

SETI and the Search for Extraterrestrial Life

Dick Carrigan and Nancy Carrigan

2011/3/14

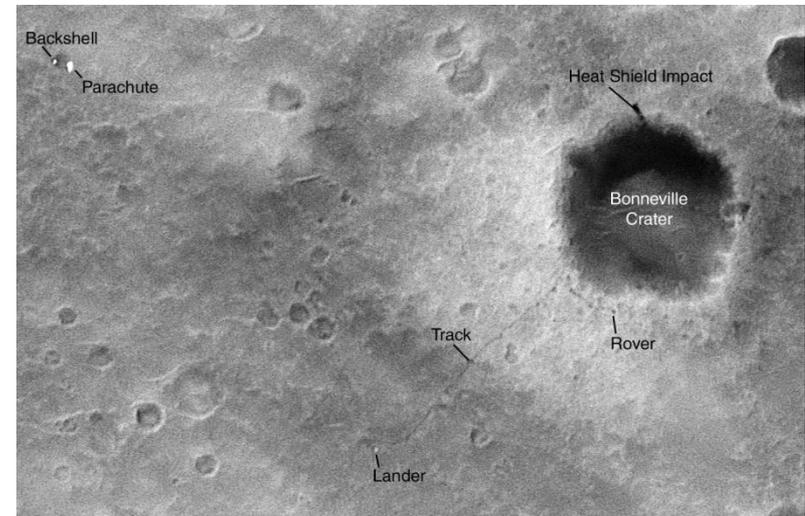
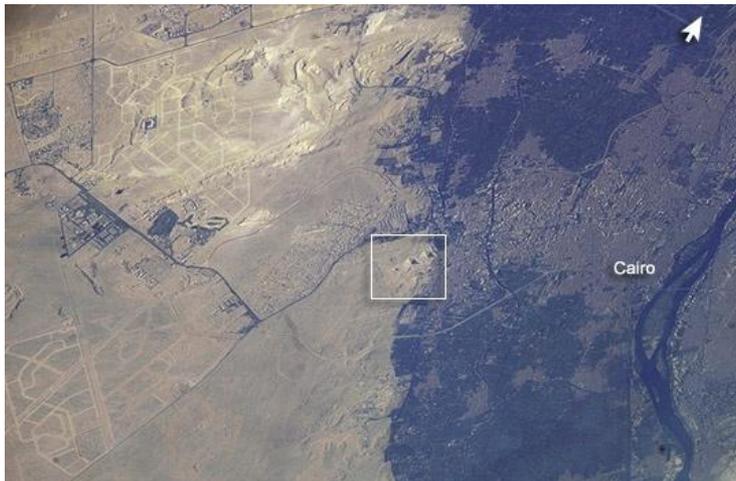
Interstellar Archaeology

"in Bill Grove's honor"

pyramids from space station

Interplanetary Archaeology

(NASA photos)



Mars Rover but maybe
robot anthropology

- **New cosmology, new biology**
- Four signatures for interstellar archaeology
- Summing up

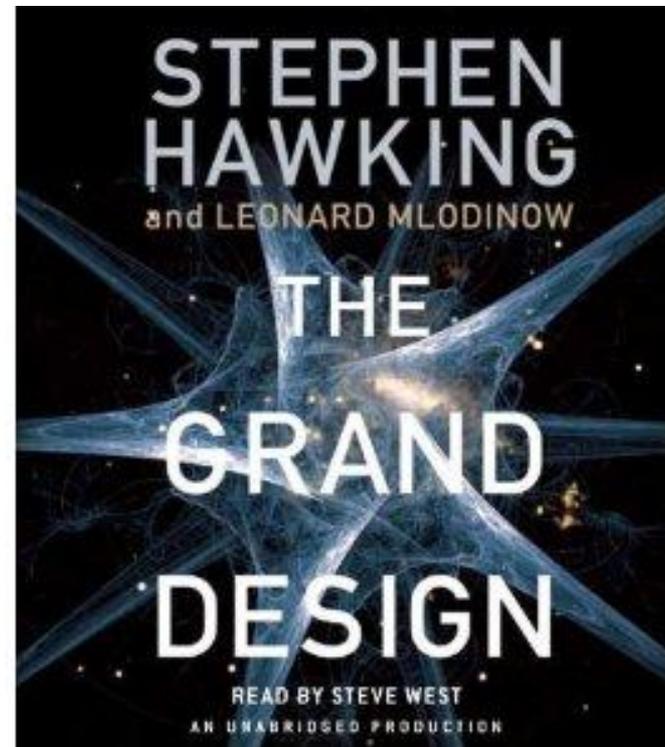
The birth of planets, stars, and universes

