Journal of Astrobiology and Outreach

Dr. Akos Kereszturi

Editorial Board member

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Hungarian Academy of Sciences
Hungary

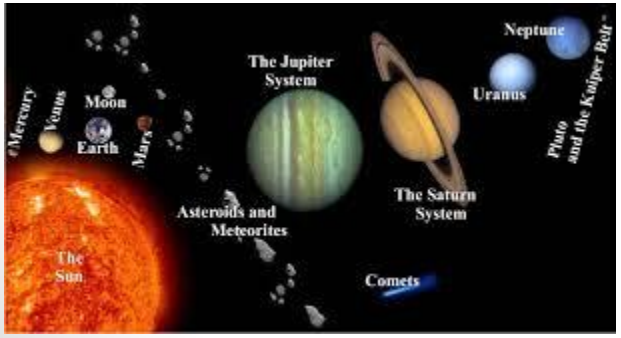
Dr. Akos Kereszturi

Biography

- Akos Kereszturi has PhD in geology and working on planetary surface processes and astrobiology, focusing on the analysis of Mars, Europa and analog locations on the Earth. He also works for ESA under the Mars Express project and for NASA Astrobiology Institute in the TDE focus group.
- Beside research he teaches astrobiology and planetary science at two Hungarian universities, working on to use astrobiology as an interdisciplinary link between natural sciences.
- As the vice president of the Hungarian Astronomical Association and the national coordinator of the European Association for Astronomy Education he works on the popularization of astronomy and astrobiology, organizing lectures and public demonstrations.
- As a part time journalist he writes papers for printed journals and online websites

Research Interests

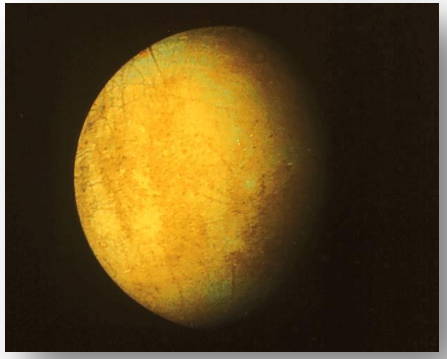
- Ancient wet locations on Mars (morphology, spectral data), possible occurrence of liquid (interfacial) water and brine on Mars today, survival of cyanobacteria in cryptobiotic crust at simulated Mars surface conditions, Mars analog terrains and the survival strategy of extreme organisms there, surface tectonics and possibility of subsurface water migration toward the surface on the satellite Europa, educational methods both for secondary students and at university level, connecting research in astrobiology (related missions) with university courses,



Recent Publications

1. How to Size an Exoplanet? A Model Approach for Visualization, Akos Kereszturi, Research Article: Astrobiol Outreach 2013, 1:1

2. Review of Wet Environment Types on Mars with Focus on Duration and Volumetric Issues, Akos Kereszturi. Astrobiology. June 2012



What is Astrobiology?

"Astrobiology is the study of life in the universe. It investigates the origin, evolution, distribution, & future of life on Earth, & the search for life beyond Earth."

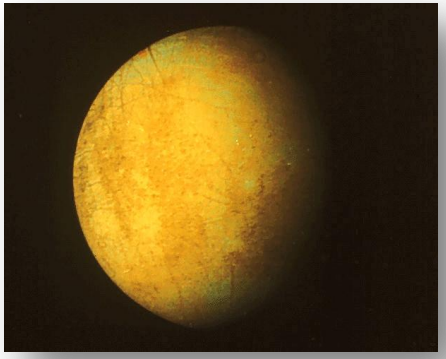
Astrobiology addresses three fundamental questions:

1) How does life begin & evolve?
2) Is there life beyond Earth & how can we detect it?
3) What is the future of life on Earth & in the universe?"

Astrobiology addresses the question of whether life exists beyond Earth, and how humans can detect it if it does!!

