

Worlds For the Interplanetary Conference

Mercury

- Mercury is the closest planet to the Sun (0.387 AU) in quite an eccentric orbit ($e=0.206$)
- A day is 58 Earth days - it is locked in a resonance with the Sun (not quite tidally locked)
- Therefore it gets very hot on the Day side and very cold on the night side -there is no atmosphere to keep heat in.
- The only place on Mercury where water could exist may be in deep craters at the poles
- In these deep craters life may be able exist in the dark but with liquid water under the surface

Early Venus

- Initially early Venus would have been similar to early Earth and likely quite hospitable, liquid water on the surface etc.
- Then (see class notes) there was a run away greenhouse making life on the surface very difficult...

Early Moon (with hot core)

- Life could have been seeded on the early Moon by panspermia from early life on Earth.
- Early on when the moon had a hot core life could have survived by subsurface melt water from the ice deposited by comets
- The moon is not big enough to support a dense atmosphere
- There is even today evidence that there surface water ice in the deep craters in the southern pole of the Moon

Early Mars

- Again there is good evidence that early on Mars had liquid water on (or near) the surface.
- However, life would have to adjust to subsurface locations to enjoy liquid water today (see class notes)

Jupiter sort of (same size and placement but with a solid crust)

- maybe life was brought by panspermia and then evolved off the hostile surface to take to the air -a "balloon-like" species living off the rich organic chemistry produced by the lightning in the atmosphere
- **Water world with no land masses on surface**
Life could do well here but it would be always underwater....

Io

- Io is very hot due to massive tidal heating. (see class notes)
- Life on Io would be tough however.
- Sulfate based bacteria could use $\text{H}_2\text{SO}_4 + 4\text{H}_2 \rightarrow \text{H}_2\text{S} + 4\text{H}_2\text{O}$ to survive. this would also produce H_2O .

Frozen Ice world with hot core.

- This would be a lot like Callisto but could be anywhere in its solar system

Europa

- hydrothermal vents in deep ICE covered ocean
- [link here for more info about life on Europa](http://www.jpl.nasa.gov/europaorbiter/europao.htm) <http://www.jpl.nasa.gov/europaorbiter/europao.htm>

Callisto like world with hot inner core

- pockets of liquid water around vents at the Silicate (rock) Ice boundary

Titan

- CH_4 based life?

Pluto like world at the temperature of liquid methane

- Here Pluto is "warm" enough (-180 C) to have liquid Methane left over from cometary impacts
- To have life that is stable in a non-polar solvent like the symmetric Methane (CH_4) molecule will require non-polar biological polymers. So Cell membranes and DNA molecules must be polar to avoid dissolving in the non-polar solvent.
- Life on Pluto would have very little power from the Sun. Reactions like those used by Methanogenic Bacteria could be the norm on Pluto world

Planet orbiting a pulsar

- Here is world that may have been habitable on the surface at one time and then underwent a horrible explosion when it's primary star went supernova.
- The blast would have destroyed all surface life, atmosphere. However, this planet may have had some life below the surface that could have survived the supernova.
- This underground life could survive off subsurface liquid water.
- Overtime the outgassing from the volcanoes could rebuild an atmosphere.
- But the loss of light from the star (since it is now just a neutron star (or black hole)) means that the surface will soon be too cold to be habitable again.

Ammonia Ocean World

- Here we are "warm" enough (-40 C) to have a liquid Ammonia Ocean
- To have life that is stable in a non-polar solvent like the symmetric Ammonia (NH_3) molecule will require non-polar biological polymers. So Cell membranes and DNA molecules must be polar to avoid dissolving in the non-polar solvent.
- Although the chemistry of life would be very different life could develop using liquid ammonia as a solvent
- Perhaps having electric dipoles for all the molecules would allow a sort of electrical based life form....