Stephen Hawking's cosmology

2011 – planets - **one day after February snowstorm** Kepler mission announced > 700 exoplanets.



2010 - See about p. 135 in the actual book for discussion of early “time” in our Universe.



The birth of stars

Nancy Carrigan's cosmology



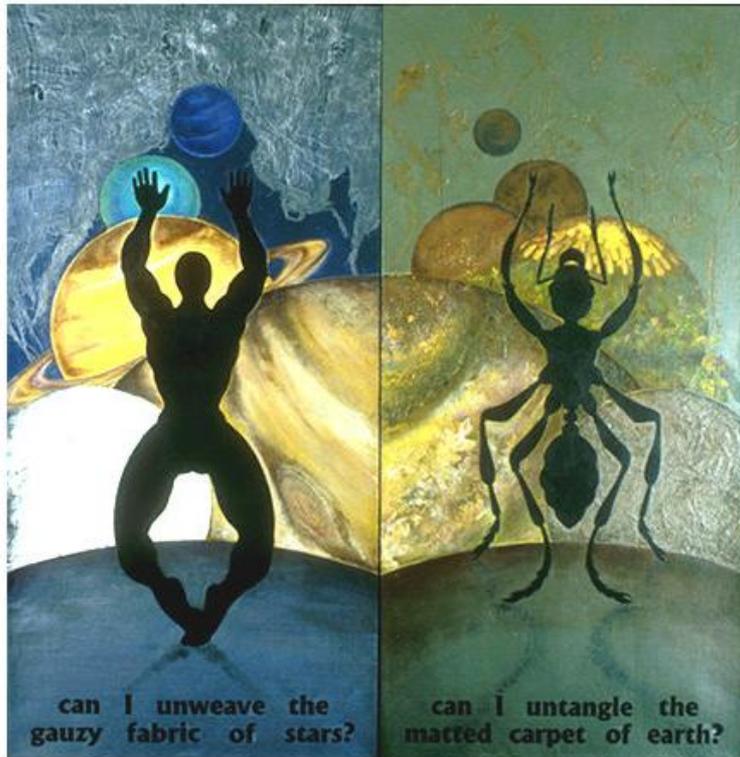
NASA – Pillars of Creation
Hubble, 1995, Hester & Paul
http://en.wikipedia.org/wiki/Eagle_Nebula

*Nancy's poems –
"The Eagle's Child"*



The emergence of life and complex life on Earth and in the Universe

Nancy Jean Carrigan



"Astrophysics and the Ant"

Acrylic on Linen

Nancy Jean Carrigan © 2000

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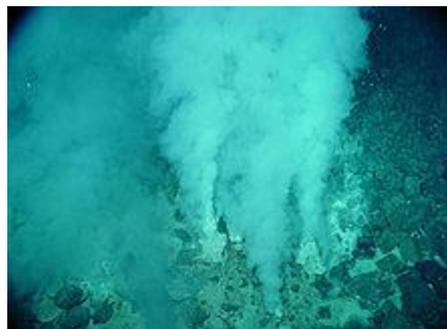
Carrigans - SETI and the Search for
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*Nancy's poems –
"The astronomer
and the ant"*

