SETI -

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

Donna M. Jurdy
Northwestern University


MEL GIBSON
SIGNS

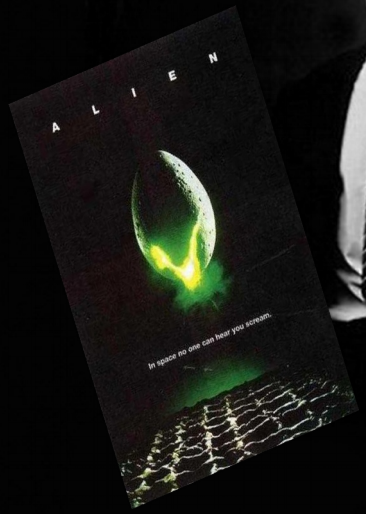

The ultimate in alien terror.
THE THING

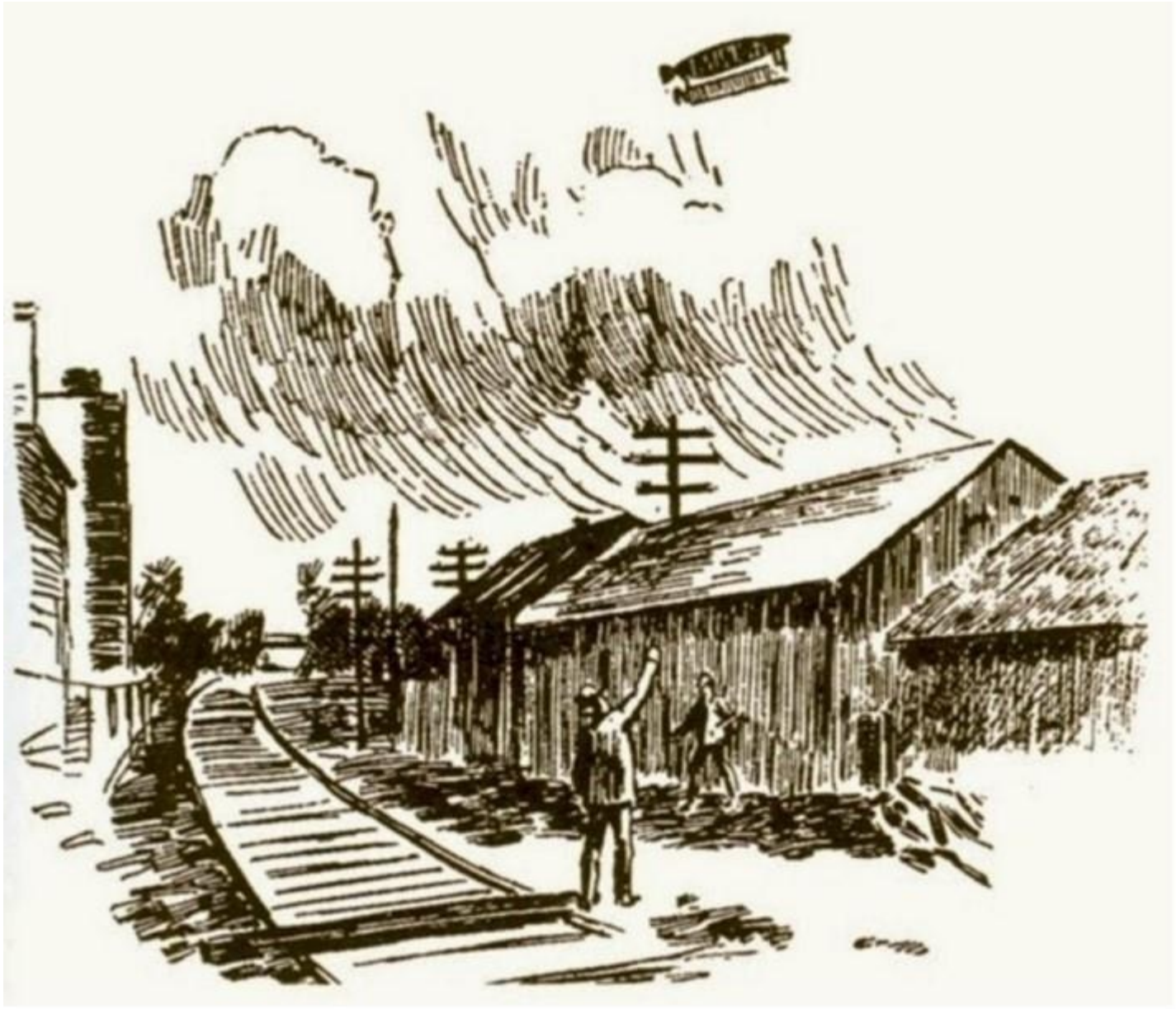

WHO'S UP FOR A CLOSE ENCOUNTER?
SIMON PEGG
NICK FROST
SETH ROGEN
PAUL
FROM THE PRODUCERS OF HOT FUZZ
VALENTINE'S DAY 2011

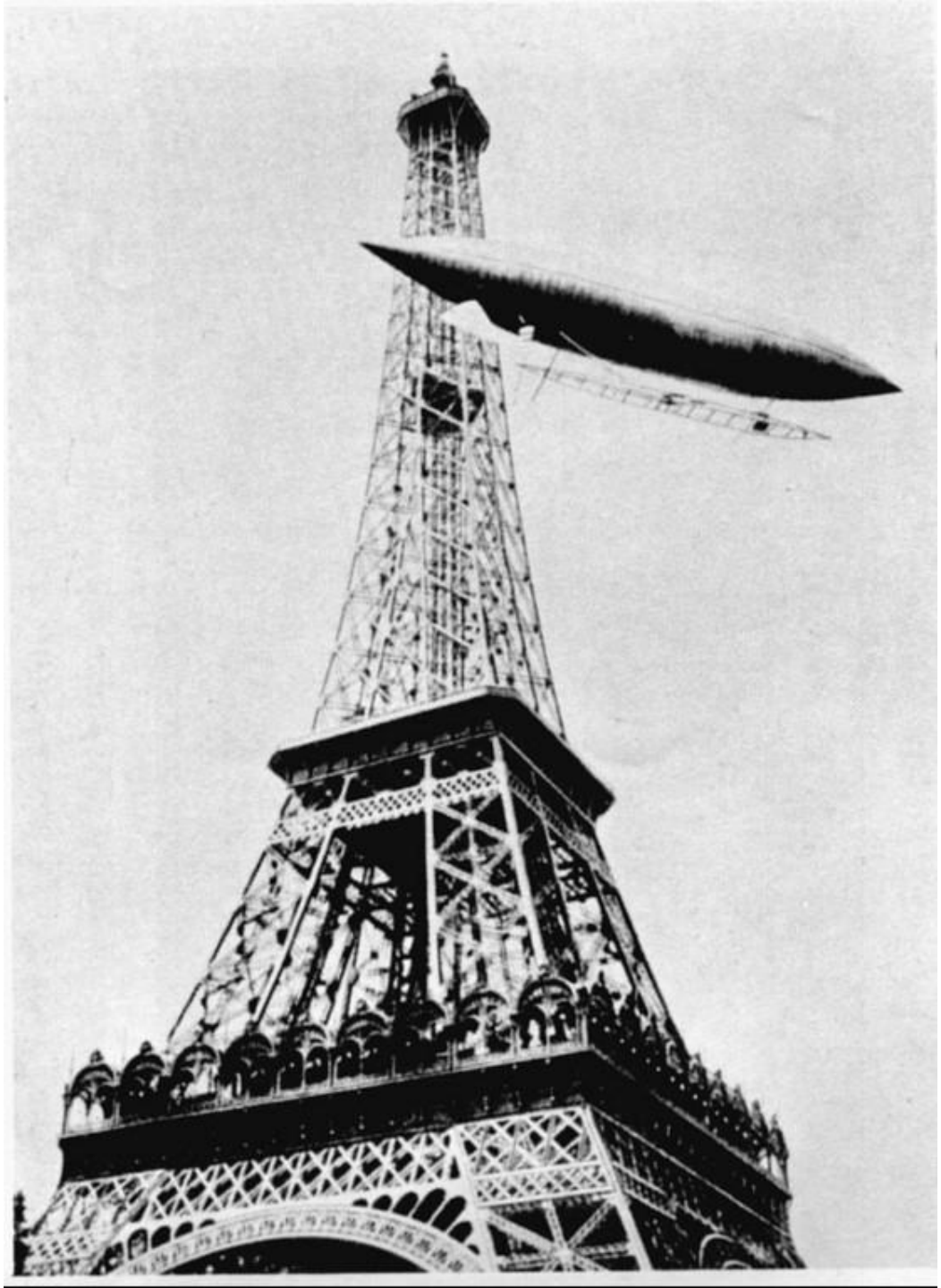

INDEPENDENCE DAY


CLOSE ENCOUNTERS
OF THE THIRD KIND


STAR TREK
THE NEXT GENERATION

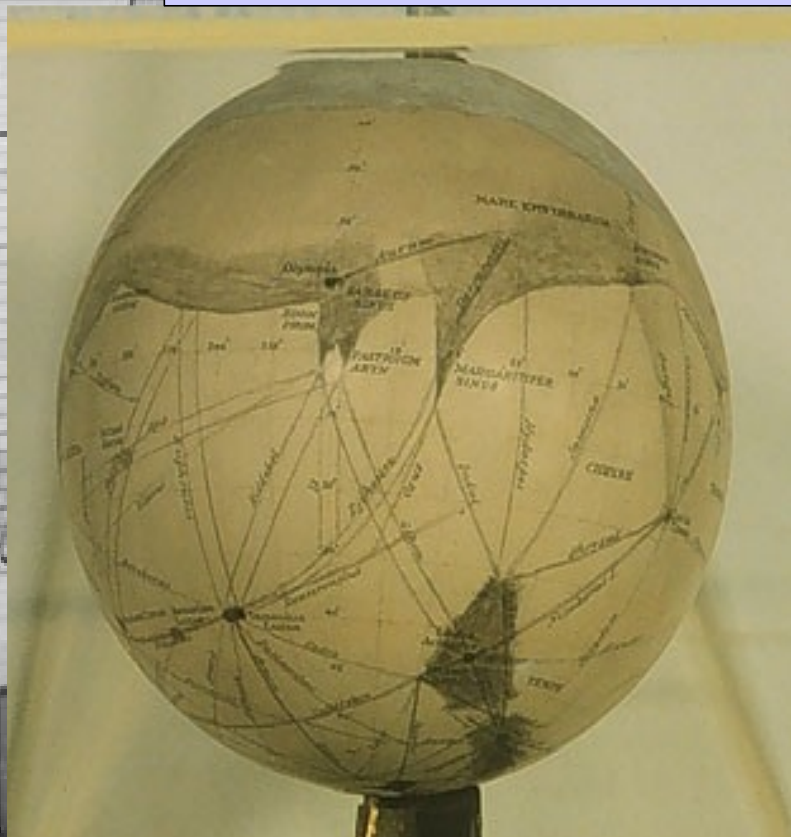

ALIEN
In space no one can hear you scream.

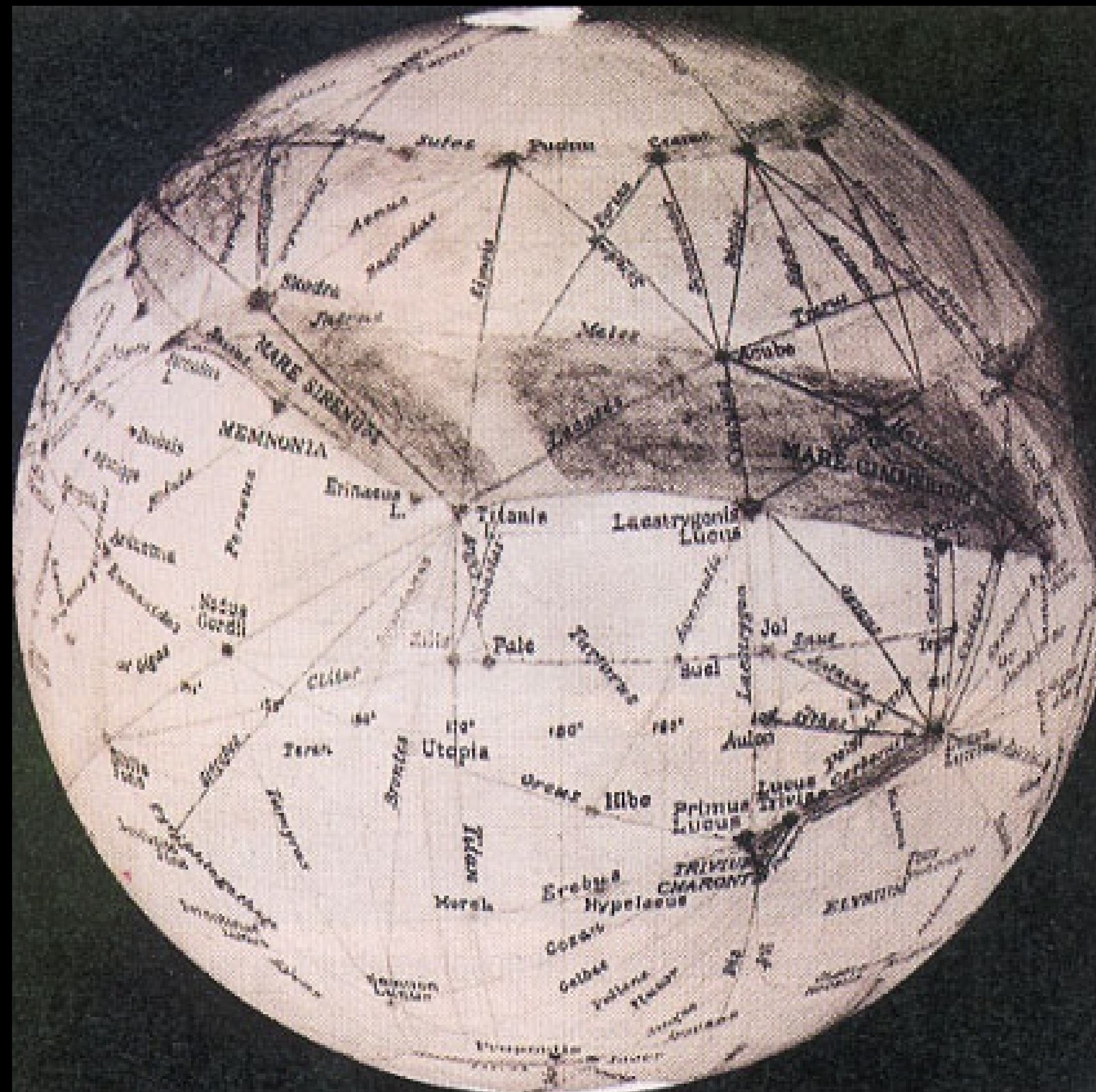




PERCIVAL LOWELL AT THE 24 INCH REFRACTOR, FLAGSTAFF, ARIZONA OBSERVING MARS DURING FAVORABLE OPPOSTION (PERIHELIC OPPOSTION) OF 1894

