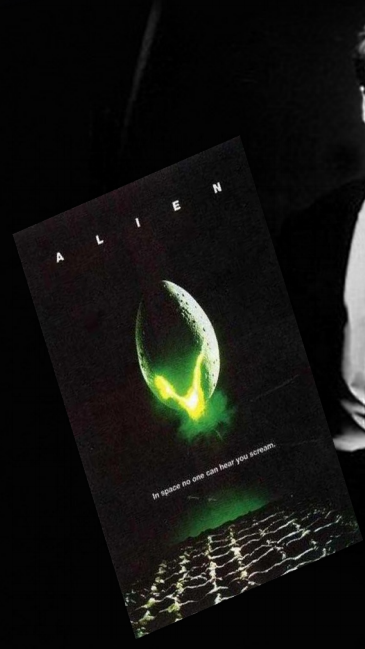
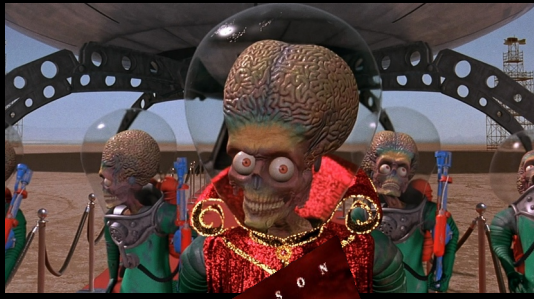


SETI -

*Search for Extra-terrestrial Intelligence -
Perspectives of an Earth Scientist*

*Donna M. Jurdy
Northwestern University*





Mars • Global Dust Storm

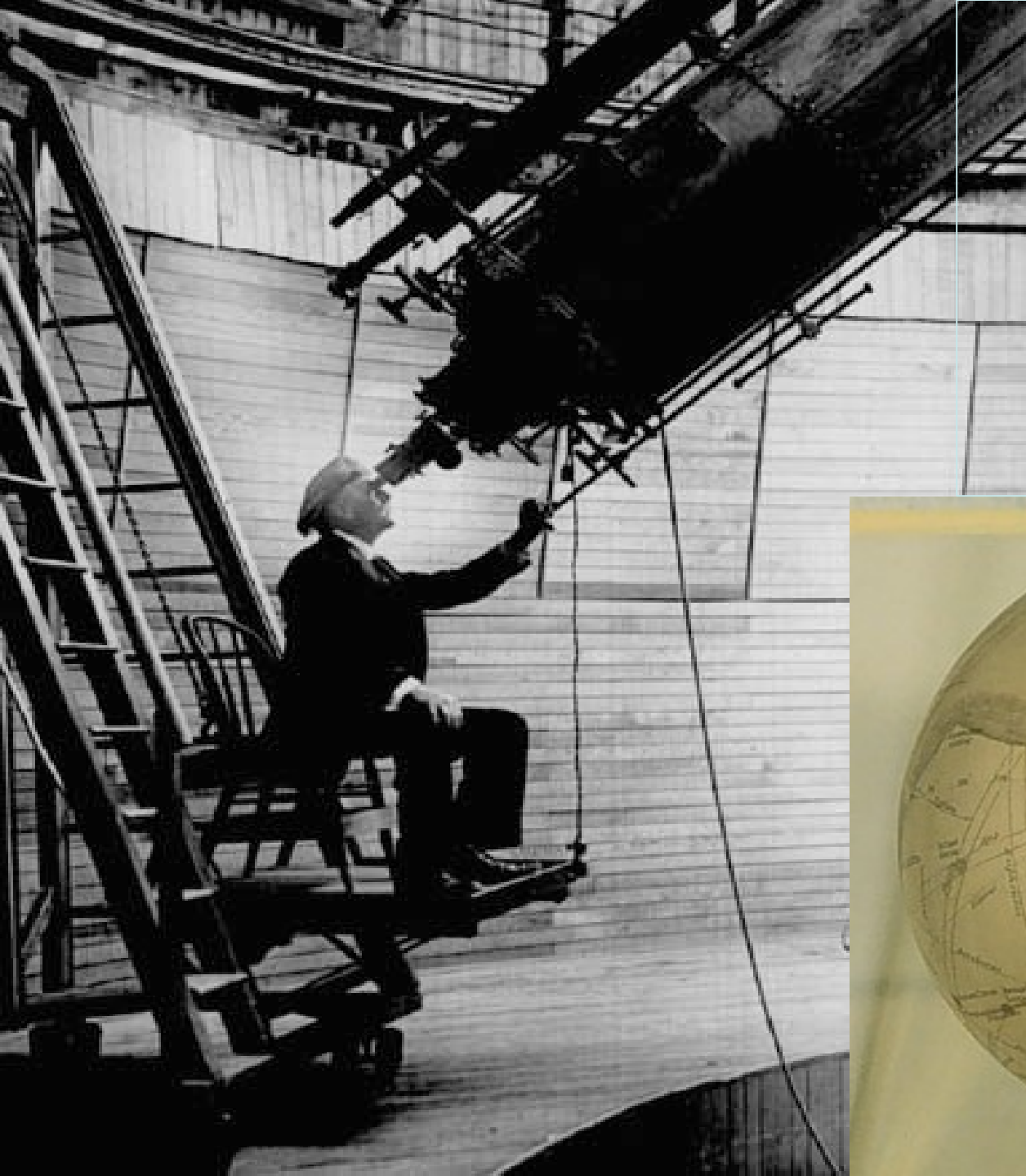


June 26, 2001



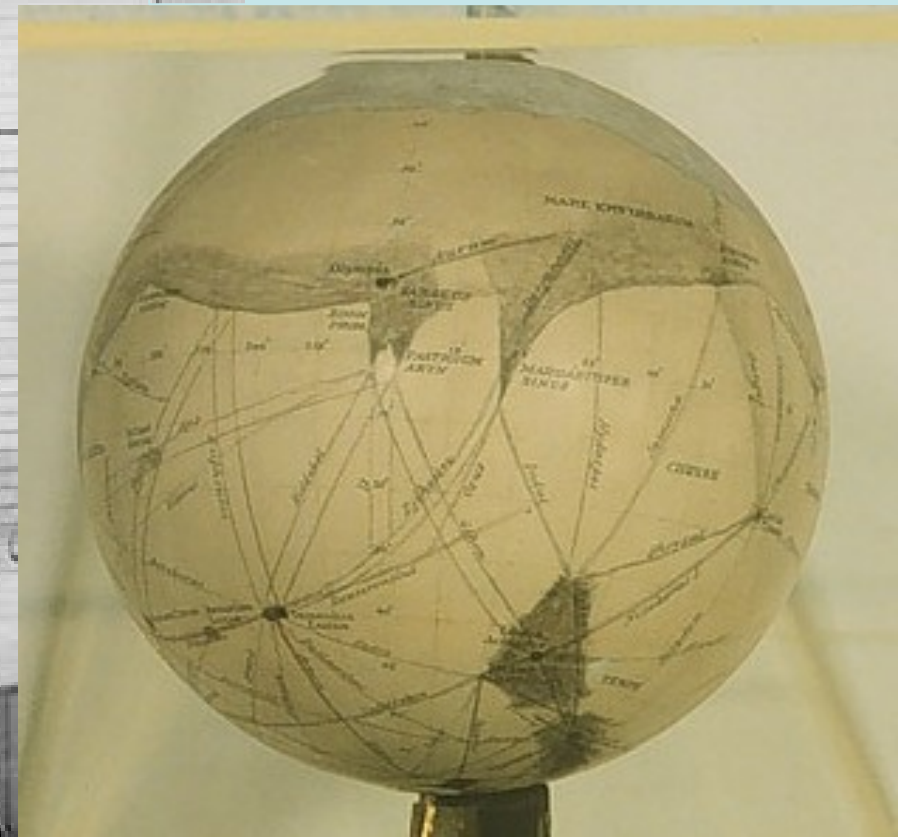
September 4, 2001

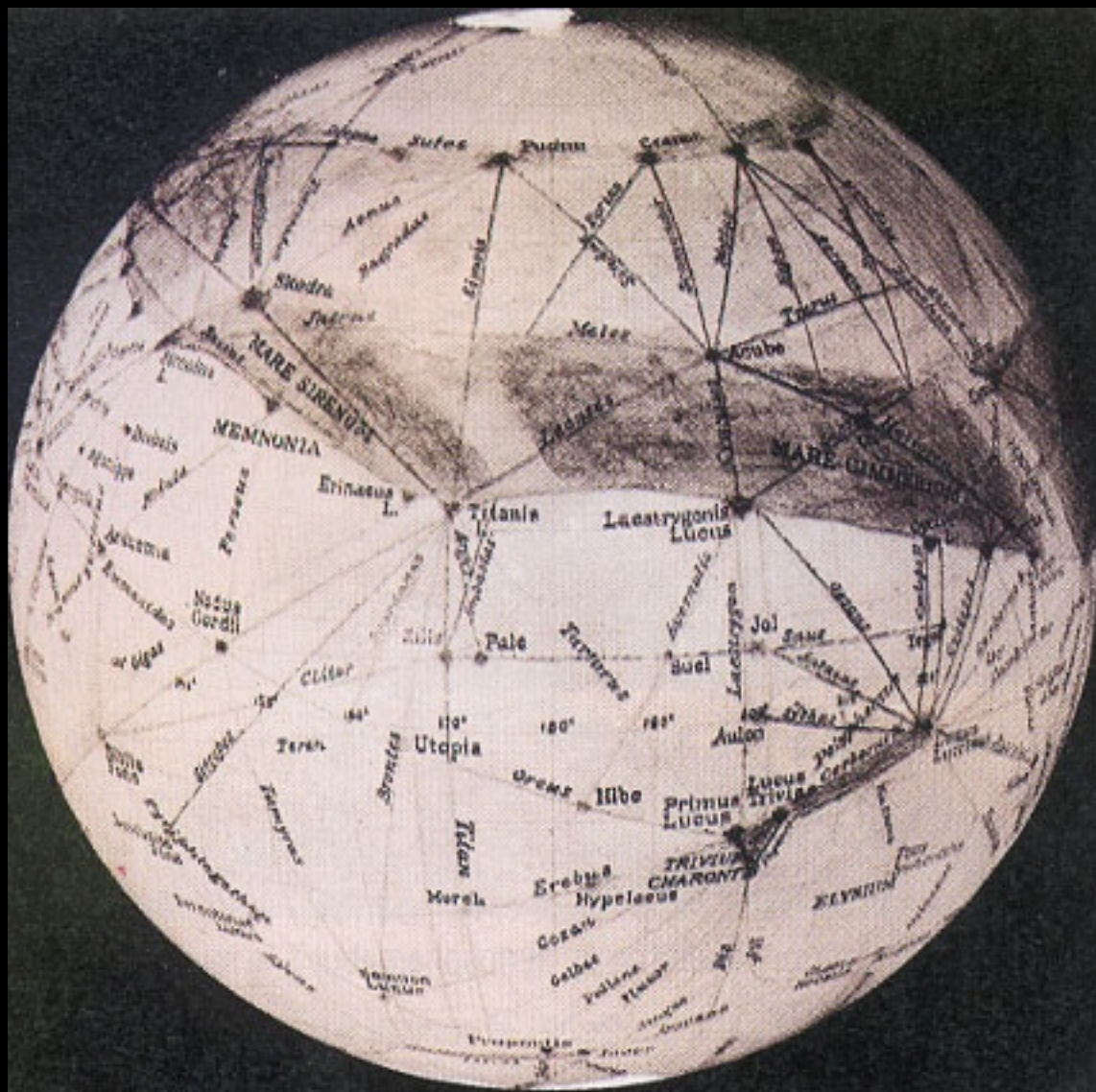
Hubble Space Telescope • WFPC2



PERCIVAL LOWELL
at his 24" Refractor,
Flagstaff, Arizona observing
Mars during the favorable
perihelic opposition, 1894.

Below, a globe constructed
from his sketches.



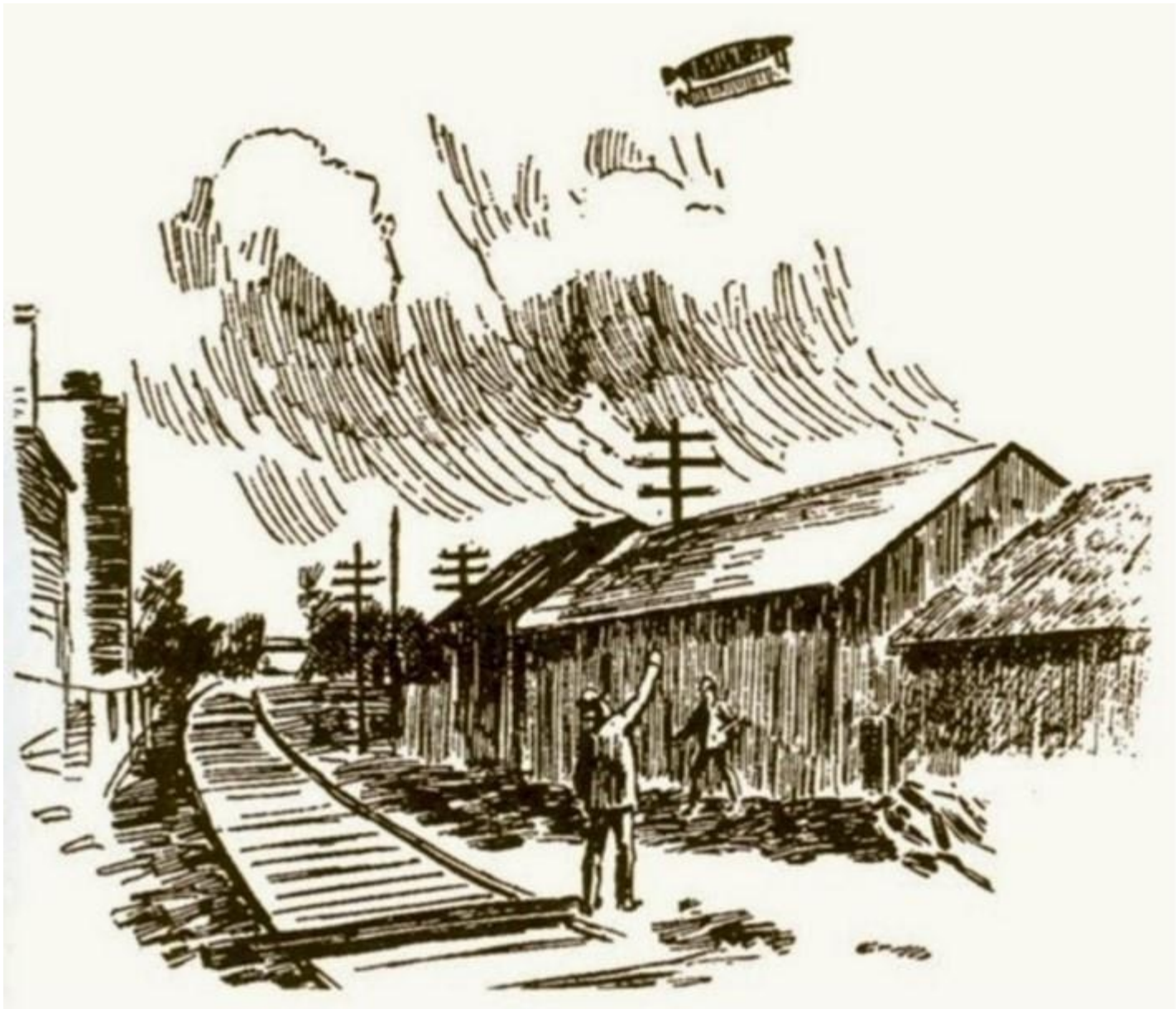


The WAR of the WORLDS

By H. G. Wells

Author of "Under the Knife," "The Time Machine," etc.

