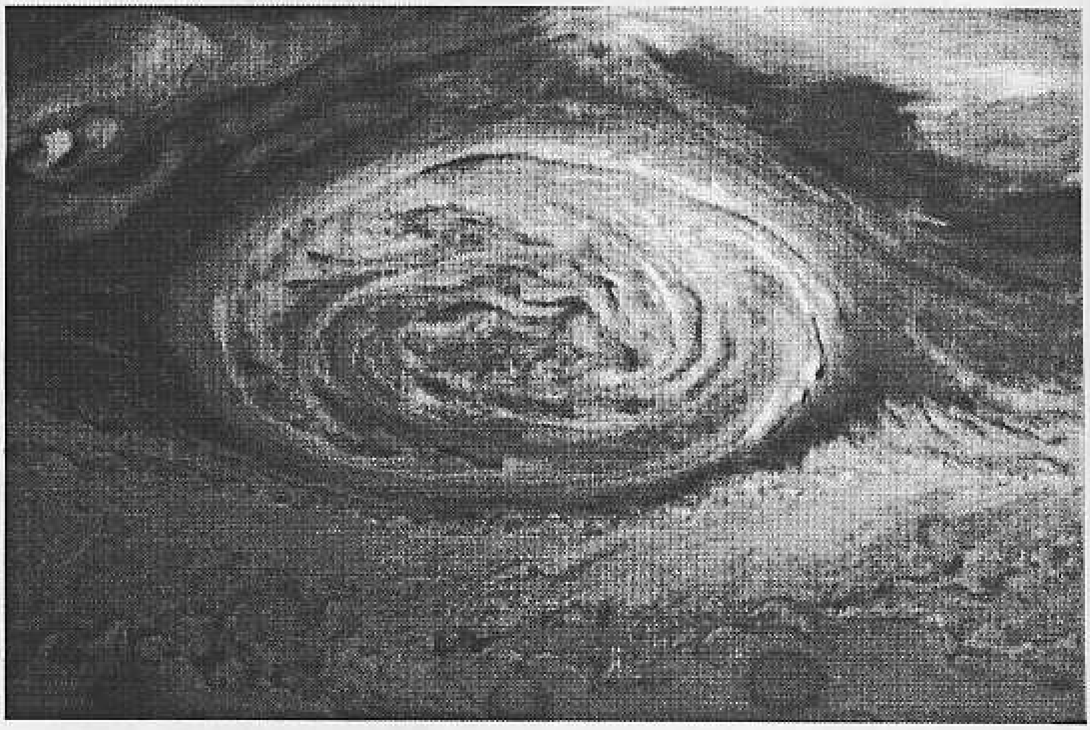
Reflections ~~Reflections~~

of the University Lowbrow Astronomers

August 1996

Galileo, Cassini, and the Great Red Spot

Credit: Galileo Project, JPL, and NASA (from APOD Archives)



Imagine a hurricane that lasted for 300 years! Jupiter's Great Red Spot indeed seems to be a giant hurricane-like storm system rotating with the Jovian clouds. Observed in 1655 by Italian-French astronomer Jean-Dominique Cassini, it is seen here over 300 years later - still going strong - in a mosaic of recent Galileo spacecraft images. The Great Red Spot is a cold, high pressure area 2-3 times wider than planet Earth. Its outer edge rotates in a counter clockwise direction about once every six days. Jupiter's own rapid rotation period is a brief 10 hours. The Solar System's largest gas giant planet, it is presently well placed for evening viewing. (Thanks to Alan Radecki for assembling a preliminary mosaic from the Galileo imagery!)

The University Lowbrow Astronomers

is a club of Astronomy enthusiasts which meets on the third Friday of each month in the University of Michigan's Physics and Astronomy Building (Dennison Hall, Room 807). Meetings begin at 7:30 pm and are open to the public. Public star parties are held twice a month at the University's Peach Mountain Observatory on North Territorial Road (1.1 miles west of Dexter-Pinckney Road; further directions on page 9) on Saturdays before and after the new Moon. The party may be cancelled if it's cloudy at sunset. For further information, call 480-4514.

Important Dates

This Month:

Aug 10 - **Public Star Party** at Peach Mountain Observatory

Aug 16 - Meeting at 807 Dennison - speaker and topic to be announced

Aug 17 - Public Star Party at Peach Mountain Observatory

Next Month:

Sep 7 - Public Star Party at Peach Mountain Observatory

Sep 14 - Public Star Party at Peach Mountain Observatory

Sep 20 - Meeting at 807 Dennison - speaker and topic to be announced

Meteorite Yields Evidence of Primitive Life on Early Mars

NASA Press Release

A NASA research team of scientists at the Johnson Space Center (JSC), Houston, TX, and at Stanford University, Palo Alto, CA, has found evidence that strongly suggests primitive life may have existed on Mars more than 3.6 billion years ago.

The NASA-funded team found the first organic molecules thought to be of Martian origin; several mineral features characteristic of biological activity; and possible microscopic fossils of primitive, bacteria-like organisms inside of an ancient Martian rock that fell to Earth as a meteorite. This array of indirect evidence of past life will be reported in the August 16 issue of the journal Science, presenting the investigation to the scientific community at large for further study.

The two-year investigation was co-led by JSC planetary scientists Dr. David McKay, Dr. Everett Gibson and Kathie Thomas-Keprta of Lockheed-Martin, with the major collaboration of a Stanford team headed by Professor of Chemistry Dr. Richard Zare, as well as six other NASA and university research partners.

"There is not any one finding that leads us to believe that this is evidence of past life on Mars. Rather, it is a combination of many things that we have found," McKay said. "They include Stanford's detection of an apparently unique pattern of organic molecules, carbon compounds that are the basis of life. We also found several unusual mineral phases that are known products of primitive microscopic organisms on Earth. Structures that could be microsopic fossils seem to support all of this. The relationship of all of these things in terms of location - within a few hundred thousandths of an inch of one another - is the most compelling evidence."