BELOW IS A GLOBE CONSTRUCTED FROM HIS DRAWINGS




MARE SIRENUM
MEMNONIA
Skodra
Titania
Laestrygonia
Lucus
MARE CIMMERIUM
Nodus
Gordii
Pale
Jol
Suel
Utopia
Hibe
Primus
Lucus
TRIVIUM
CHARONTIS
Erebus
Hypelaeus
Aulon
Mare
Crater
Arabe

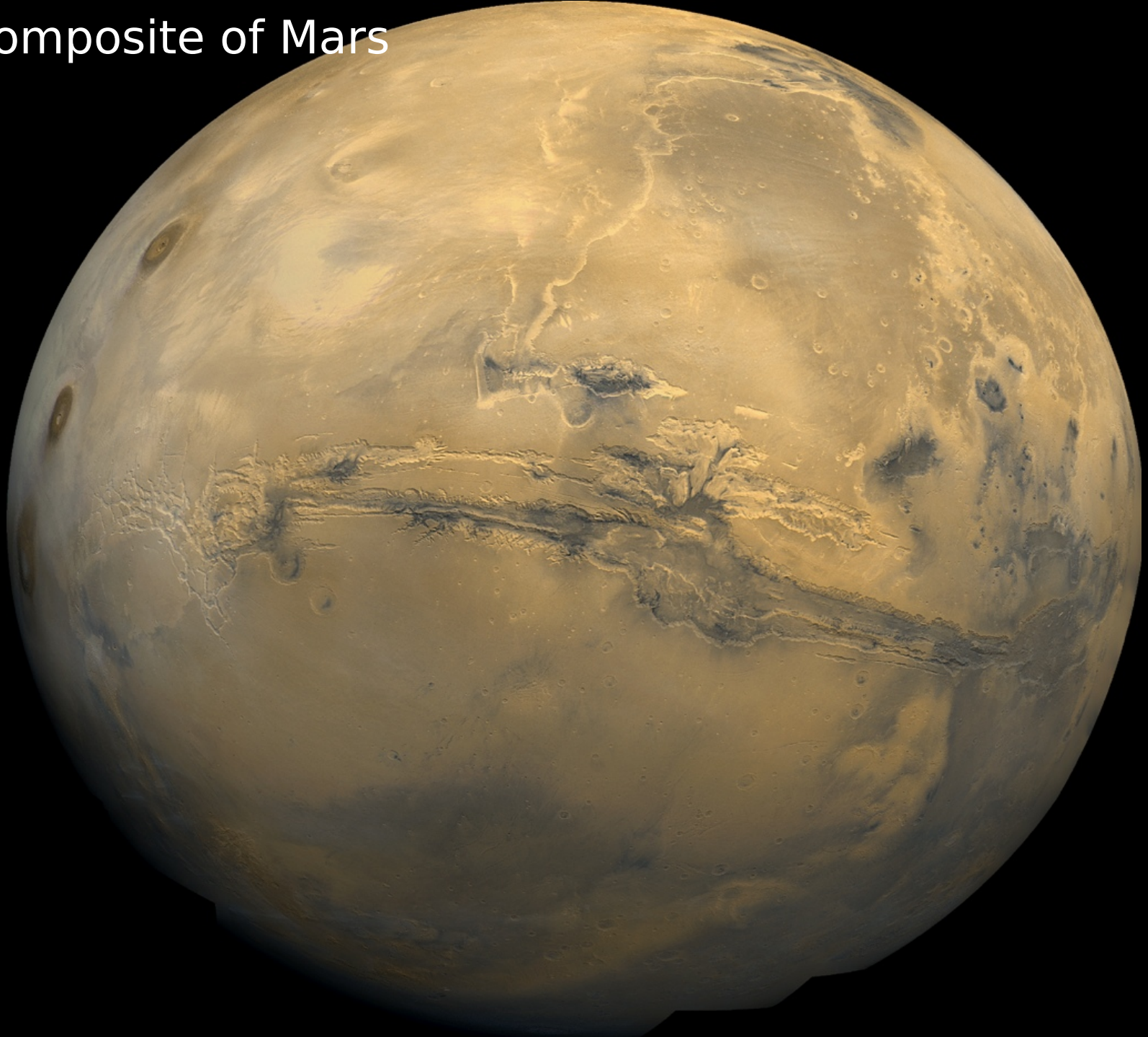
The WAR of the WORLDS

By H. G. Wells

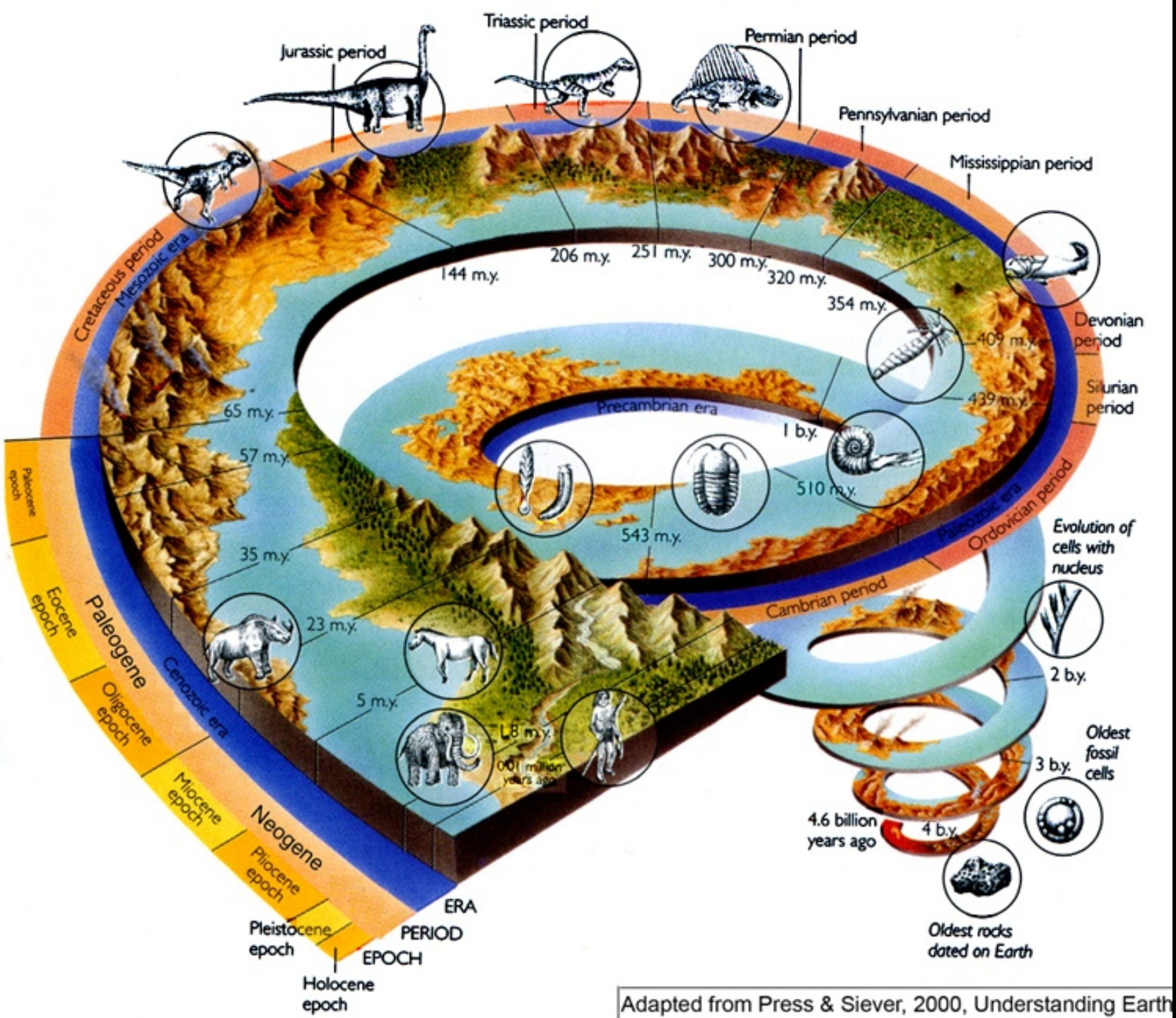
Author of "Under the Knife," "The Time Machine," etc.