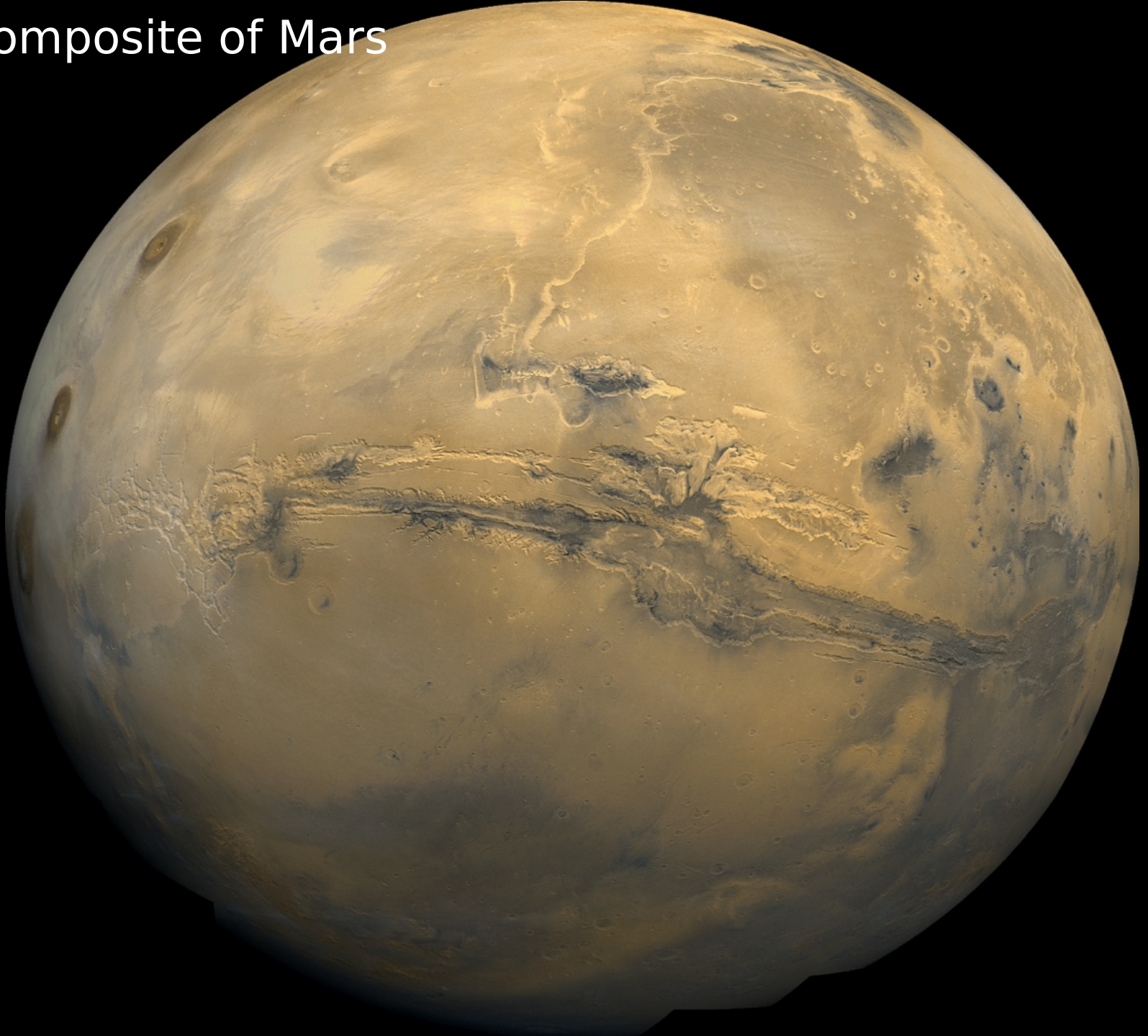






Viking composite of Mars

mid 1970's

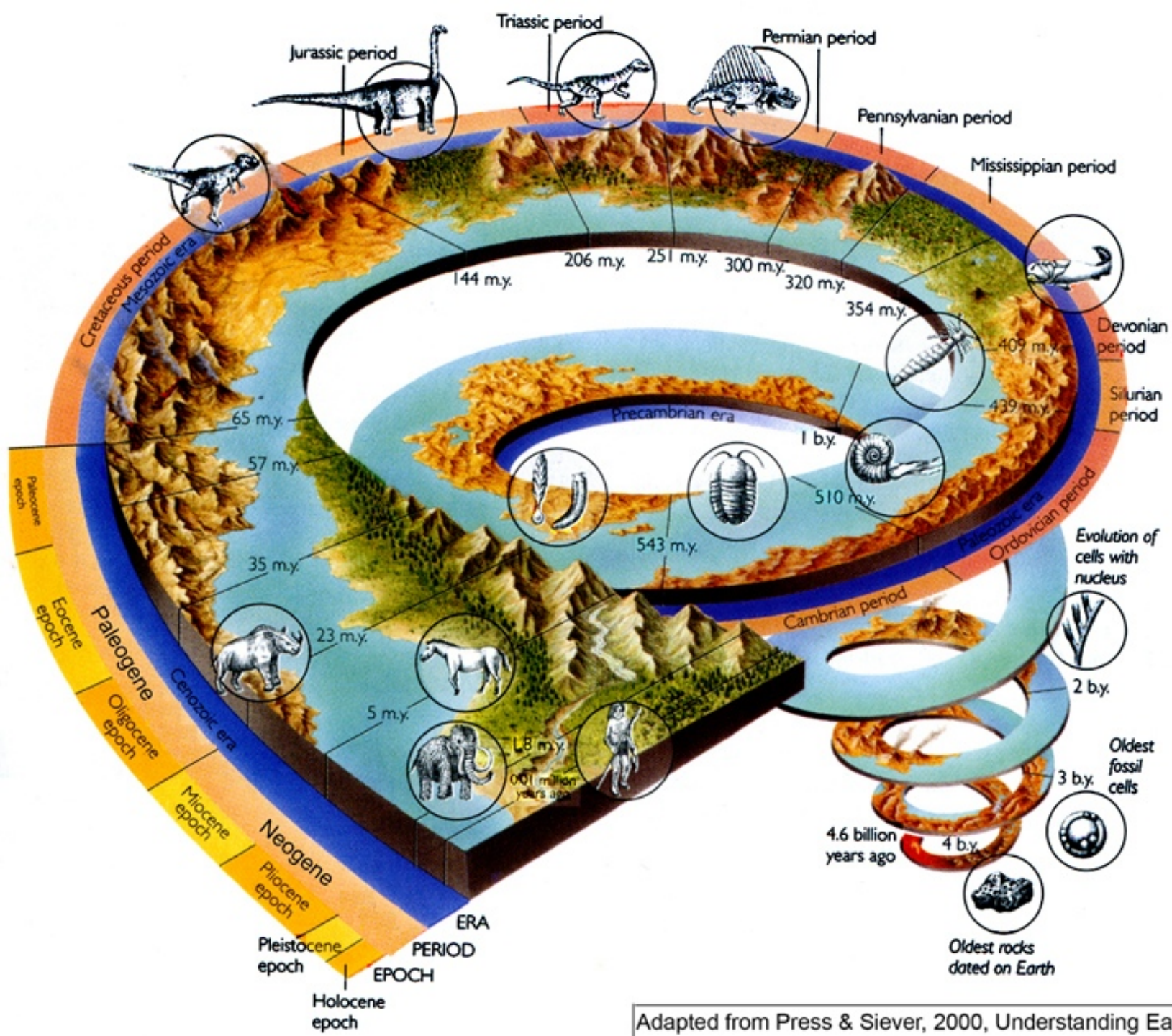


ALH84001,0

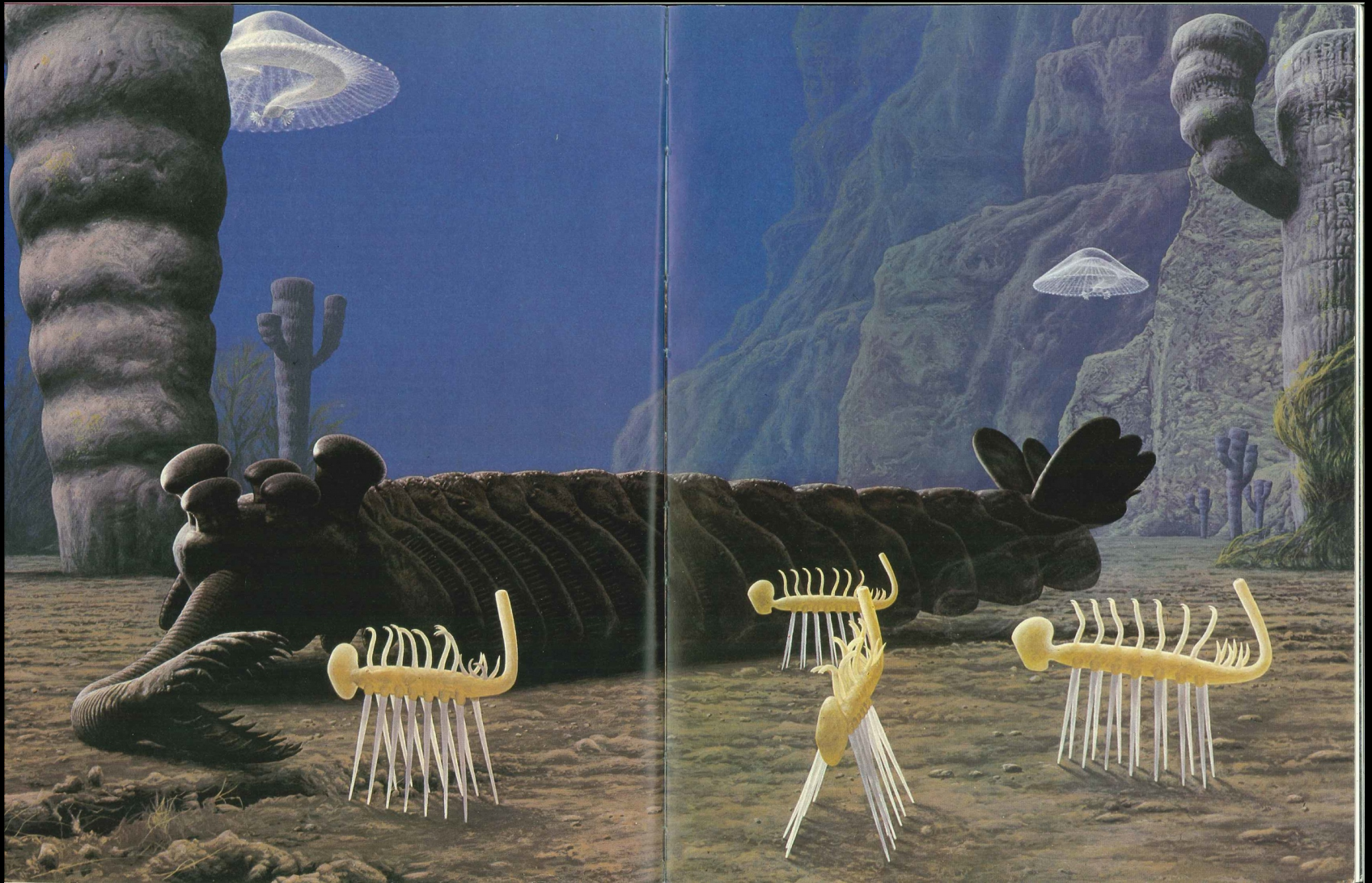


ALH84001 thin section – Martian fossils?