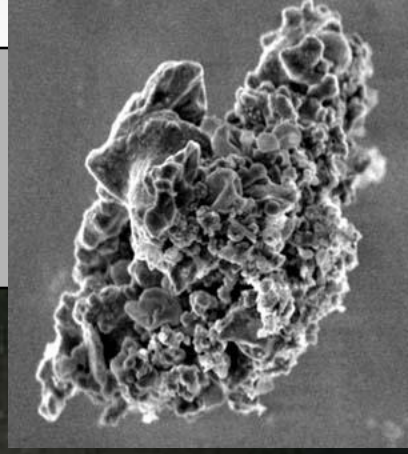
Life Elsewhere

- Studies of life in extreme environments on Earth have led us to focus on some prime places to look for life
- Mars
- Europa (moon of Jupiter)
- Titan (moon of Saturn)



Life in the Universe

Hubble Space Telescope image of Sedna- takes 10,500 years to circle the Sun!



Interplanetary Dust Particle -10 µm across made by dying and exploded stars

Our Solar System has planets, dwarf planets, moons, asteroids, comets, and interplanetary dust.

Milky Way galaxy has 100 billion (100,000,000,000) stars.
Universe has 100 billion (or more) galaxies.
Many stars have planets.
- **Some like Jupiter and Saturn.**
- **Some may be like Earth.**

Potential for a large number of Earth-like planets (ELPs).

Astrobiology, Incremental Data Accumulation, New Ideas & Understanding, Paradigm Shifts

NOTICE THE TIME FRAMES….

Search for Extrasolar Planets	~ 15 years
Deep Time: Reinterpreting Early Earth	< 5-10 years
Life on the Edge (extreme environments)	Late 70's Vents
The Rock that Started it all- Scientific Process	Mid 90's
Asteroids and Dinosaur Extinction	~ '79
Human Microbiomes	~ 5-10 years

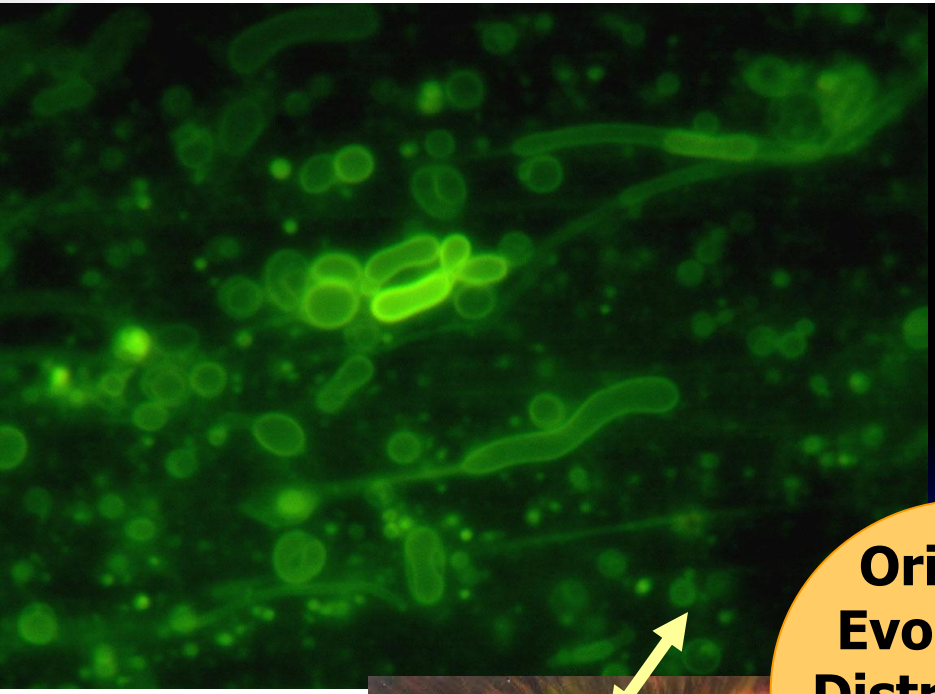
Astrobiology makes use of physics, chemistry, astronomy, biology, molecular biology, ecology, planetary science, geography, and geology to investigate the possibility of life on other worlds and help recognize biospheres that might be different from the biosphere on Earth.

