HAARP's particle beam. By changing the frequency of the circular polarization during the HAARP pulse, an aurora-like curtain of extremely fast particles can be made to drop down from the magnetosphere to just above the top of the atmosphere along the direction that the HAARP signal is sent.

In the HAARP spectrum shown on the cover, the sloping lines of the green/yellow color are caused by the base frequency of 0.9 to 1 Hz being shifted slightly during the pulse. What is seen in the graph is the higher frequency harmonics of the square wave pulses, which heat the ions, but it is the Ultra Low Frequency (ULF) component which fires them into space. And it is the slow shifting of the ULF component during the pulse which produces the vertical curtain shield. And the shield can be dropped down from the magnetosphere to any point above the top of the atmosphere at will.

The cold war has officially ended. That is the story that our government-controlled media gives us. In a perverted sense that is true, the cold war is actually hotter than it once was. Marshall Smith[4] writes of this:

> At the present time, both the Russian's and Chinese have demonstrated their ability and inclination to engage in warfare, especially space warfare. It would thus seem clear the "coincidence"

[4] http://geocities.com/brojongazette/frontpage/bj0201.html

of the massive Russian war games and the sudden increase in the output of HAARP in a warfare mode, would indicate that on this Presidents Day Weekend 2001, warfare is actually occurring, not just games. Just as in 1983, when planes were destroyed and US airmen died,[5] the story was completely covered up, but it nonetheless had great implications on the relations between the governments of the world.

There are, of course, no airmen on the Russian missiles, nor the Chinese and Russian satellites in orbit. This is the new hi-tech robotic remote control warfare of outer space. But, the "war games" are real, nonetheless. The massive increase in the output of HAARP, under the control of the Air Force's Space Vehicles Command which operates HAARP and has the mission of engaging in space warfare, would indicate a lot of expensive space hardware is now biting the dust. The Russians will claim their exercise was a "success." The Chinese who have just lost their "eyes in orbit" will say nothing. And the US will claim, as usual, "What, who me? HAARP hasn't been in operation since October '99." But you can listen for yourself on any shortwave receiver by tuning to 3.390 MHz. Good Listening.

Another potential application of HAARP is to use it for submarine communications. In order to send signals under water, extremely low frequencies are utilized. In part, the idea is to make them seem like the sounds made by whales and other marine life, or even some tectonic (earthquake-like) noise. Through the extremely low frequencies of HAARP (i.e., the 0.9 Hz wave), signals could be coded that could be received by submarines or others. It wouldn't be fast, but it would be hard to interfere with.

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[5] Smith reports that: "In 1983 a number of Air Force ER-135 electronic warfare planes were shot down in the Sea of Japan. They were apparently making a covert entry into soviet airspace to test the latest Russian technology. What the Air Force did not know then was the Soviets had developed a stealth fighter so the 135's never saw the Russians coming and all 5 of the US e-warfare planes were shot down. To cover this 'covert' event, the US shot down a 747 [presumably empty –*Ed*.], a plane similar to the 135's (or modified Boeing 707's whose parts are very similar to a 747) so if plane parts are found in the Sea of Japan they are claimed to be the 747. This is the supposed 'Russian' shoot down of Korean Airlines Flight 007, on Sept 1, 1983.

"The proof of a covert event with stealth Russian fighters shooting down 5 Air Force ER-135's is documented in R.W. Johnson's book, *Shootdown*, published in 1986. The most convincing evidence is the strange fact that 27 US active duty electronic warfare officers somehow end up on the passenger list among the dead on the civilian Flight 007 going to Korea. I only point this out to show how high tech secret warfare between Russia and the US may result in deaths and the destruction of hardware, and yet is never reported to the public."

Several years ago, we reported on some potential complications, some possible dangers of the HAARP project.[6] Both dealt with the possibility that the earth's magnetic field could temporarily collapse and freeze the region of the poles. Such would be accompanied by an incredibly tremendous electrical discharge, dwarfing any lightning bolt ever before observed. Such events are still possible, but the power and amperage of the current HAARP output is too small to trigger such. Unless the power estimates of critic and advocate alike are grossly underestimated, for the foreseeable future, this will remain the case.