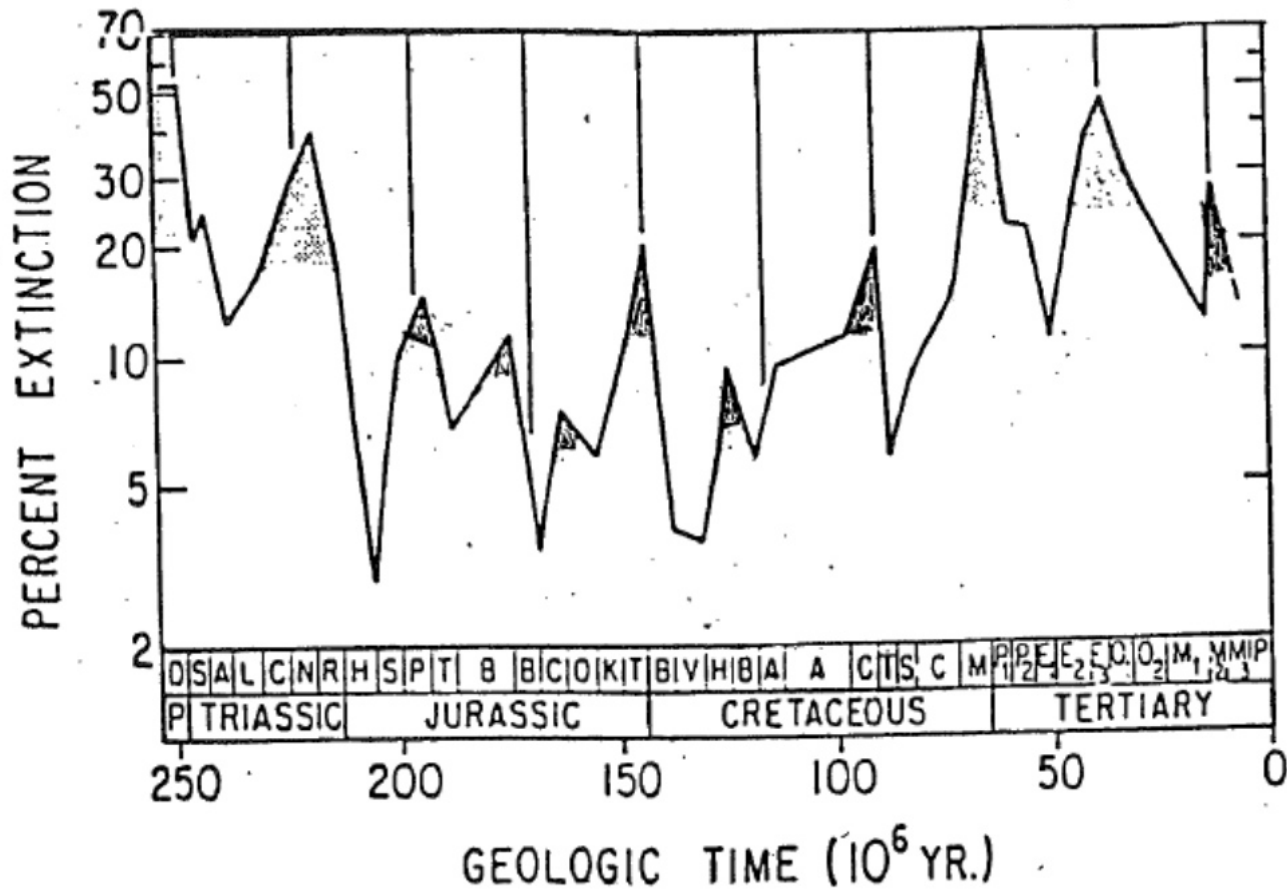


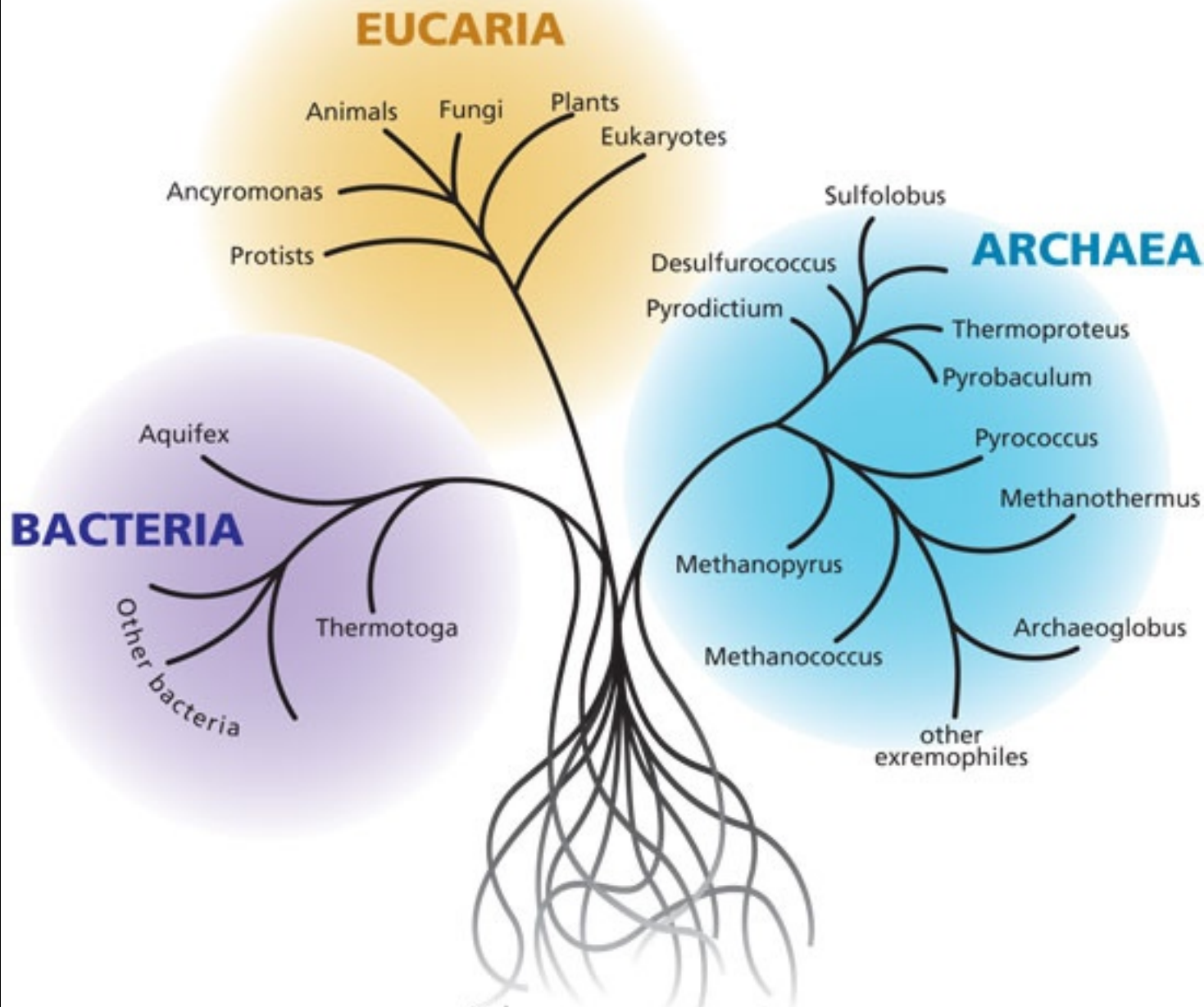
Adapted from Press & Siever, 2000, Understanding Earth





from: Raup & Sepkowski, "Periodicity of extinctions in the geologic past"
 Proc. National Academy of Sciences, vol. 81, pp. 801-805, 1984.





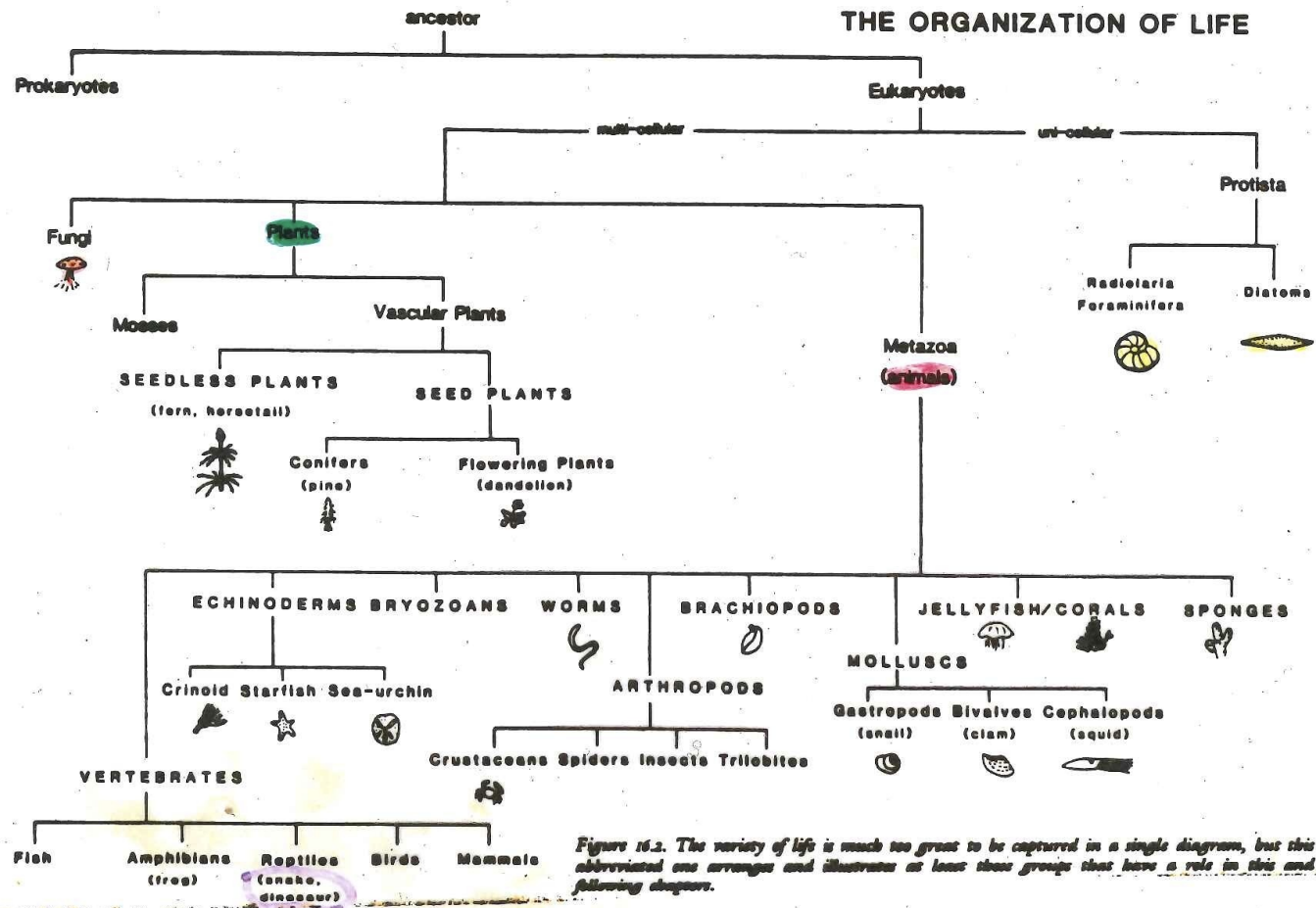
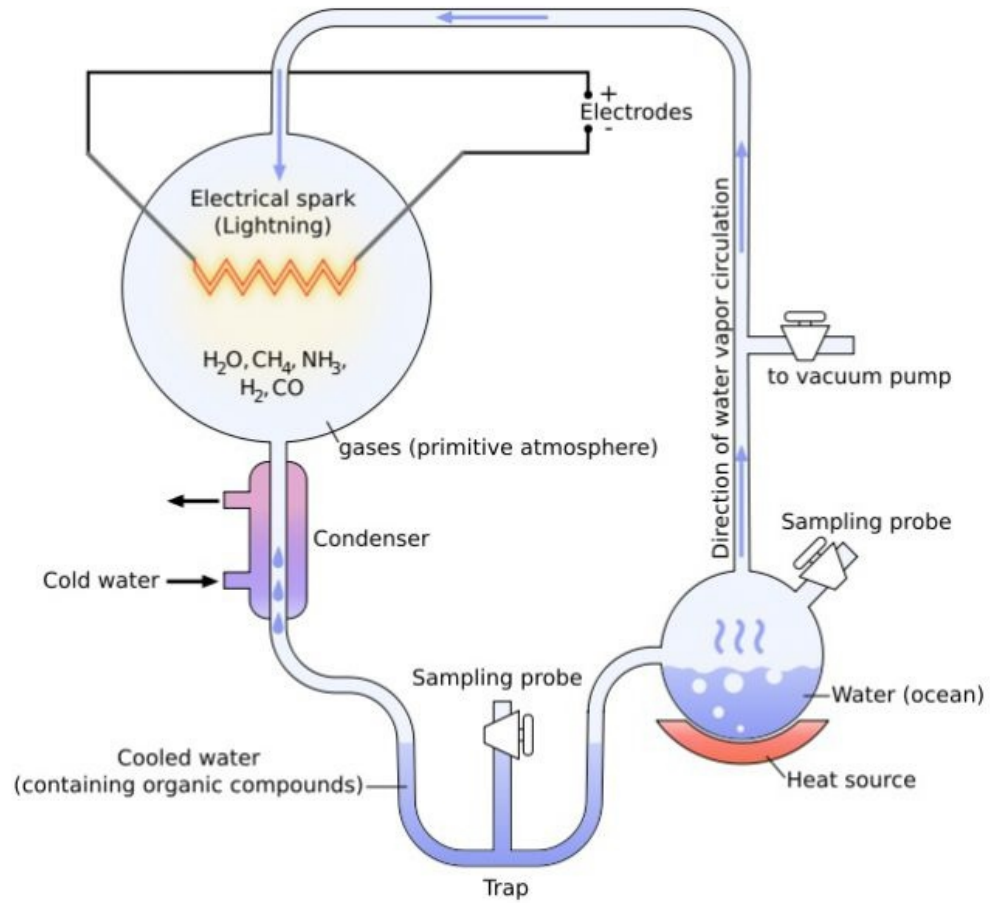


Figure 16.2. The variety of life is much too great to be captured in a single diagram, but this abbreviated one arranges and illustrates at least those groups that have a role in this and following chapters.

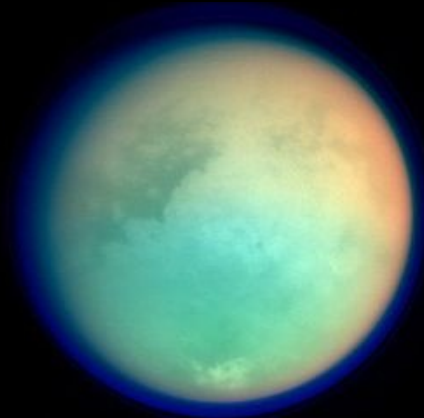


Life in the Solar System?

Pole-to-Equator Temperature Difference on Other Planets



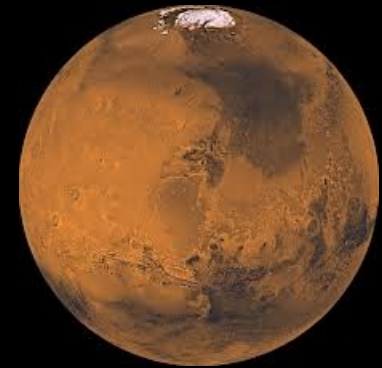
~ 0 K



~ 4 K



a few 10 K



a few (more) 10 K



Thicker Atmosphere

Needed for Habitability?