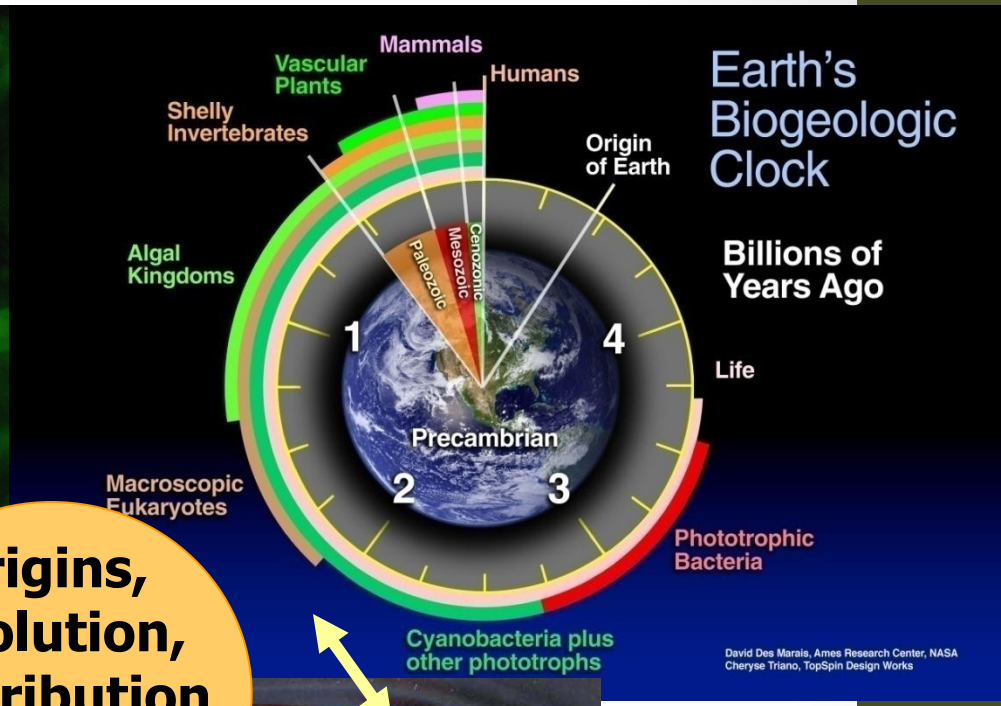
Astrobiology concerns itself with interpretation of existing scientific data; given more detailed and reliable data from other parts of the universe, the roots of astrobiology itself—physics, chemistry and biology—may have their theoretical bases challenged.

Although speculation is entertained to give context, astrobiology concerns itself primarily with hypotheses that fit firmly into existing scientific theories.

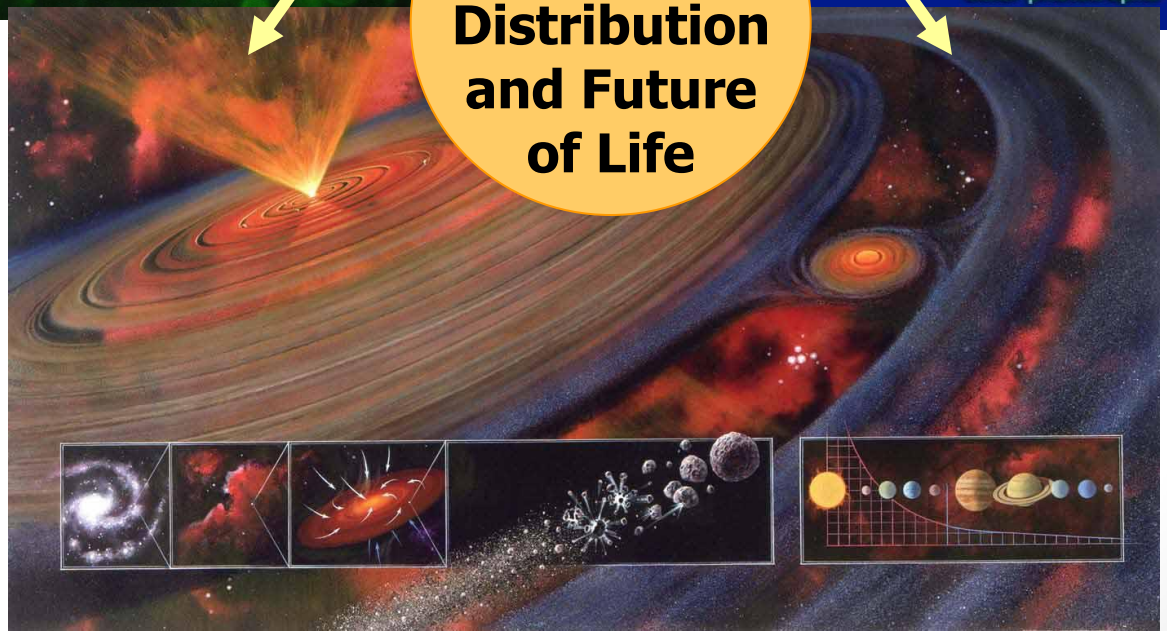
It has been proposed that viruses are likely to be encountered on other life-bearing planets.Efforts to discover current or past life on Mars is an active area of research.