Such a collapse may well have happened in Peleg's day (Genesis 10:25), when the land was divided. The time was about 200 years after the flood, and the continent that once was, was split into today's continents and drifted rapidly apart. A concomitant temporary collapse of the magnetic field trapped in the Van Allen belts could blast-freeze the mammoths in the Arctic, and produced the ice age. The latter lasted about five hundred years.

If such a collapse happened today, it could destroy much of Canada, Russia, and Scandinavia, and maybe the northern U.S., northern China, Japan, southern Africa, southern South America, New Zealand, and possibly even the southern section of Australia. Most likely it would wipe out most, if not all, electronic equipment around the world, too. That would throw warfare back to the days of swords, spears, and chariots: at least for several decades. In the meantime the war continues.

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[6] 1966. "Harping on HAARP," *Biblical Astronomer*, **6**(78):4. Also, the Fall 1999 Panorama note: "Giauque-Debye effect and the wooly mammoths," *ibid*., **9**(90):26.

SPATIAL MEASUREMENTS: CEPHEID VARIABLES AND OTHER DISTANCE INDICATORS

This is the sixth article in a series on the distance scale of the universe.[7] Previous articles have laid the foundation of the debate in terms of what the Bible says and doesn't say about the size of the universe. The consensus of all authors thus far is that the universe is finite. Although Byl's article looked at that very issue, there are some modern arguments for an infinite universe we shall, Lord willing, consider at a later time, perhaps the next issue. The articles also looked at how the distance scale is derived in modern astronomy, starting with parallax, which is the yearly motion of nearby stars when seen against background stars, and then, based on parallax, we looked at how a color-magnitude diagram (akin to a Hertzsprung-Russell Diagram, named after its co-discoverers) extends the distance scale to tens of thousands of light years, and rarely, to other nearby galaxies.

In this article, we shall examine the distance determinations that are based on the color-magnitude diagram. But first, let's review some common misconceptions shared by many about the nature of the distance scale.

The Earth's equator as baseline

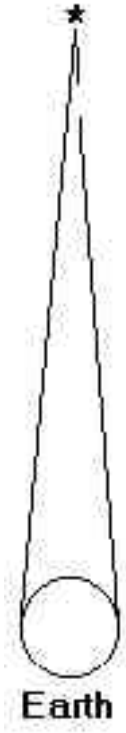
As explained in the second article of the series, there are three interpretations of parallax, which are found among modern geocentrists. One is that the sun and stars are carried along by the entire universe in a yearly motion about the earth; the second is that the eccentricity of the earth-sun motion is the only real baseline; and the third is that the earth's equator is the only basis for parallax.

The figure on the next page illustrates the latter scenario. Here the parallax has no yearly motion, but a daily one. This view has not been fully critiqued in any previous paper, so it behooves us to examine

[7] The previous ones were: (1) Lifschultz, David, 1999. "Spatial Measurement and Modern Science," *Biblical Astronomer*, **9**(90):3. (2) Bouw, G. D., 2000. "Spatial Measurement and Modern Science: A Reply," *ibid*., **10**(91):10. (3) Lifschultz, David, 2000. "Spatial Measurement and Modern Science: Part II," *ibid*. **10**(92):5. (4) Byl, John, 2000. "God, Space and Time," *ibid.*, **10**(94):10. (5) Bouw, G. D., 2001. "Spatial Measurements: the Hertzsprung-Russell Diagram," *ibid*., **11**(95): 5.

this model before proceeding on with the distance scale built on the color-magnitude diagram.

In the diagram, the diameter of the earth is the basis from which the parallax is measured. The parallax is half the angle at the star, that is, it uses the earth's radius as base line, not the diameter.