"It is very difficult to prove life existed 3.6 billion years ago on Earth, let alone on Mars," Zare said. "The existing standard of proof, which we think we have met, includes having an accurately dated sample that contains native microfossils, mineralogical features characteristic of life, and evidence of complex organic chemistry."

"For two years, we have applied state-of-the-art technology to perform these analyses, and we believe we have found quite reasonable evidence of past life on Mars," Gibson added. "We don't claim that we have conclusively proven it. We are putting this evidence out to the scientific community for other investigators to verify, enhance, attack — disprove if they can — as part of the scientific process. Then, within a year or two, we hope to resolve the question one way or the other."

"What we have found to be the most reasonable interpretation is of such radical nature that it will only be accepted or rejected after other groups either confirm our findings or overturn them," McKay added.

The igneous rock in the 4.2-pound, potato-sized meteorite has been age-dated to about 4.5 billion years, the period when the planet Mars formed. The rock is believed to have originated underneath the Martian surface and to have been extensively fractured by impacts as meteorites bombarded the planets in the early inner solar system. Between 3.6 billion and 4 billion years ago, a time when it is generally thought that the planet was warmer and wetter, water is believed to have penetrated fractures in the subsurface rock, possibly forming an underground water system.

Since the water was saturated with carbon dioxide from the Martian atmosphere, carbonate minerals were deposited in the fractures. The team's findings indicate living organisms also may have assisted in the formation of the carbonate, and some remains of the microscopic organisms may have become fossilized, in a fashion similar to the formation of fossils in limestone on Earth. Then, 16 million years ago, a huge comet or asteroid struck Mars, ejecting a piece of the rock from its subsurface location with enough force to escape the planet. For millions of years, the chunk of rock floated through space. It encountered Earth's atmosphere 13,000 years ago and fell in Antarctica as a meteorite.

It is in the tiny globs of carbonate that the researchers found a number of features that can be interpreted as suggesting past life. Stanford researchers found easily detectable amounts of organic molecules called polycyclic aromatic hydrocarbons (PAHs) concentrated in the vicinity of the carbonate. Researchers at JSC found mineral compounds commonly associated with microscopic organisms and the possible microscopic fossil structures.

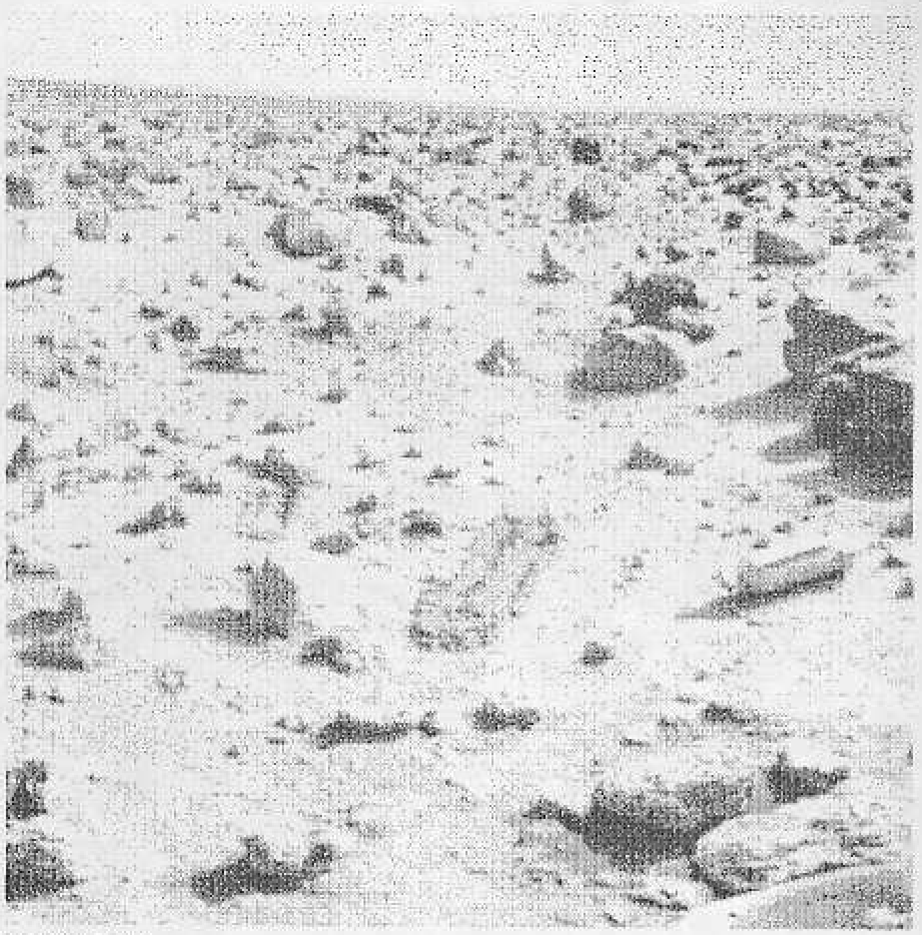
The largest of the possible fossils are less than 1/100 the diameter of a human hair, and most are about 1/1000 the diameter of a human hair - small enough that it would take about a thousand laid end-to-end to span the dot at the end of this sentence. Some are egg-shaped while others are tubular. In appearance and size, the structures are strikingly similar to microscopic fossils of the tiniest bacteria found on Earth.

The meteorite, called ALH84001, was found in 1984 in Allan Hills ice field, Antarctica, by an annual expedition of the National Science Foundation's Antarctic Meteorite Program. It was preserved for study in JSC's Meteorite Processing Laboratory and its possible Martian origin was not recognized until 1993. It is one of only 12 meteorites identified so far that match the unique Martian chemistry measured by the Viking spacecraft that landed on Mars in 1976. ALH84001 is by far the oldest of the 12 Martian meteorites, more than three times as old as any other.

