

NASA Space Grant Spring 2014 National Meetings

February 27 – March 1, 2014
Arlington, VA

Yervant Terzian
Chair, National Council of Space Grant Directors

- Feb26 meeting at NASA HQ with new Leadership
- Very positive, transparent
- SG very valuable and important program to continue after evaluation
- RFP on community colleges to be issued very soon

- SG NATIONAL BUDGETS
- 2014 \$40 M appropriated
- 2015 \$40 M requested

- SG Meetings
- Fall 2014 Regional meetings
- Winter 2015, DC
- Fall 2015 Tucson, Arizona

- AGENDA
- FRIDAY BANQUATE

- Why the astronaut could not book a room on the Moon? Because the Moon was FULL.
- What do you think about the new restaurant on the Moon? Food was good, but it has no atmosphere.
- How many astronomers do you need to change a bulb? None, astronomers are not afraid of the dark.

Latest Headlines

spaceREF

ONORBIT SPACE STATION NASA HACK SPACE CALENDAR NEWS ARCHIVES MISSIONS SPACE WEATHER
MERCURY VENUS EARTH MOON MARS JUPITER SATURN PLUTO ASTEROIDS & COMETS GET UPDATES

52nd Robert H. Goddard Memorial Symposium
Science and Exploration: Engineering the Future
March 4-6, 2014 - Greenbelt, Maryland

www.astronautical.org

Astronaut Leland Melvin to Leave NASA

Status Report Source: Posted Saturday, January 11, 2014



I am sorry to inform the NASA family that my good friend and our Associate Administrator for Education, Leland Melvin, has decided to retire next month after more than 24 years of NASA service.

Since assuming the role of AA in 2010, Leland has streamlined NASA's education organization and portfolio to deliver science, technology, engineering and mathematics (STEM) content more effectively to educators and students. Using NASA's unique missions, programs and other agency assets, he has helped cultivate the next generation of explorers – one that is truly inclusive and properly reflects the diverse make up and talent of this nation's youth and our agency's future.

His innate ability to bring people together has helped forge partnerships with both traditional and non-traditional organizations. Building a network that broadly shares and leverages individual strengths and capabilities to deliver more robust STEM education content and eliminate duplication of effort has been instrumental in this era of fiscal challenges.

Leland was co-chair of the Office of Science and Technology Policy's Committee on STEM education, ensuring that NASA has had a prominent place at the table for national discussions and decisions about the role of the federal sector in providing STEM content and opportunities. This will serve the NASA education program well for years to come.

Prior to coming to Headquarters, Leland was a mission specialist in the NASA astronaut corps at Johnson Space Center. He flew aboard the space shuttle Atlantis on two missions: STS-122 in 2008 and STS-129 in 2009. He also held a variety of roles within the astronaut office and led the agency on the Educator Astronaut program. He joined NASA in 1989 at the Langley Research Center as a research scientist working in the fiber optics lab. He has received numerous NASA awards and honors during his quarter-century of service.

Leland received a bachelor's degree in chemistry from the University of Richmond and a master's in materials science engineering from the University of Virginia. Before an injury sidelined his career, Leland was a wide receiver for the Detroit Lions and the Dallas Cowboys.

CALENDAR

Events Launches Your Event

23 Feb: [Space Exploration Alliance Legislative Blitz](#)

24 Feb: [NASA Advisory Council Human Exploration and Operations Committee; Research Subcommittee Meeting](#)

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Dr. Roosevelt Y. Johnson, Deputy Associate Administrator for Education | NASA - Mozilla Firefox

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Dr. Roosevelt Y. Johnson, Deputy Associ... +

www.nasa.gov/offices/education/leadership/johnson_bio.html#UvkelvuGdjM ☆ Google

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Dr. Roosevelt Y. Johnson, Deputy Associate Administrator for Education **June 12, 2012**

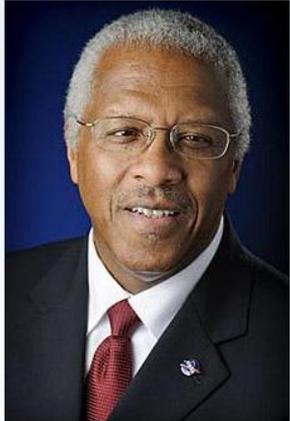
Dr. Roosevelt Y. Johnson, deputy associate administrator for education, is a member of the senior management team responsible for the development and implementation of NASA's education programs to strengthen involvement and public awareness about the agency's scientific goals and missions.

In addition to serving on the Education Coordinating Committee, an agencywide collaborative structure that maximizes NASA's ability to manage and implement its education portfolio, Johnson serves as one of NASA's representatives on the Cross Agency Priority Goal team working in conjunction with the White House National Science and Technology Council's Committee on Science, Technology, Engineering and Mathematics Education, or CoSTEM.

During his career, Johnson has been a champion and leader of groundbreaking efforts to broaden participation in science, technology, engineering and mathematics disciplines. For more than 20 years, he served as a program director for the National Science Foundation, or NSF, working to increase the participation and advancement of underrepresented minorities, women and girls, persons with disabilities, and minority-serving institutions in science and engineering disciplines, as well as promoting innovative and transformative STEM education program development at a national level.

Johnson's academic and administrative breadth and depth have been demonstrated through his service in every division of NSF's Directorate for Education and Human Resources, including the Human Resource Development division, the Division of Graduate Education, the Division of Undergraduate Education, and the Division of Research on Learning in Formal and Informal Settings. He also represented NSF on governmentwide committees, active at North Atlantic Treaty Organization, or NATO, Postdoctoral Fellowship meetings.

His past accomplishments include serving as deputy executive director and acting executive director of the National Science Foundation's Office of Minority Affairs and Partnerships for Minorities in Engineering and Science (GEM Consortium). At GEM, Johnson has worked with and mentored students and faculty members from a wide range of disciplines among some of the nation's most productive graduate degree-granting institutions. He also has had the opportunity to develop and use program evaluation and assessment tools for the American Association for the Advancement of Science, or AAAS, Center for Advancing Science and Engineering Capacity.



Dr. Roosevelt Y. Johnson, Deputy Associate Administrator for Education

Image Credit: Paul Alers

[View larger image](#)

Dr. Roosevelt Johnson has been appointed as NASA's Acting Associate Administrator for Education.



NASA



**National Space Grant
College and Fellowship Program**

Celebrating 25 YEARS



Charleston, South Carolina, October 2013

- Exhibitions
- On View**
- Coming
- Online
- Past



Image courtesy of NASA/JPL-Caltech/Cornell

Home > Exhibitions > On View > Spirit & Opportunity: 10 Years Roving Across Mars

Spirit & Opportunity: 10 Years Roving Across Mars

Open through September 14, 2014

This exhibition celebrates the amazing images and achievements of the two Mars Exploration Rovers on the 10th anniversary of their landings on the Red Planet.

The twin Mars Exploration Rovers *Spirit* and *Opportunity* were launched toward Mars in the summer of 2003. They arrived months later in spectacular fashion, bouncing down safely on the surface after a harrowing six-minute descent through the thin atmosphere. *Spirit* arrived on January 3, 2004, and *Opportunity* on January 24, 2004.

One of the mission's main scientific goals was to search for and study a wide range of rocks and soils that hold clues to past water activity on Mars. To do this, the rovers landed on opposite sides of Mars in locations that appear to have been affected by liquid water in the past.

The goal of each rover was to travel up to 1 kilometer (2/3 mile) during a primary mission of 90 Martian days. Both rovers far exceeded these expectations. *Spirit* traveled 7.7 kilometers (4.8 miles) over more than six years. *Opportunity* has traveled more than 38 kilometers (23.6 miles) over an ongoing mission that has reached 10 years.

This exhibition is made possible through the generosity of Cornell University, the Jet Propulsion Laboratory, and NASA.