Viking composite of Mars

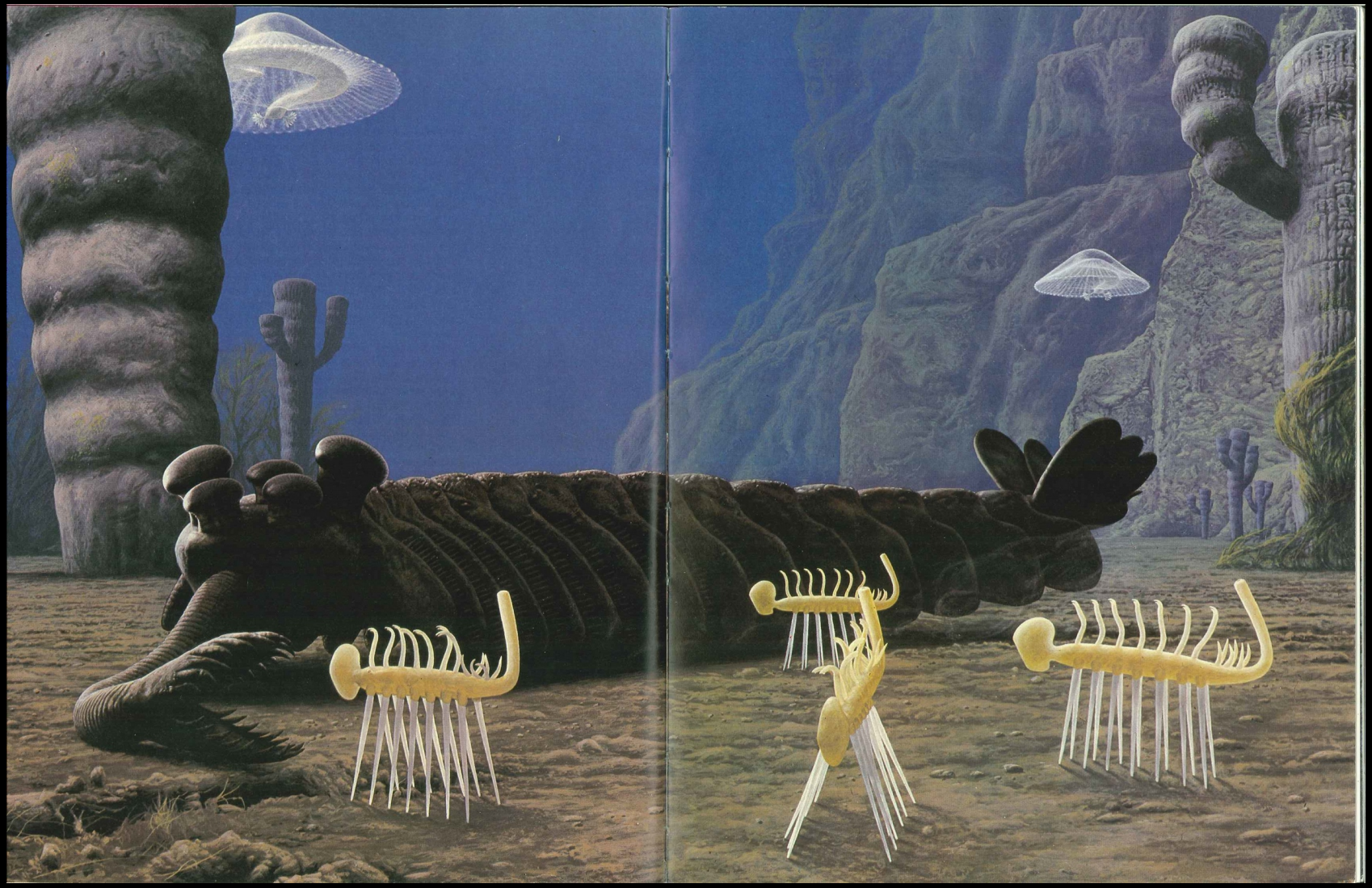
mid 1970’s




ALH84001,0
N
1 cm



Adapted from Press & Siever, 2000, Understanding Earth



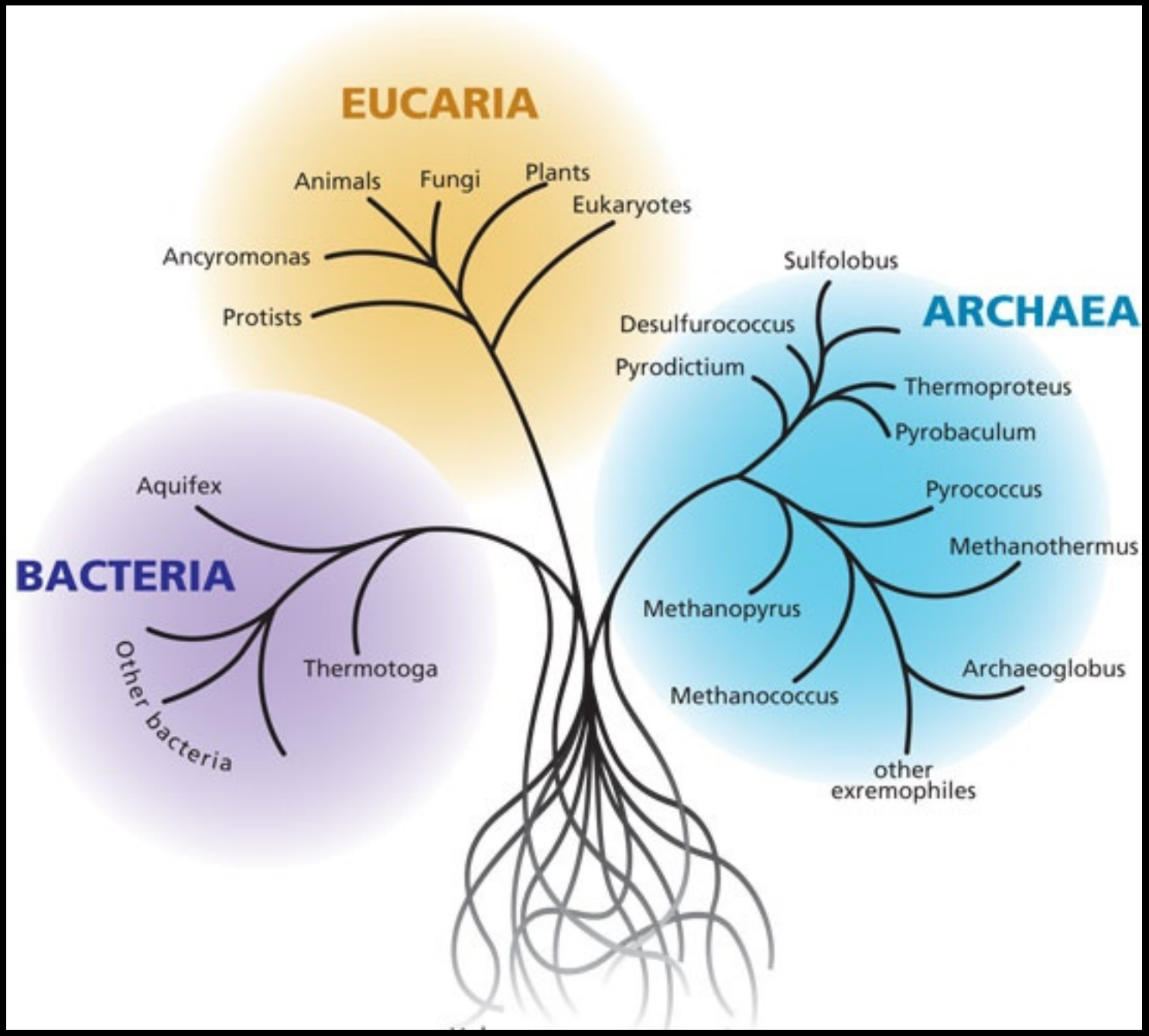
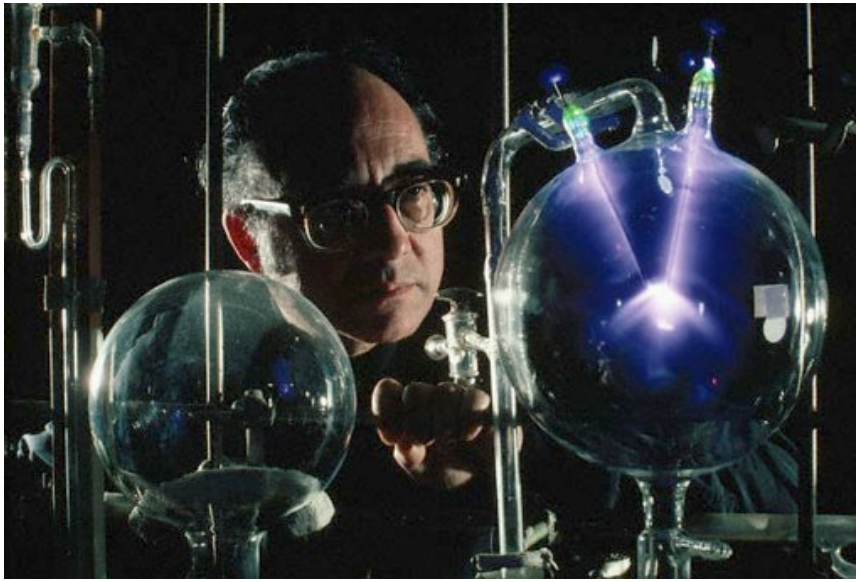
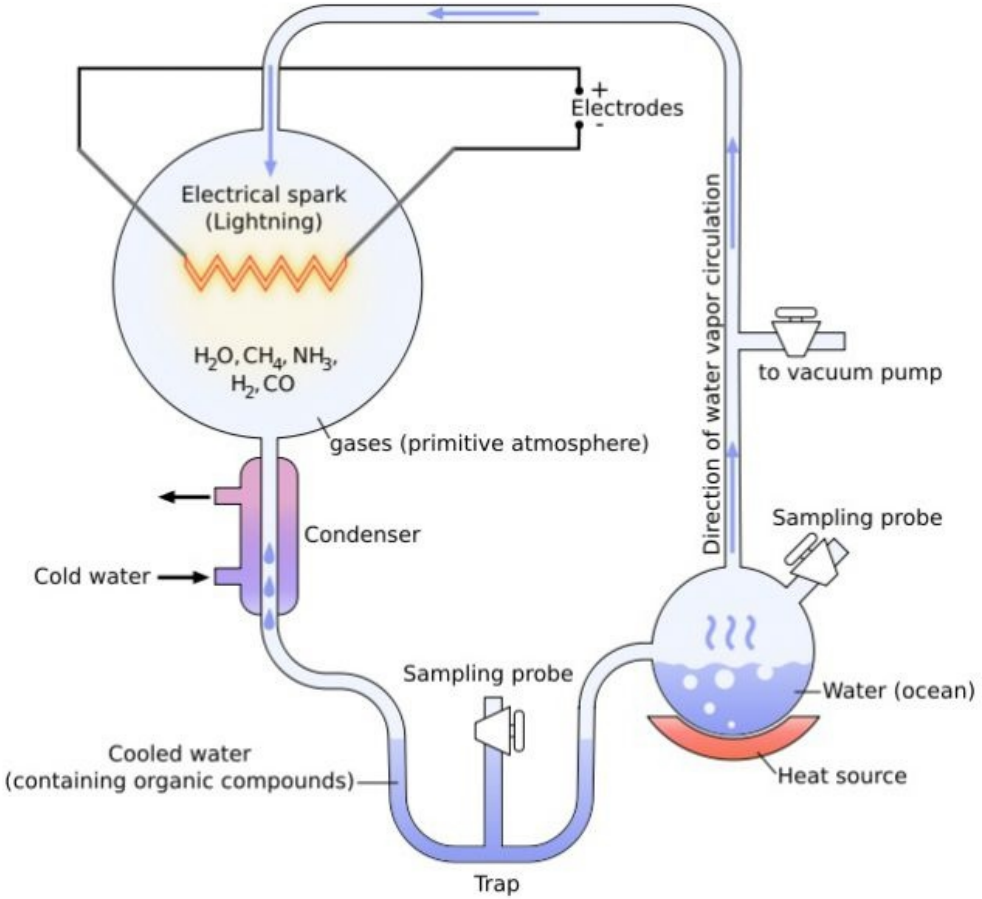


Image Credit: Woods Hole Oceanographic Institution




+
Electrodes
-
Electrical spark
(Lightning)
$H_2O, CH_4, NH_3,$
H_2, CO
gases (primitive atmosphere)
Direction of water vapor circulation
to vacuum pump
Sampling probe
Condenser
Cold water
Sampling probe
Water (ocean)
Cooled water
(containing organic compounds)
Heat source
Trap

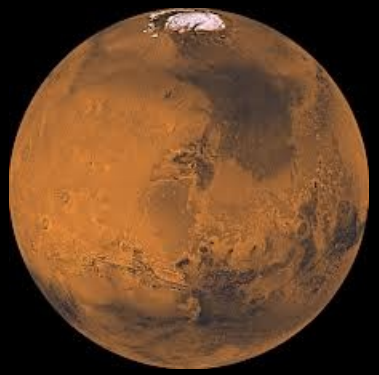
Life in the Solar System?

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?

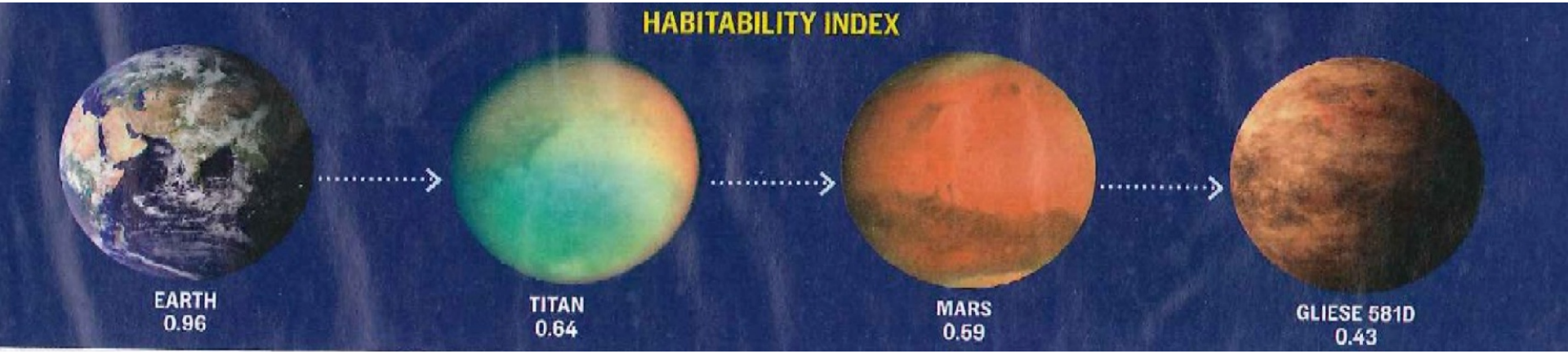
Solid surface

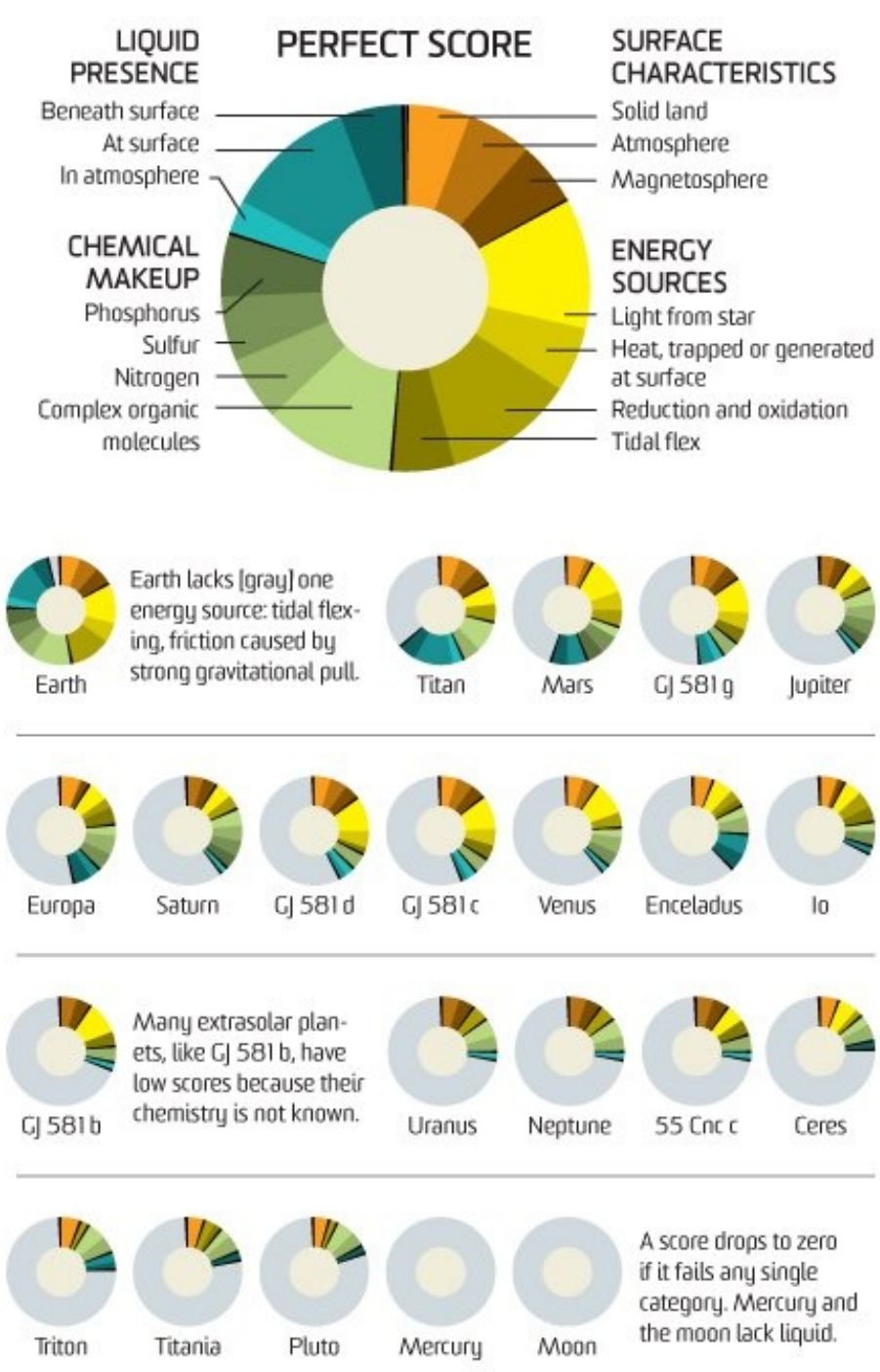
Atmosphere

Liquid on surface:

Need not be water

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





Habitability Index

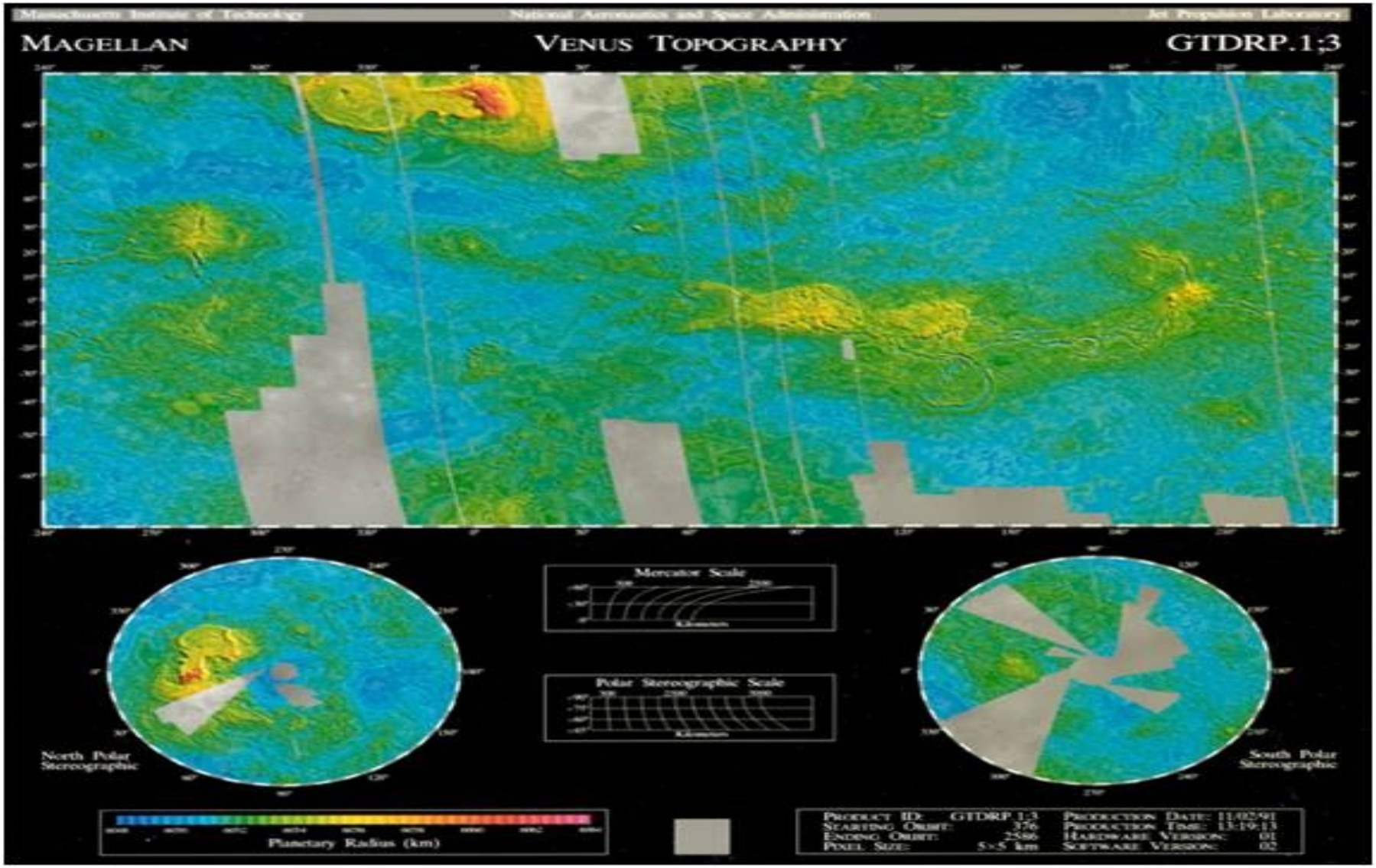
Earth = 0.96

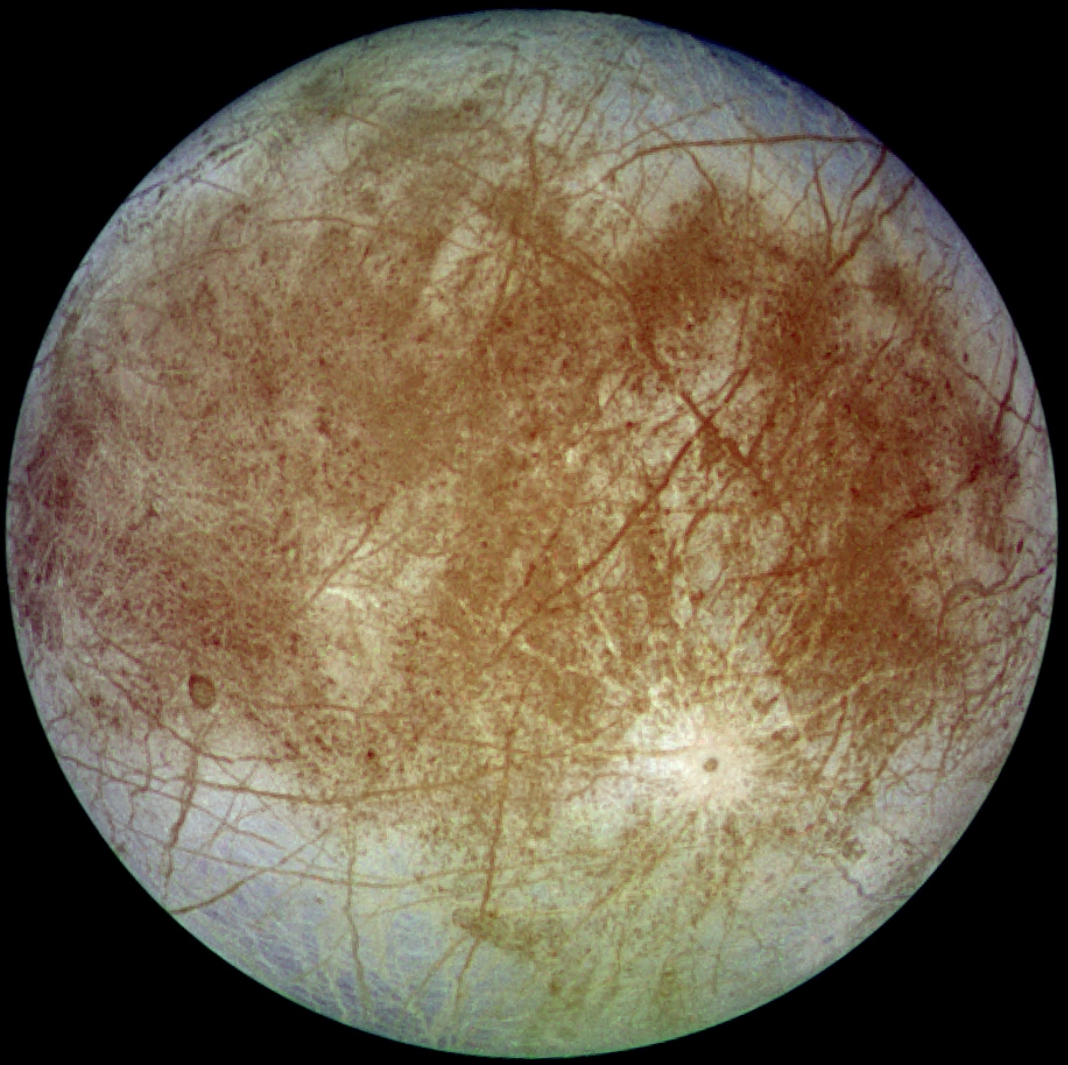
Titan = 0.64

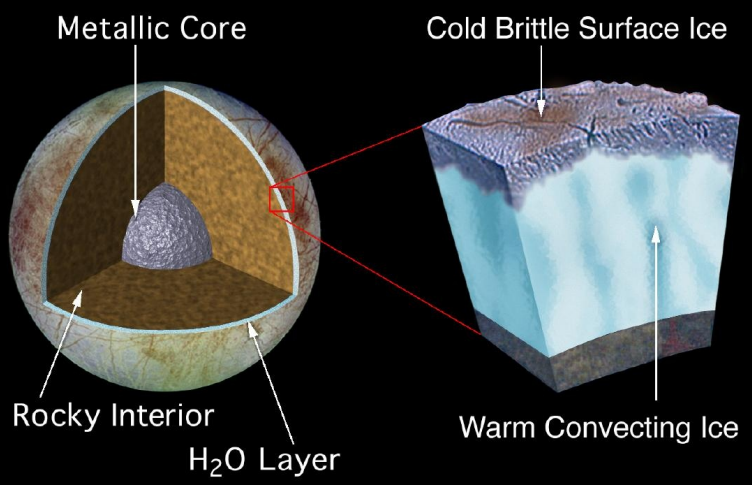
Mars = 0.59

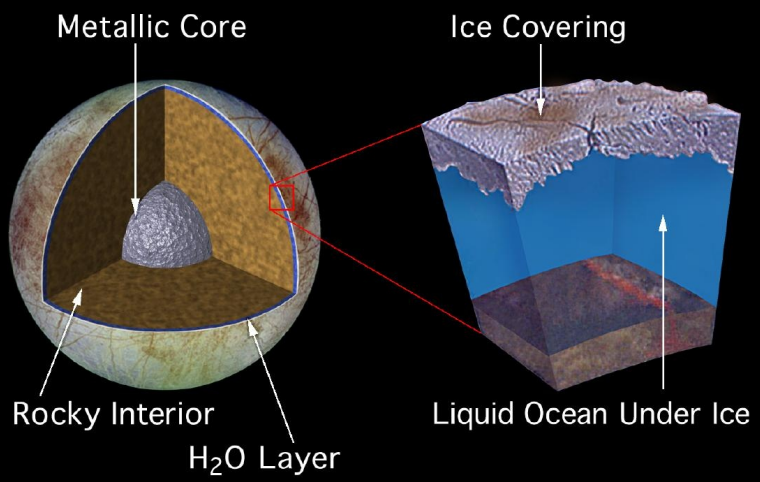
Gliese 581d = 0.43

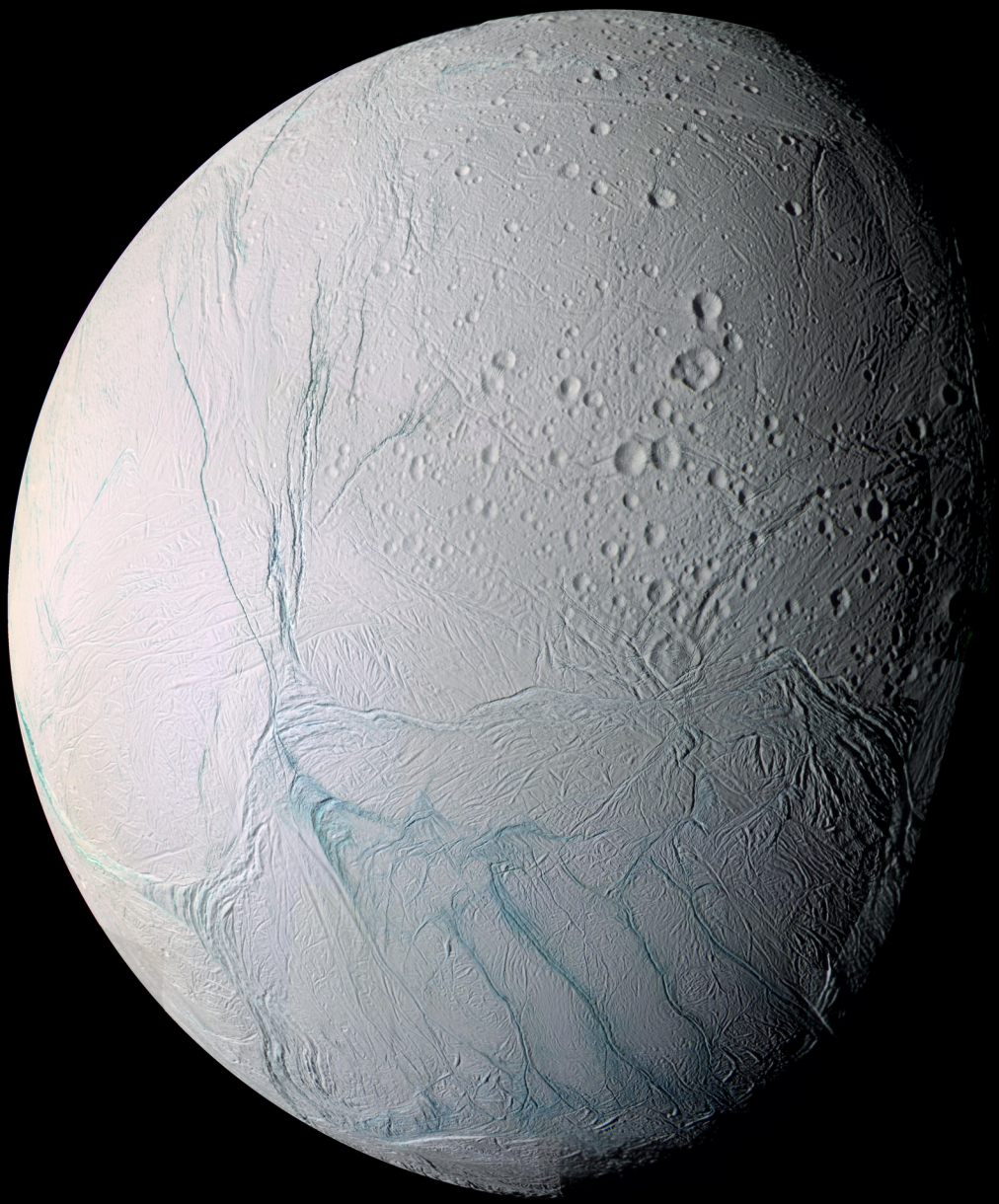
Credit: *Popular Science*

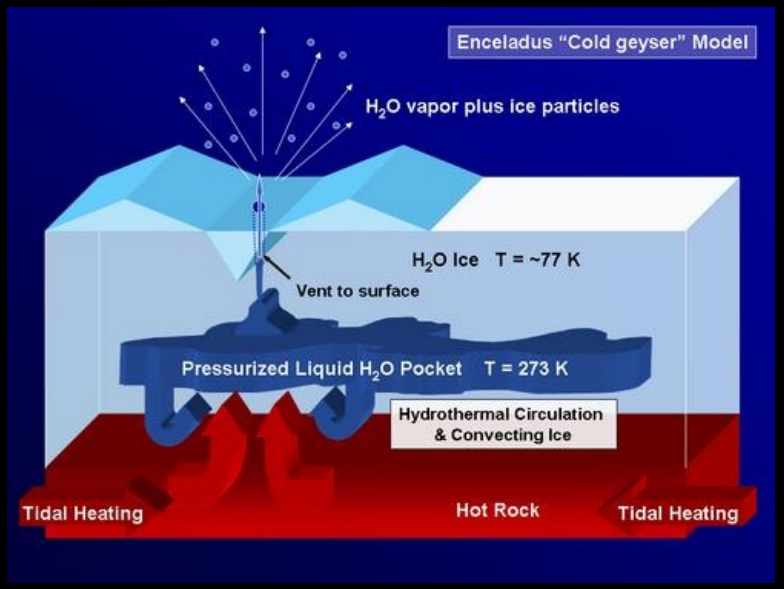

Massachusetts Institute of Technology
National Aeronautics and Space Administration
Jet Propulsion Laboratory
MAGELLAN
VENUS TOPOGRAPHY
GTDRP.1;3
Mercator Scale
Polar Stereographic Scale
North Polar Stereographic
South Polar Stereographic
Planetary Radius (km)
PRODUCT ID: GTDRP 1;3
STARTING ORBIT: 376
ENDING ORBIT: 2586
PIXEL SIZE: 5×5 km
PRODUCTION DATE: 11/02/91
PRODUCTION TIME: 13:19:13
HARDWARE VERSION: 01
SOFTWARE VERSION: 02