Now let us take the parallax for our nearest star, Alpha Centauri. It's parallax is 0".756 or 756 milli-arc-seconds. Let the distance to the star measured from the center of the earth be represented by *D*. Let *R* represent the radius of the earth, and let π represent the parallax. Then, since we know π=0".756 and R= 6.38×10^8 cm, then given from trigonometry that:

$$\tan \pi = R/D,$$

it follows that *D* is 1.7×10^{15} cm. Now the earth-sun distance (called the *astronomical unit* by astronomers) is 1.50×10^{13} cm, thus we can express D = 11.6 a.u. which is about 19 million miles beyond the orbit of Saturn. By contrast, Uranus, the next planet beyond Saturn, has an orbit that is roughly 900 million miles past Saturn's.

We find then a flaw with the approach that the earth's radius forms the basis for parallax, namely, that the stars would lie inside the solar system and are closer than the planets we've visited by spacecraft.

But that's actually the least of the objections to this model. Note that an observatory located at the pole would not detect any parallax at all, for any star. Since most observatories lie between the equator and the poles, the value measured for a given east-west parallax is a function of latitude. The parallax for any given star will be greatest when measured at the equator, and least when measured at the poles. Thus, for example, if the above parallax for Alpha Centauri were measured from 45 degrees south latitude, then its value would be about 70% of the above value, that is, 0".53. The distance would still be the same, however. Observatories at different latitudes would observe different values for the parallax of any given star. The further one goes from the equator, the smaller the measured parallax. Thus Sweden's Upsala observatory should always have very much smaller east-west parallaxes for stars such as 61 Cygni (first star to have its parallax measured less than 200 years ago), than the same star measured at France's Pic du Midi.

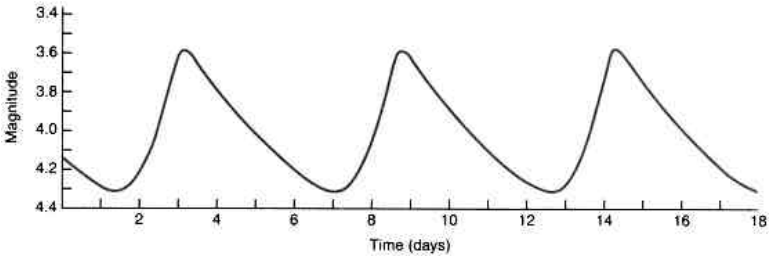
Likewise, the same star's parallax should be even greater when observed at Cairo, etc.

Besides this, stars lying in the plane of the equator should exhibit a parallax when measured from pole to pole. That is, in the above figure we assumed that the lines originated from an eastern point on the equator, went to the star, and then connected to the western point on the equator. However, the picture is not at all changed if the right line originated from the earth's south pole, and the left line from the north pole. Ditto anywhere else on earth. Especially when parallaxes were measured using photographic plates, any such strictly north-south parallax would have been detected. Furthermore, the parallax should vary between sunrise and sunset; that is over a period of twelve hours, not the observed six months.

So we are forced to conclude that, unless there is a totally new and unknown mechanism in play, the postulate that parallaxes are due to the diameter of the earth is not supported by observation.