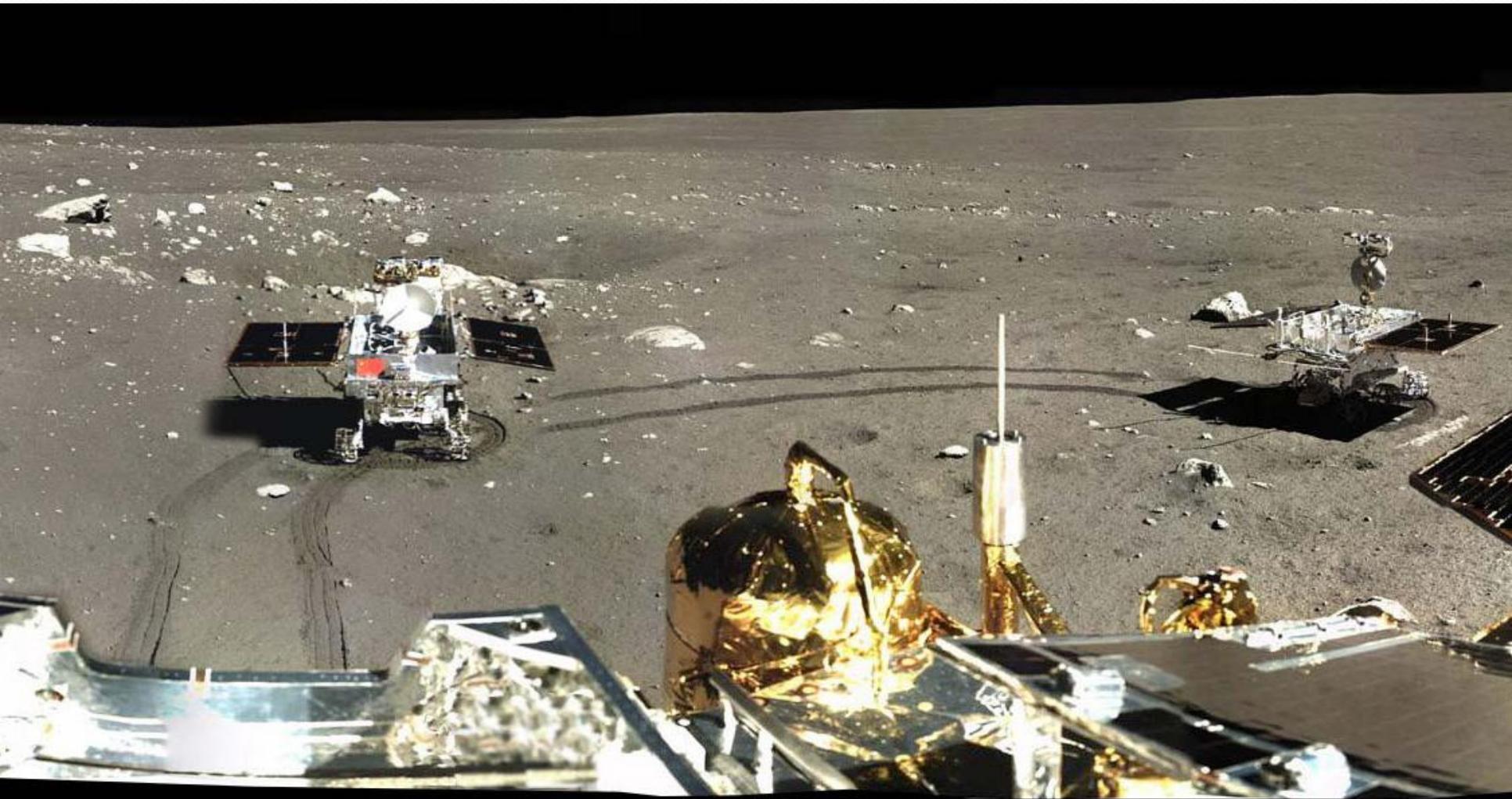
Highlights:



Location in Museum



Plan Your Visit to the Museum in Washington, DC >>



1st Chang'e-3 Timelapse Color Panorama

Credit: CNSA/Chinanews/Ken Kremer/Marco Di Lorenzo

Lunar Time Lapse Panorama including Yutu Rover

<http://apod.nasa.gov/apod/ap140203.html>



Sol 3528
Before



Sol 3540
After

Jelly Donut Shaped Rock Appears on Mars

<http://apod.nasa.gov/apod/ap140129.html>

William Shatner to NASA: What's Up with the Mystery Rock on Mars?

by Tariq Malik, Managing Editor | February 03, 2014 04:50pm ET

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It's official: The mystery of a strange rock on Mars that suddenly appeared in front of NASA's Opportunity rover has warped into the final frontier. Even "Star Trek" actor William Shatner wants to know what's going on with the stone, which looks like a jelly doughnut.

Shatner, who portrayed Captain James Kirk of the Starship Enterprise on "Star Trek," asked NASA about the [strange Mars rock found by Opportunity](#) via Twitter during a press conference on Opportunity's latest discoveries last month.

In the Jan. 23 event, Squyres went on to reiterate what he views as the most plausible explanation for the weird Martian rock's sudden appearance in Opportunity's camera views. ...

"We think the most likely scenario is that that rock wasn't thrown, it wasn't kicked out of a crater. It was flicked out by one of our wheels," Squyres said. "And we're going to take a close look at that hypothesis just in the upcoming days."

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Three CubeSats Released

<http://apod.nasa.gov/apod/ap140106.html>



Earth
1 mass



Kepler 78b
1.8 mass

Kepler-78b: Earth-Sized Planet Discovered

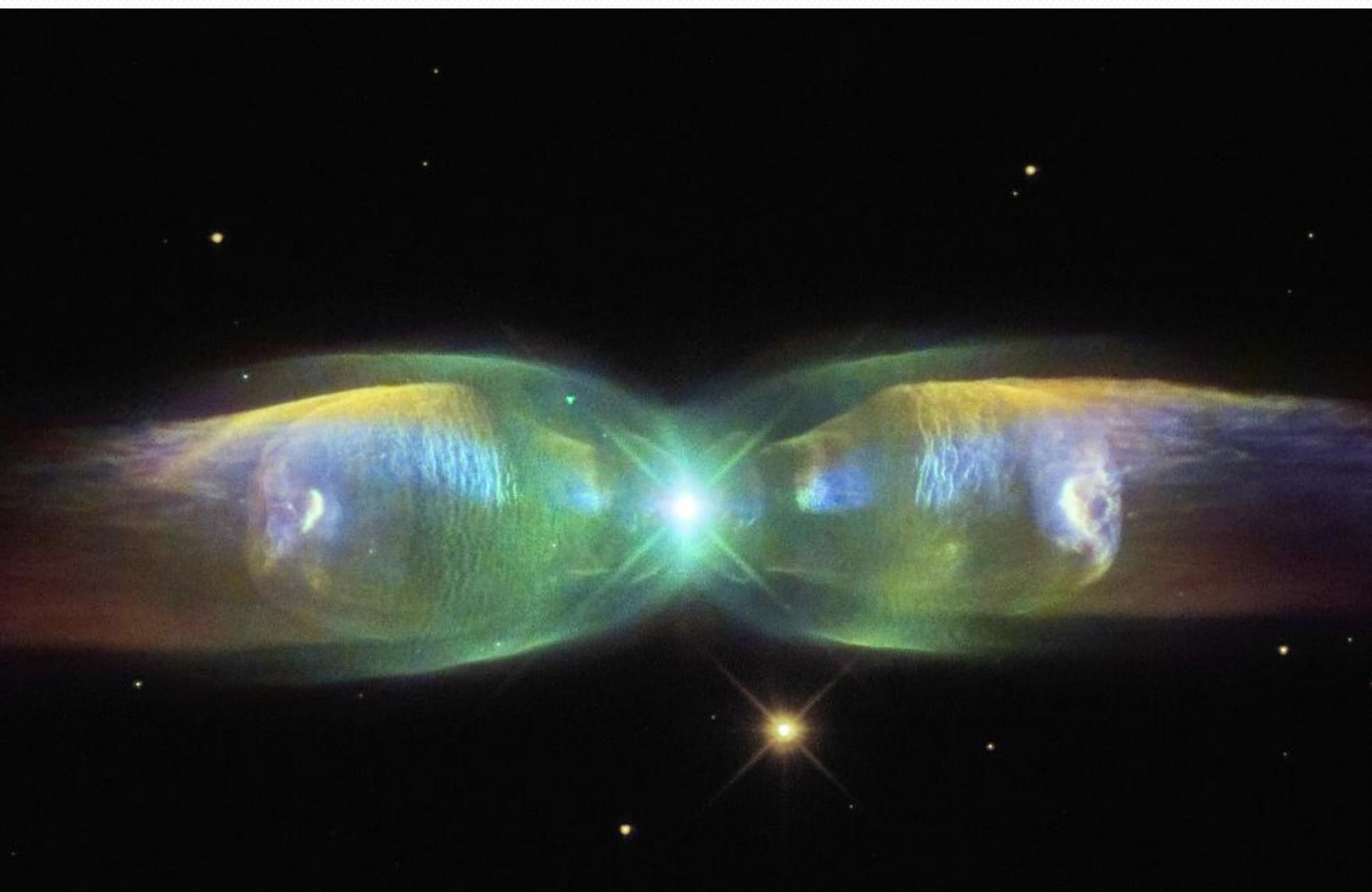
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Hale-Bopp: The Great Comet of 1997