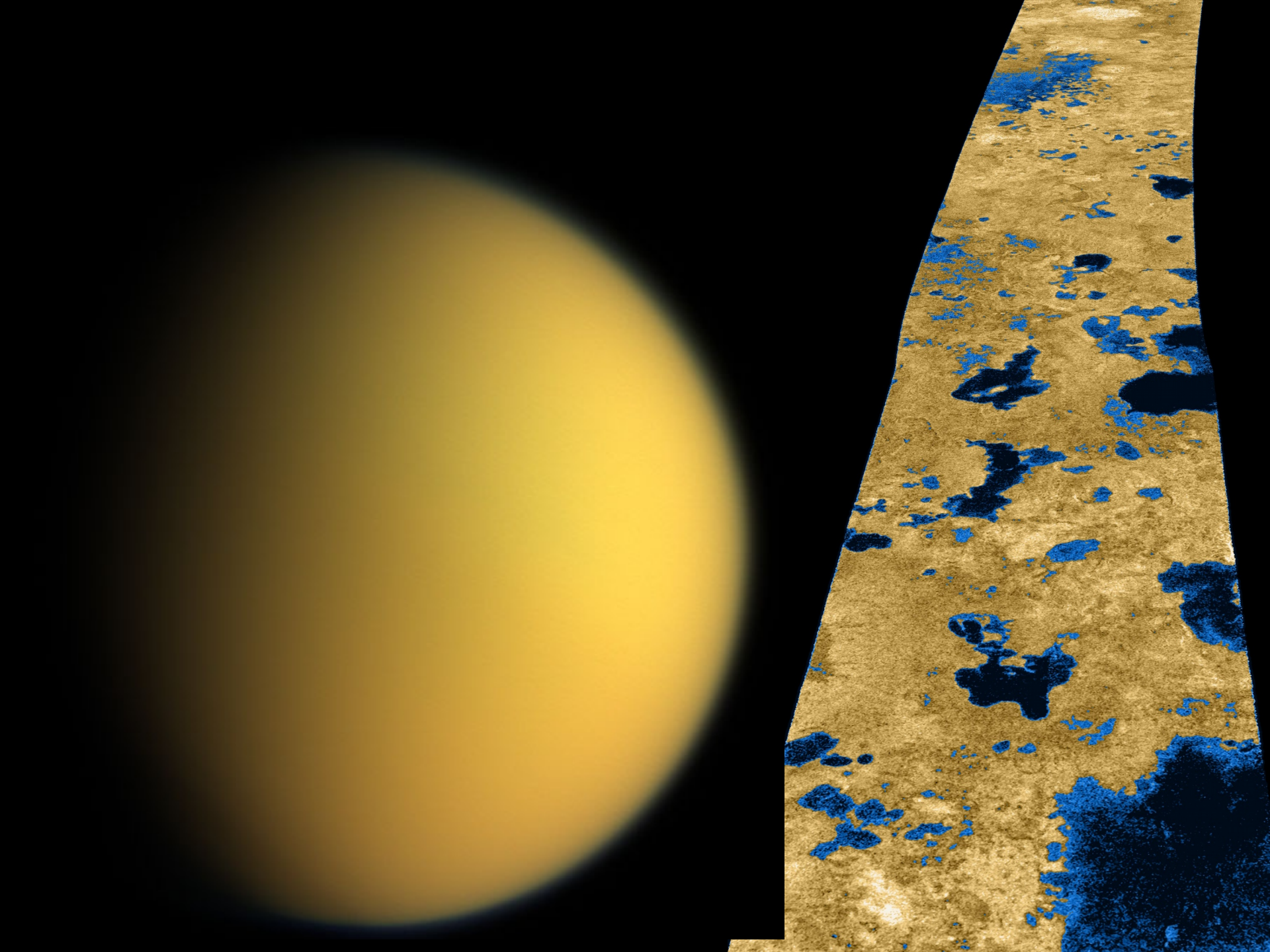



Metallic Core
Cold Brittle Surface Ice
Rocky Interior
H_2O Layer
Warm Convecting Ice


Metallic Core
Ice Covering
Rocky Interior
H_2O Layer
Liquid Ocean Under Ice




Enceladus "Cold geyser" Model
H_2O vapor plus ice particles
H_2O Ice T = ~77 K
Vent to surface
Pressurized Liquid H_2O Pocket T = 273 K
Hydrothermal Circulation & Convecting Ice
Tidal Heating
Hot Rock
Tidal Heating



Huygens Landing Site

Landed January 14, 2005 at 10.2S, 192.4W

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

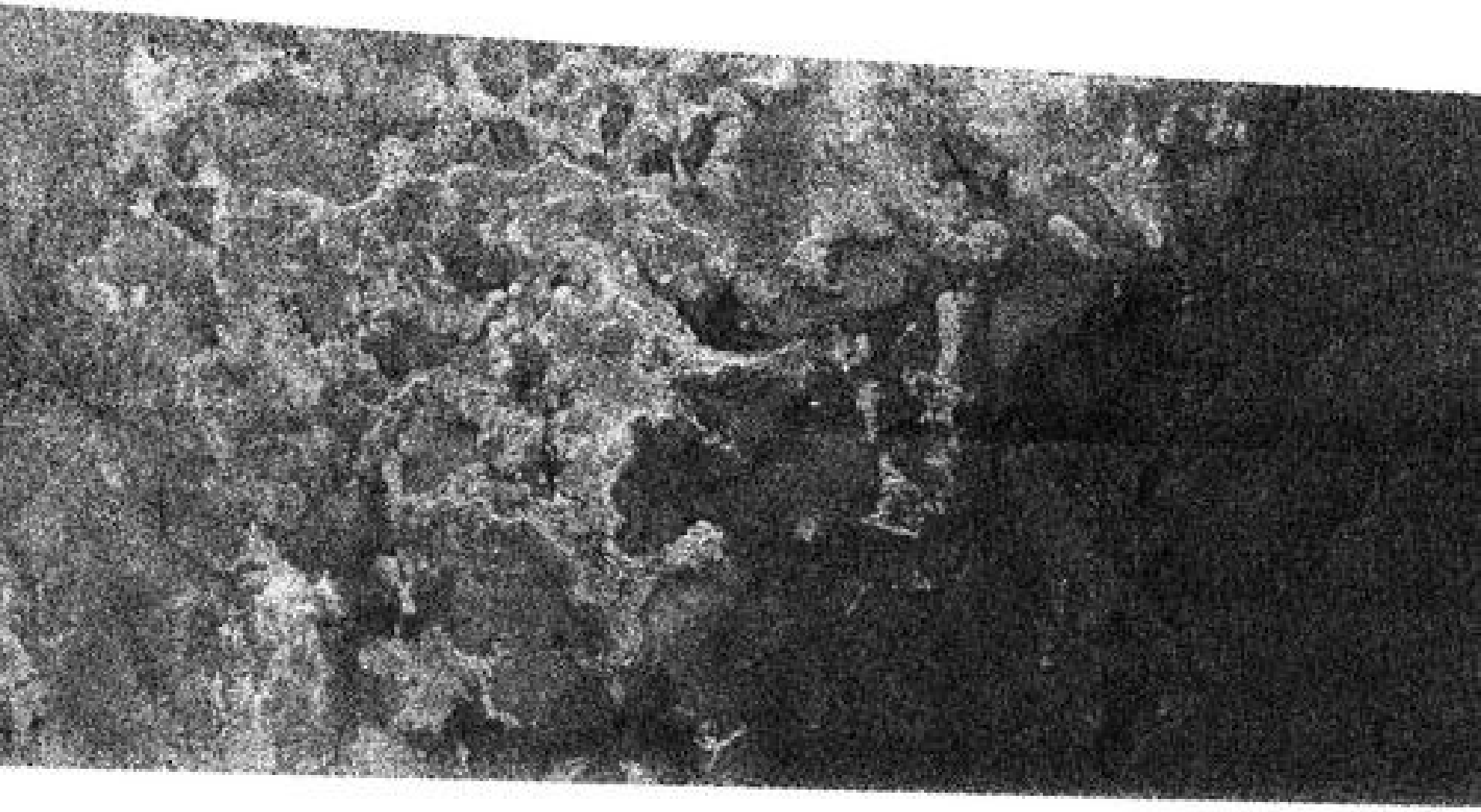
Fluvial activity (methane?)

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

Titan Earth

Image Credit: NASA

Possible Shoreline



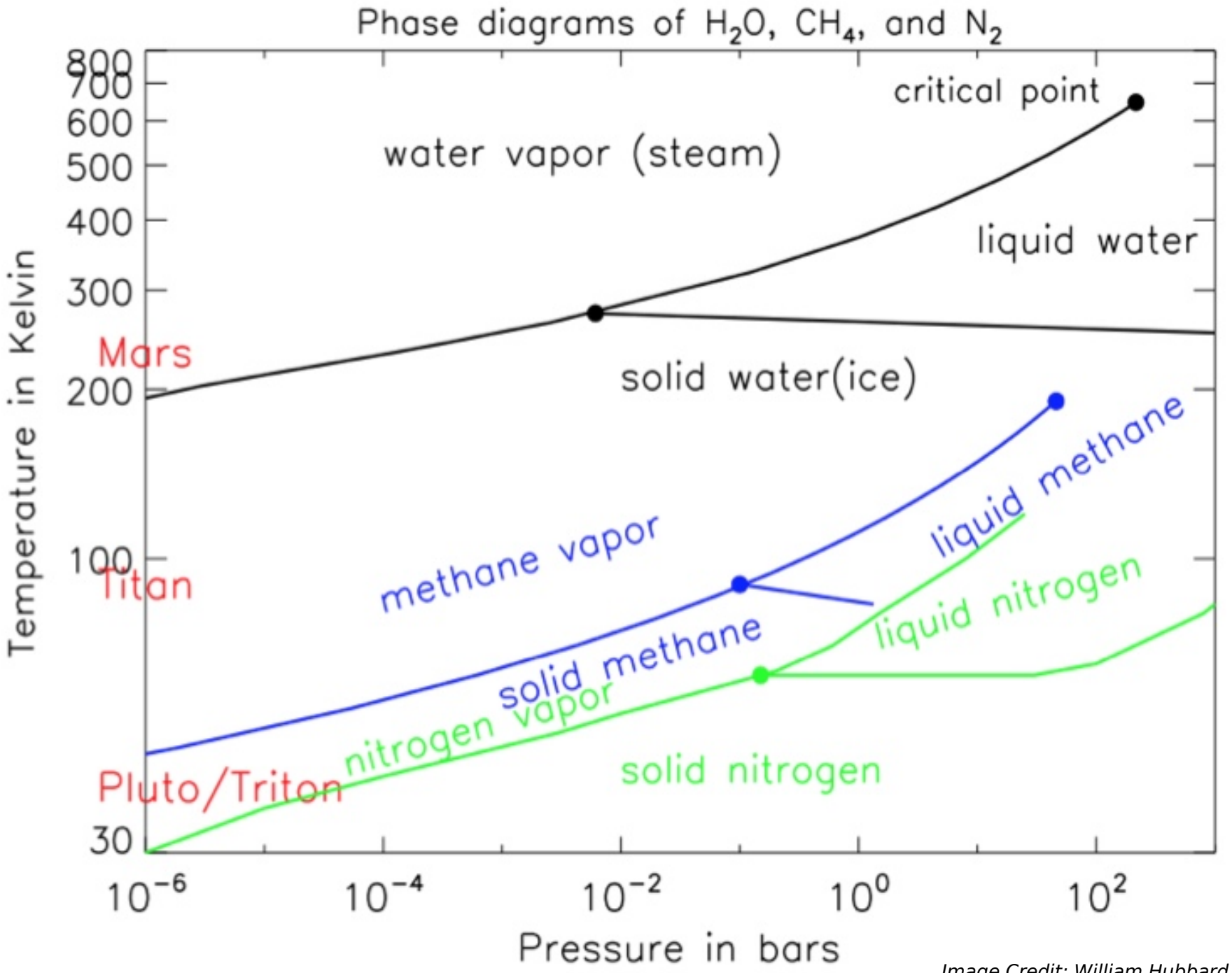
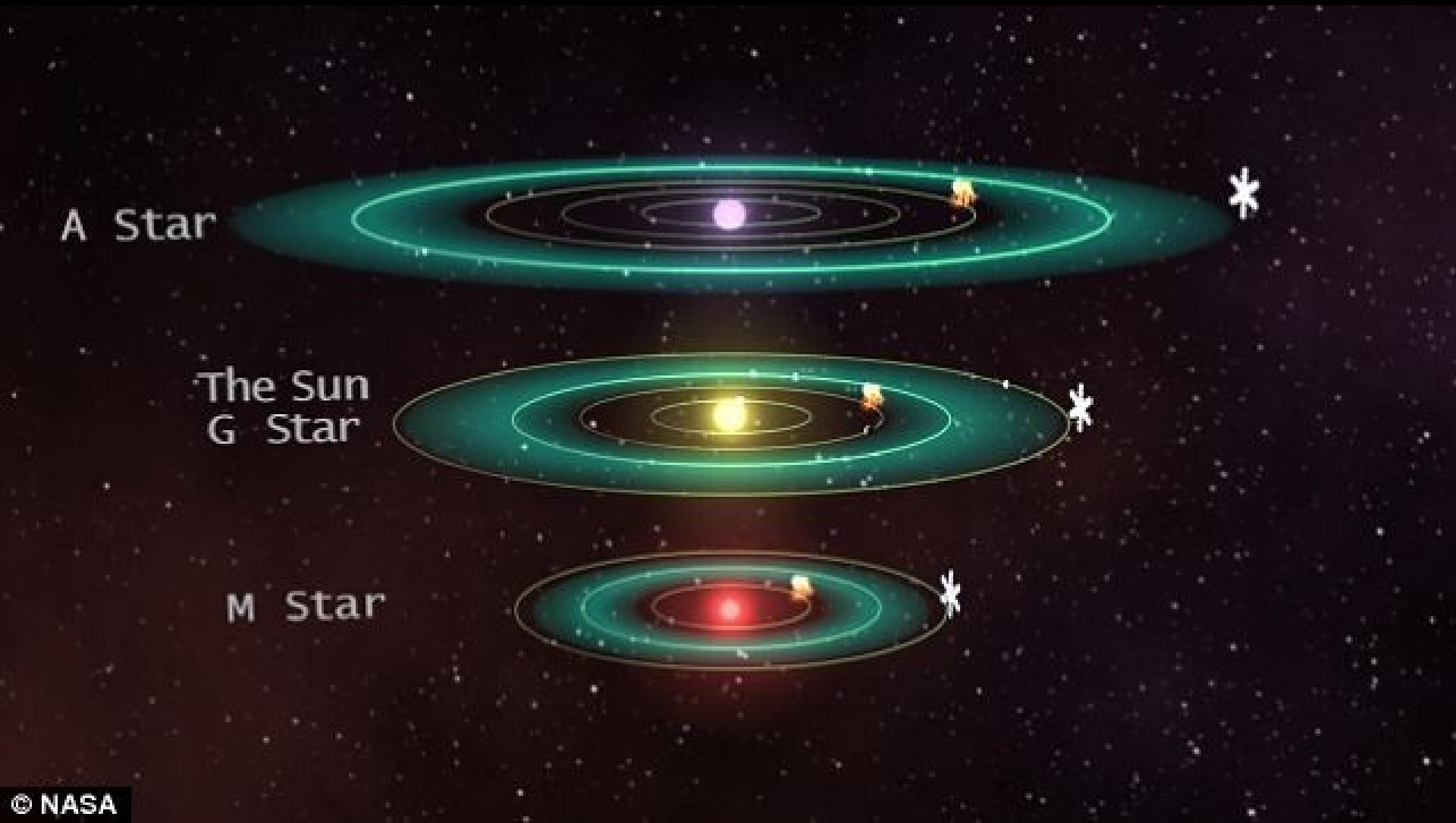