Astrobiology Unites Disciplines to Study Life in the Universe





Origins, Evolution, Distribution and Future of Life



While it is an emerging and developing field, the question of whether life exists elsewhere in the universe is a verifiable hypothesis and thus a valid line of scientific inquiry. Though once considered outside the mainstream of scientific inquiry, astrobiology has become a formalized field of study.

Earth is the only place in the universe known to harbor life.However, recent advances in planetary science have changed fundamental assumptions about the possibility of life in the universe, raising the estimates of habitable zones around other stars, along with the discovery of hundreds of extrasolar planets and new insights into the extreme habitats here on Earth, suggesting that there may be many more habitable places in the universe than considered possible until very recently.

On 4 November 2013, astronomers reported, based on *Kepler*space mission data, that there could be as many as 40 billion Earth-sized planets orbiting in the habitable zones of sun-like stars and red dwarf stars within the Milky Way Galaxy.11 billion of these estimated planets may be orbiting sun-like stars.

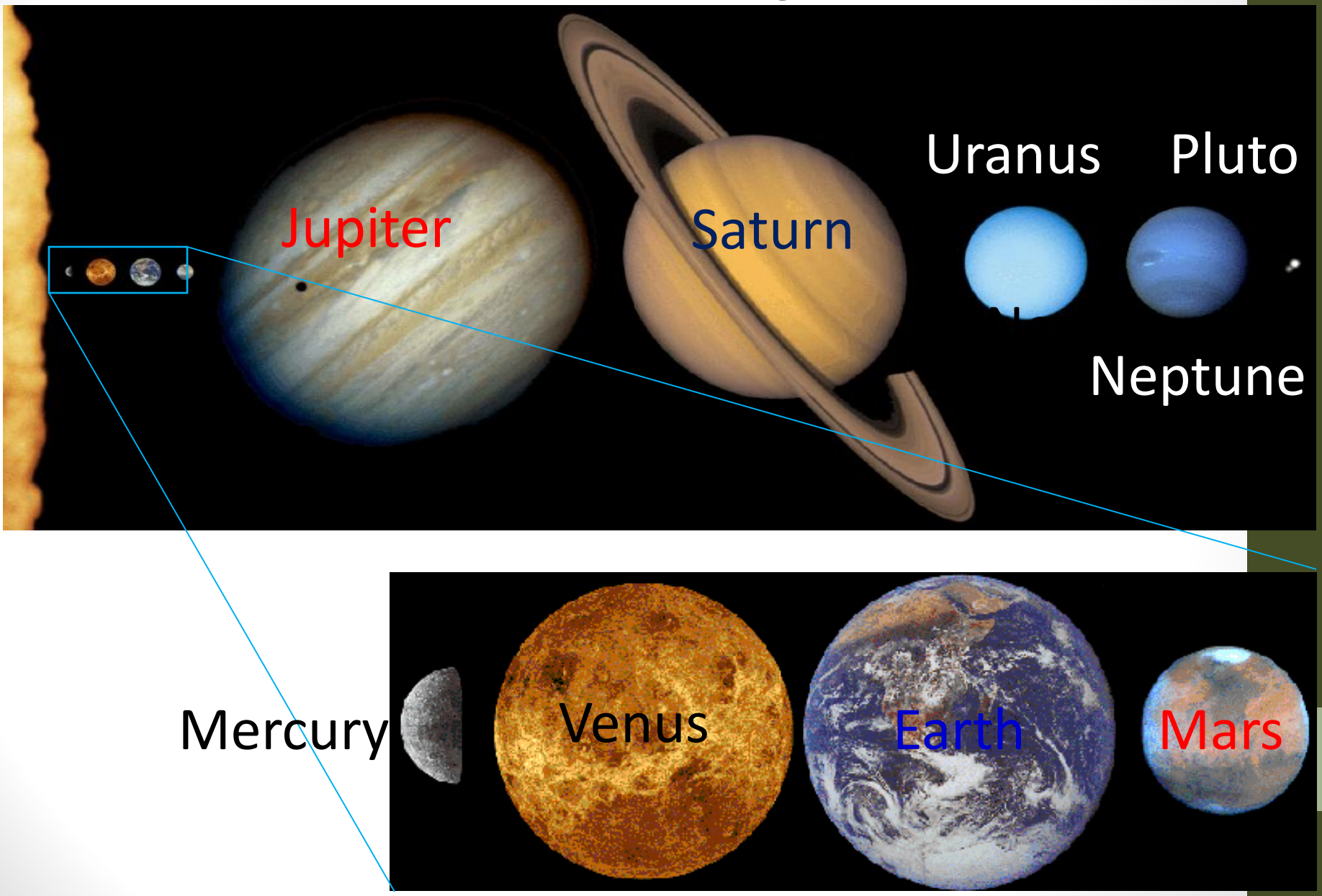
The Origin of Life on Earth

4 billion years ago

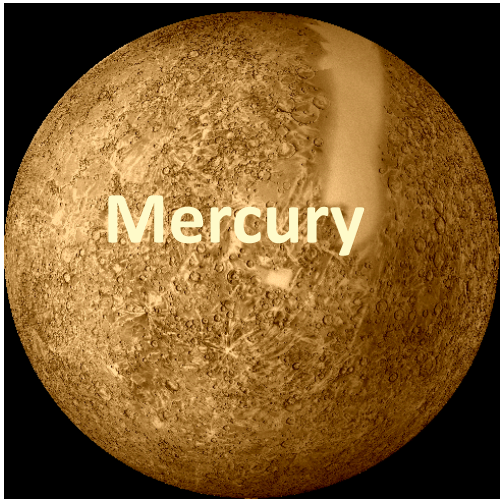
The nearest such planet may be 12 light-years away, according to the scientists.

A particular focus of current astrobiology research is the search for life on Mars due to its proximity to Earth and geological history. There is a growing body of evidence to suggest that Mars has previously had a considerable amount of water on its surface, water being considered an essential precursor to the development of carbon-based life