<http://apod.nasa.gov/apod/ap131013.html>



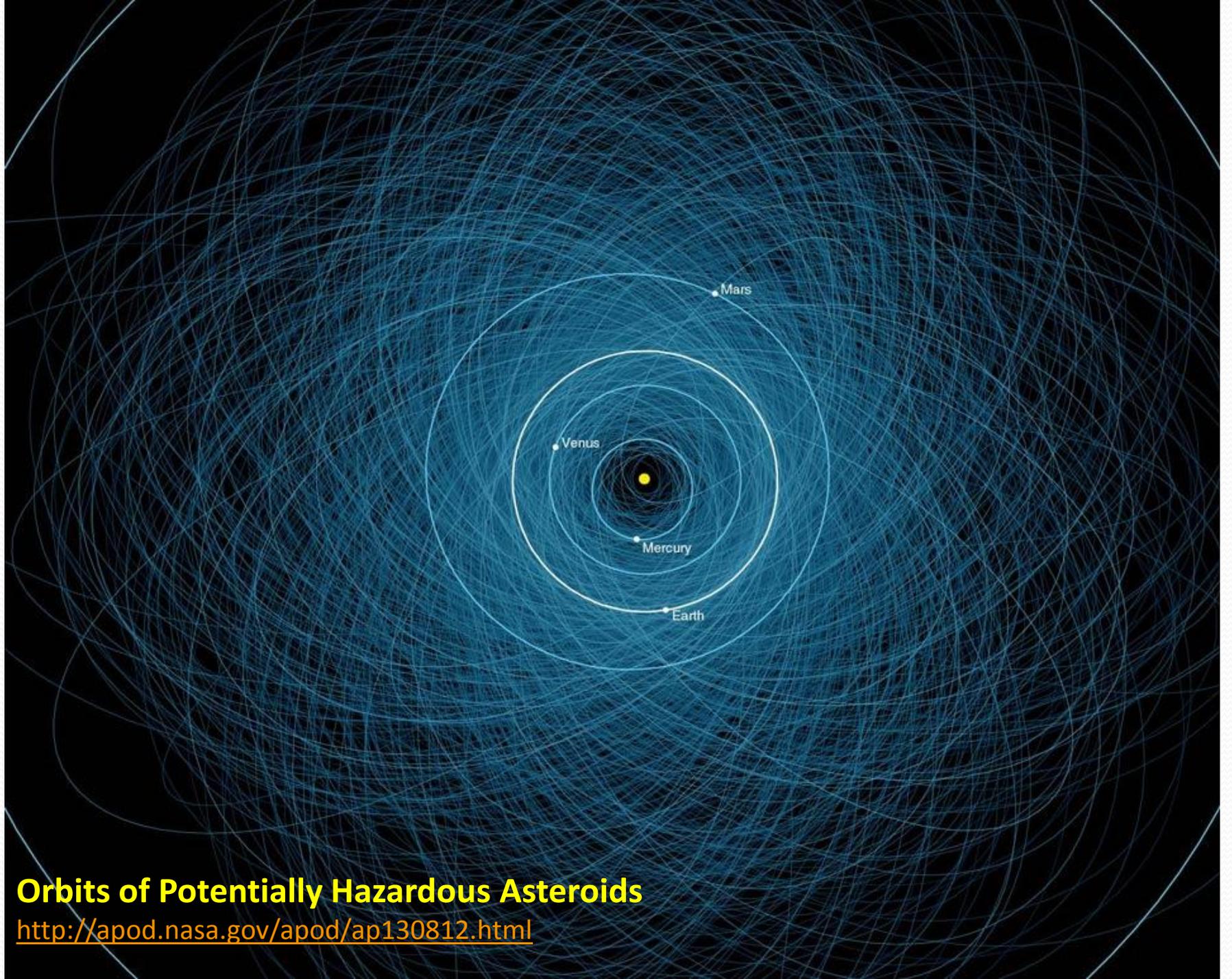
M2-9: Wings of a Butterfly Nebula

<http://apod.nasa.gov/apod/ap130915.html>

The image displays the Crab Nebula (M1) as a complex, multi-colored structure of ionized gas. The central region is a bright, white, glowing core. From this core, a dense network of red filaments extends outwards, forming a large, irregular, and somewhat circular shape. The red filaments are composed of many fine, interconnected strands, giving the nebula a lace-like or web-like appearance. Interspersed among the red filaments are patches of blue and cyan, which are primarily located towards the outer edges of the nebula. The entire nebula is set against a dark, black background filled with numerous small, bright stars of various colors, including white, yellow, and blue. The overall effect is one of a dynamic and expanding cosmic structure.

M1: The Incredible Expanding Crab

<http://apod.nasa.gov/apod/ap130905.html>



Orbits of Potentially Hazardous Asteroids

<http://apod.nasa.gov/apod/ap130812.html>

Search for
Extra-
Terrestrial
Intelligence

SETI

- Contact with ETI will be the most important human discovery.
- In the 4th century BC the Greek philosopher Epicurus wrote a letter to Herodotus and said 'There are infinite world's both like and unlike our own'.
- Leucippus and Democritus justified many worlds due 'atomism'. Democritus once said 'Nothing exists except atoms and empty space, everything else is opinion'.
- The Roman poet Lucretius adopted atomism and said 'In an infinite universe many worlds must exist'.
- The Pythagoreans thought that the Moon was inhabited by beings superior to us.
- In the Renaissance Giordano Bruno, who supported the Copernican model of the solar system, argued for an infinite number of worlds. He was burned to death by the church in 1600 for his views.
- I. Kant, author of the theory of planetary formation, wrote about the existence of other worlds. And Charles Darwin's biological evolution modernized life everywhere.
- Around 1820, the mathematician Karl Gauss proposed seeding Siberia with a giant Pythagorean triangle so Martians could see it and know we are here. Others suggested to create geometrical shapes filled with oil and put on fire in the Sahara desert for us to be seen by people on the Moon, Mars, and Venus.

- The Italian astronomer Giovanni Shiaparelli in 1877 reported seeing “canals” on Mars and hence evidence of life.
- The American astronomer Percival Lowell established the Lowell Observatory in Flagstaff, Arizona to study the “canals” on Mars.
- In 1898 the science fiction novel ‘War of the Worlds’ was published by H.G. Wells, where Martians decide to invade the attractive planet Earth.

