Astronomy 330



HW #6



This class (Lecture 19):
Cultural Evolution
Jack Holzman
Steven Kallal

Next Class:
Evolution of World View
Jared Evans
Carol Regalbuto

Music: Space Oddity – David Bowie

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• Yi: http://www.illuminati-news.com/ufos-and-aliens/html/area51 the ufo cover up.htm

 Cheryl: http://www.nidsci.org/pdf/rullan.pdf

 Allison: http://www.bltresearch.com/

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Presentations



• Steven Kallal: Life without the Sun



Outline



- What is f_i ?
- From intelligence to communication
- Will a civilization develop that has the appropriate **technology** and **worldview**?
- Requires knowledge of quantum mechanics and astronomy.

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Drake Equation





That's 2.9 life systems/decade				Drake			
				Dated			
N =	R _*	\times f _p \times	< n _e >	$\times f_{ }$	$\times f_i$	$\times f_{c}$	\times L
# of advanced civilizations we can contact in our Galaxy	Star formation rate	Fraction of stars with planets	# of Earthlike planets per system	Fraction on which life arises	Fraction that evolve intelligence	Fraction that commun- icate	Lifetime of advanced civilizations
today	19 stars/ yr	0.4 systems/ star	1.25 x 0.07 = 0.0875 planets/	0.44 life/ planet	intel./ life	comm./intel.	yrs/ comm.





- 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?

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f_i Considerations

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- 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? Fast: severely limits ETs. Slow: there can be multiple ETs.

f, Considerations



- Intelligent life is a very 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.

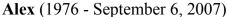
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f_i Considerations

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- 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 10⁻⁷⁰%.
- 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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