Many of the team's findings were made possible only because of very recent technological advances in high- resolution scanning electron microscopy and laser mass spectrometry. Only a few years ago, many of the features that they report were undetectable. Although past studies of this meteorite and others of Martian origin failed to detect evidence of past life, they were generally performed using lower levels of magnification, without the benefit of the technology used in this research. The recent discovery of extremely small bacteria on Earth, called nanobacteria, prompted the team to perform this work at a much finer scale than past efforts.

The nine authors of the Science report include McKay, Gibson and Thomas-Keprta of JSC; Christopher Romanek, formerly a National Research Council post-doctoral fellow at JSC who is now a staff scientist at the Savannah River Ecology Laboratory at the University of Georgia; Hojatollah Vali, a National Research Council post-doctoral fellow at JSC and a staff scientist at McGill University, Montreal, Quebec, Canada; and Zare, graduate students Simon J. Clemett and Claude R. Maechling and post-doctoral student Xavier Chillier of the Stanford University Department of Chemistry.

The team of researchers includes a wide variety of expertise, including microbiology, mineralogy, analytical techniques, geochemistry and organic chemistry, and the analysis crossed all of these disciplines. Further details on the findings presented in the Science article include:



Mars' surface with the Viking Ground Scoop

* Researchers at Stanford University used a dual laser mass spectrometer — the most sensitive instrument of its type in the world — to look for the presence of the common family of organic molecules called PAHs. When microorganisms die, the complex organic molecules that they contain frequently degrade into PAHs. PAHs are often associated with ancient sedimentary rocks, coals and petroleum on Earth and can be common air pollutants. Not only did the scientists find PAHs in easily detectable amounts in ALH84001, but they found that these molecules were concentrated in the vicinity of the carbonate globules. This finding appears consistent with the proposition that they are a result of the fossilization process. In addition, the unique composition of the meteorite's PAHs is consistent with what the scientists expect from the fossilization of very primitive microorganisms. On Earth, PAHs virtually always occur in thousands of forms, but, in the meteorite, they are dominated by only about a half-dozen different compounds. The simplicity of this mixture, combined with the lack of light- weight PAHs like napthalene, also differs substantially from that of PAHs previously measured in non-Martian meteorites.

* The team found unusual compounds — iron sulfides and magnetite — that can be produced by anaerobic bacteria and other microscopic organisms on Earth. The compounds were found in locations directly associated with the fossil-like structures and carbonate globules in the meteorite. Extreme conditions — conditions very unlikely to have been encountered by the meteorite — would have been required to produce these compounds in close proximity to one another if life were not involved. The carbonate also contained tiny grains of magnetite that are almost identical to magnetic fossil remnants often left by certain bacteria found on Earth. Other minerals commonly associated with biological activity on Earth were found in the carbonate as well.

* The formation of the carbonate or fossils by living organisms while the meteorite was in the Antarctic was deemed unlikely for several reasons. The carbonate was age dated using a parent-daughter isotope method and found to be 3.6 billion years old, and the organic molecules were first detected well within the ancient carbonate. In addition, the team analyzed representative samples of other meteorites from Antarctica and found no evidence of fossil-like structures, organic molecules or possible biologically produced compounds and minerals similar to those in the ALH84001 meteorite. The composition and location of PAHs organic molecules found in the meteorite also appeared to confirm that the possible evidence of life was extraterrestrial. No PAHs were found in the meteorite's exterior crust, but the concentration of PAHs increased in the meteorite's interior to levels higher than ever found in Antarctica. Higher concentrations of PAHs would have likely been found on the exterior of the meteorite, decreasing toward the interior, if the organic molecules are the result of contamination of the meteorite on Earth.

The Steady State Galaxy Theory

by Rufus Young
submitted by Tom Petit

Introduction

The purpose of this document is to show that the Steady State Galaxy Theory can provide an alternative to the Big Bang Theory in explaining the universe around us. It covers the operation of Galaxies and shows that they recycle both Matter and Energy and are able to carry on indefinitely. It also explains the Shape of Galaxies, Red Shift, Microwave Background Radiation, Entropy and the Hydrogen-Helium Ratio.

If the reader takes an open-minded approach and looks at all aspects of the material presented here before reaching any conclusions, it will, at least, provide them with some food for thought.

Basic Operation of Galaxies

When a star has exhausted its internal thermonuclear fuels at the end of its life, it becomes unstable and collapses inward upon itself due to gravitational forces. Smaller stars become either white dwarfs or, if they have sufficient mass, the matter within them is crushed into neutrons at a density of about 2x10^-17g/cm^3 and they become neutron stars. At this point the nuclear forces become dominant and prevent any further compaction as more matter is added to the neutron mass (Neutroid).

Under ordinary circumstances once the neutroid reaches a size of about 3 solar masses, it's escape velocity exceeds the speed of light and it becomes a black hole. Some scientists believe that as more matter is added to the neutroid, a point will be reached where the gravitational forces will overpower the nuclear forces and the neutroid will collapse to a singularity (However, this has not been proven).

Since the black hole will continue to attract matter it must either, continue to grow more intense, or else, it must have a mechanism for shedding the matter that it attracts. I believe the latter to be the case and at the center of each galaxy is a neutroid forming a black hole which acts to recycle all the matter and energy in the galaxy. This neutroid has reached a size where the pressure and temperature at its surface are great enough to generate a nuclear fusion process. In the areas of the neutroid's magnetic poles, the products of fusion are trapped by the magnetic field and are pushed out along the magnetic field by the pressure of the nuclear fusion process going on below.

We can use the analogy of a water pump to illustrate this process. If you place the bottom of a vertical pipe in a pool of water and put a suction pump on the top, the maximum you can suck the water up the pipe is about 26 feet. If, on the other hand, you place a pressure pump at the bottom of the pipe, the only limit to the height you can pump the water is determined by the power of the pump and the strength of the pipe.