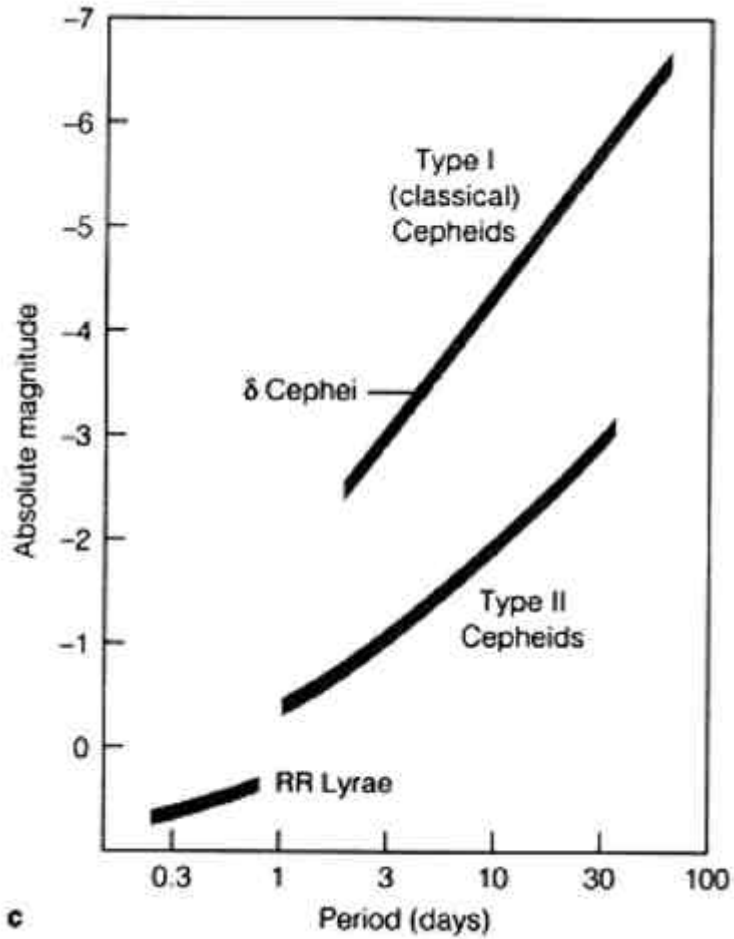
Cepheids and other variable stars

In 1912 Henrietta Leavitt was photographically observing the Magellanic clouds when she discovered a set of bright stars which seemed to vary in regular fashion. The shape of the light curves were like that of the star Delta Cephei in the constellation of Cephus, hence these stars received the name "Delta Cepheids," or Cepheids for short.



Further analysis showed that stars of the same brightness seemed to have the same period, which means that astronomers can find the star's intrinsic brightness by determining its period. The figure above is a typical Cepheid light curve with a period of about six days.

Because the stars in the Magellanic clouds are all roughly the same distance from earth, it was thought that these variable stars could serve as a distance indicator for not only the outer reaches of the Milky Way and its satellites, the Magellanic Clouds, but also for the nearby galaxies. To test this, the brightness of the stars was plotted against the length of their periods. The resulting plot is called a "Period-



Luminosity diagram" or a "PL diagram" for short. The PL diagram is shown above. (Note that the period is a logarithmic scale.)

The main problem with the procedure is that the width of the line is crucial to its success. The narrower the line, the better. Other sources of errors include dust between us and the star, and back in those early days, the fact that photographic film was not uniformly sensitive to all colors of light. Those were problems up to ten years ago, but in the interim film has been replaced by charged-coupled devices (CCDs) which have a flat response over the needed color range, and observations in the infrared which minimizes errors introduced by intervening dust. The variations in brightness range from a few percent

to a factor of ten, but does not appear to relate to the period. The longer-period Cepheid variables are brighter than the short-period Cepheids, so by timing the period of variation, astronomers can determine a Cepheid's absolute magnitude. Then by comparing the star's absolute magnitude to its apparent magnitude (called the *Distance Modulus*[8]), they can compute the distance of the star from earth. Several hundred Cepheid variables are known in our Galaxy. Polaris, the North Star, is a Cepheid variable with a period just under four days.

Minimizing the width of the band

The main source of uncertainty in using Cepheid variables for distance indicators lies in the width of the band, the top line in the second figure. To determine the color or temperature of a star, astronomers divide light into certain regions, each labeled with a characteristic color. A letter designates each of these color bands. U stands for ultraviolet, next is B for blue, then V for visual (yellow), R for red, and I for infrared. Further into the infrared come J, H, and K, respectively, the latter is centered at 2.2 microns.