Solid surface

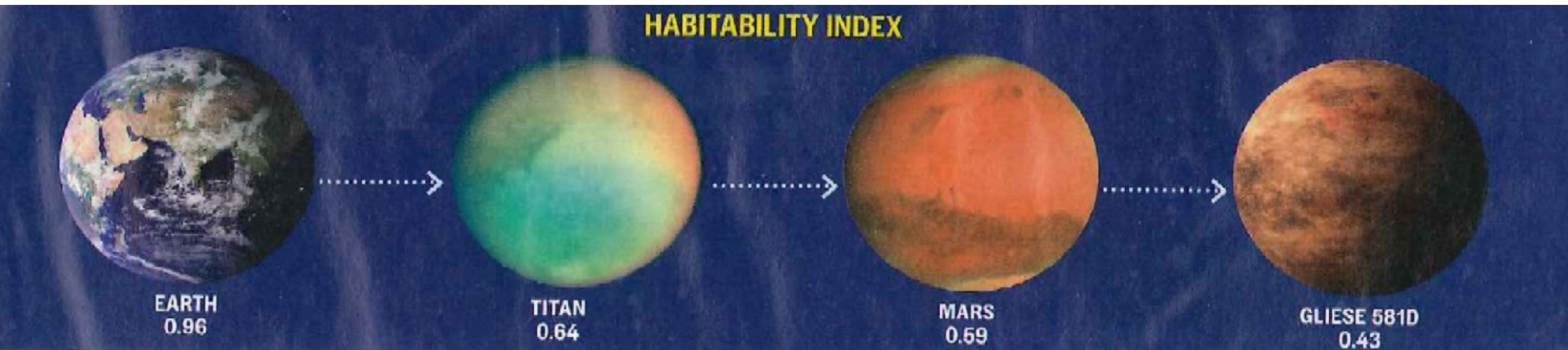
Atmosphere

Liquid on surface:

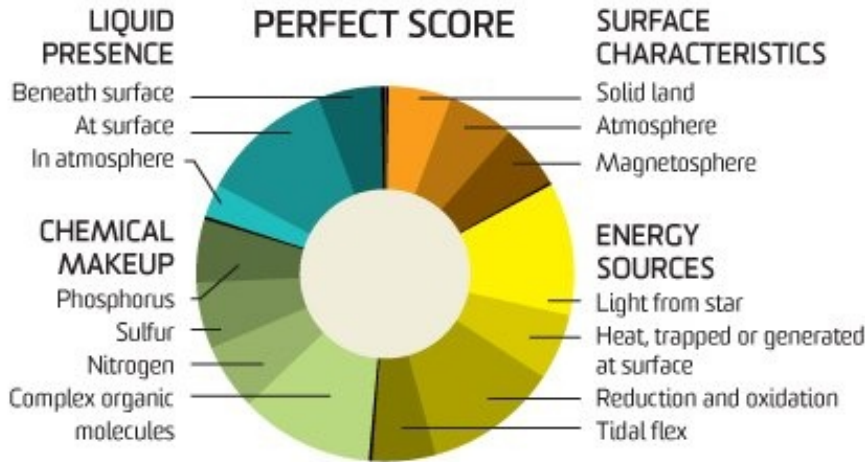
Need not be water



PHI – Planetary Habitability Index:
Schulze-Makuch et al., 2011



Habitability Index

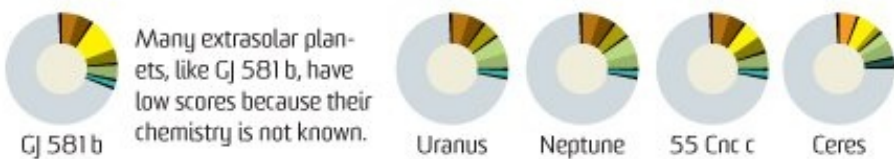
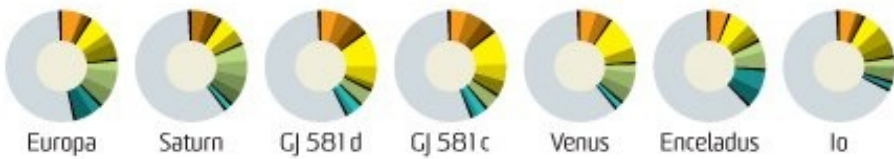
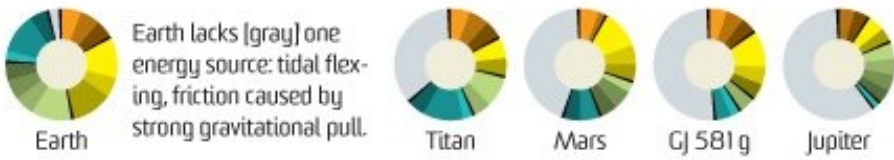


Earth = 0.96

Titan = 0.64

Mars = 0.59

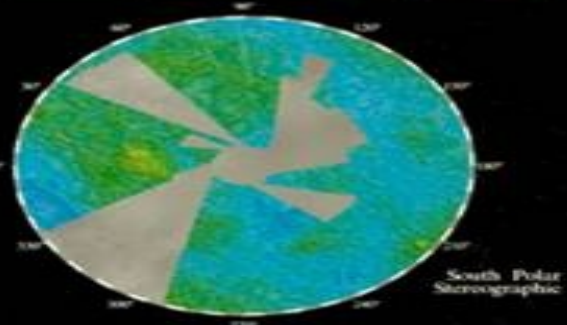
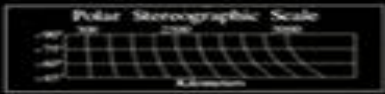
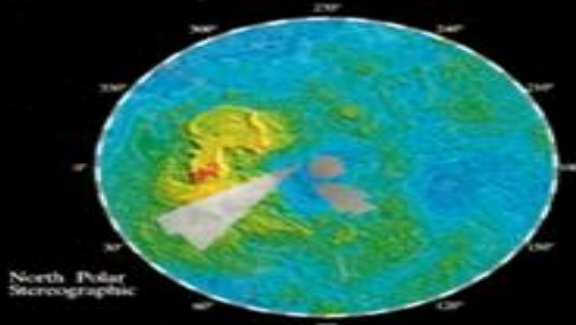
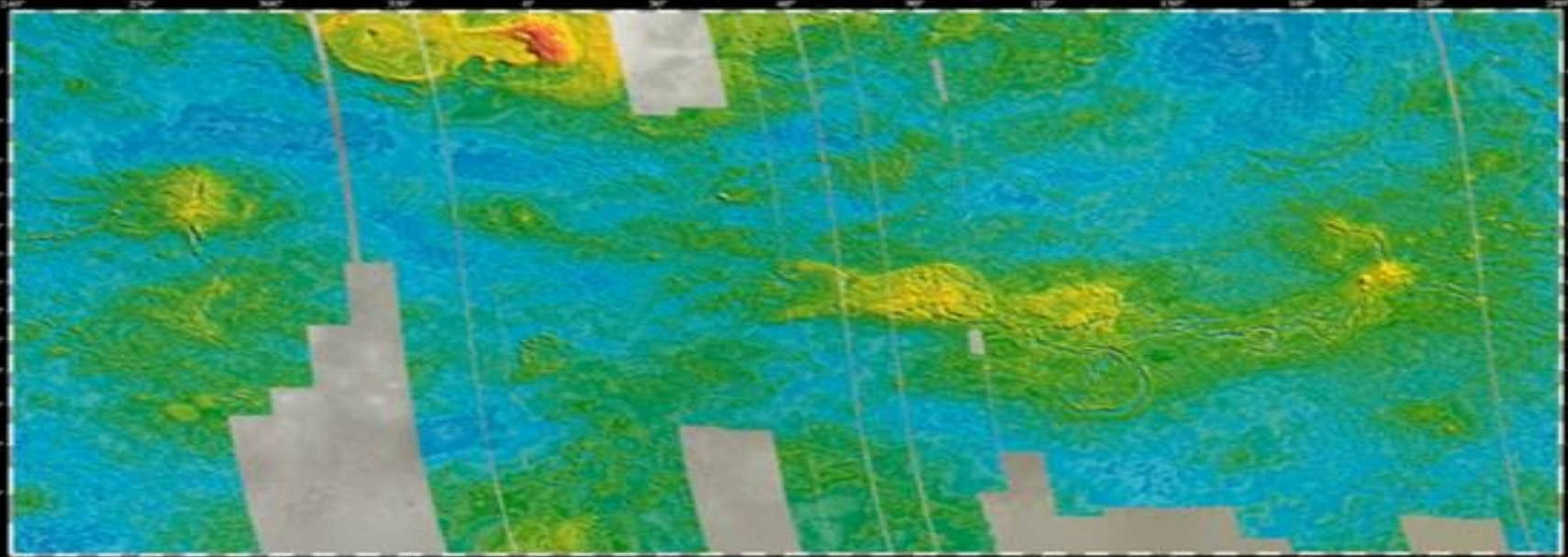
Gliese 581d = 0.43



MAGELLAN

VENUS TOPOGRAPHY

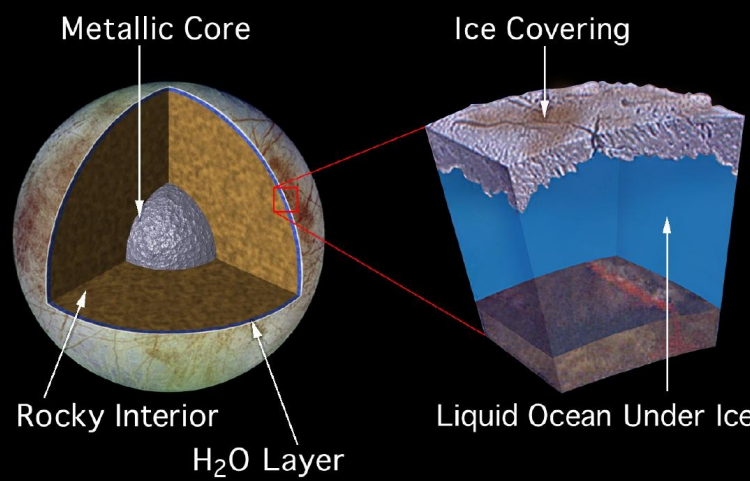
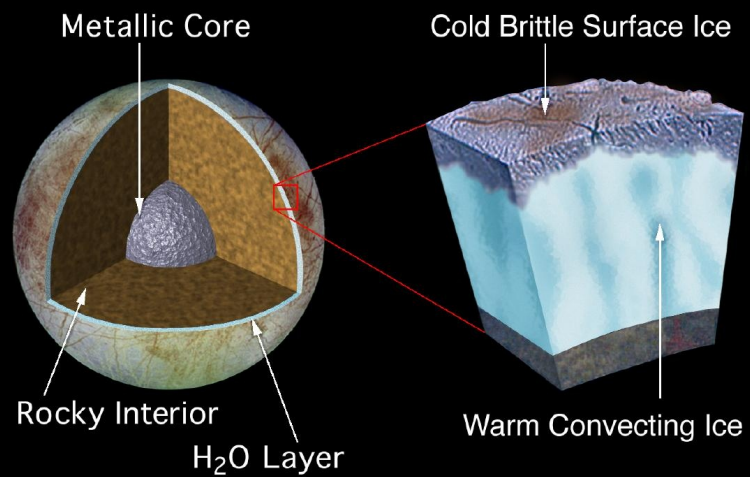
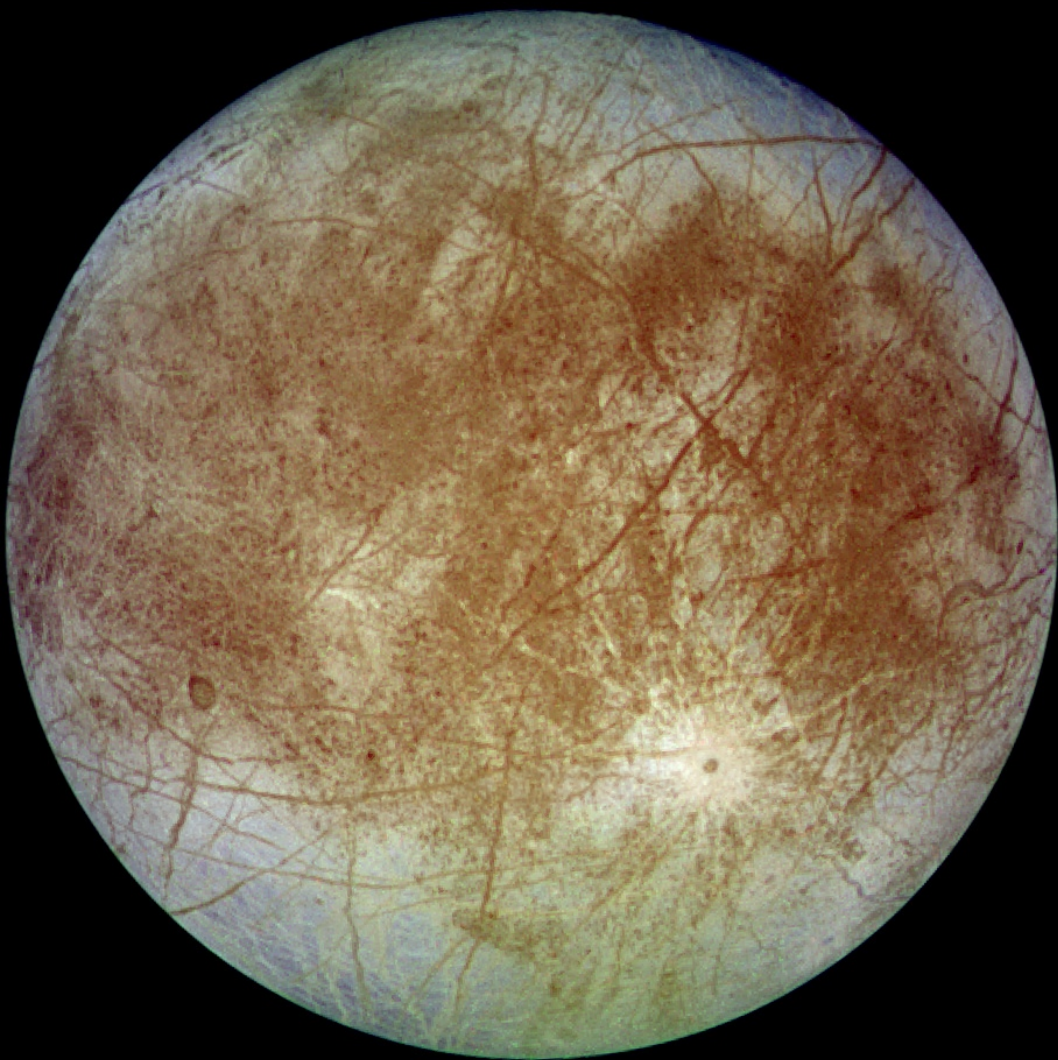
GDRP.1;3