In the case of the neutroid, the magnetic field at its magnetic poles acts as the pipe and the fusion process acts as the pump pushing the products of the fusion process out from the neutroid. As in the example of the water pump, if the pipe is strong enough and the pump powerful enough, there is no limit to the distance from the neutroid that it can move the matter being pumped. If the material being 'pushed out' from the neutroid at the center of the galaxy is contained by a magnetic field, then there will be two columns of material moving out from the neutroid at essentially a constant velocity until it reaches a point where the magnetic field is no longer strong enough to contain it. If these columns extend out past the event horizon, it is not necessary for the material to be travelling at greater than the speed of light when it leaves the surface of the neutroid for it to escape the black hole. (This is due to the fact that it does not start slowing down in accordance to the inverse square law until it escapes the neutroid's magnetic field.)

This process enables the black hole to eject matter from itself and results in jets of hydrogen and helium ions being produced at each of the neutroid's two magnetic poles. The larger the neutroid becomes, the greater the size and velocity of its jets. This becomes a stable and self-limiting process where the amount of material attracted to the neutroid will be equal to the amount of material expelled at its magnetic poles. Eventually if too much material is added to the system, the velocity of the material being ejected from the magnetic poles will be sufficient for it to escape from the system altogether, thus limiting the total mass the system can accumulate. This process forms the basis of operation of all galaxies. The size and shape of galaxies are determined by the size of the neutroid at their center and its rate of rotation. In the case of our own galaxy (The Milky Way) these jets have sufficient momentum to carry the material out to 100,000 light years distance from the center.

As the jets of gas stream out from the Neutroid, large clouds of it condense and form the stars which are predominately located in the spiral arms of the Galaxies. These stars eventually burn up their Hydrogen fuel and in the process create the other heavier elements we find in the universe, all the while continuing to travel to the outer edge of the galaxy. It has probably been at least 10 Billion years since the material of which our solar system is composed was initially ejected from the neutroid. It is now located about 2/3rds the distance to the edge of the galaxy, but since it is constantly decelerating in accordance to the inverse square law it will take it another 20 billion years to reach its maximun distance from the neutroid. The total transit time from when material is ejected from the neutroid at the center of the Milky Way to when it returns to the neutroid will be about 60 Billion years.

Although the material ejected by the neutroid appears to travel in a spiral arc, in actual fact it is travelling in a straight radial line out from the neutroid and will eventually travel back along the same radial path to the neutroid. To help visualize this process,

Steady State, con't

imagine setting up two super cannons, each on opposite sides of the earth at the equator and each pointing straight up and each capable of firing a projectile with sufficient velocity that it will take 12 hours to reach the top of its projectory. Now, fire a projectile from each cannon every hour for 12 hours and plot the position of each projectile at the end of the 12 hours. The result, as shown in figure 1, will be two spiral arms much like the Galactic arms are shaped.

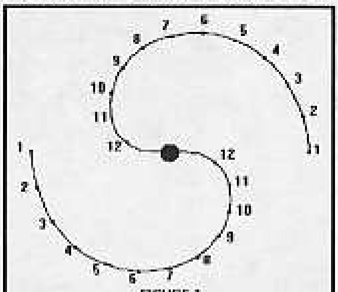


FIGURE 1

If we continue the experiment for another 3 hours and draw a new plot, figure 2, we find that the first projectiles that were fired have now passed the peak of their altitude and have started to fall back to earth and the whole spiral pattern appears to have rotated counterclockwise 45 degrees. However, the only changes in the positions of projectiles No.1 have been to move slightly closer to the earth along a radial line and they will continue falling back to earth along the same radial path and will impact the earth 24 hours after being fired. They do not themselves travel in a spiral path around the earth although the loci of their instantaneous positions forms a spiral which appears to be rotating.

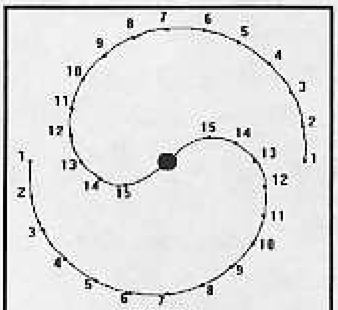


FIGURE 2

Figure 3 represents a typical small galaxy which is composed of 3 parts, (a) a Central Core (Area 1), (b) 2 Jets of material being ejected from the core (Areas 1 to 2), and (c) Spiral Arms (Areas 2 to 3). The Central Core consists of a neutroid at the center and an obscuring mass of material trapped in the Neutroid's magnetic field. The areas from 1 to 2 are gigantic jets of gas which are being ejected by the Neutroid and are contained within its magnetic field. Star formation occurs in these areas. At point 2 the magnetic field of the Neutroid weakens to the extent that it no longer constrains the material within it and as the material continues to move outward it will now trace a spiral arc as per the previous illustrations in Figs. 1 & 2. At point 3 the hydrogen fuel has been consumed and although the remains of the burned out stars are still there they become invisible dark matter as they continue to travel to the top of their projectory and then fall back to the Neutroid.

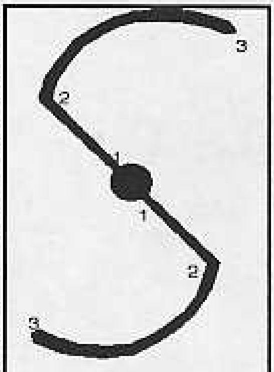


FIGURE 3

Thus, the galaxies form huge recycling systems which will carry on indefinitely.

1. Hydrogen and helium Gas is ejected from the Neutroid.
2. This gas forms stars which emit energy and convert the gas to heavier elements.
3. These heavier elements form planets for new star systems.
4. All this material eventually returns to the Neutroid where it is crushed into neutrons and the process starts again.