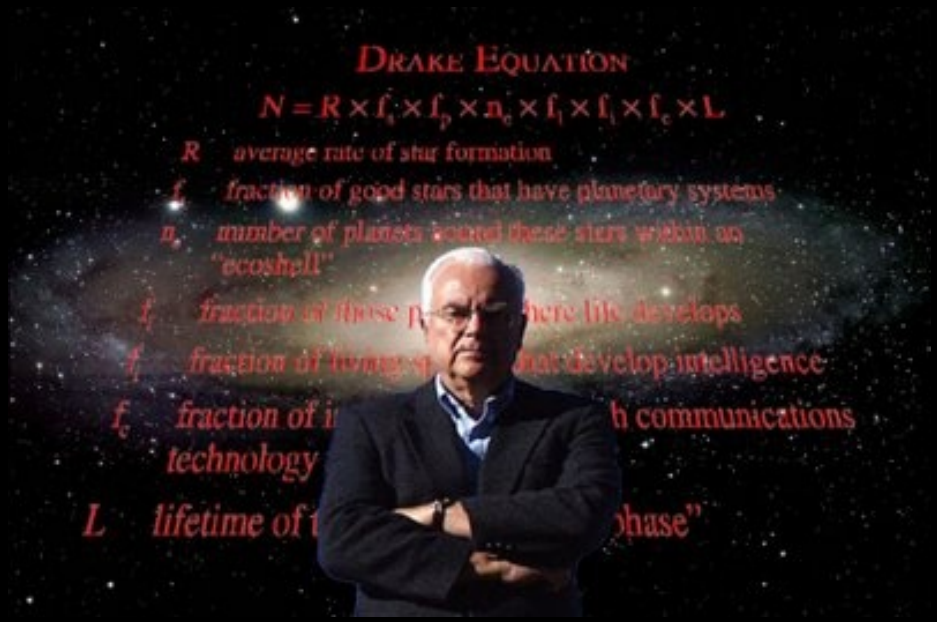
Image Credit: William Hubbard, UA LPL

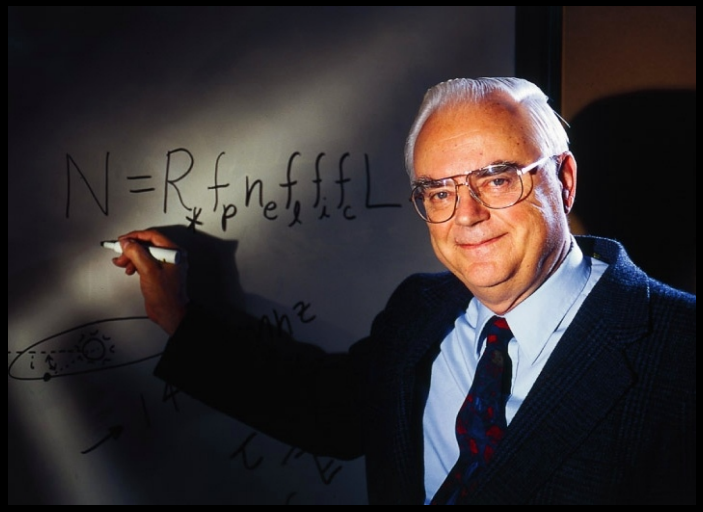
Life Around Other Stars

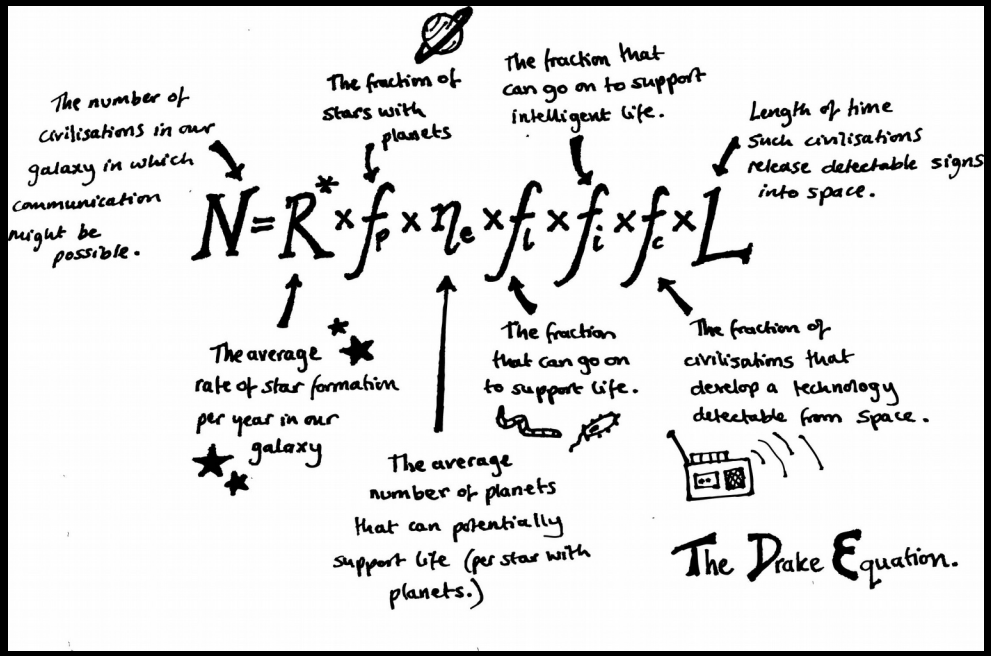


The Drake Equation

How many civilizations are out there?








UFO
INFORMATION
CENTER

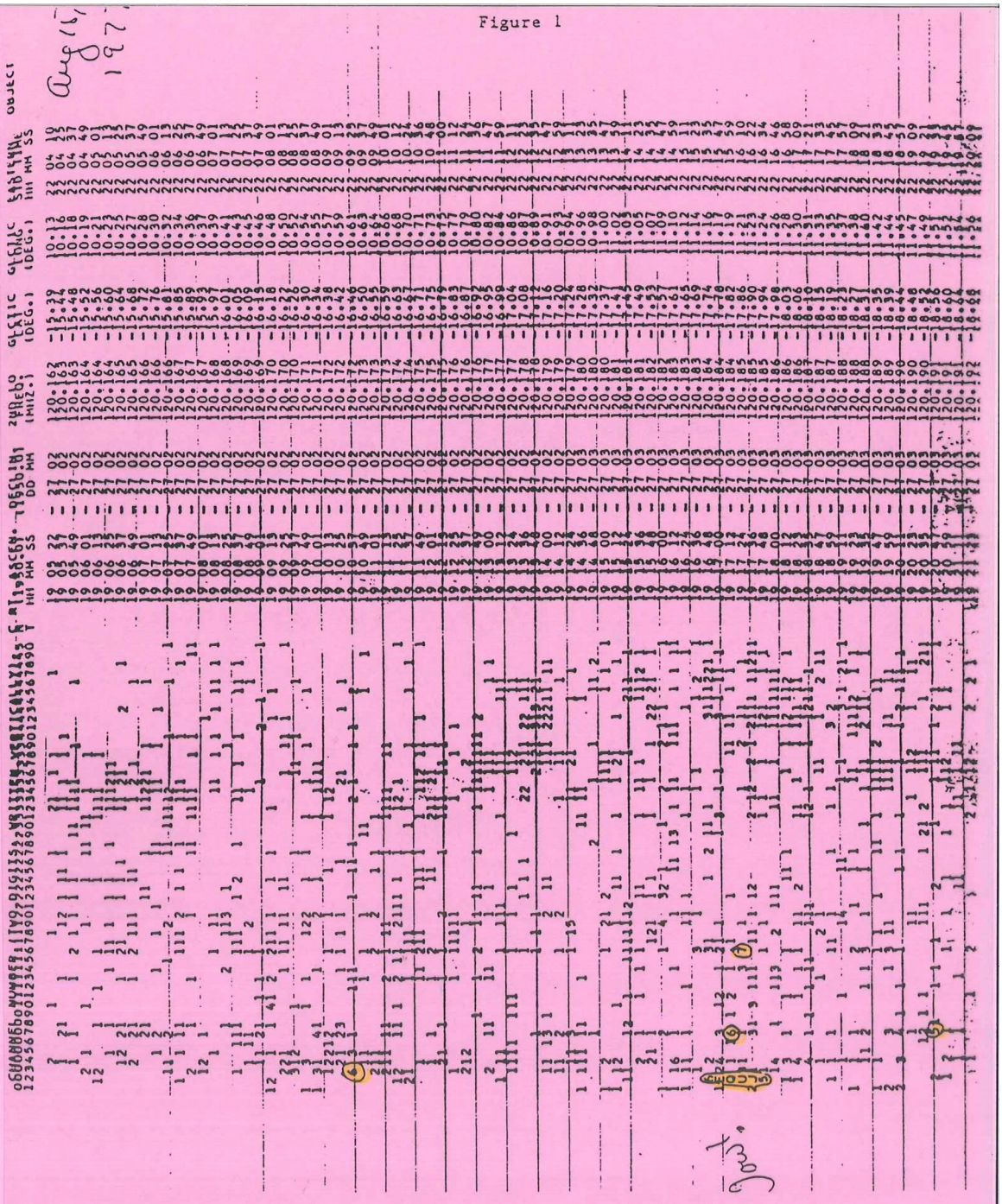
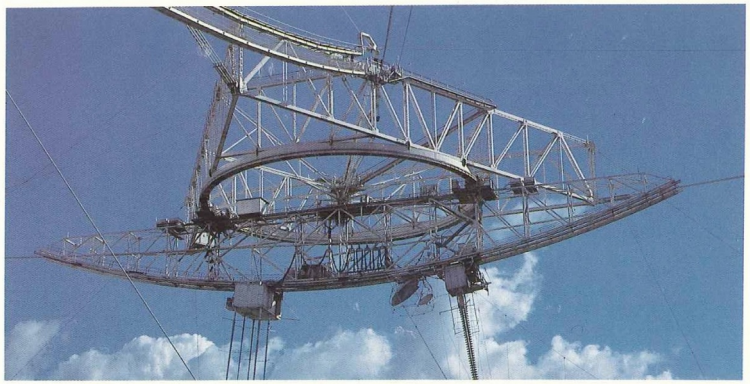


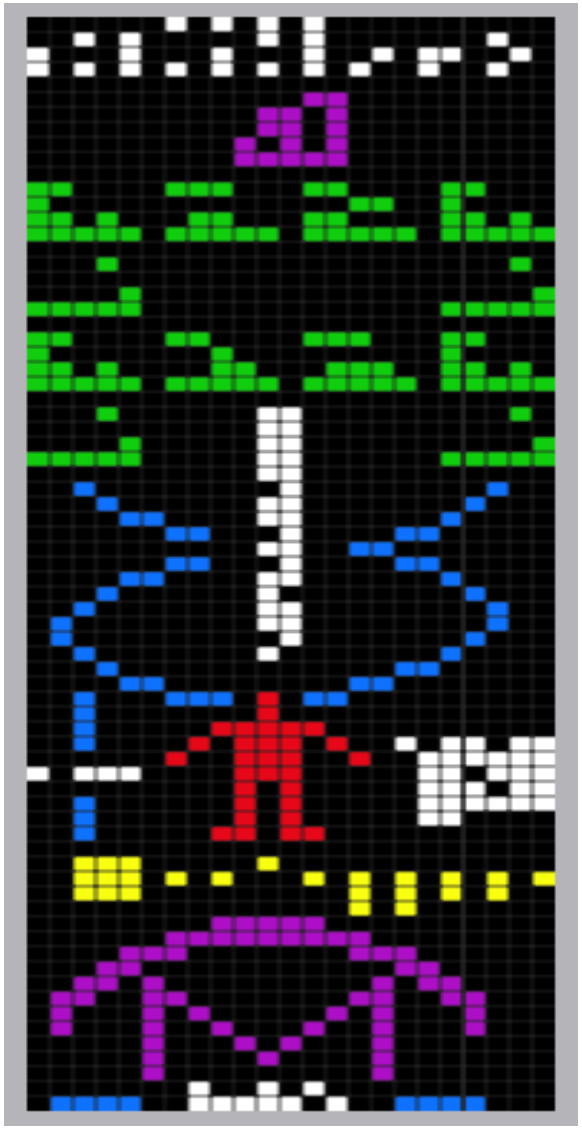
Figure 1. The "Wow!" signal. It was recorded on a computer printout of radio noise intensity from 50 frequency channels (digits and letters at left) at varying sky positions. *(Photo: Courtesy Robert Dixon; Ohio State University Radio Observatory.)*

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.