SETI Modern Scientific Approach

- J. C. Maxwell. Electromagnetic theory, the spectrum and radio waves, and modern physics guided our thoughts about SETI.
- G. Cocconi and P. Morrison, then at Cornell, in 1959 suggested to try and listen to ETI at radio waves where stellar interference is low. F. Drake, then at NRAO in Green Bank, in 1960 tried to listen at 1.4 GHz: the Ozma Project.
- In other developments, in the 1950s the structure of the DNA was understood by Watson and Crick , and in 1953 Stanley Miller and Harold Urey at the University of Chicago simulated the conditions of the primitive Earth and created amino acids and other organic molecules vital to life. Soon radio astronomers discovered more than 100 molecular species in the interstellar medium.
- There were also false alarms when pulsars were discovered. Also media hype began such as:
 - TV – *Star Trek*
 - Movies – *2001: A Space Odyssey*, *ET*, and *Contact*, and also the *UFOs*
- Today we have discovered dozens of planets around other stars. We are exploring Mars where water may have existed. And we are searching at radio waves, such as Project Phoenix.

COSMIC CALENDAR

13.7 BILLION YEARS

January 1	Big Bang
May 1	Origin of the Milky Way galaxy
September 9	Origin of the Solar System
September 14	Formation of Earth
September 25	Origin of life on Earth
October 9	Date of oldest fossils

COSMIC CALENDAR

December	1	Oxygen atmosphere develops
December	16	First worms
December	19	First fish
December	20	Plants begin colonization of land
December	21	Animals begin colonization of land
December	23	First trees; first reptiles
December	24	First dinosaurs
December	26	First mammals
December	27	First birds
December	28	Dinosaurs become extinct
December	29	First primates

COSMIC CALENDAR

December 31

10:30	p.m.	First humans
11:46	p.m.	Domestication of fire
11:59	p.m.	Extensive cave paintings in Europe
11:59:20	p.m.	Invention of agriculture
11:59:59	p.m.	Euclidean geometry; Archimedean physics
11:59:59	p.m.	Renaissance in Europe
	NOW:	Science and Technology; means for self-destruction of the human species; planetary exploration

SEARCHING FOR INTERSTELLAR COMMUNICATIONS

By GIUSEPPE COCCONI* and PHILIP MORRISON†

Cornell University, Ithaca, New York

NO theories yet exist which enable a reliable estimate of the probabilities of (1) planet formation; (2) origin of life; (3) evolution of societies possessing advanced scientific capabilities. In the absence of such theories, our environment suggests that stars of the main sequence with a lifetime of many billions of years can possess planets, that of a small set of such planets two (Earth and very probably Mars) support life, that life on one such planet includes a society recently capable of considerable scientific investigation. The lifetime of such societies is not known; but it seems unwarranted to deny that among such societies some might maintain themselves for times very long compared to the time of human history, perhaps for times comparable with geological time. It follows, then, that near some star rather like the Sun there are civilizations with scientific interests and with technical possibilities much greater than those now available to us.

* Now on leave at CERN, Geneva.

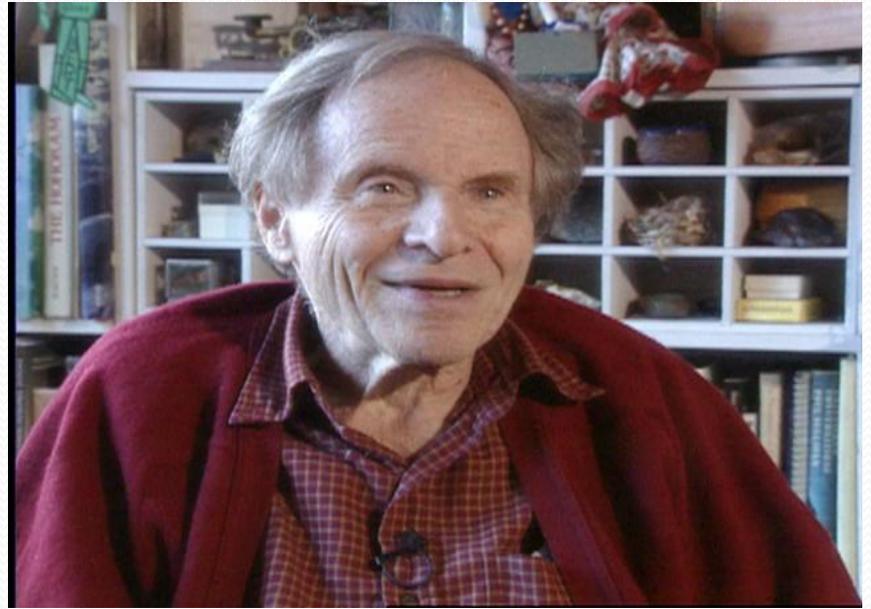
† Now on leave at the Imperial College of Science and Technology, London, S.W.7.

To the beings of such a society, our Sun must appear as a likely site for the evolution of a new society. It is highly probable that for a long time they will have been expecting the development of science near the Sun. We shall assume that long ago they established a channel of communication that would one day become known to us, and that they look forward patiently to the answering signals from the Sun which would make known to them that a new society has entered the community of intelligence. What sort of a channel would it be?

The Optimum Channel

Interstellar communication across the galactic plasma without dispersion in direction and flight-time is practical, so far as we know, only with electromagnetic waves.

Since the object of those who operate the source is to find a newly evolved society, we may presume that the channel used will be one that places a minimum burden of frequency and angular discrimi-



now at hand. Few will deny the profound importance, practical and philosophical, which the detection of interstellar communications would have. We therefore feel that a discriminating search for signals deserves a considerable effort. The probability of success is difficult to estimate ; but if we never search, the chance of success is zero.

SETI

The rate at which intelligent civilizations appear in our Galaxy depends on:

R_* The rate of star formation (~ 1 per year)

f_p The fraction of these stars that form planets
($\sim 1/2$?)

n_p The number of planets suitable for life (1 or 2)

f_l The fraction of these where life develops (~ 1 ?)

f_i The fraction of these on which
intelligence appears (~ 1 ?)

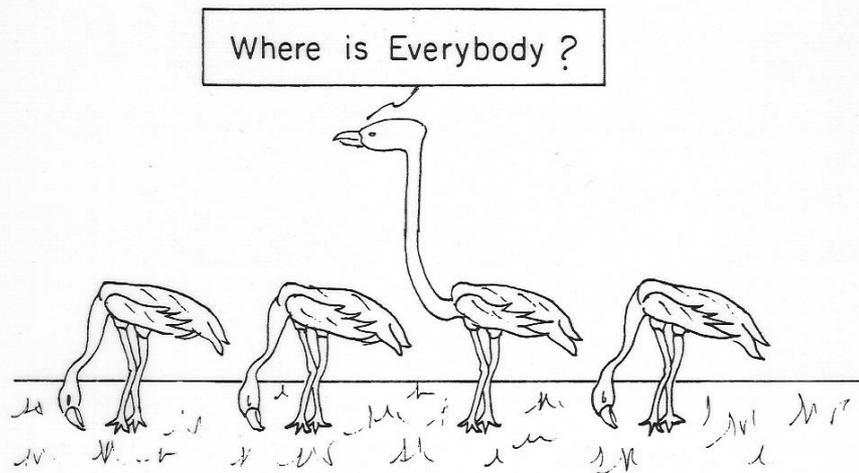
$$R_i = R_* \times f_p \times n_p \times f_l \times f_i$$

The Number of Intelligent Civilizations

1. The growth rate of intelligent civilizations in our Galaxy is about:

$$R_i \sim 1 \times 1/2 \times 2 \times 1 \times 1 \sim \text{One per year!!}$$

2. The age of our galaxy is about ten billion years old ($t_g = 10,000,000,000$ years).
3. Therefore about ten billion intelligent civilizations should have formed in our Galaxy ($R_i \times t_g = 10,000,000,000$).
4. Intelligent life should be very common.