This concept of the operation of galaxies has far reaching implications. The time required for our galaxy to complete one cycle of operation would be about 60 Billion years or more and since the MilkyWay is a large mature galaxy, it has probably taken it Thousands of Billions of Years to reach it present state. This runs counter to the Big Bang Theory which suggests that the universe is less than 15 Billion years old.

Due to space limitations, I am unable to reprint Mr. Young's entire essay. He goes on to cover how the Steady State Theory covers the shape of galaxies, red shift, microwave background radiation, entropy and hydrogen-helium. You can read the entire essay at http://www.mi.net/dialin/rufus/ *or you can contact him by mail at R. Young; 59 West Street; Moncton, New Brunswick; CANADA E1E 3N5. Mr. Young has expressed that he is interested in feedback on his ideas.*

History of the Universe

Author Unknown - from the 'Net

Quantum fluctuation. Inflation. Expansion. Strong nuclear interaction. Particle-antiparticle annihilation. Deuterium and helium production. Density perturbations. Recombination. Blackbody radiation. Local contraction. Cluster formation. Reionization? Violent relaxation. Virialization. Biased galaxy formation? Turbulent fragmentation. Contraction. Ionization. Compression. Opaque hydrogen. Massive star formation. Deuterium ignition. Hydrogen fusion. Hydrogen depletion. Core contraction. Envelope expansion. Helium fusion. Carbon, oxygen, and silicon fusion. Iron production. Implosion. Supernova explosion. Metals injection. Star formation. Supernova explosions. Star formation. Condensation. Planetesimal accretion. Planetary differentiation. Crust solidification. Volatile gas expulsion. Water condensation. Water dissociation. Ozone production. Ultraviolet absorption. Photosynthetic unicellular organisms. Oxidation. Mutation. Natural selection and evolution. Respiration. Cell differentiation. Sexual reproduction. Fossilization. Land exploration. Dinosaur extinction. Mammal expansion. Homo sapiens manifestation. Animal domestication. Food surplus production. Civilization! Innovation. Exploration. Religion. Warring nations. Empire creation and destruction. Exploration. Colonization. Taxation without representation. Revolution. Constitution. Election. Expansion. Industrialization. Rebellion. Emancipation Proclamation. Invention. Mass production. Urbanization. Immigration. World conflagration. League of Nations. Suffrage extension. Depression. World conflagration. Fission explosions. United Nations. Space exploration. Assassinations. Lunar excursions. Resignation. Computerization. World Trade Organization. Internet expansion. Composition. Extrapolation?

Bootstrapping Space

by Douglas Warshow

Space travel is not a cheap endeavor. The operation even a partially reusable rocket system like the Space Shuttle runs into the billions of dollars. Considering that this is a vehicle that operates only in low Earth orbit (LEO), imagine how much a similar system would cost if it had to be capable of going to the moon and back. Since capital costs tend to be more expensive than operational costs, how can we hope to establish a permanent presence on the moon?

Bruce A. Mackenzie of Draper Laboratories offered a possible solution at the 1995 International Space Development Conference. He proposed that the best method would be to "bootstrap" space, that is, to use the space environment to augment the development of space.

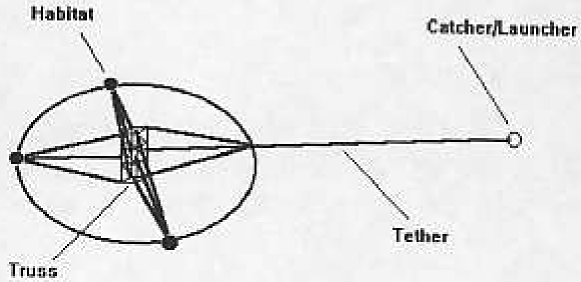
Bootstrapping, though, still needs a starting point. Mackenzie proposes the use of orbiting rotating tethers to launch payloads from LEO towards the moon. Here is how it works: take a length of polyethylene, graphite or kevlar tether, attach a "bucket" at one end and spin the combination as it orbits the Earth. A payload, also in LEO, can be scooped up by the bucket and released when the bucket reaches the furthest point from Earth (also known as apogee). The added speed of the revolving bucket at the release point puts the payload into a higher orbit.

Now suppose that the payload consisted of a packaged tether assembly. When the second tether reaches its new orbit, the package unfurls and you have a second boosting device. The two tethers could raise a third tether to an even higher orbit, et cetera.

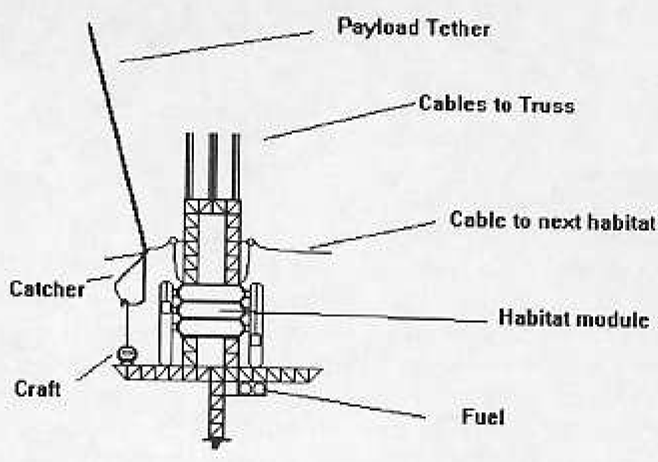
Of course there is a catch: each time a tether throws a payload into a higher orbit, the tether enters a lower orbit (due to conservation of energy). This could be offset by having thrusters push the tether back into its original orbit. Or even better yet, one can boost the tether by having it catch a payload that originated from a higher orbit (again, via conservation of energy). Thus little, if any, correction will be needed once payload are sent from the moon to the Earth.