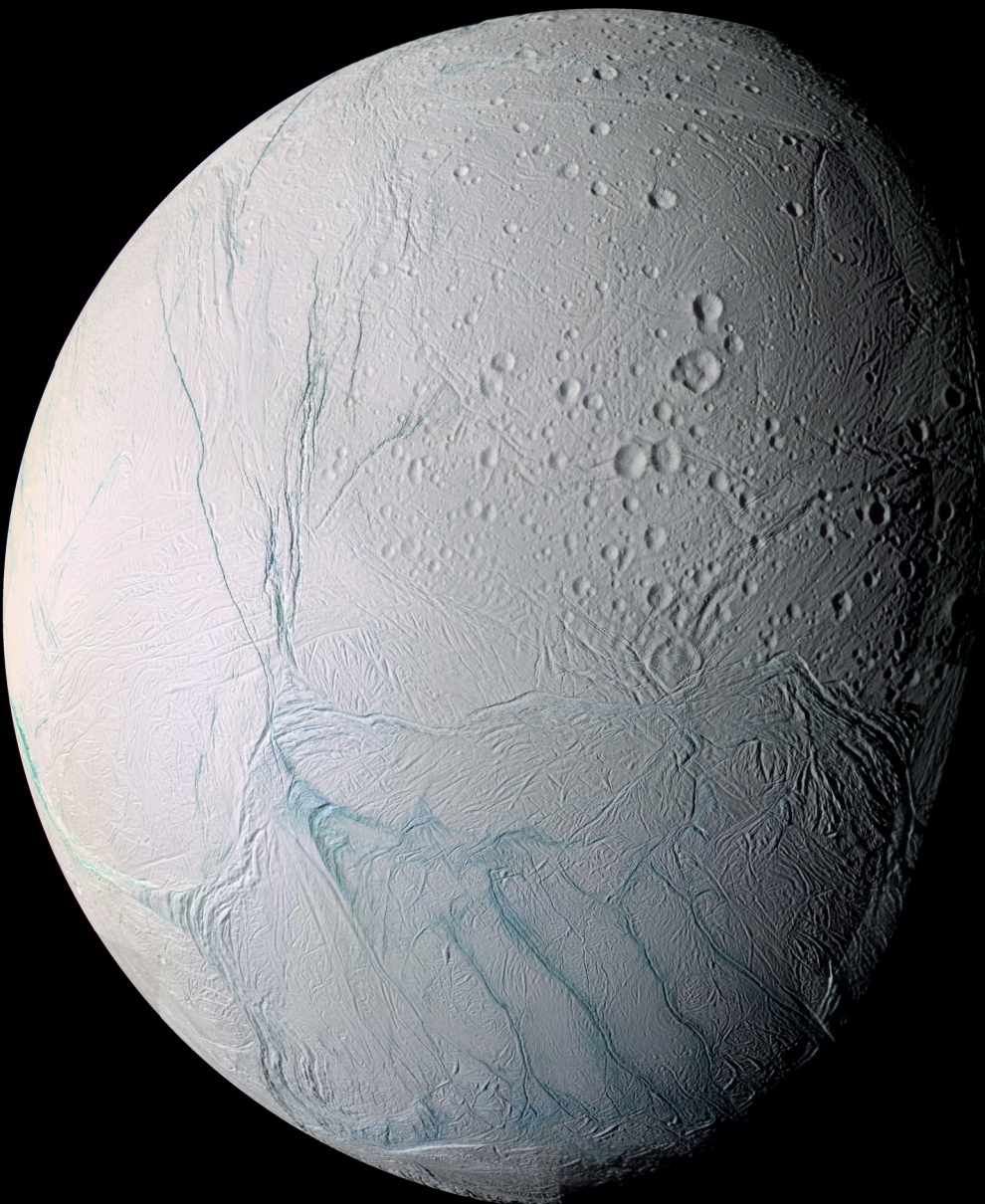
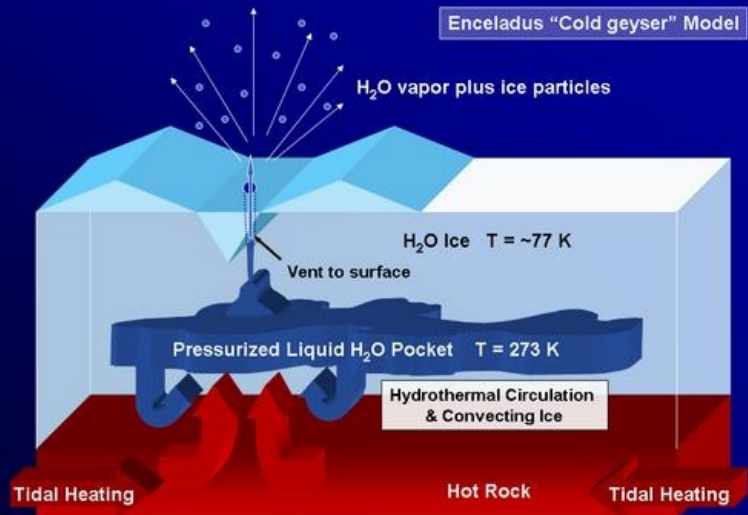
PRODUCT ID:	GDRP.1;3	PRODUCTION DATE:	11/02/91
STARTING ORBIT:	376	PRODUCTION TIME:	13:19:13
ENDING ORBIT:	2586	HARDWARE VERSION:	01
PIXEL SIZE:	5x5 km	SOFTWARE VERSION:	02

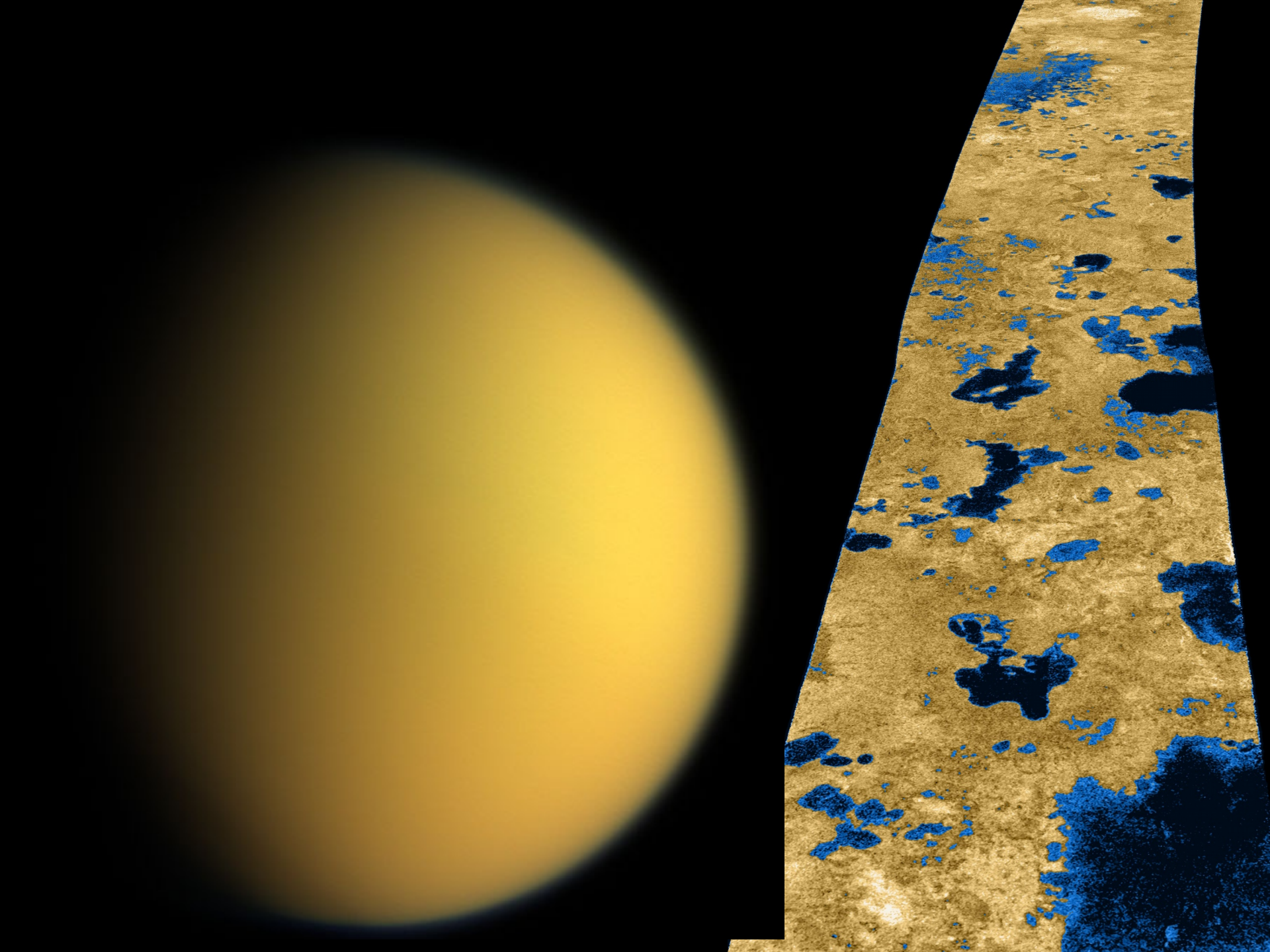
Early View of Venus





Enceladus "Cold geyser" Model





Huygens Landing Site

Landed January 14, 2005 at 10.2S,
192.4W

Discovered small “rocks”, possibly made
of water ice, at the landing site.

Fluvial activity (methane?)

Images taken during descent showed no
open areas of liquid, but indicated liquid
had once flowed

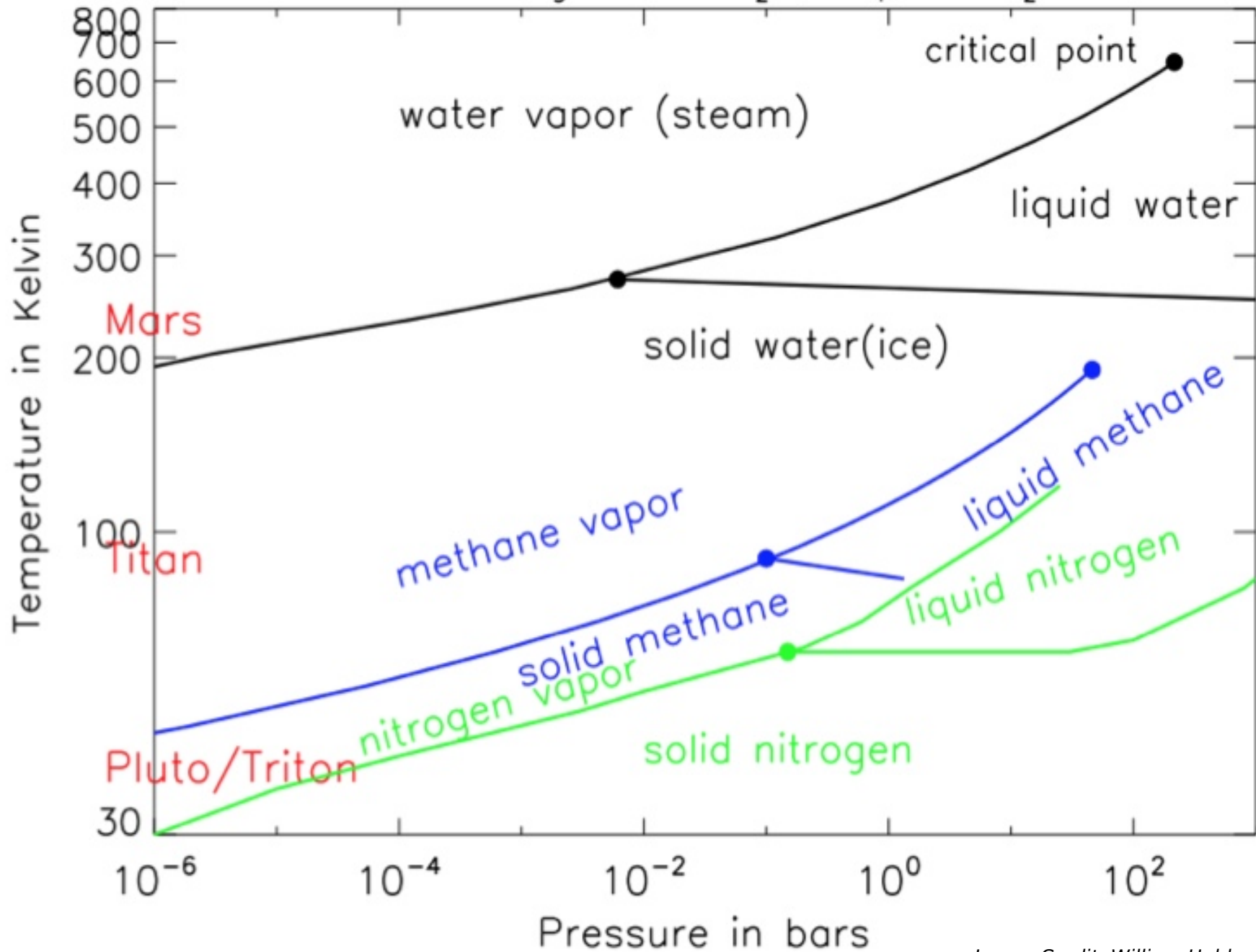


Titan

Earth



Phase diagrams of H₂O, CH₄, and N₂



The Drake Equation

How many civilizations are out there?