Chaz Vukotic

(Frank Drake)

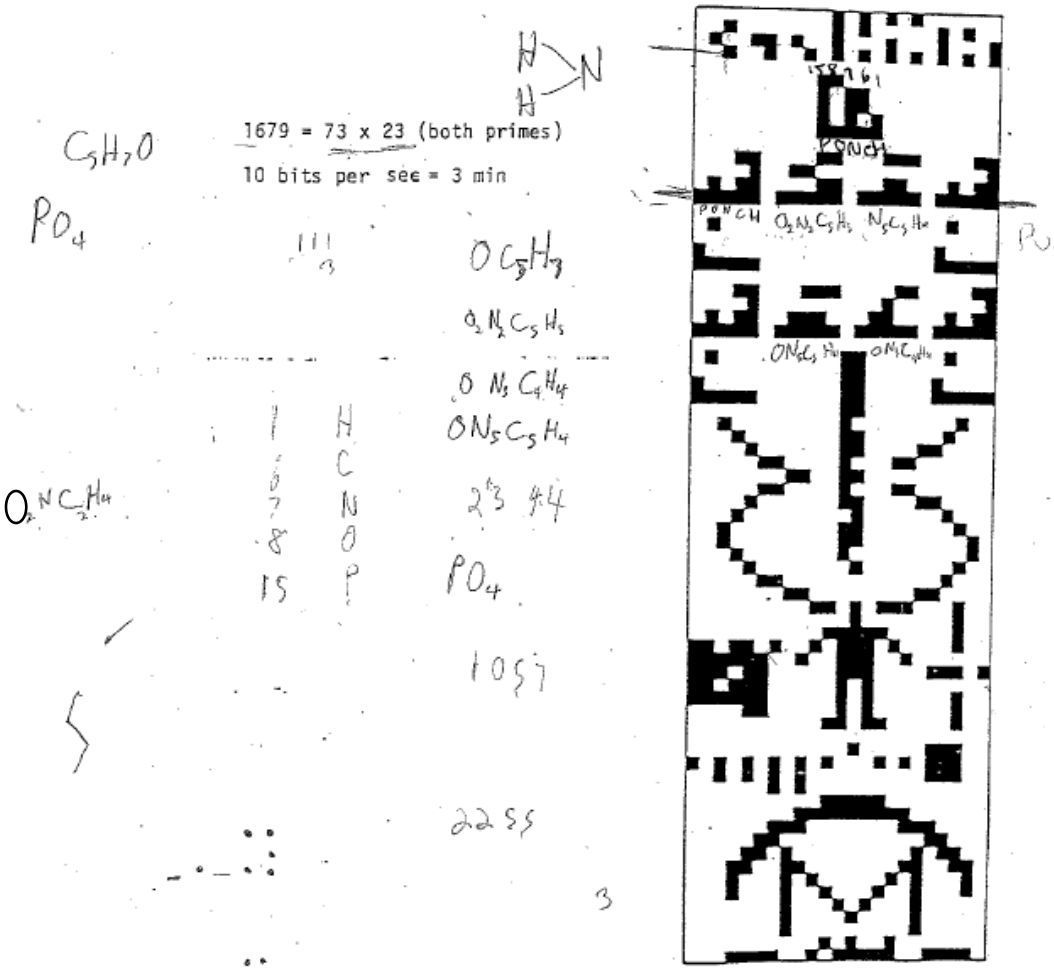


FIGURE 8.10. Diagram of the Arecibo radio message t
ted toward the Great Cluster in the constellation
(1974).

OC_5H_7 = Deoxyribose

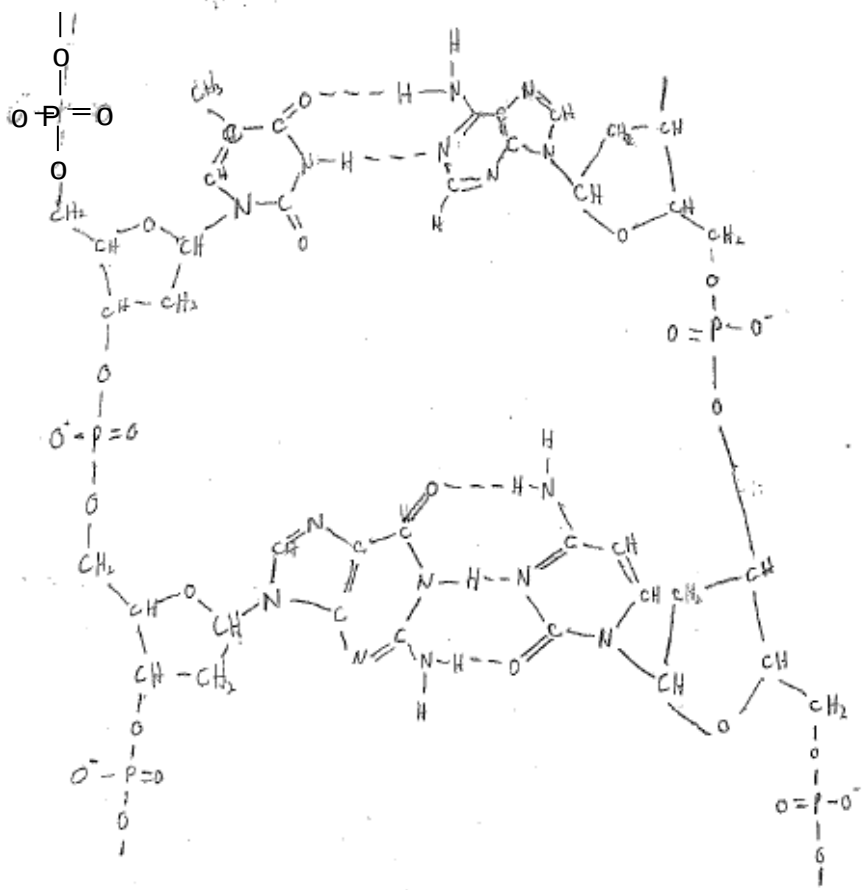
$ON_5C_5H_4$ = Guanine

$ON_3C_4H_4$ = Cytosine

Adenine

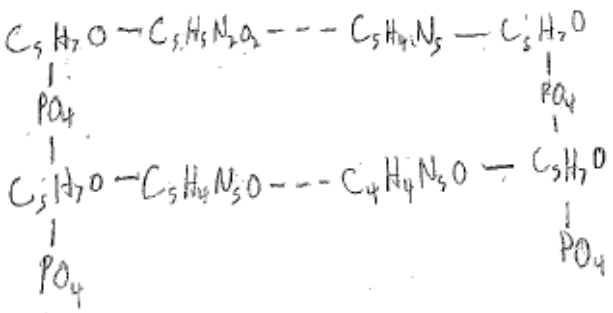
$N_5C_5H_4$ = Adenine

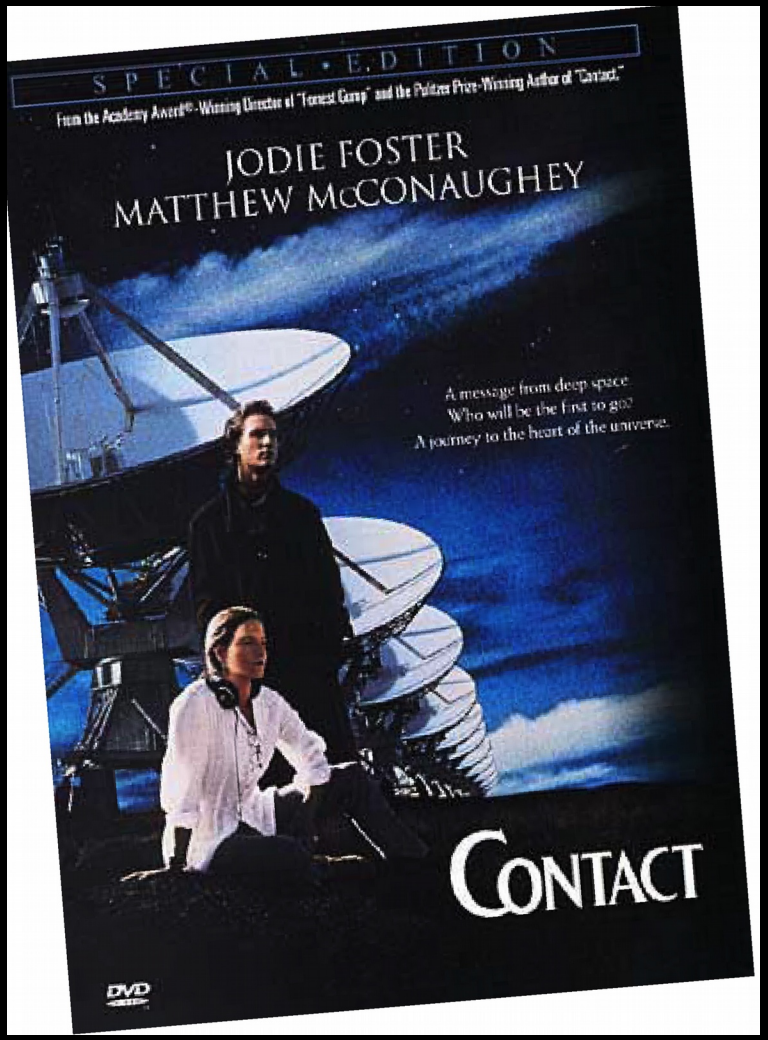
$O_2N_2C_5H_5$ = Thymine

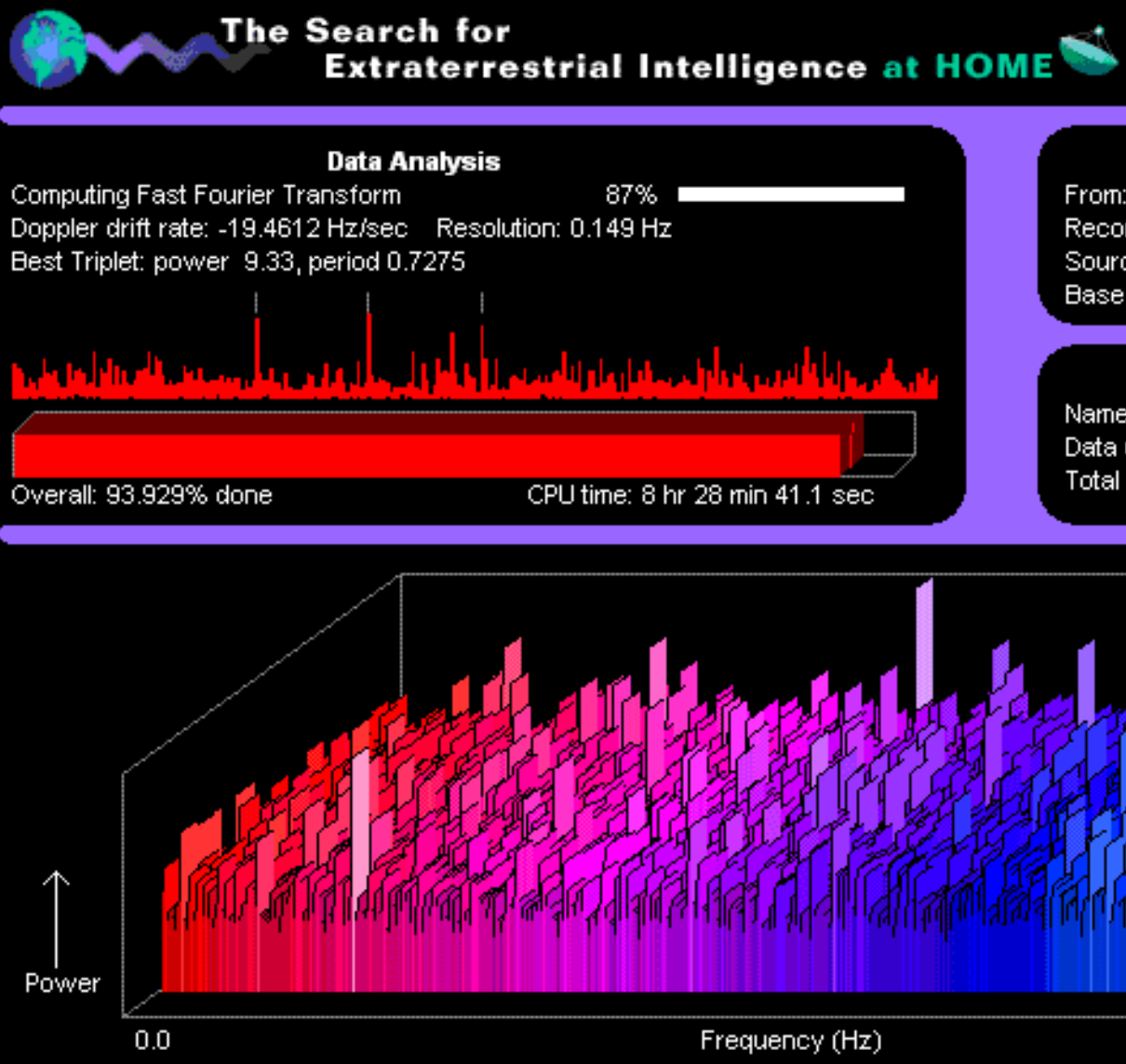


2 sets of base pairs

Whole of human genome.




SPECIAL EDITION
From the Academy Award®-Winning Director of "Forrest Gump" and the Pulitzer Prize-Winning Author of "Contact."
JODIE FOSTER
MATTHEW McCONAUGHEY
A message from deep space.
Who will be the first to go?
A journey to the heart of the universe.
CONTACT
DVD


The Search for
Extraterrestrial Intelligence at HOME
Press F1 for info
Version 3.03
http://setiathome.berkeley.edu
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
Power
0.0
Frequency (Hz)
9765.620
0
Time (sec)
107.4

Kepler Mission: A search for habitable planets.