The width of the band depends on the color one uses. For example, the range in magnitude for Cepheids measured in the blue (B) band is 1.2 magnitudes. In the visual band (V) it drops to 0.9 magnitude. If the two colors are combined, the B-V (B minus V) scatter is 0.4 magnitudes. Just how big is the effect of this on distance? Well, an error of $\pm 0^m.6$ in B results in an uncertainty of 30% in distance. If two or three dozen Cepheids can be found in an object at the same distance, this error drops to ±10%. Likewise, observing further into the infrared reduces the scatter so that in the K region it is down to about $\pm 0^m.13$.

So the techniques for refining the PL line have been refined to such a limit. But these techniques are observational and have no dependence on the theory underlying the structure and aging (called *evolution* by astronomers) of these variable stars. To calibrate them to the

[8] The distance modulus is a measure of distance expressed in magnitudes, that is, a measure of the brightness of a star, related to distance. The magnitude scale is erected so that each magnitude is 2.5 times fainter than the next. The difference between the brightest stars (magnitude 0) in the sky and the faintest (magnitude 5) is five magnitudes. That means that the brightest stars are 2.5^5 or 100 times fainter than stars of magnitude 0. If M represents the magnitude of a star would have if it were placed 10 parsecs (32.6 light years) from earth, and m represents the magnitude it has now, measured from earth, then the distance modulus is the difference $m - M$ and relates to distance, d, as:

$$m - M = 5 \log d - 5.$$

The distance modulus is thus zero at a distance of 10 parsecs and increases by 5 magnitudes for each factor of 10 in distance.

distance measurements we're covered so far, we need the find Cepheids with observed parallaxes. Since the nearest Cepheids are one to two thousand light years away, such stars with measured parallaxes are few. Based on 26 Cepheids with parallaxes measured by the Hiparchos satellite, the absolute visual magnitude depends on the period as follows:[9]

$$M_v = -2.81 \log (P) - 1.43.$$

These can be matched with other techniques (such as Zero-Age Main Sequence Fitting mentioned previously). The greatest repositories of Cepheid variables at the same distance are the Magellanic clouds. Using the parallax based relation, above, the distance modulus to the Magellanic Cloud is 18.70 ± 0.10. The distance modulus (*D*) is the apparent visual magnitude m_v (a magnitude is a measure of a star's brightness) less the absolute visual magnitude M_v. A star's absolute magnitude is the magnitude the object would have if placed ten parsecs[10] from earth. Since the brighter a star, the smaller its magnitude, the relationship is:

$$D = (m_v - M_v).$$

Reddening is the primary source of error in determining the width, slope, and zero point of the Cepheid period-luminosity line. Once that is stabilized (by observing at wavelengths unaffected by dust) then secondary uncertainties can be dealt with. These include the effect of metalli-city (in astronomy the term usually means elements heavier than helium) which appears to be no more than $\pm 0^m.02$, companion stars, carbon-nitrogen-oxygen abundance (CNO), helium abundance, mass loss, magnetic fields, and the possibility of curvature in the PL relation (such as observed in the Type II Cepheid line. All these are observational problems and not theoretical. Studies of Cepheids in specific galaxies and even regions of neighboring galaxies are helping resolve these observational issues. The most common objects studied are the Magellanic Clouds, the Fornax system, and the Andromeda Galaxy (M31).

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[9] Feast, M.W. & R.M. Catchpole, 1997. *Mon. Not R. Astron. Soc*., 286:1

[10] One parsec is the distance from earth at which a star's parallax is one second of arc. It amounts to 3.258 light-years, 3.086×10^{13} kilometers, or 1.918×10^{13} miles. It comes from par(allax) + sec(ond).