DRAKE EQUATION

$$N = R \times f_p \times n_p \times f_l \times f_i \times f_c \times L$$

R average rate of star formation

f_p fraction of good stars that have planetary systems

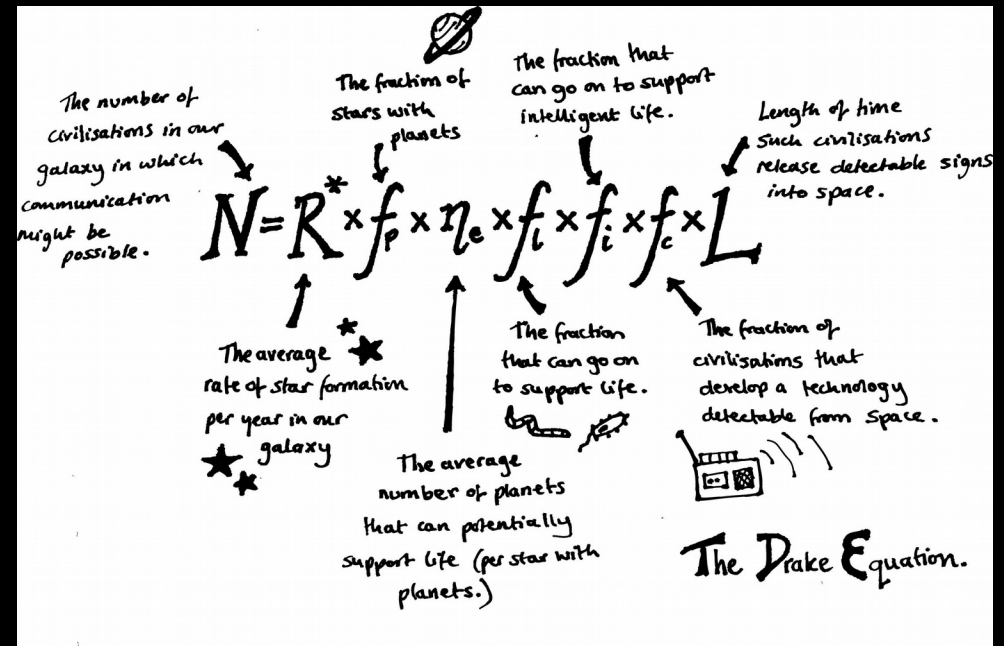
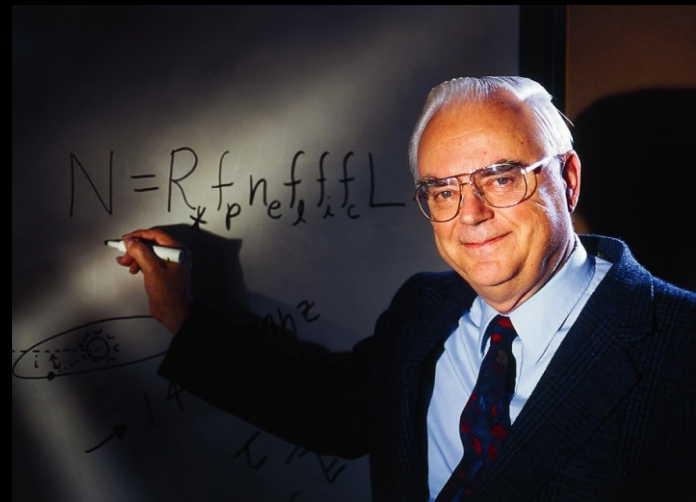
n_p number of planets found these stars within an "ecoshell"

f_l fraction of those planets where life develops

f_i fraction of living planets that develop intelligence

f_c fraction of intelligent civilizations with communications technology

L lifetime of the communications phase







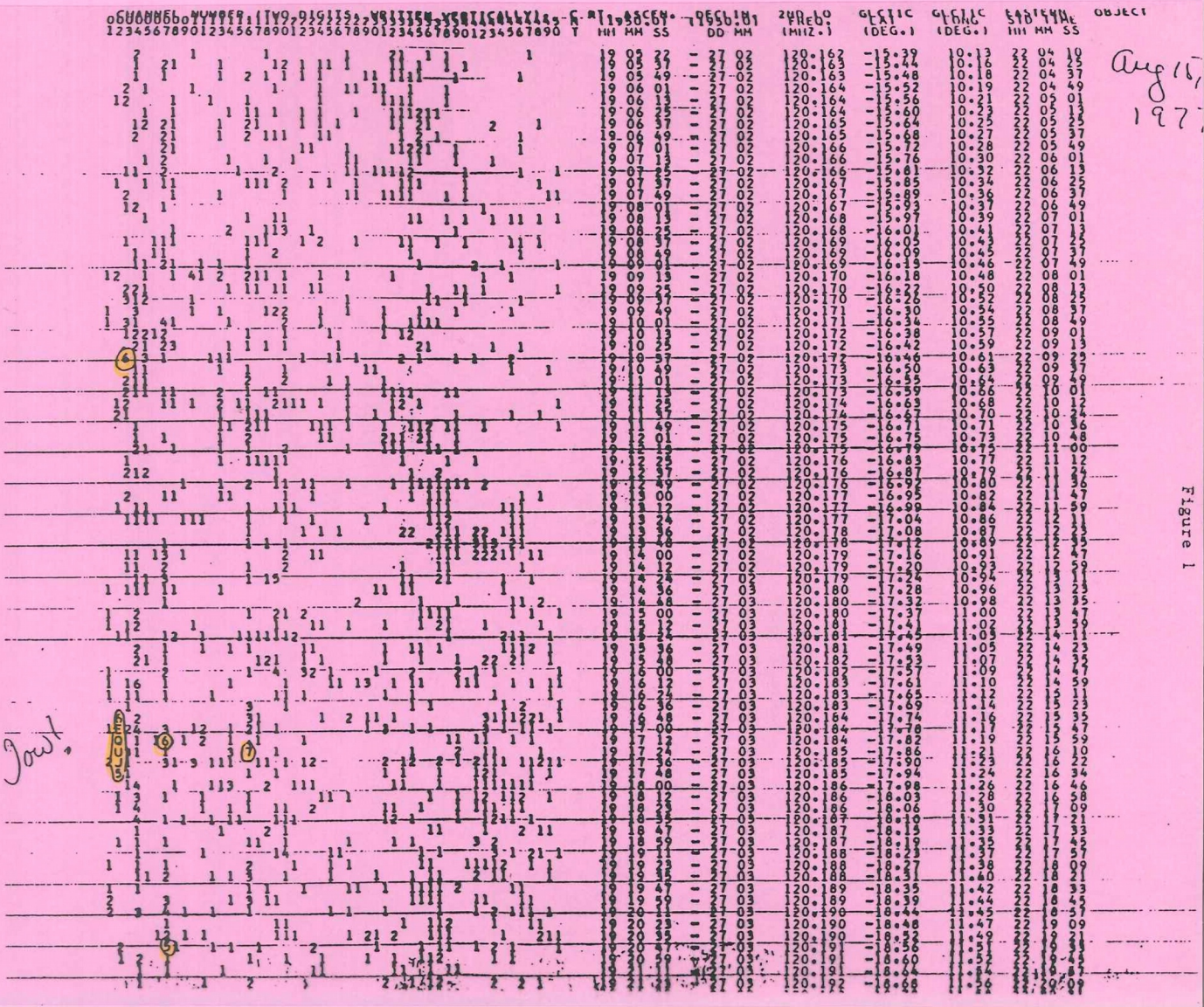


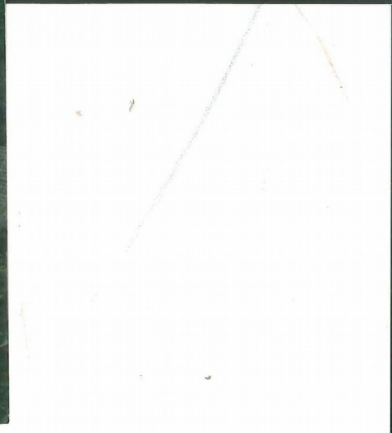
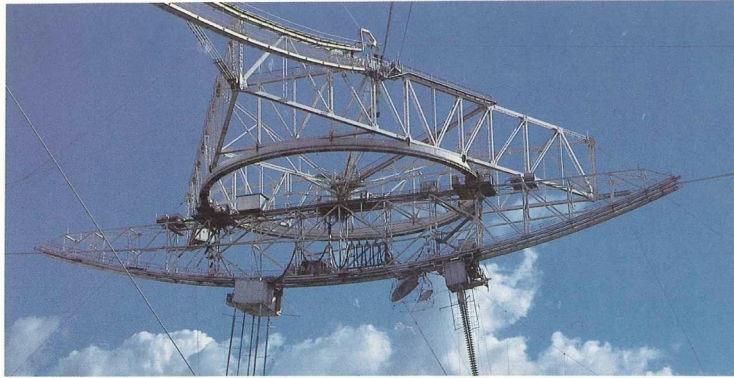
Figure 1. The "Wow!" signal. It was recorded on a computer printout of radio noise intensity from 50 frequency channels (digits and letters at left) at varying sky positions. (Photo: Courtesy Robert Dixon, Ohio State University Radio Observatory.)

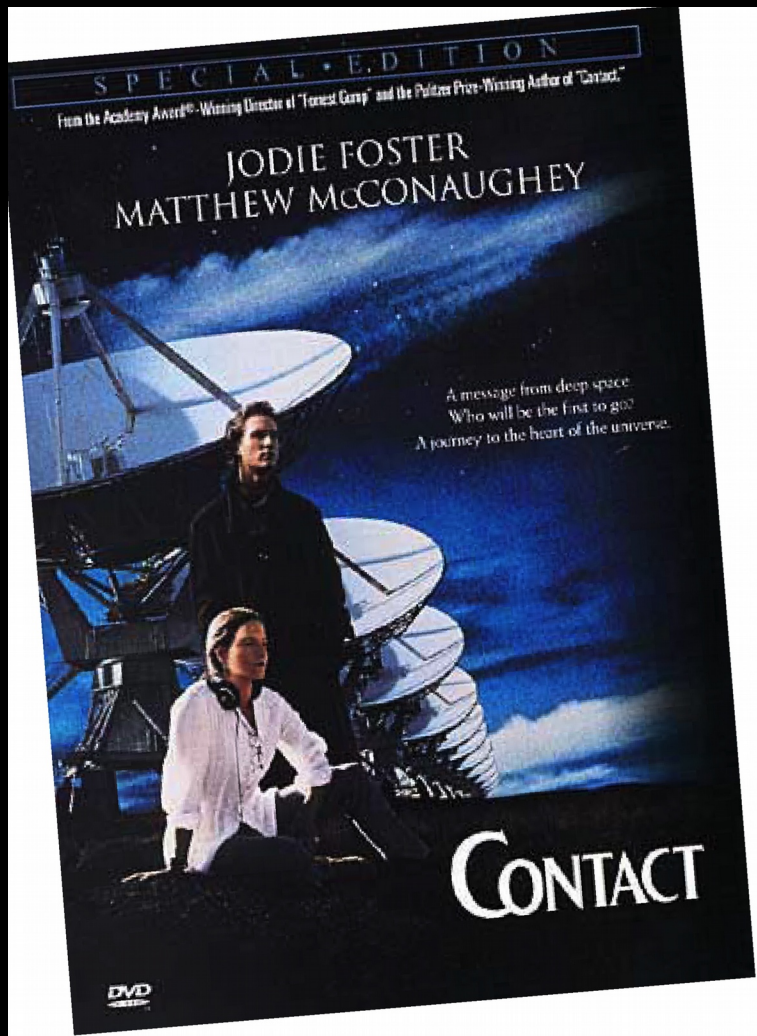
Figure 1

ARECIBO OBSERVATORY
ARECIBO, PUERTO RICO

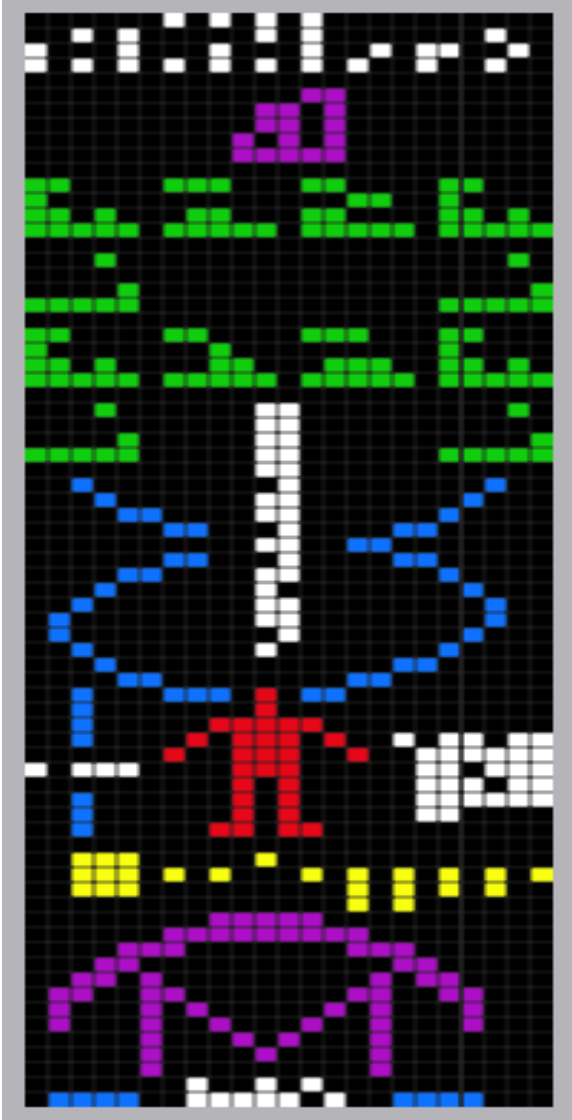


NATIONAL ASTRONOMY
AND IONOSPHERE CENTER
OPERATED BY CORNELL UNIVERSITY
UNDER COOPERATIVE AGREEMENT
WITH THE
NATIONAL SCIENCE FOUNDATION





Arecibo Message



Broadcast on November 16th 1974
from the Arecibo radio telescope.

Aimed toward globular star cluster
M13.

M13 is 25,000 light years away.