Each of the Earth-orbiting tethers would have a mass of 500 kg plus a 2000 kg counterweight on the opposite end from the bucket. A third tether would be sent to lunar orbit by having some electric thrusters strapped to it. After the lunar tether becomes operational, the first two tethers bucket brigade 100 kg spacecraft to the moon. The lunar tether catches each craft and releases them at pericynthion (the point closest to the moon). In this manner the spacecraft velocity is reduced by just under 3 km/s. Normal chemical rockets aboard the craft allow them to land on the surface.

The first payloads will includes items such as 10 kg teleoperated rovers and regolith rockets. The former devices are used to collect, sift and load lunar soil onto the rockets. The latter use preheated lunar soil as their reaction mass. A liquified gas is injected onto the hot mass which then vaporizes and is forced out the rocket's nozzle, providing thrust. The lunar cargo is then sent back to LEO via the tether-relay system for manufacturing. (It is easier and cheaper to support a factory that orbits the Earth rather than one that orbits the moon. The manufacturing plant can then process the lunar soil into glass (for populated space facilities and habitats), shielding (from the resulting slag) and solar panels; not to mention aluminum, oxygen, fiberglass and steel. Notice that with this scheme, no human have to land on the moon. This results in a large reduction in cost.



The processed materials can even be used to build inhabited tether facilities; after all, if one is going to need simulated gravity to survive for long periods in space anyway, why not kill two birds with one stone? Mackenzie suggests two types of tether habitats. The small version has living modules at radii of 110 and 290 meters and rotates at 1.75 RPM. This yields simulated gravity values of 0.375 g and 1.000 g respectively. (1 g equals the gravitational force felt on the surface of the Earth.) The attached tether would have a length from five to eight kilometers, making it capable of changing the cargo velocity from 1.0 to 1.5 km/sec, respectively. The larger station has a radius of 5.4 km and rotates at 0.25 RPM, yielding a simulated gravity of 0.375 g for the inhabitants. The tethers on this version can be extended to 38 km, providing a payload velocity change of 1.0 km/sec, but at a low enough acceleration to also launch passenger craft. A graphite tether would have to have a mass of 8300 kg to catch 2-person 5000 kg spacecraft.



Lastly, if we were to add a few more tethers in higher orbits, payloads - included manned ones - could be "bucket-brigaded" to other planets. This set up could be used to start the bootstrapping process again, this time for an interplanetary colony. Cheap development of space? You bet!

Skywatcher's Diary

compiled by Robert C. Victor, Abrams Planetarium

Saturday, August 10

At nightfall, the two outermost satellites of Jupiter's Galilean satellites are easily visible in binoculars. Callisto appears to the east (left) of Jupiter, and Ganymede, the largest and brightest moon, appears to the planet's west (right). For recent findings and images, visit the Project Galileo website at: http://www.jpl.nasa.gov/galileo/index.html

This is a great year for the Perseid meteor shower, with the Moon just a slender morning crescent. Meteors should increase in numbers until dawn's first light. Sunday nightfall until Monday dawn will be even better! As dawn brightens on Sunday, look in E to ENE for the old crescent Moon with Mars 9 degrees above, brilliant Venus to their upper right, and the Twins to their left. Binoculars show Procyon rising 13 degrees to Moon's lower right.

Sunday, August 11

Tonight is the peak of the Perseid meteor shower. There's a slight possibility of a sharp peak near nightfall in eastern North America, and a better chance around midnight for Europe. Even if that peak doesn't occur, the annual broad "normal" maximum will bring us its greatest number of meteors in the dark hours just before dawn's first light on Monday. As dawn brightens on Monday, the slender crescent old Moon will appear low in ENE, 25 degrees to Venus' lower left. Using binoculars, try for Procyon rising a few degrees north of east, 11-12 degrees to Moon's right, and still later, Sirius, the Dog Star, rising in ESE 26 degrees to Procyon's right. Seen from latitude 31 degrees north, Moon, Sirius, and Prosyon rise together about 1 hour 25 minutes before sunrise. From farther south, Sirius rises first, and Procyon's name, "before the Dog", is no longer appropriate.

Monday, August 12

An hour before sunup on Tuesday, find brilliant Venus in east, with Orion's two brightest stars, Betelgeuse and Rigel, respectively 14 degrees and 33 degrees to its right. Between these stars lies Orion's 3- star belt. Procyon, "before the Dog", has already risen; look just N of east, 24 degrees below Venus and 26 degrees lower left of Betelgeuse. If you're in northern U.S., wait another 15 minutes or so to catch the rising of the "Dog Star", Sirius, in ESE. Sirius completes the Winter Triangle with Betelgeuse and Procyon.

Tuesday, August 13

The Moon is New on Wednesday at 3:34 a.m. EDT, so the next several evenings are still dark enough for fine viewing of the Milky Way and Comet Hale-Bopp. At nightfall locate bright Jupiter in S and reddish Antares in SSW, 29 degrees to Jupiter's west. Next, locate the 3.3-mag star Nu Ophiuchi 16 degrees to Jupiter's upper right and 27 degrees to Antares' upper left. Comet Hale-Bopp is 2.2 degrees upper right of Nu and shifting its position against the stars by about 1/4 degree per day.

Wednesday, August 14

Locate bright Jupiter in S at nightfall, and look below it for eight stars of 2nd and 3rd magnitude forming the Teapot of Sagittarius. The four of its stars to lower right of Jupiter form the Archer's bow and arrow as well as the spout and top of the Teapot's lid; the other four stars, to Jupiter's lower left, form the handle. The Great Sagittarius Star Cloud (a part of the Milky Way) looks like a puff of steam just emerging from the Teapot's spout.

Thursday, August 15

The center of our Milky Way Galaxy is hidden from our view by cosmic dust clouds. It lies in a direction within 5 degrees upper right of the 3rd- magnitude star Gamma in Sagittarius, tip of the Archer's arrow, or tip of the Teapot's spout. Look for this star 10 degrees lower right of bright Jupiter, in the south at nightfall.

The young Moon might be glimpsed from southern U.S. early this evening, very low in W 20 to 30 minutes after sunset, with Mercury 9 degrees to its upper left. Use binoculars.