The Zoo Hypothesis

Intelligent Civilizations

- The TOTAL NUMBER of intelligent communicative civilizations in our Galaxy depends on:
 - R_i The rate of their formation
 - L The *longevity* of intelligent communicative life; the time interval that a civilization is detectable (unknown)

$$N = R_i \times L$$

- If $L \sim 10,000$ years, then there are about 10,000 communicative civilizations in the Galaxy, and the average distance between them is about 1000 light years.
- If the longevity is millions of years, then the closest communicative civilization might be only a few light years away!

A Puzzle?

1. Suppose we accept that life is common in the Universe.
2. Consider then our “typical” civilization and forecast our likely future – more or less the future of others.
3. Eventual space exploration and colonization seems probable.
4. How long will it take for one Galactic civilization to colonize the whole Galaxy?
5. Ten million years (at $1/100^{\text{th}}$ the speed of light)? (or longer?)
6. The age of the Galaxy is ~10 billion years. Then colonization should have happened long ago.
7. Therefore, we should likely be the descendants of long-ago settlers!
8. Which we certainly are *not!!*

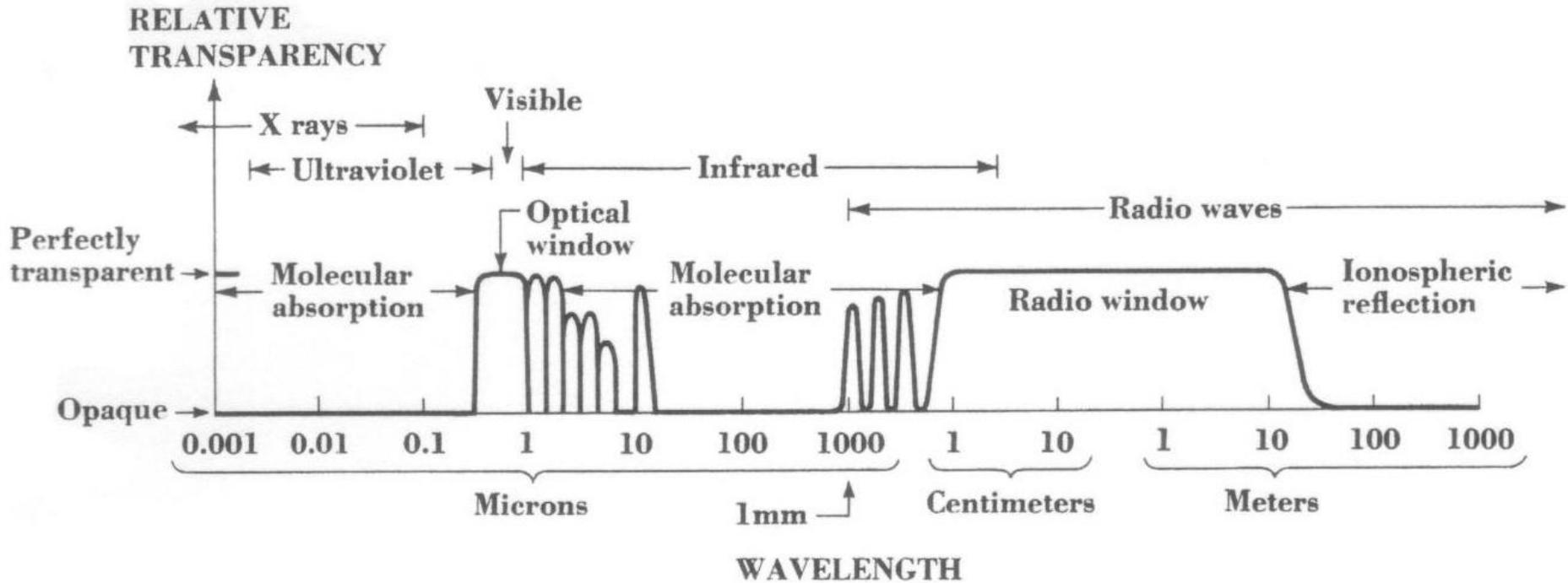
Which assumptions are wrong?

Interstellar Communications

- Put a message at the end of a very long stick!
- Send of rocket full of people!
- Send a robot!
- ESP! ?
- Send a telegram (very economical with radiowaves, and travels at the speed of light!)
- DO NOT COMMUNICATE (danger of being discovered by hostile “invaders”)

RADIO ASTRONOMY

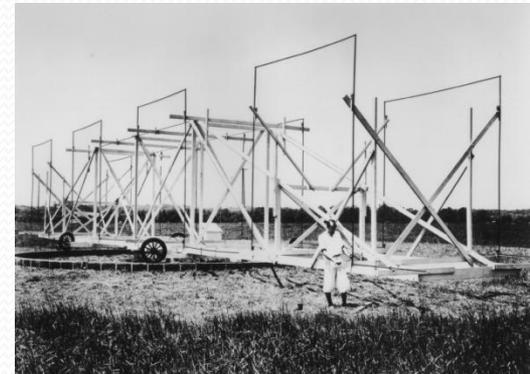
Atmospheric Transmission



Radio window discovered by **Karl Jansky** (1931).

Grote Reber followed this work in the 1940's.

Development during World War II in England, Holland and Australia.

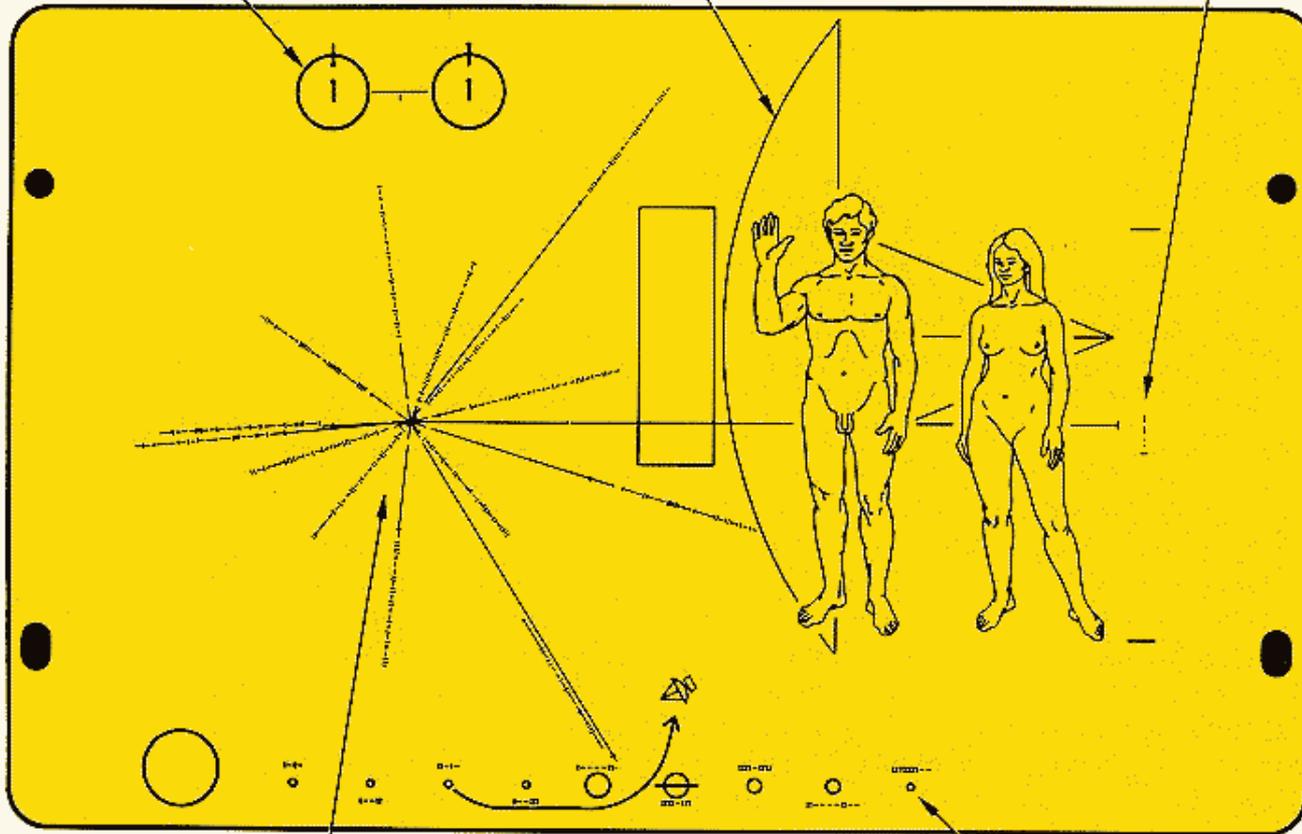


Pioneer 10 and 11 plaques

HYPERFINE TRANSITION OF NEUTRAL HYDROGEN

SILHOUETTE OF SPACECRAFT

BINARY EQUIVALENT OF DECIMAL 8



POSITION OF SUN
RELATIVE TO 14
PULSARS AND THE
CENTER OF THE GALAXY

PLANETS OF SOLAR
SYSTEM AND BINARY
RELATIVE DISTANCES

PROJECT OZMA (1960)