Our Solar System

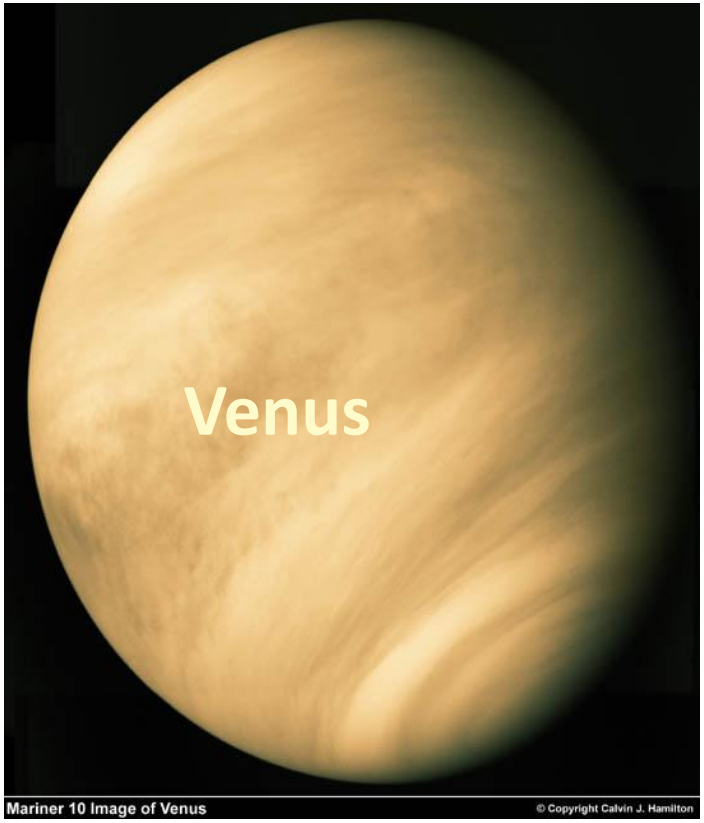


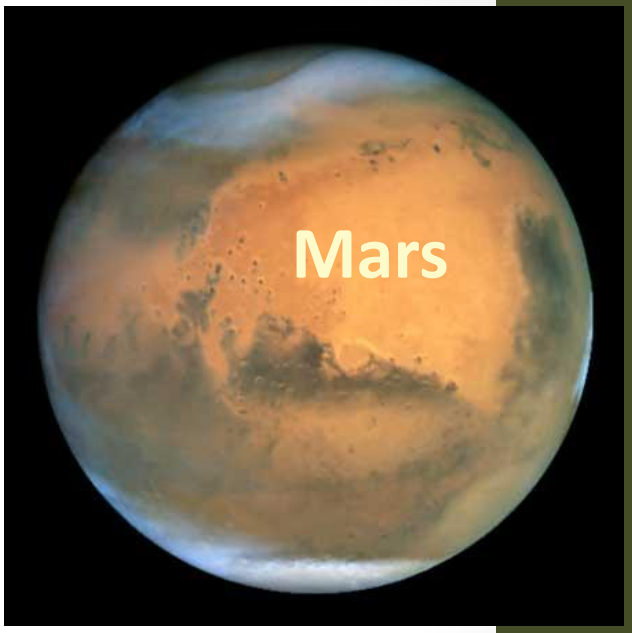
The Terrestrial Planets



Very near the Sun

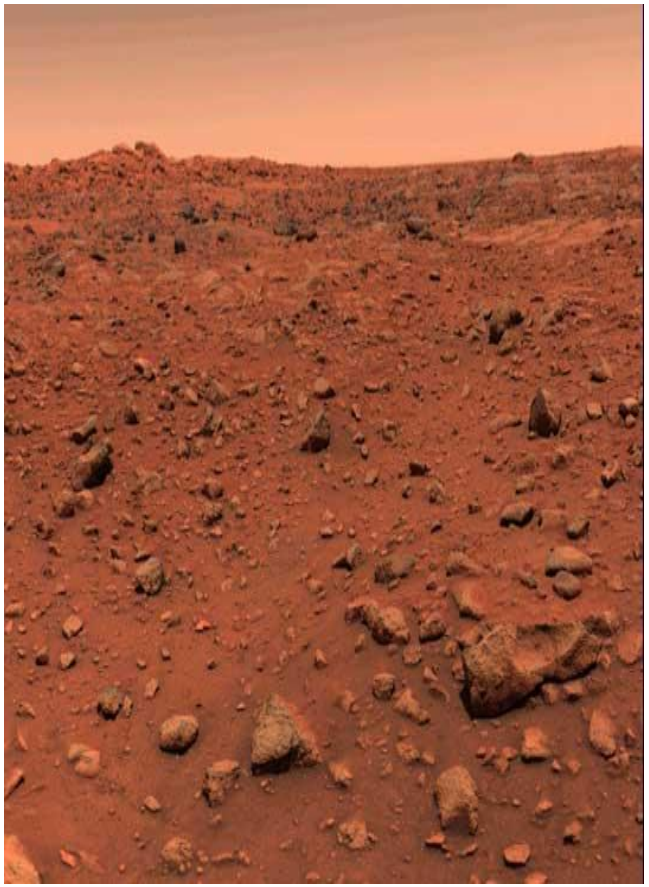
Very hot because its atmosphere



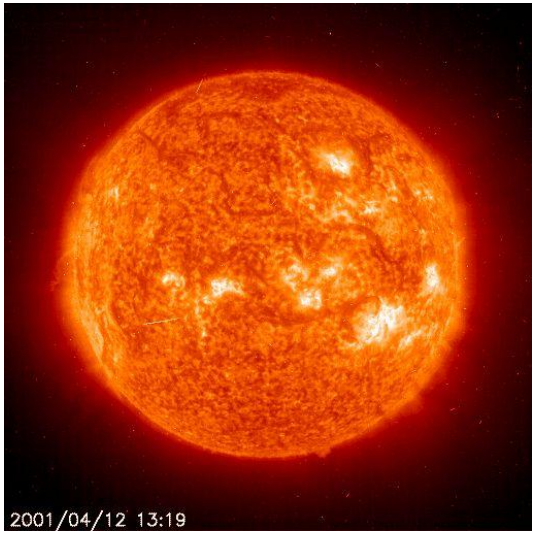


No atmosphere, cold but…

Mars



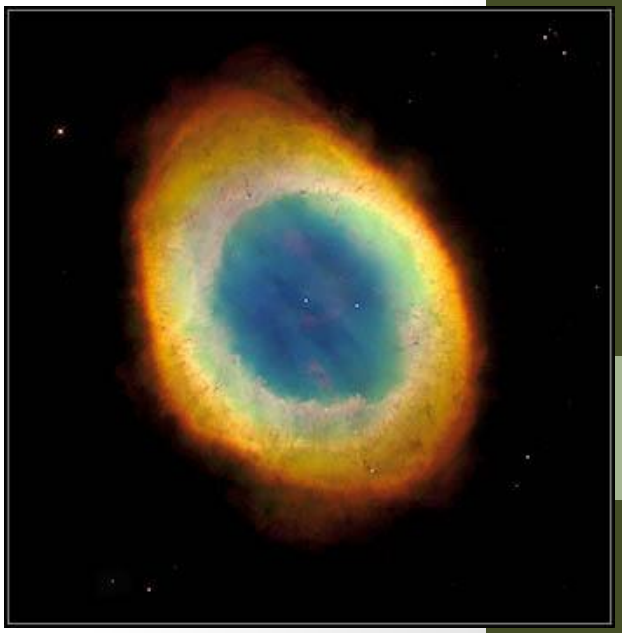
The life of the stars



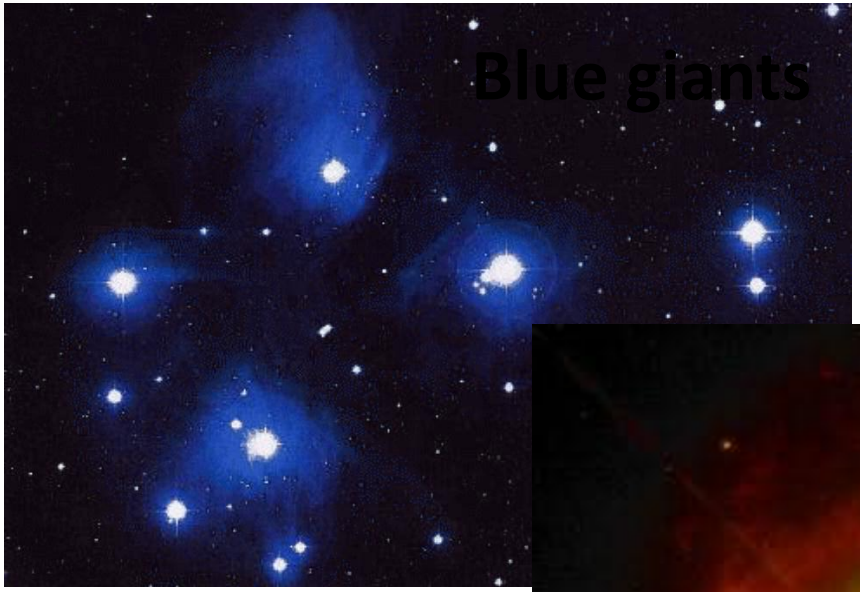
Yellow dwarf
10 billion years

Red Giant

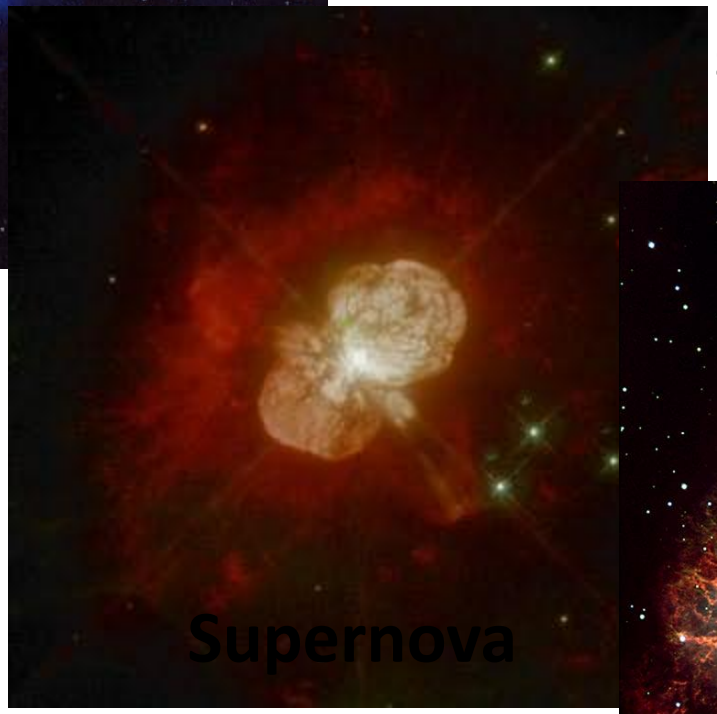
Panetary nebula
and white dwarf



The life of the stars



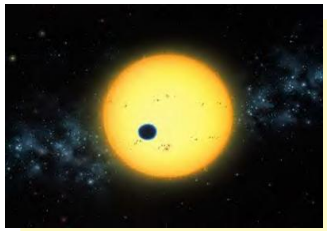
100 million years



Supernova remmanent and neutron star

Multiple Different Search Types

SETI Searches



Extrasolar/Habitable Planets

Exobiology in the Solar System

Multiple Different Search Types

SETI Searches

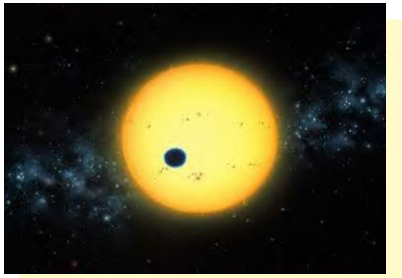
Radio-telescopes - within Galaxy

Discovery: Intelligent Life

Unknown Biology or Chemistry