The Large Magellanic Cloud

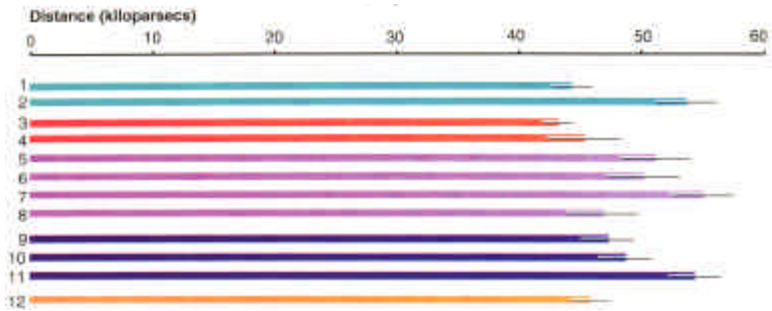
The next calibration step, beyond our own Galaxy, is the Large and Small Magellanic Clouds. The Magellanic Clouds were named after Magellan who observed these cloud-like starry patches in the Southern sky and told of them to Europe upon his return from his round-the-world voyage. These star clouds, satellites of our Galaxy, are the testing grounds for the "standard candles," as these distance-determination objects are called. One of the key standardization points is the observed expansion of supernovae.

The 1987 supernova (exploding star), SN 1987A in the Large Magellanic Cloud, was observed to "expand" into a ring. The ring surrounded the star, presumably. In principle, the true ring size can be computed by measuring the time delay between the flash of the supernova and the later reflection off the ring. The speed of light times the delay time would give the size. But the light does not simply reflect off the ring. The supernova's light causes the ring to fluoresce, and, just as it takes time for a fluorescent light to start, so it takes time for the atoms in the ring (which are only a few per cubic inch verses many times more in a light) to start fluorescing. The time can be computed, however, but the ring is tilted instead of face-on. Thus the secondary bursts of light, the echoes of the supernova's explosion, are further spread out in time because of the different distances the light from them has to travel to reach earth. Based on those observations, several researchers derived the distance modulus for the Large Magellanic Cloud. The following is a list of some of the researchers' results: 18.61 ± 0.11, 18.52 ± 0.13, 18.50 ± 0.13, and 18.38 ± 0.07. Compare that with the 18.70 derived from Milky Way Cepheids reported above. But estimates in the last three or four years, based on a more complete picture of the ring, not tend to hover around 18.4 which corresponds to 47 thousand parsecs (kpc). The above distance moduli hover around 50 kpc, but bear in mind that the Small Magellanic cloud is itself at least 5 kpc wide and the Large Magellanic Cloud is at least 8 kpc wide at that distance.

Another group of variable stars have similar dependency of period and luminosity but not as bright as Cepheids are the RR Lyrae stars. These are also diagrammed on the first figure.

Newer, and also promising as a standard candle, is the tip of the red giant branch (TRGB) method. It is comparable in accuracy to the Cepheid PL relation but can be used further out as it deals with brighter stars. Furthermore, it is applicable to any galaxy containing a detectable population of old, metal-poor, low mass stars. In practice, this means

that most nearby galaxies, regardless of galaxy type or inclination, can now be placed on a common distance scale out to the crowding and flux limits of CCD detectors and telescopes. These distances will allow, for the first time, a complete sample of accurate, uniformly-measured distances to all galaxies within the Local Group and out to distances of about 10 million parsecs (32 million light years).



The figure above compares various distance estimates to the Magellanic Clouds. These are obtained by various methods. Distances 1 and 2 are from RR Lyrae stars, 3-4 from red clump stars, 5-8 from Cepheids, 9-11 from the supernova 1987A, and 12 from an eclipsing binary (double stars where one passes between the other and earth).

The use of variable stars such as Cepheids and RR-Lyrae stars appears to give a loosely consistent distance or brightness relationship with period. The noise or uncertainty in the Period-Luminosity relationship appears to introduce an uncertainty of ten to twenty percent for an object based on a small sample of stars (the above chart has a scatter of about 12%). Distance estimates based on rarer events, such as supernovae, are not inherently as accurate, although they can be seen at much greater distances. The problem is, at this time, primarily statistical. One would need hundreds of events in nearby galaxies to build a statistically significant foundation upon which to build a distance indicator. Until such happens, several other methods are used to estimate distances to galaxies. From this point on, these methods are tied to redshifts.