Launch of the Kepler Spacecraft

Videos:

21 Mb AVI (best for PCs) | 2.5 Mb MPEG4 (best for fast download) | 17 Mb Quicktime (best for Mac)

Launch blog

Mission Clock

Launch videos

SUCCESSFUL LAUNCH: 2009 March 6 at 10:49 pm EST.

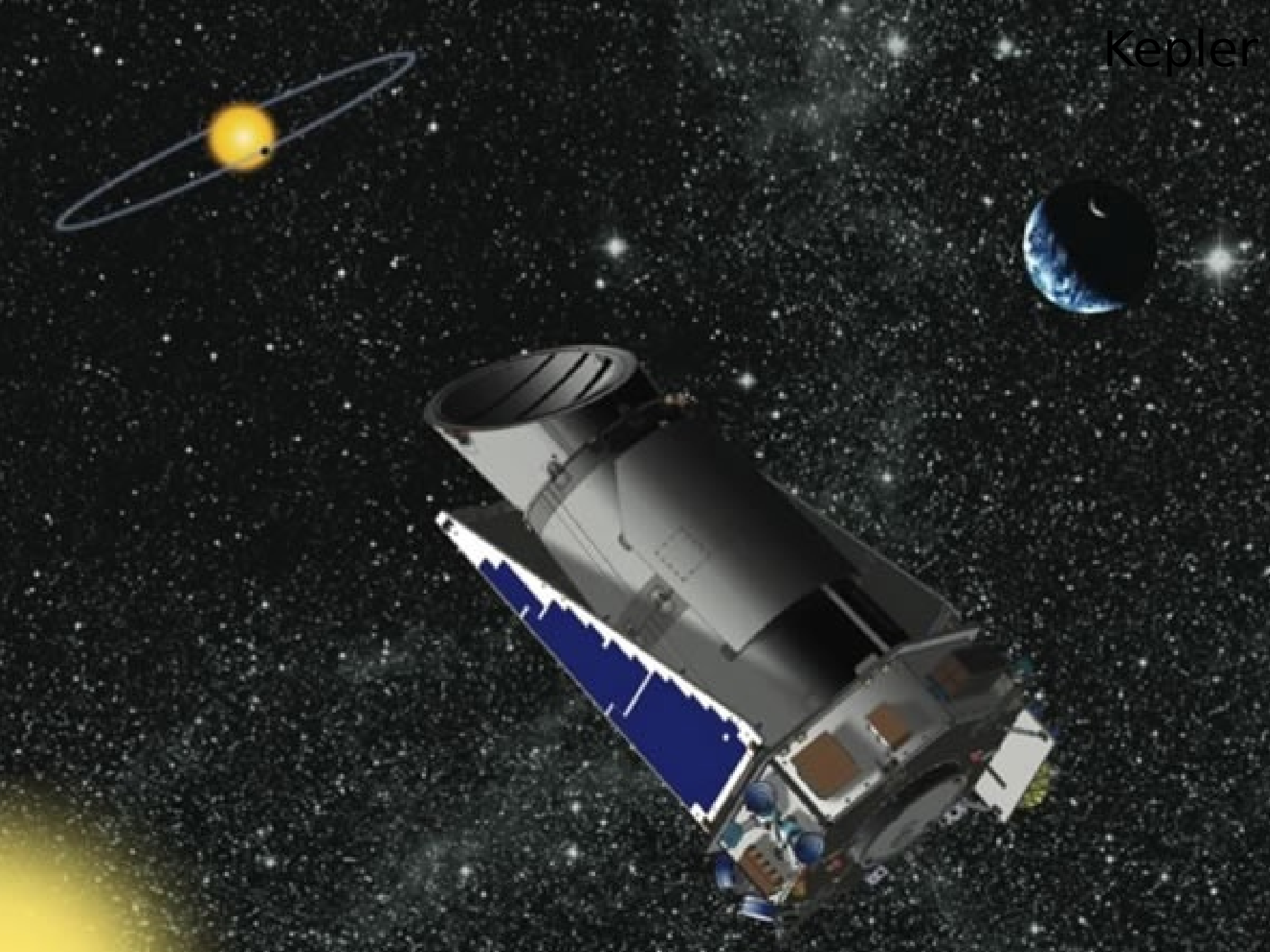
Media from Kennedy Space Center (KSC)

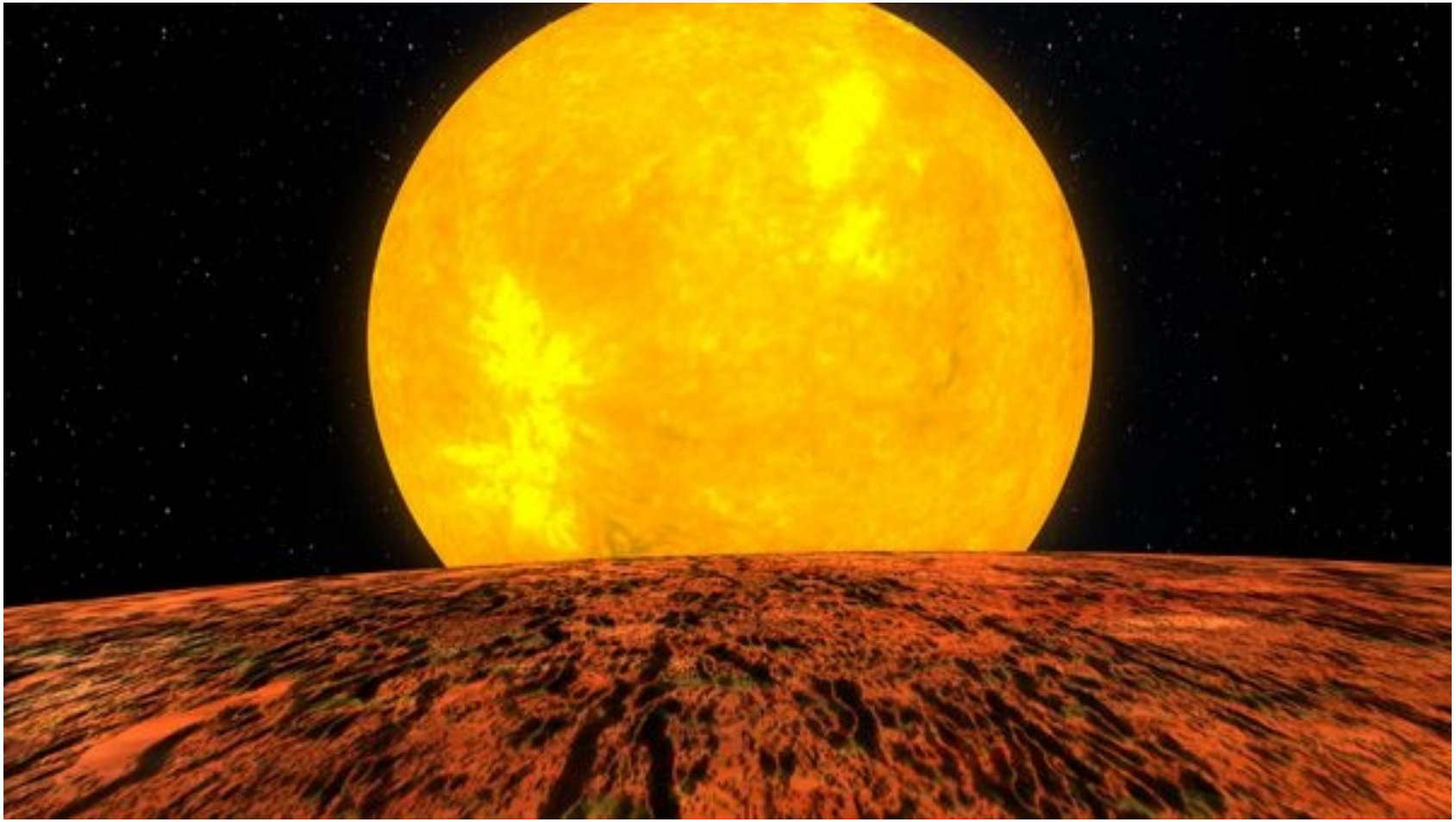
Press Conference Media Resources
Full Press Kit (3 Mb pdf)

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

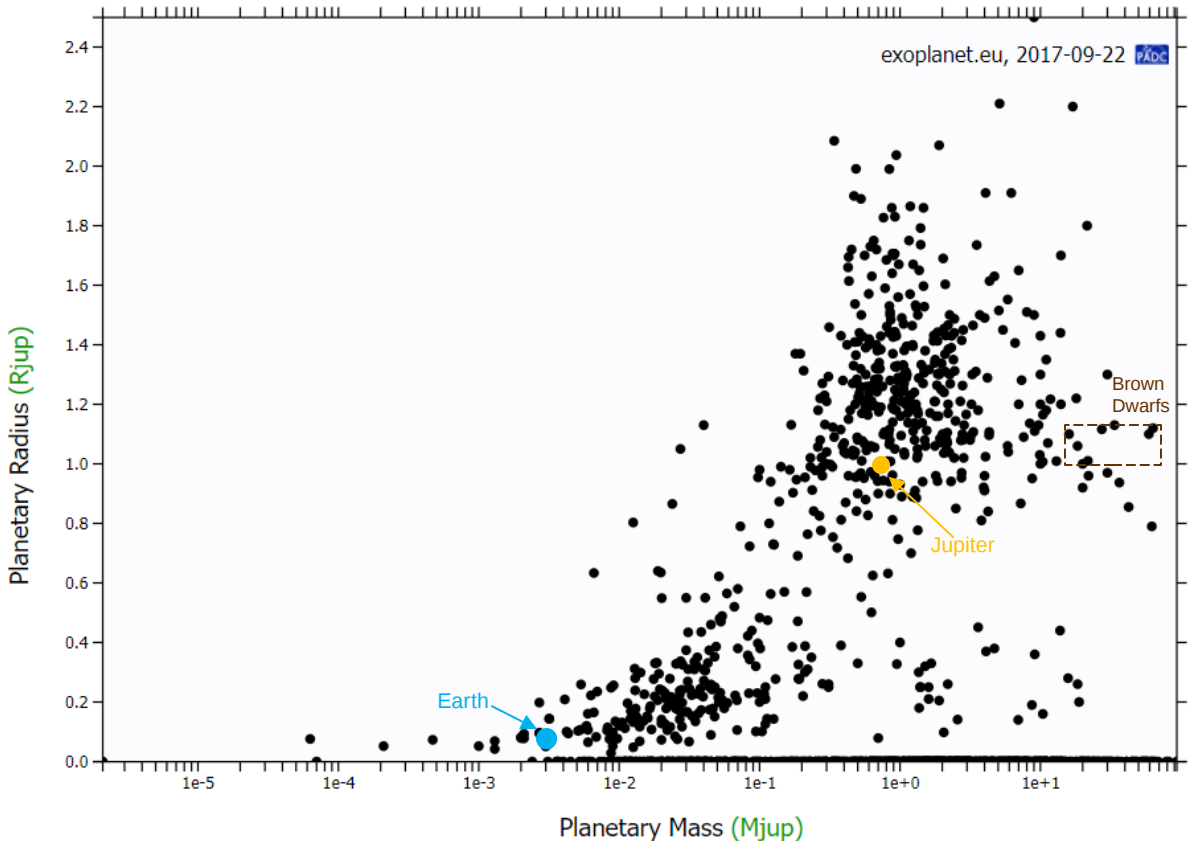


Imagined View from Planet Kepler-10b (Artist's Depiction)
Credit: NASA/Kepler Mission/Dana Berry

Diagrams: scatter plot

Histogram plot →

Status | Detection | "confirmed" in planet_status



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

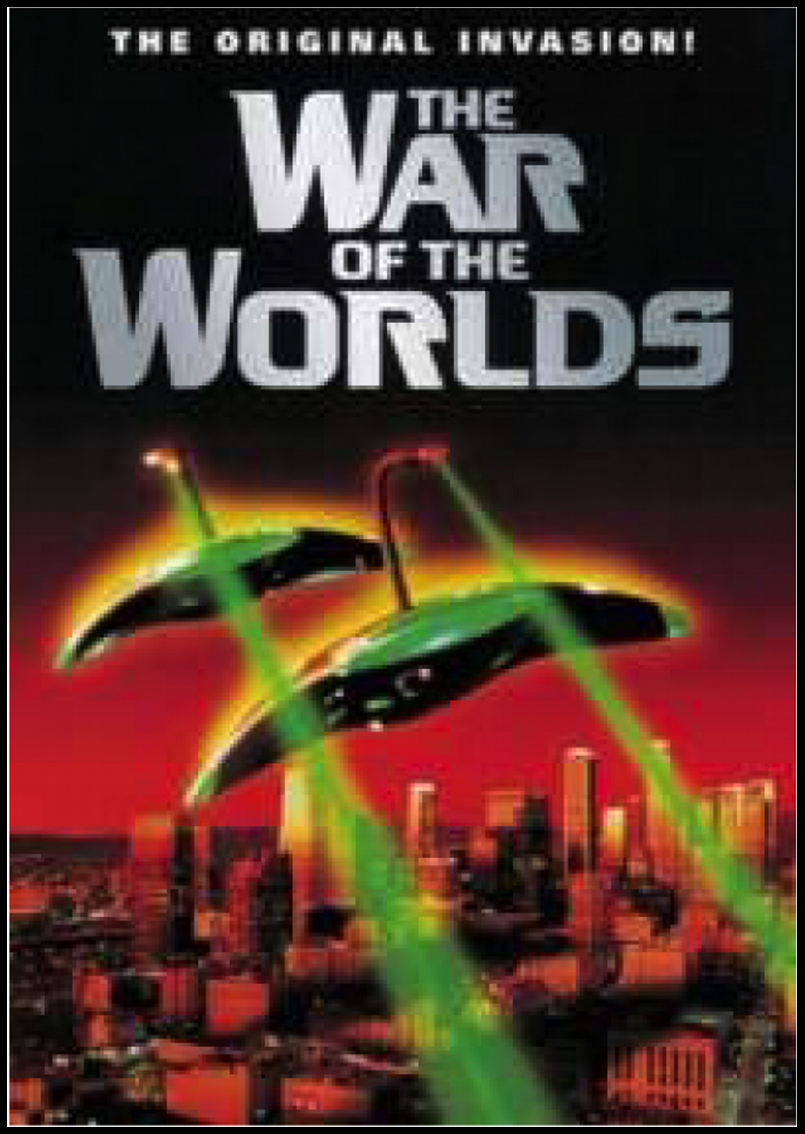
Selection mode

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