Light Years Away (still exist?)

Aliens ???



Extrasolar/Habitable Planets

Telescopes - within Galaxy

Discovery: Other Solar Systems; Terrestrial Planets?

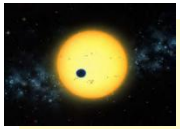
Information on Atmospheres (Compostion/Conditions?)

Maybe Habitable?

Life ???

Multiple Different Search Types

SETI Searches



Extrasolar/Habitable Planets

➢ Exobiology in the Solar System **

Missions -- *visits*

Meteorites -- Fossil Evidence?

Cosmochemistry (Process; Replication)
Origin of Life Research (Lab Experiments)

** ***Real Time; Potential for Cross Contamination; Biohazards***

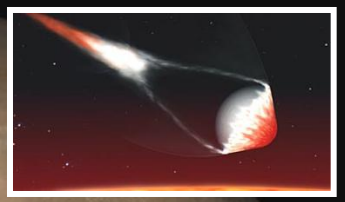
Strategy Has Worked on Mars…

1976

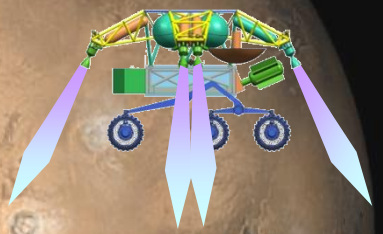
1996

Built Understanding about Mars and its Environment over time...

2003



2007



2011

More and more indications of water found...
Small and large scales...

According to *Akos Kereszturi ,*