NEW ITEMS IN STOCK

The phrase, in stock, has two meanings. The one you're probably thinking of is the first, namely, we have a set of items ready to be sold and shipped out to you. But the second meaning is also *à propos*, things that are being prepared for the future. We have items of both types.

New payment options for readers

As mentioned on the inside cover, payment for subscriptions, membership, and merchandise can now be made over the Internet. It is even possible to pay by credit card, even though the Biblical Astronomer does not accept credit cards. Now those with a connection to the Internet can go to www.paypal.com and register with them. PayPal acts as an intermediary, guaranteeing that transactions will flow smoothly. Once registered, which requires either a credit card or a bank account number, payments can be made electronically. Although at present we don't have a merchandise page on the Internet, all one has to do is to figure out the total cost of items ordered and shipping, then make the payment via PayPal to the gbouw@bw.edu e-mail account. You will be given a chance to add a message and in that message you can list the items ordered. If you leave an email address, your order will be confirmed in three or four business days.

Although this method may not have much appeal for readers in the United States and Canada, it is especially practical for readers located outside North America. In particular, it means that it is no longer to exchange money and send cash or check drawn on a bank with American address – not that cash has ever disappeared from an envelope sent to us from overseas. (Yes, it did happen once domestically, but the envelope was not sealed when it arrived.)

The new videos

We have now finished a video featuring the first geocentric orrery that was described in the Fall 2000 issue, no. 94, p. 5. The new video explains the motions and seasons from a geocentric perspective. Titled ***Geocentricity: the Scriptural Cosmology***, it's over an hour long, using both video and animations. The seasons are explained, as well as the retrograde motions of the outer planets and parallax. The total motion of the universe's rotation about the earth, with the yearly motion of the sun about the earth are demonstrated by the orrery. Prices are on the inside front cover.

In addition to the new video tape done by the Biblical Astronomer, we have also obtained an inventory of the works of Philip Stott, a South African lecturer. He was born in England in 1943 and has maintained a life-long interest in several branches of science. He has a B. S. (honors) and M.S. degrees, and has been a lecturer at universities in Nigeria and South Africa, practiced as a Civil Engineer, and done research in Applied Mathematics. After many years as a firm atheist, he was converted to Christianity in 1976. For the last several years he has traveled widely, lecturing, presenting slide shows, and taking part in conferences dealing with scientific and religious matters.

Mr. Stott has long been both a creationist and geocentrist. His works bring fresh insight to the American public because American creationists tend to ignore European contributions. I've found them quite well done.

Among his works are three video tapes: ***Evidence for the Flood***, ***Problems in Astronomy***, and ***Where in the Universe Are We?***

The first tape deals with the evidences for the flood. It focuses mainly on the evidence for the great flood which evidence is found in the proverbial geologic column. Mr. Stott uses both American and European sources to paint a convincing picture for the reality of Noah's Flood.

The second tape, *Problems in Astronomy*, examines the evidence for a young universe, one created about 6,000 years ago. It touches on geocentricity. I did find one flaw in this video. In adjoining sentences, Orion is accidentally called a galaxy, and the Horsehead Nebula in Orion is on screen, but called the Great Nebula in Orion accompanied by a correct description of the Orion Nebula. A picture of the Great Nebula, also called the Orion Nebula, starts off the video.

The last tape, *Where in the Universe Are We*, looks at geocentricity and the evidences for it.

New geocentric books

Philip Stott has also published a couple of books which we have in stock. The first is ***The Earth: Our Home***, the second is ***Vital Questions***.

About *The Earth: Our Home*, one has written: "The wise men, philosophers, and scientists of the world have repeatedly changed their minds about such things as space and our position in it. This book provides and historical look at the topic of geocentricity and offers evidence for it."

Vital Questions tackles just how flimsy the evidence is for such well-established ideas as the Big Bang, Relativity, and evolution. It, too, presents a geocentric perspective.

