Astronomy 330



HW #3



This class (Lecture 18):

Origin of Intelligence

Michael Murphy David Mayer

Next Class:

Cultural Evolution

Joshua Seiter Jonah Wolff • Bryan White:

http://www.geocities.com/tasosmit2001/alien.htm

• Se Hee Jang:

http://www.mufon.com

• Nick Leners:

http://www.dailymail.co.uk/pages/live/articles/news/news/html?in article id=470579&in page id=1770

Music: Aliens Exist – Blink 182

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Presentations



Outline



- Michael Murphy: Light the Universe and 42
- David Mayer: Self-Replicating Probes

• What is f_1 ?

Cultural evolution

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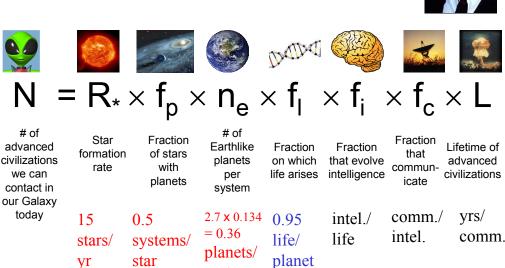
Drake Equation

Frank Drake



That's 2.6 Life systems/year

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- Overall, the evolution leading to H. sapiens was not a smooth and steady path.
- At some points there were 4-6 distinct hominid species living.
- Modern humans emerged from a situation with many variant species adapting to fill different environmental niches.
- Only one path lead to much larger brains, and we do not truly understand what environmental factor favored it.

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f_i Considerations

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system



- Complexity leads to intelligence, but complexity seems to require a benign environment. Harsher environments tend to have simpler organisms.
- Perhaps life may exist on harsh planets, but more intelligent life?
- Remember, human intelligence took 4.5 billion years.
- Systems very near the center of the galaxy are more likely to be hit with supernovae event in that time.
- 4.5 Byrs is about half the age of our Galaxy. Were we fast or slow? <u>Fast</u>: severely limits ETs. <u>Slow</u>: there can be multiple ETs.

f_i Considerations



- Intelligent life is a <u>very</u> recent development on Earth with the emergence of the primates, hominids, and H. sapiens.
- Everyone agrees that this particular evolution will not occur on other planets.
- But, will the characteristics of H. sapiens be common to human-like intelligence?
 - Manipulative organs
 – hands
 - Walking upright?
 - Is tool use and larger brains associated with walking upright?
 - Pair bonding?
 - Human brains quadruple in size after birth compared to other primates which double.

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f_i Considerations

- How unique is our intelligence?
- Teaching sign language to chimps and gorillas have shown they are more intelligent than we thought.
- Don't forget Alex the parrot!







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What is fi

- What is the fraction of life that forms human or better intelligence in less than about 4.5 billion years?
- If you think that it always does, then $f_i = 100\%$
- If you think that it is a statistical fluke or required supernatural invention then you could use 1/billion or 10⁻⁷%.
- Anywhere in between is fair game.

f_i Considerations



- Whales and dolphins are speculated to be of high intelligence.
- With all of this in hand, we are ready to make the next estimate in the Drake equation.
- This term is only intelligent life that can communicate abstract thought to each other, not technological able to communicate.



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Drake Equation











That's? Intelligent systems/year











= $R_* \times f_p \times n_e \times f_l \times f_i \times f_c \times L$

of advanced civilizations we can contact in our Galaxy today

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Star formation Fraction of stars with planets

Earthlike planets per

Fraction on which life arises

that evolve intelligence communicate

Lifetime of advanced civilizations

15 0.5 systems/ stars/ yr star

 2.7×0.134 = 0.36planets/

system

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system

0.95 life/ planet

intel./ 1ife

comm./ intel.

vrs/ comm.