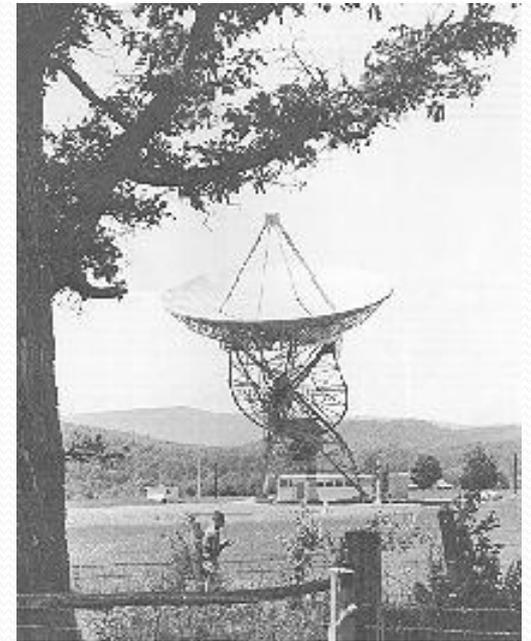
- NRAO
- Green Bank, West Virginia
- $\lambda = 21 \text{ cm}$
- Listened for intelligent messages from possible planets around the stars:



Frank
Drake

τ Ceti
 ϵ Eridani

Sorry, no messages!