Friday, August 16

Look very low west 30-40 minutes after sunset for the thin crescent Moon. It's unusually low for its age, 65 to 68 hours after New from mainland U.S. Binoculars may show Mercury within 3 or 4 degrees to the Moon's right. The Moon sets before dark, allowing us another superb view of the summer Milky Way. Follow its course past Jupiter and the Teapot in the south, through the Summer Triangle overhead, and through the "W" of Cassiopeia in the northeast. Note the "Great Rift" of dark clouds of interstellar dust dividing the Milky Way into two streams, from the Summer Triangle southward.

Saturday, August 17

About 40 minutes after sunset, find the waxing crescent Moon low in W to WSW. As sky darkens, look for Spica 17 degrees to setting Moon's upper left. Bright Jupiter is then in south. To find Comet Hale-Bopp, look for the 3.3-mag star Nu Ophiuchi 16 degrees to Jupiter's upper right. Using binoculars, look for a hazy patch of light 3 degrees upper right of Nu. It's the comet!

Sunday, August 18

Look low in WSW an hour after sunset to see the crescent Moon with Spica 5 degrees to its left. This first-magnitude star marks the spike of wheat or ear of corn in Virgo's hand.

Monday, August 19

Find Moon in SW to WSW at dusk. Watch for Spica within 9 degrees to its lower right.

In the eastern sky before sunrise on Tuesday, note the striking alignment of brilliant Venus with three red objects. From left to right, they are Pollux, Mars, Venus, and Betelgeuse, shoulder of Orion, the Hunter. Orion's belt points down to Sirius, just risen in ESE. Low in east below Venus is Procyon, completing the Winter Triangle with Sirius and Betelgeuse. Venus appears farthest from Sun on Tuesday, 46 degrees. A telescope shows Venus about half full.

Diary, con't

Tuesday, August 20

At nightfall the fat crescent Moon is low in SW. For the next few days, binoculars show spectacular detail near the Moon's terminator (day- night boundary). Tonight, can you see the 3rd-magnitude star Alpha Librae about one Moon's width below the crescent's lower cusp? Comet Hale-Bopp becomes more difficult to see in coming nights, as the Moon brightens and moves closer to it. Tonight look 20 degrees upper right of Jupiter, and within 4 degrees upper right of 3.3-mag Nu Ophiuchi.

Wednesday, August 21

Examine the Moon at nightfall, noting what fraction of its disk is illuminated. Can you determine the direction of the Sun by looking at the Moon? Tonight the Moon is at First Quarter phase, 90 degrees or one-quarter of a circle from the Sun. Note Antares, heart of Scorpius, 14 degrees to Moon's lower left.

Thursday, August 22

Today the star Regulus appears on the far side of the Sun and is hidden in the solar glare. Six months from now, in February, the Earth will have moved halfway around its orbit. Then the night side of Earth will face Regulus, and the star will be visible all night. An hour after sunset, Moon is in SW. with Antares 8 degrees below. Antares will be hidden on the far side of the Sun at the start of December.

Friday, August 23

At nightfall, the waxing gibbous Moon is in SSW. Bright Jupiter is within 13 degrees left. Unfortunately for would-be comet-watchers, Comet Hale-Bopp is only 12 degrees north (upper right) of the Moon tonight.

Saturday, August 24

An hour after sundown face south to see bright Jupiter 5 degrees to Moon's lower right. As night turns to dawn Sunday, Mars is within 5 degrees lower left of brilliant Venus in east. They'll remain within 5 degrees through Sept. 13, and appear within 3 degrees Sept. 2-6. Look often and watch for changes in their positions against background stars.

Sunday, August 25

Although moonlight floods the evening sky, you'll still have nearly a one-hour window of dark moonless skies Monday morning, between moonset and first light of dawn. After Sirius rises and before Altair sets, both the Summer Triangle in W to NW and Winter Triangle in E to ESE are visible simultaneously, as well as three bright planets and five other stars of first magnitude or brighter.

Monday, August 26

Spica will soon disappear from the evening sky before Earth's orbital motion makes it appear on the far side of the Sun in mid-October. Look for the Big Dipper in NW an hour after sunset, and remember to "Follow the arc to Arcturus (the bright star well up in west) and drive a spike to Spica (very low in WSW)."

Tuesday, August 27

At nightfall find first-magnitude reddish Antares in SSW, 28 degrees to Jupiter's lower right. Note 2.4-mag Eta Ophiuchi 14 degrees uppper left of Antares. Tonight through Sunday a line from Antares to Eta Oph, extended 12 degrees straight past Eta (directly away from Antares), locates Comet Hale-Bopp. Beginning Saturday, moonlight won't interfere, provided you look before moonrise. From now until Sunday the comet will be passing 1.6 degrees above a 4.6-mag star, Mu Ophiuchi.

Wednesday, August 28

Across the northern U.S., from places where the air is very clear and the east and west horizons unobstructed, it may be possible to see the setting Sun and rising Moon simultaneously. Otherwise, wait a few minutes and enjoy the rising Moon! Tonight's Green Corn or Grain Moon rises about 8 degrees south of due east.

Thursday, August 29

The Moon rises a degree or two south of due east, half an hour after sunset from mid-lower Michigan, and longer after sunset from more southerly latitudes in the U.S. The rising Moon will be an impressive sight in the deep blue twilight of the eastern horizon, opposite the Sun. Within another hour, Saturn appears about 10 degrees to Moon's lower left.

Friday, August 30

Tonight the Moon rises about 5 degrees N of due east, within 1-1/4 hours after sunset as seen from northern U.S. Satuirn appears 4 or 5 degrees to Moon's right. By an hour before sunup Saturday, Moon is well up in SW, with Saturn 8 degrees to its lower right.