- The astrobiological significance of certain environment types on Mars strongly depends on the temperature, duration, and chemistry of liquid water that was present there in the past.
- Recent works have focused on the identification of signs of ancient water on Mars, as it is more difficult to estimate the above-mentioned parameters.
- In this paper, two important factors are reviewed, the duration and the volume of water at different environment types on past and present Mars.
- Using currently available information, we can only roughly estimate these values, but as environment types show characteristic differences in this respect, it is worth comparing them and the result may have importance for research in astrobiology.

- Impact-induced and geothermal hydrothermal systems, lakes, and valley networks were in existence on Mars over the course of from 10^2 to 10^6 years, although they would have experienced substantially different temperature regimes.
- Ancient oceans, as well as water in outflow channels and gullies, and at the microscopic scale as interfacial water layers, would have had inherently different times of duration and overall volume: oceans may have endured from 10^4 to 10^6 years, while interfacial water would have had the smallest volume and residence time of liquid phase on Mars.
- Martian wet environments with longer residence times of liquid water are believed to have existed for that amount of time necessary for life to develop on Earth between the Late Heavy Bombardment and the age of the earliest fossil record.
- The results of this review show the necessity for more detailed analysis of conditions within geothermal heat-induced systems to reconstruct the conditions during weathering and mineral alteration, as well as to search for signs of reoccurring wet periods in ancient crater lakes.

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