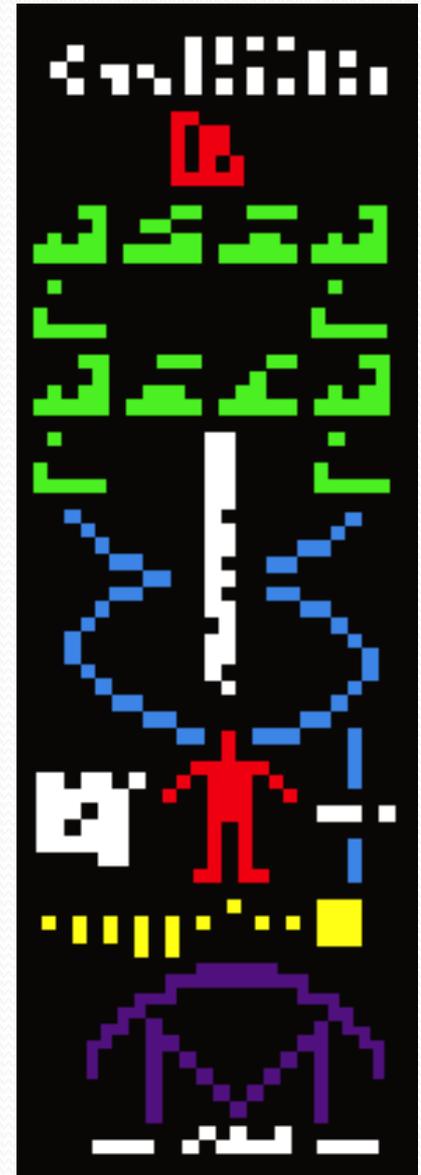


Tatel Telescope
at Green Bank

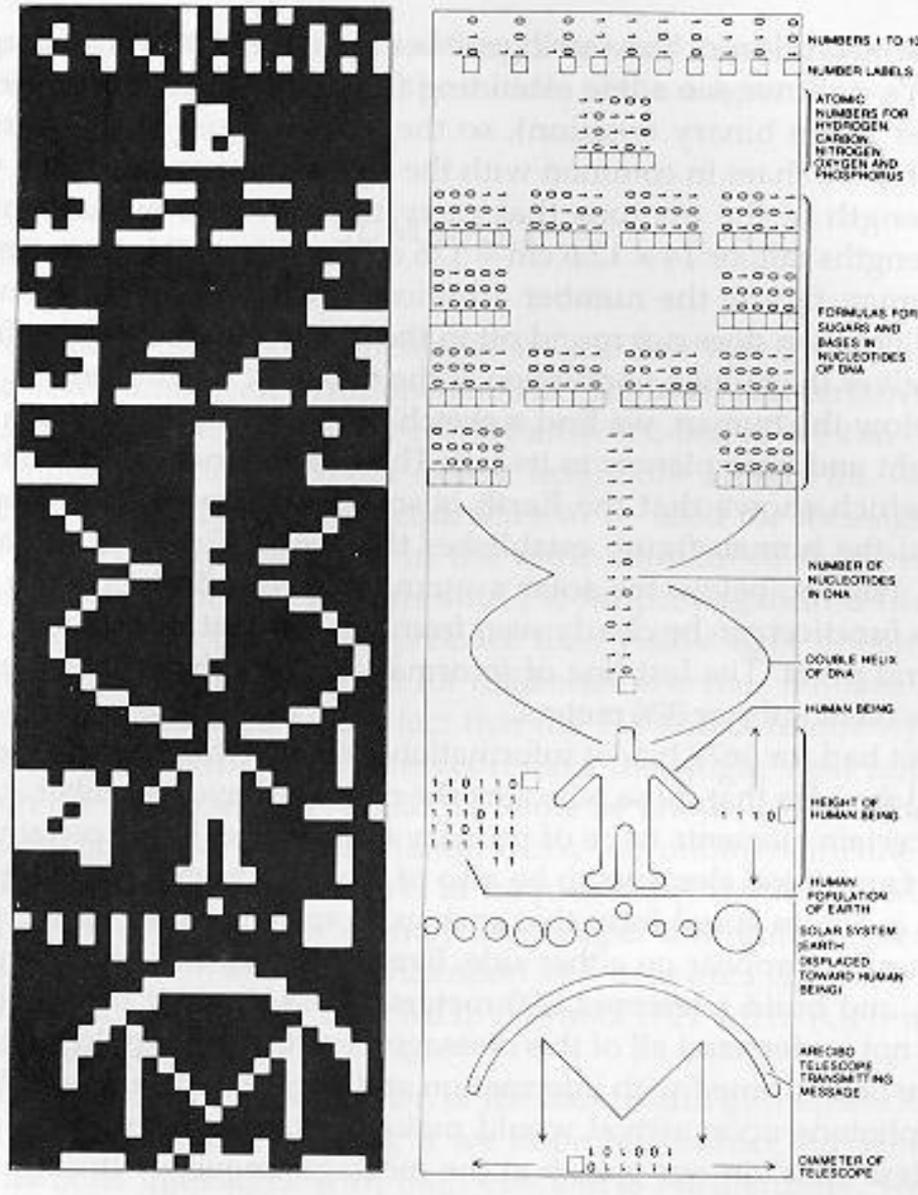


SETI
At Arecibo

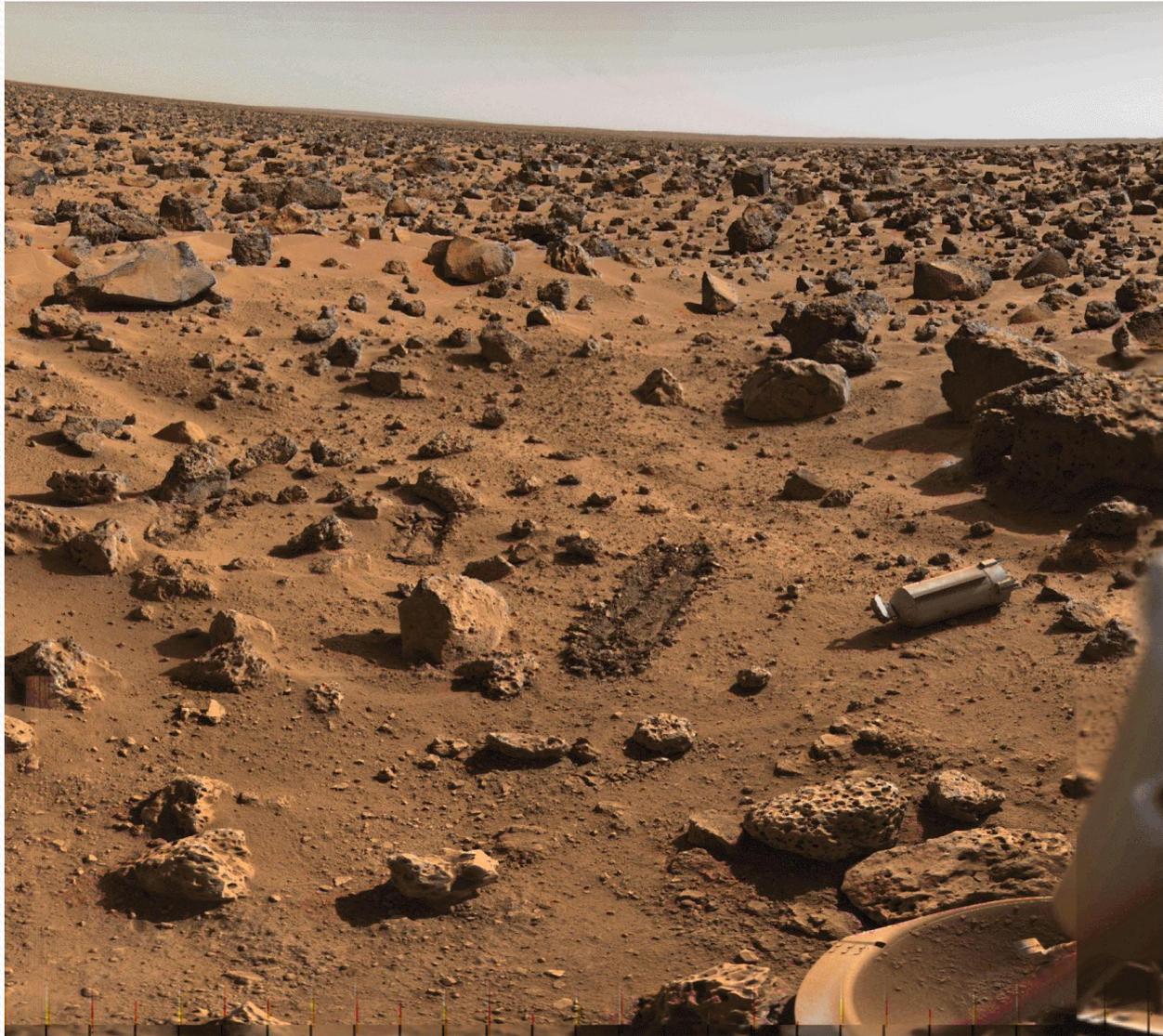
The Arecibo Message



The Arecibo Message



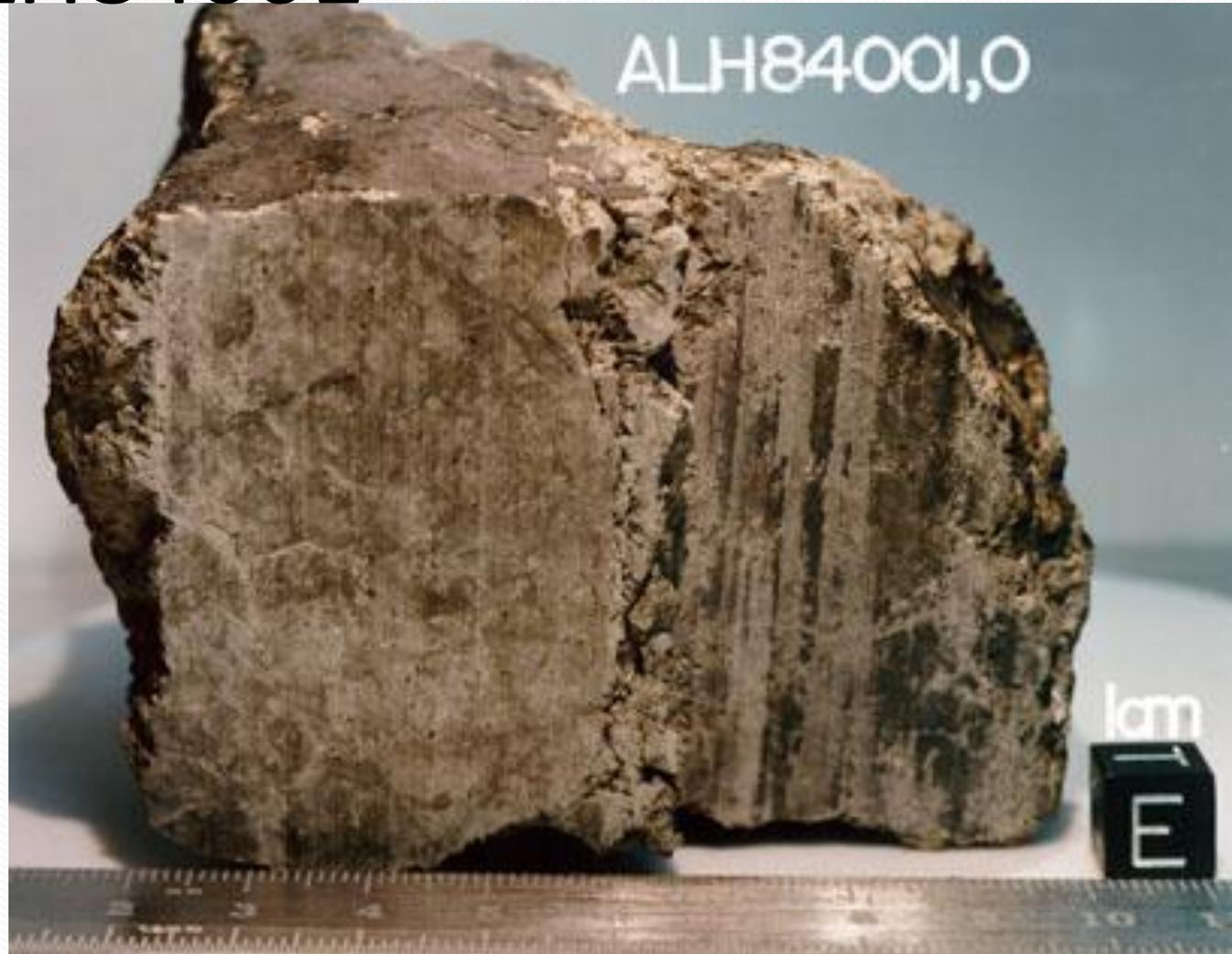
If we arrange the 1679 bits into 23 columns of 73 bits each (both are prime numbers), and color the ons and offs differently, we find the pattern shown here. The message was directed at the Globular Cluster **M13** in the constellation Hercules.