Saturday, August 31

Beginning tonight, if you look before moonrise, you'll have dark skies for viewing the Milky Way and Comet Hale-Bopp. The dark window is brief tonight, with Moon rising only 1-3/4 hours after sundown for Michigan skywatchers, and later for viewers farther south. At nightfall, locate Jupiter in S and Antares in SSW, 28 degrees lower right of Jupiter. Look for 2.4-mag Eta Ophiuch 14 degrees upper left of Antares, and Comet H-B another 11 degrees upper left of Eta. All three bodies appear in a straight line. A 4.6-mag star, Mu Ophiuchi, lies 1.6 degrees below the comet.

Editor's Note: The Abrams Planetarium also publishes a Sky Calendar each month. A sample calendar for a previous month is available at

http://www.pa.msu.edu/abrams/may96skycal.html

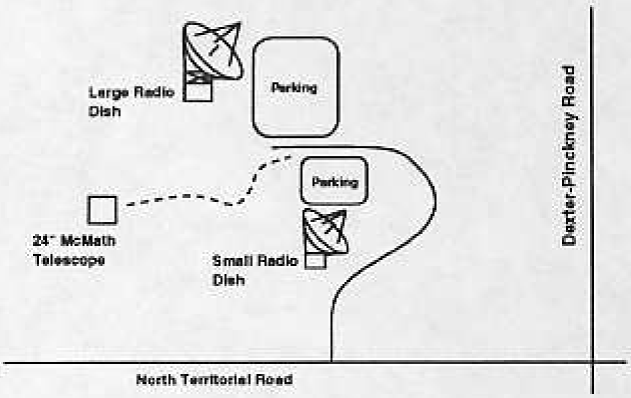
Or send a long, self-addressed stamped envelope to:

September Sky Calendar
Abrams Planetarium
Michigan State University
East Lansing, MI 48824

Places

Dennison Hall, also known as The University of Michigan's Physics and Astronomy building, is the site of the monthly meeting of the University Lowbrow Astronomers. It is found in Ann Arbor on Church Street about one block north of South University Avenue. The meeting is held in room 807.

Peach Mountain Observatory is the home of The University of Michigan's 25 meter radio telescope as well as the University's McMath 24 inch telescope which is maintained by the Lowbrows. The observatory is located northwest of Dexter. The entrance is on North Territorial Road, 1.1 miles west of Dexter-Pickney Road. A small maize-and-blue sign marks the gate. Follow the gravel road one mile to a parking area near the radio telescopes. Walk along the path between the two fenced in areas (about 300 feet) to reach tthe McMath telescope building.



Times

Monthly meetings of the Lowbrows are held on the 3rd Friday of each month at 7:30 PM in 807 Dennison Hall. During the summer months, and when weather permits, a club observing session at Peach Mountain will follow the meeting.

Computer subgroup meetings are held on the first of each month, rotating among member's houses. See the calendar on the cover page for the location of next meeting.

Public Open House/Star Parties are held on the Saturday before and after each new Moon at the Peach Mountain Observatory. Star Parties may be canceled if the sky is cloudy at sunset or the temperature is below 10 degrees F. Call 480-4514 for a recorded message on the afternoon of a scheduled Star Party tocheck on the status. Many members bring their telescopes and visitors are welcome to do likewise. Peach Mountain is home to millions of hungry mosquitos - bring insect repellent, and it does get cold at night so dress warmly!

Dues

Membership dues in the University Lowbrow Astronomers are $20 per year for individuals or families, and $12 per year for students. This entitles you to the monthly REFLECTIONS newsletter and the use of the 24" McMath telescope (after some training). Dues can be paid to the club treasurer Doug Scobel either at the monthly meeting or by mail at:

Doug Scobel
1426 Wedgewood Drive
Saline, MI 48176

Magazines

Members of the University Lowbrow Astronomers can get a discount on these magazine subscriptions:

Sky and Telescope: $27 / year
Astronomy: $20 / year
Odyssey: $16.95 / year
CCD Astronomy: $20 / year

For more information contact the club Treasurer. Members renewing subscriptions are reminded to send your renewal notice along with your check when applying through the club Treasurer.

Newsletter Contributions

Members and (non-members) are encouraged to write about any astronomy related topic of interest. Call the Newsletter Editor Laura Meluch or e-mail to meluch@alumni.engin.umich.edu to discuss length and format. Announcements and articles are due by the first Friday of each month. Articles should be mailed to:

Laura Meluch
522 Second Street
Ann Arbor, MI 48103

Telephone Numbers

President:	D. C. Moons	254-9439
Vice Pres:	Mark Cray	283-6311
	Tom Pettit	878-0438
	Fred Schebor	426-2363
	Mark Vincent	663-7813
Treasurer:	Doug Scobel	429-4954
Observatory Director:	Bernard Friberg	761-1875
Newsletter:	Laura Meluch	747-6998
Publisher:	Lorna Simmons	525-5731
Keyholder:	Fred Schebor	426-2363

From the Editor . . .

Hello again! By now, I think many of you know that this will be my last newsletter. Norm, Jack and I will be moving to the Washington DC area (Rockville, Maryland to be exact) where Norm will be taking a new position with a computer consulting firm. I'm sorry my tenure as Editor has been so short, as I have really enjoyed putting the newsletter together. The newsletter will be left in the very capable hands of Kurt Hillig until a long-term replacement is found (or drafted!)

I know that most of you will have already heard about the Mars meteorite, but I included the article because most news programs did not go into as much detail as this press release. I hope it "fills in the blanks" for you.

We'll miss you all - and as always, keep those cards and letters coming!

At the Painting Party

10 lashes with a wet noodle for all who didn't make it - including me! (We were stuck in Rockville, still doing househunting)

However, it looks like the job was accomplished nicely by the brave souls who did attend. The pictures above are from Mark Vincent. A hearty thanks to all who participated and made the job a success!

University Lowbrow Astronomers
1740 David Ct.
Ann Arbor, MI 48105

Check your membership expiration date on the mailing label!