Things in stock for us

Both *Geocentricity* and *The Book of Bible Problems* need another printing. *Geocentricity* also needs a reworking of chapter 28, the chapter on the firmament. Although most of what is in that chapter is correct, the conclusion that the universe has to rotate once a day for it to exist turned out to be wrong, based on copying the wrong sign in an exponent. It probably would have been noticed earlier but the error coincidentally gave an expected result.

A second orrery, a little bit smaller than the first, has now been finished. Pastor Norwalt finished it this summer. The starry background is larger, and the model is more versatile. We plan to use it in a sequel to *Geocentricity: the Scriptural Cosmology*. That is probably at least a year away, if not longer.

Timothy Unruh is making progress towards an astronomy text for home schoolers. He anticipates that it, too, is at least a year away. He has found a publisher. By the way, Mr. Stott's works are used quite a bit by home schoolers in South Africa. Mr. Unruh has also finished a slim comb-bound volume in support of the King James Bible. It is very good and I would like to offer it but I want to get the finances and the commercial web site in place first.

I spoke at a King James Bible Conference the 5th and 6th of November. While there, I presented some findings of astronomical significance relating to the defense of the King James Bible. Among those was the Morning Star article published in the previous issue. More evidence of a similar nature was uncovered while researching the witness of the stars. That will continue and eventually, Lord willing and we live, be published in book form.

It has been 34 years since the late Walter van der Kamp published his first booklet, *The Heart of the Matter*, which he later tagged as the first issue of *The Bulletin of the Tychonian Society*. It has now been thirty years since publication number 5, the first to be called "The Bulletins of the Tychonian Society" was issued (March 1971). From day one, it was a faith ministry, but it withstood the economic turn-downs of the 1970s and persists to this day. In 1991, the then "Bulletin of the Tychonian Society" was renamed "The Biblical Astronomer," and the Tychonian Society, as such, was no more. But that was the letter of the law, not the spirit. At this time, we have not quite enough money to publish and mail this issue. We could forego the color cover, but that would render the cover useless in understanding the accompanying article. The Lord will provide.

Have a blessed holiday season and a prosperous 2002.

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

TITLES AVAILABLE FROM THE B.A.

Orders can be honored only if accompanied by payment in United States currency either by cheque drawn on a U.S. bank or cash. US orders add 15% postage. Orders outside North America please add $5 per item, $2 per audio tape (sorry, the US Postal Service quadrupled postage this year).

BOOKS AND TAPES

The Book of Bible Problems. The most difficult "contradictions" in the Bible are answered without compromise. "A classic," writes Gail Riplinger. 266 pages, indexed. $12

Geocentricity. The best, most comprehensive book on the topic of geocentricity. 400 pages, 45 figures, scripture and general indexes. In Europe, Geocentricity may be purchased for £12.50 (postpaid in the U.K., postage by quotation otherwise) from Brian V. Lamb, Quarryside, Castletown, Caithness, Scotland KW14 8SS. $15

The Geocentric Papers, A compendium of papers, most of which appeared in the *Bulletin of the Tychonian Society*. A technical supplement to *Geocentricity*, including articles on geocentricity, creationism, and the Bible itself. (120 pages, 8.5x11 gluebound.) $15

New-Age Bible Versions, by Gail Riplinger. The critics love to attack the author, but they never, ever address the **real** issue, *viz*. the occult influence in the modern versions. A real eye-opener. 600^{+} pages. $15

Geocentricity Videotape. Martin Selbrede gives a first rate presentation of geocentricity. Good quality tape. (American VHS only.) $20

A Creationist Scenario for the Creation. Dr. Bouw presents a scientific approach to the creation act demonstrating that it is possible to derive a biblical scientific model of creation. (American VHS.) $20

Thinking Psych-Economically Interviews. Economist Dr. Arthur Sharron interviews Dr. Bouw on the scientific inerrancy of scripture and the decline of Biblical authority. (Two programs, American VHS.) $20

(Continued on the inside front cover.)