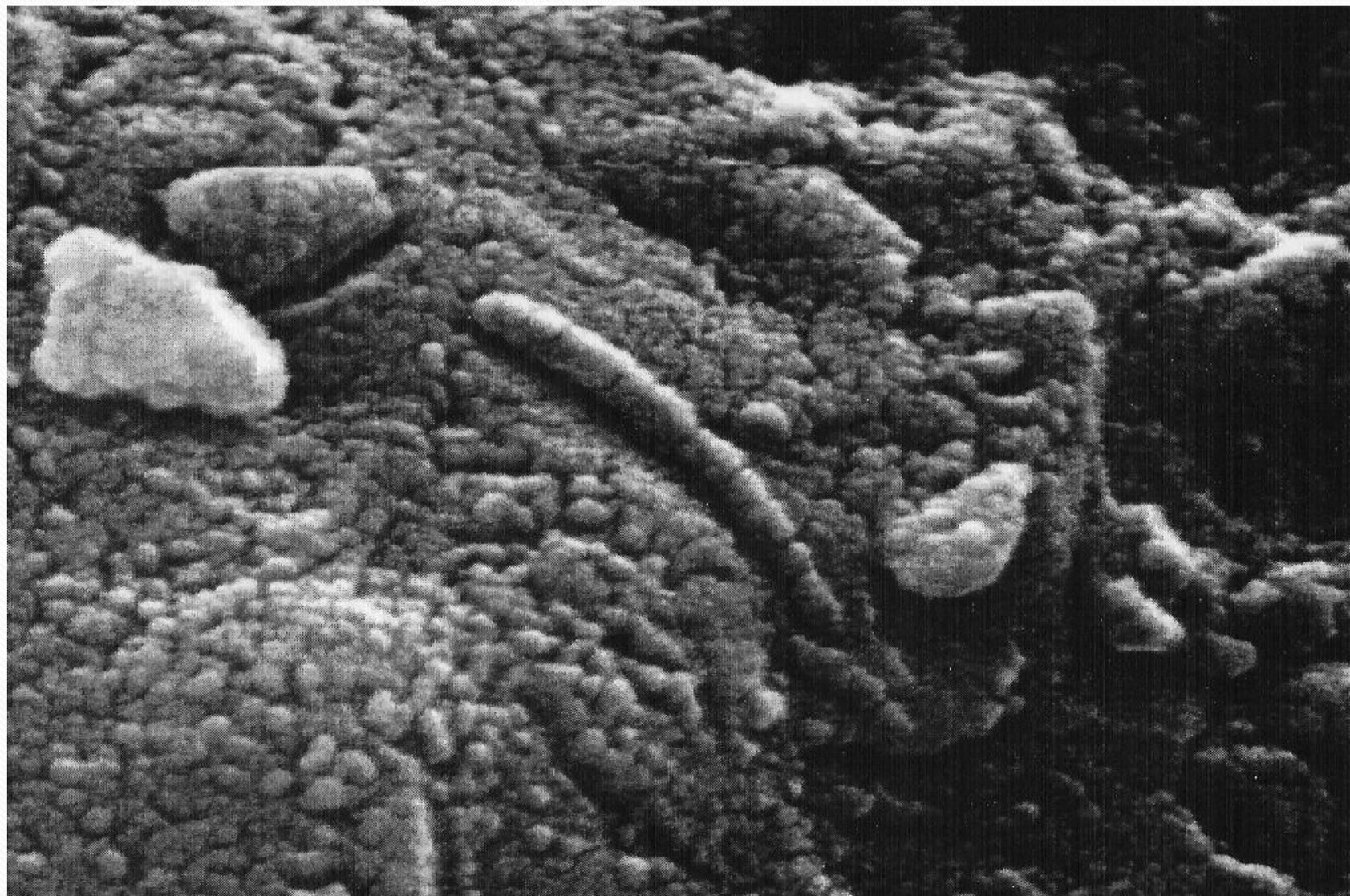
The Viking Lander

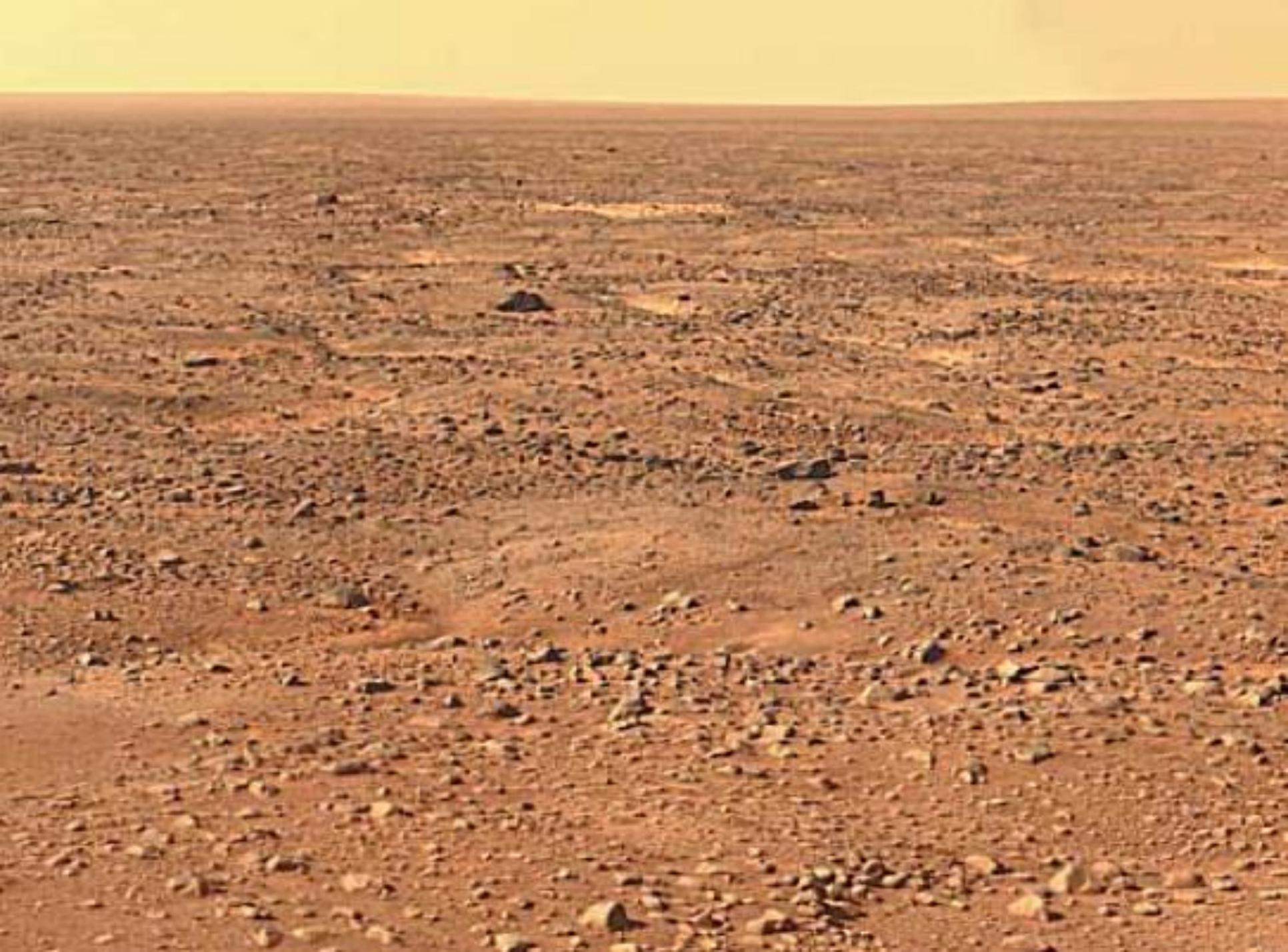


ALH84001



This 4.5-billion-year-old meteorite, labeled ALH84001, was dislodged from Mars by a massive impact about 16 million years ago and fell to Earth in Antarctica 13,000 years ago. Researchers believe it contains evidence of primitive life that existed on Mars more than 3.6 billion years ago. (Photo: NASA)





- Pi to i “Get real”
- i to Pi ‘ Get rational”

- Why was the Algebra book so sad?
- Because it had so many problems.

- What did the volcano say to his girlfriend?
- I lava you very much.

- Where did the lightning bolt propose to his girlfriend?
- On Cloud Nine.