(Frank Drake)

Chaz
Vukotic

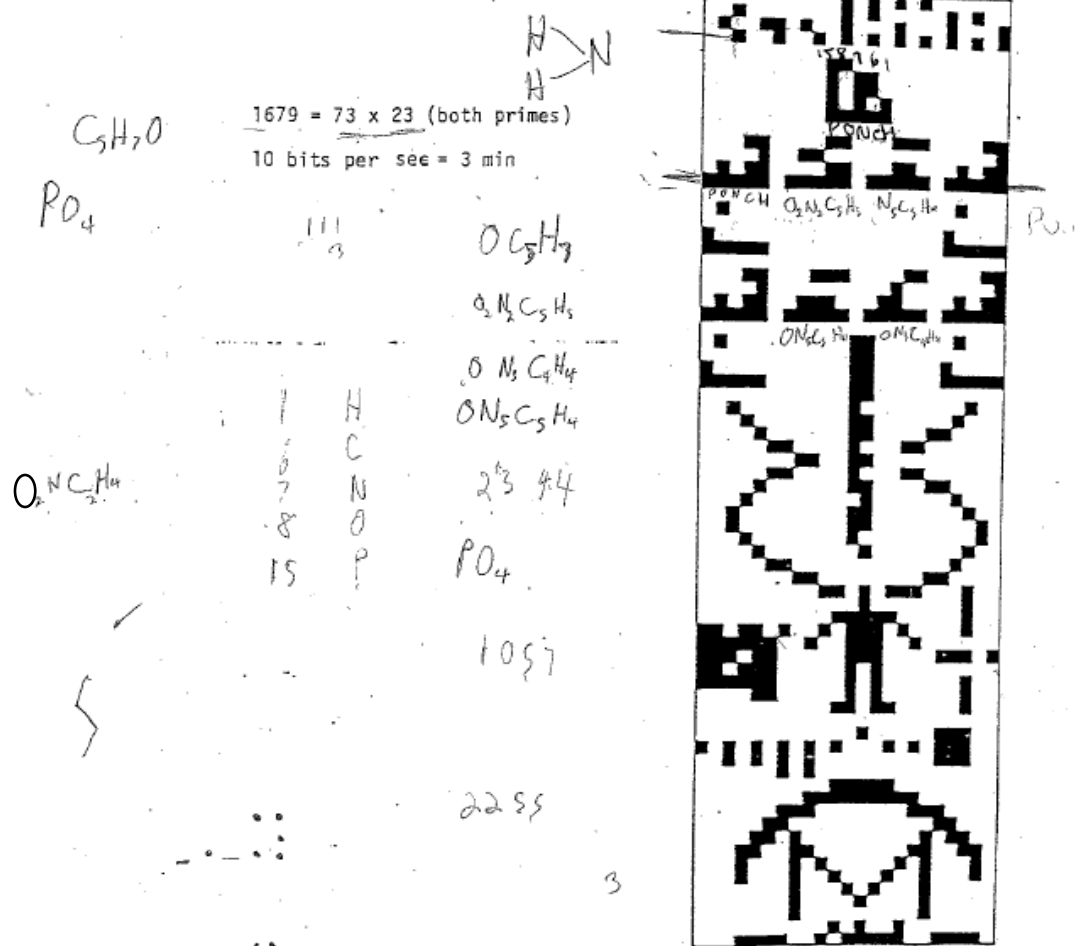
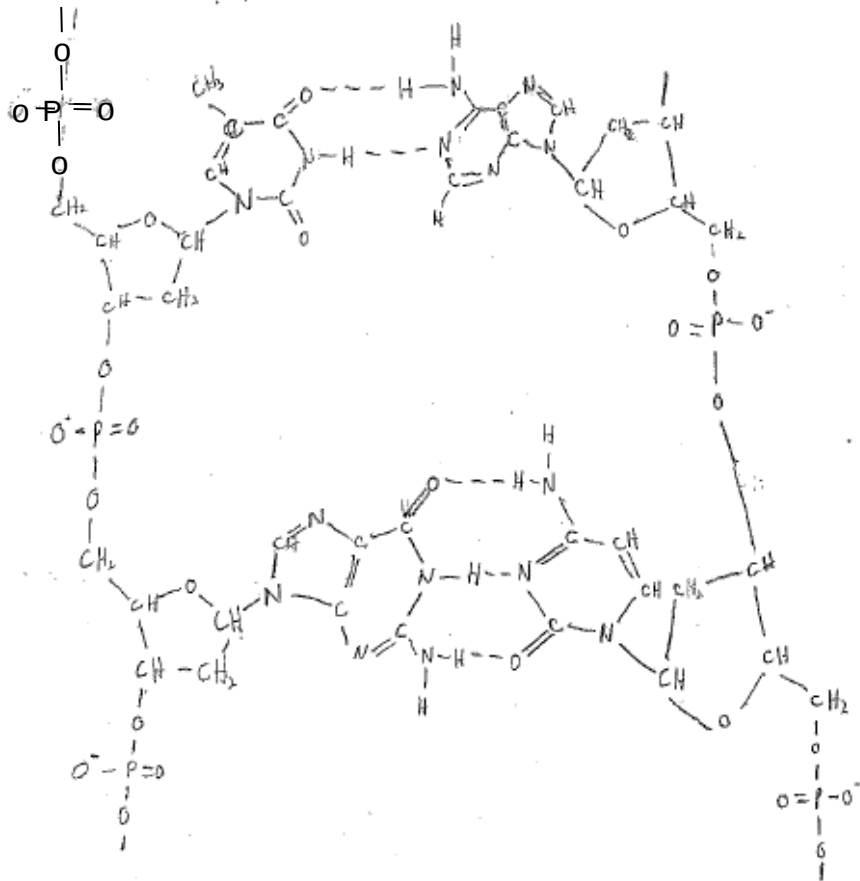


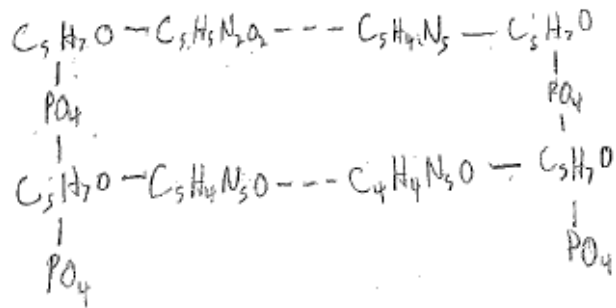
FIGURE 8.10. Diagram of the Arecibo radio message transmitted toward the Great Cluster in the constellation Sagittarius (1974).

Adenine
 $N_5C_5H_4 =$ Adenine
 $O_2N_2C_5H_5 =$ Thymine

$OC_5H_7 =$ Deoxyribose
 $ON_5C_5H_4 =$ Guanine
 $ON_3C_4H_4 =$ Cytosine

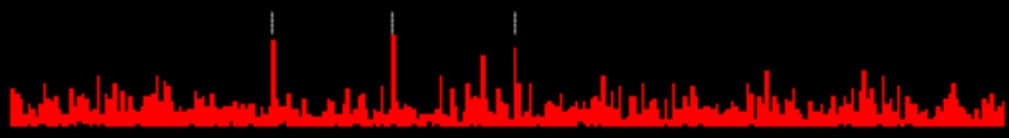


2 sets of
base pairs
whole of
human
genome.



Data Analysis

Computing Fast Fourier Transform 87% 
Doppler drift rate: -19.4612 Hz/sec Resolution: 0.149 Hz
Best Triplet: power 9.33, period 0.7275



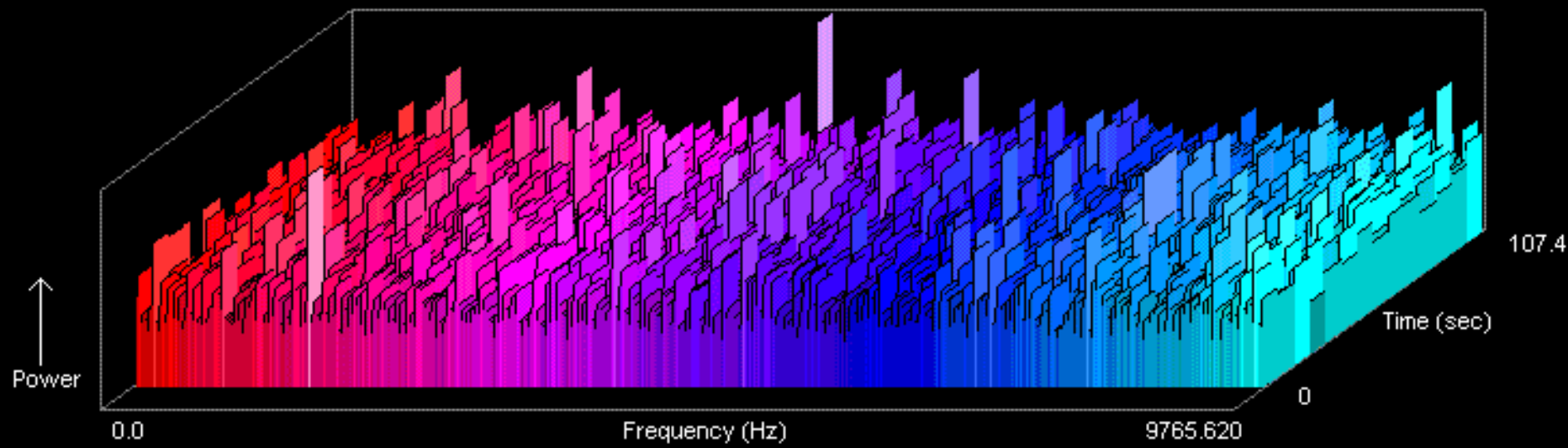

Overall: 93.929% done CPU time: 8 hr 28 min 41.1 sec

Data Info

From: 18 hr 45' 17" RA, + 13 deg 0' 36" Dec
Recorded on: Wed Mar 07 12:47:29 2001 GMT
Source: Arecibo Radio Observatory
Base Frequency: 1.419707031 GHz

User Info

Name: Alan M. MacRobert
Data units completed: 197
Total computer time: 6327 hr 20 min 01.5 sec





ATA - Allen Telescope Array

C H A R L I E S H E E N

The greatest danger

facing our world

has been the planet's

best kept secret...

until now.

T H E A R R I V A L





Kepler Mission: *A search for habitable planets.*



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Launch of the Kepler Spacecraft

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2009 March 6 at 10:49 pm EST.

[Media from Kennedy Space Center \(KSC\)](#)

[Press Conference Media Resources](#)
Full [Press Kit](#) (3 Mb pdf)

[Mission Manager's Updates](#)

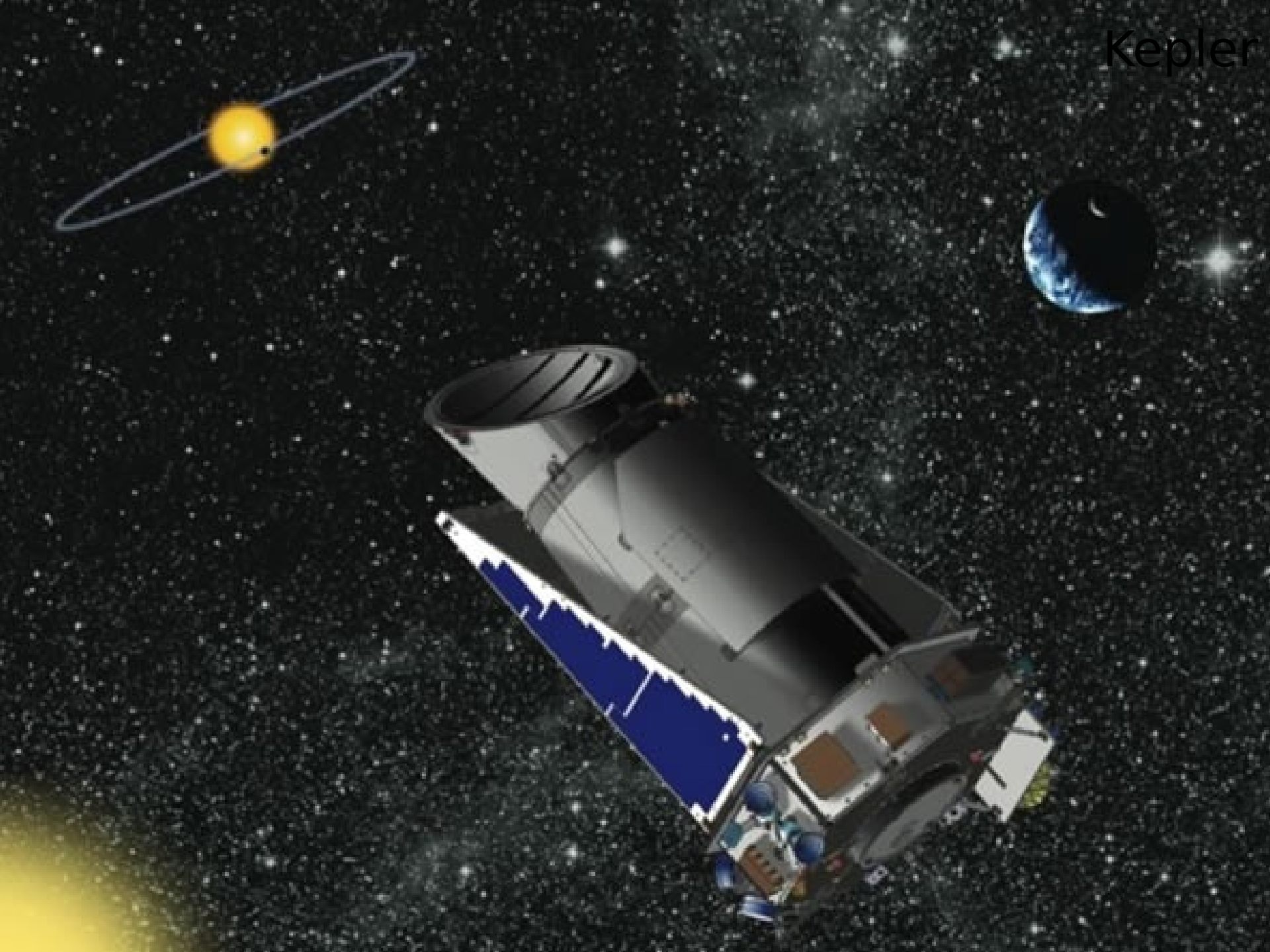
[NASA Kepler webcasts](#)



Photo below by Ben Cooper
<http://www.launchphotography.com>
originally posted at <http://apod.nasa.gov/apod/ap090309.html>

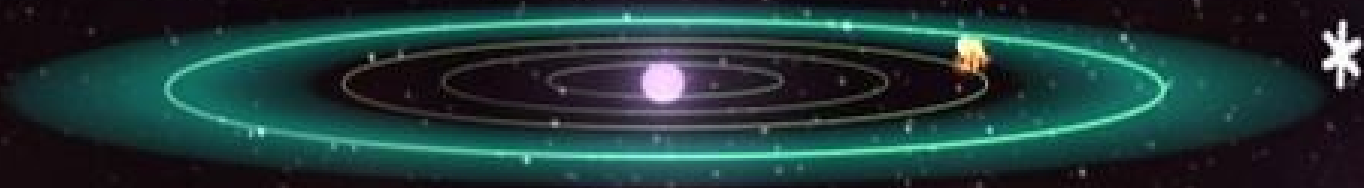


Kepler



Life Around Other Stars

A Star

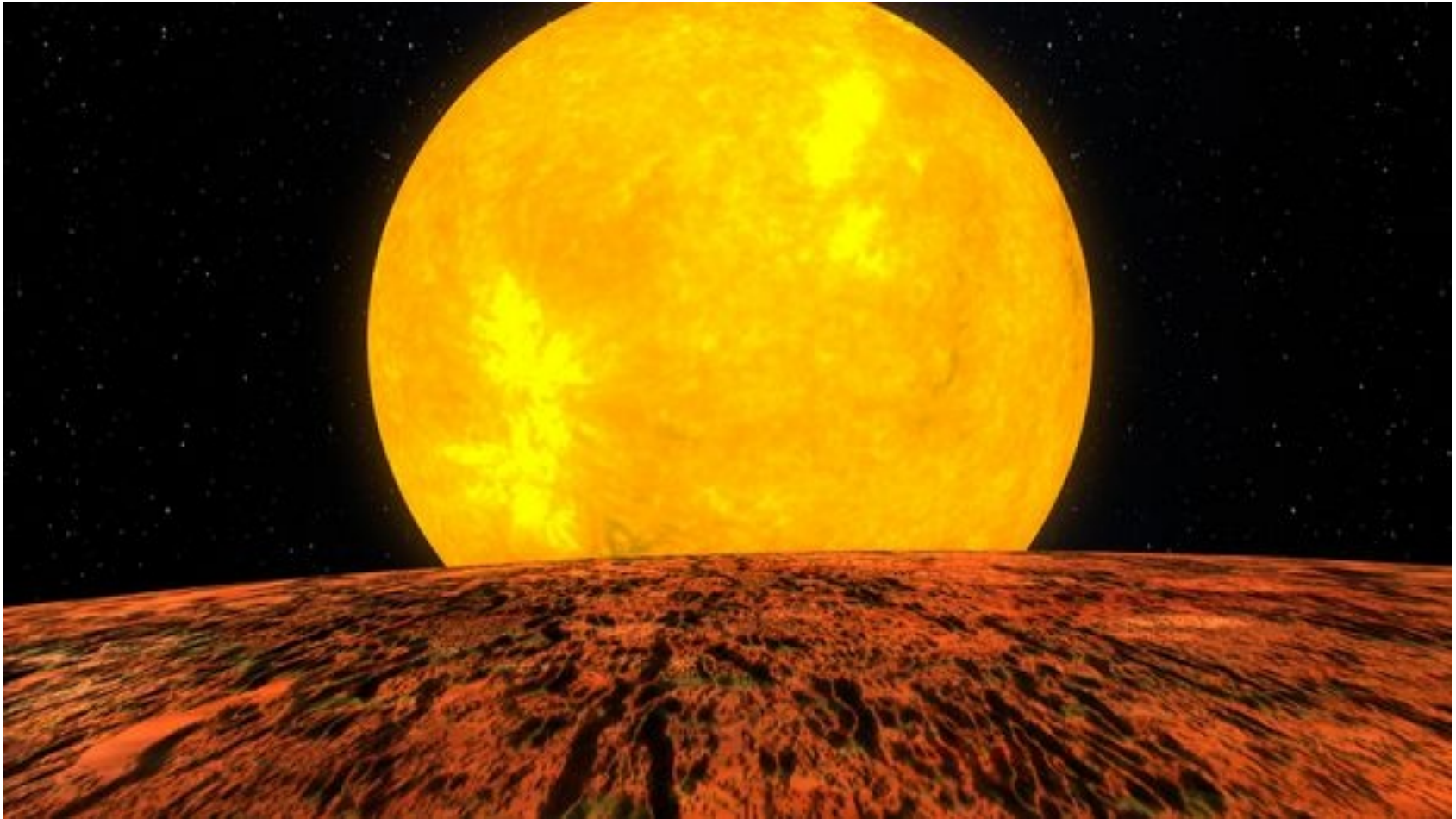


The Sun
G Star



M Star





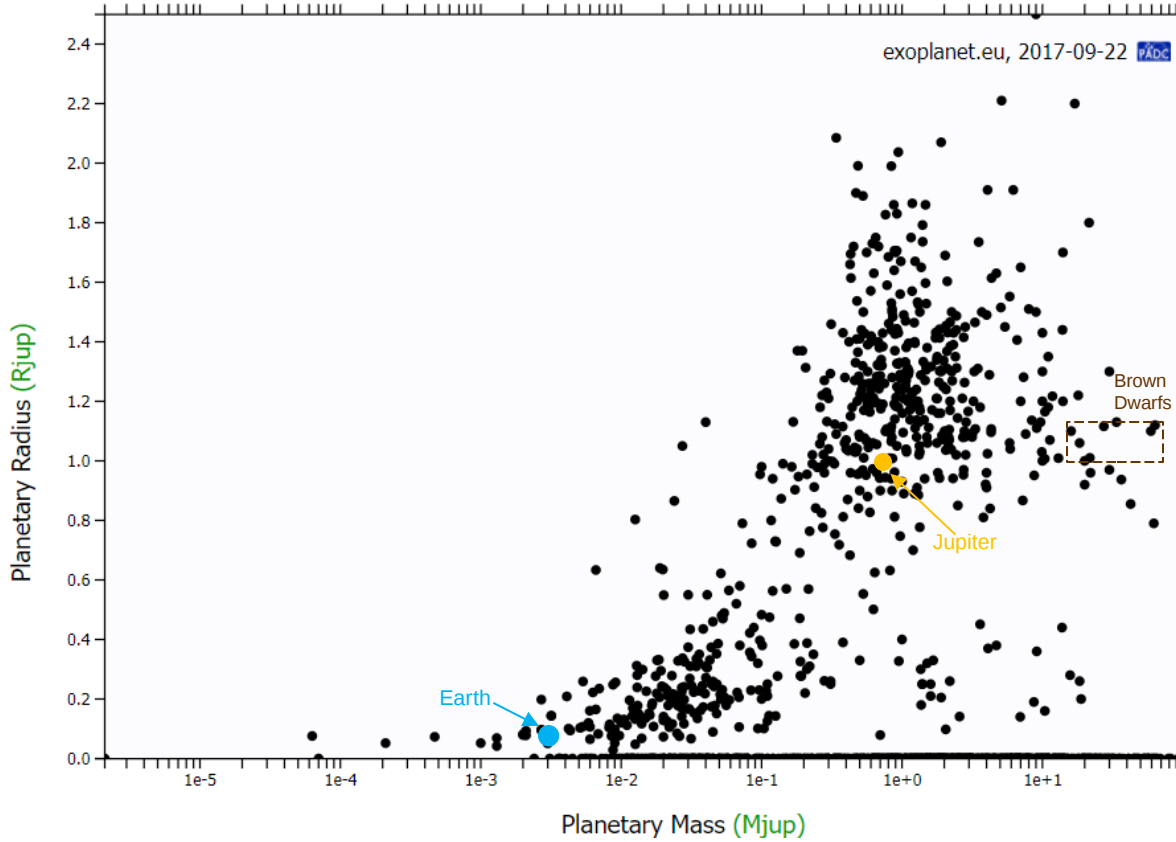
Imagined View from Planet Kepler-10b (Artist's Depiction)
Credit: NASA/Kepler Mission/Dana Berry

Diagrams: scatter plot

[Histogram plot →](#)

Status ▾
Detection ▾

?



X axis

Planetary Mass ▾

show error bars

log scale

min max

Y axis

Planetary Radius ▾

show error bars

log scale

min max

Color

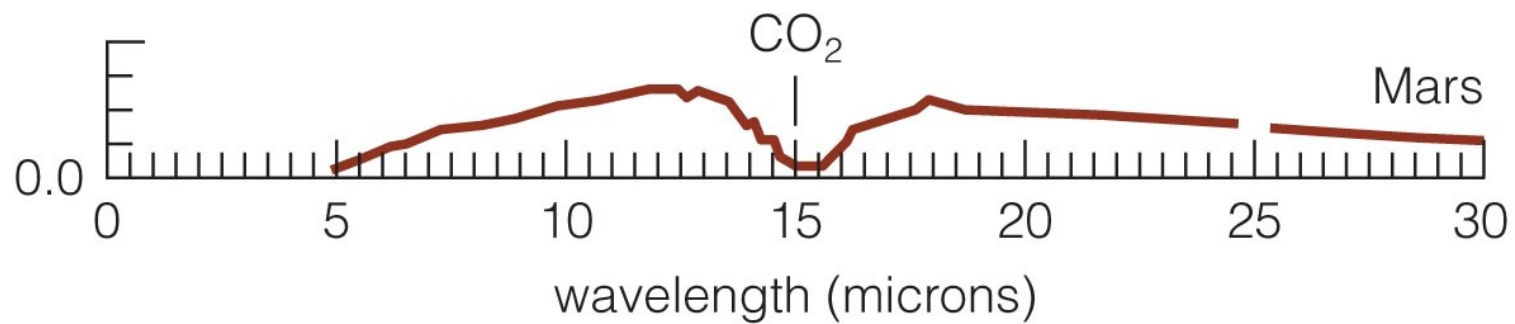
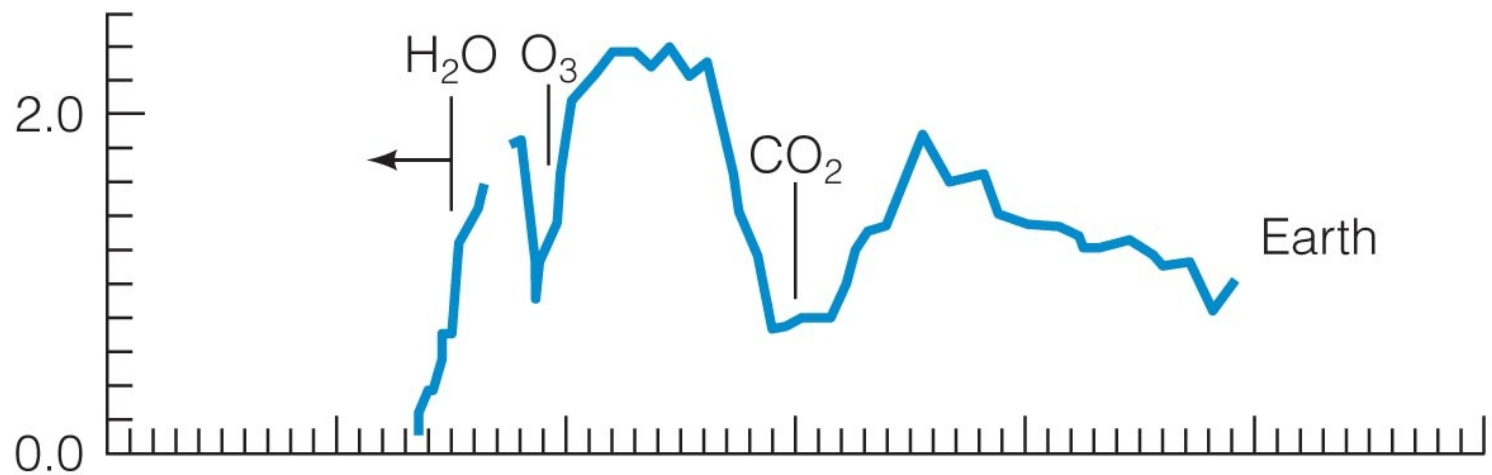
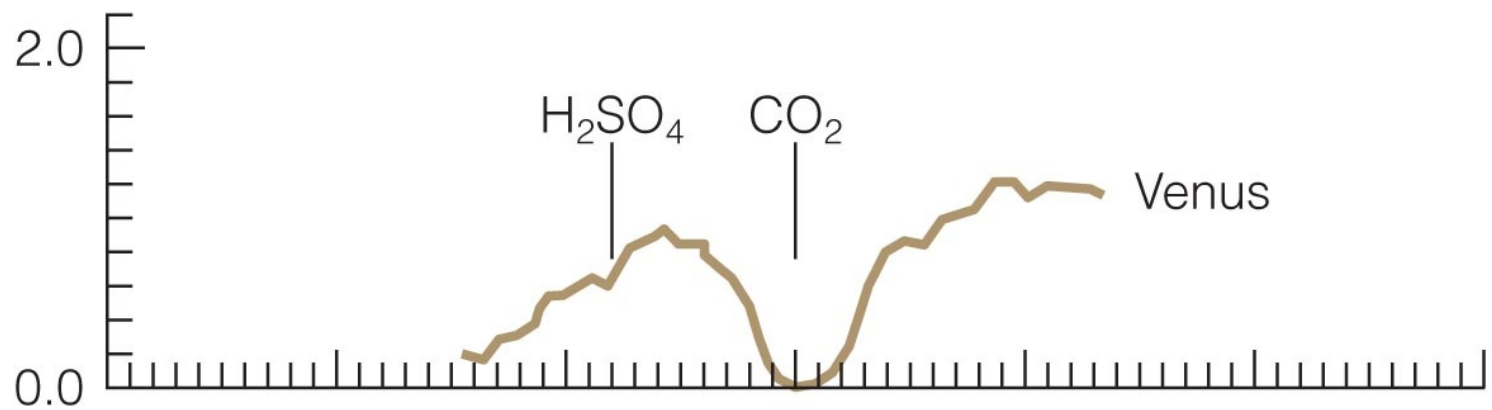
Size

Set grid

Manual Pan/Zoom

Set labels

Selection mode



In Disasters, Panic Is Rare; Altruism Dominates

ScienceDaily (Aug. 8, 2002) — WASHINGTON, DC -- Group panic and irrational behavior did not occur at the World Trade Center on September 11, 2001. Instead the event created a sense of "we-ness" among those threatened, says Rutgers University sociology professor Lee Clarke. In his article, "Panic: Myth or Reality?", in the fall 2002 edition of *Contexts* magazine, he explains that 50 years of evidence on disasters and extreme situations shows that panic is rare, even when people feel "excessive fear."

Rarity of Panic

Because this combination of conditions is so uncommon in disasters, panic is also quite rare. (6, 7) When panic does occur, it usually involves few persons, is short-lived, and is not contagious. (21) In studies of more than 500 events, the University of Delaware's Disaster Research Center found that panic was of very little practical or operational importance. (21, 22) A number of systematic studies of human behavior in disasters have failed to support news accounts of widespread panic. (5, 8, 23–26)



THE ORIGINAL INVASION!

THE WAR OF THE WORLDS