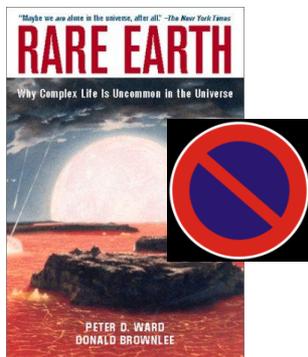
contrasts two cosmologies,
the astronomer asks "*can I
unweave the gauzy fabric of
stars?*" while the ant
ponders "*can I untangle the
matted carpet of earth?*"

But are there life and **intelligence** beyond the Sun? The chances of finding are improving

Extremophiles – now more likely



White smokers on sea floor
http://en.wikipedia.org/wiki/Hydrothermal_vent

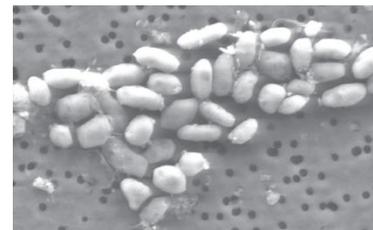


2010: Even arsenic
Felisa Wolfe-Simon at Mono
Lake in California
<http://www.ironlisa.com/>



Wolfe-Simon's bacteria

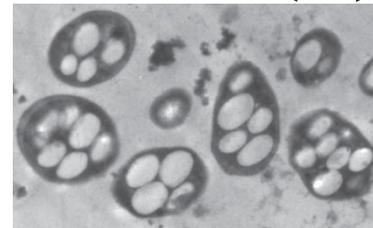
Arsenate - fat



Phosphate - thin \longleftrightarrow
 5μ



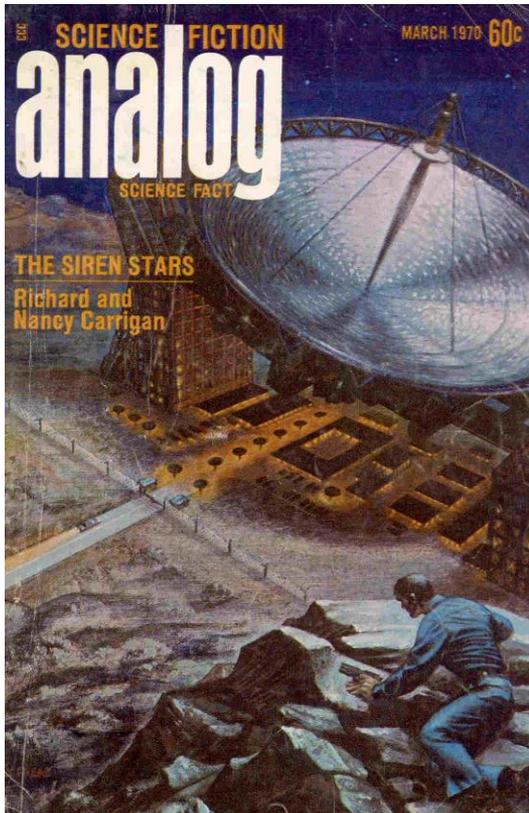
Arsenate \longleftrightarrow
 1μ



- New cosmology, new biology
- **Four signatures for interstellar archaeology**
- Summing up

Effect 1

radio and TV can span the galaxy
...but is there a message out there?



Tarter: strong TV transmission out to one light year
Arecibo planetary radar out to 3000 ly.
An advanced civilization may emit less stray radiation
SETI may detect **cultural** as distinguished from
intentional signals.



Jill Tarter
SETI
Institute



Jody Foster in *Contact*

**So far
No signal!**

Effect 2

Atmospheres of planets beyond our Sun - **type I Kardashev civilization**



Galileo 1610



Giovanna Tinetti



Lisa Kaltenegger

Have found some of the atoms and molecules of life

But no signs of life ... or **Intelligence** ... yet

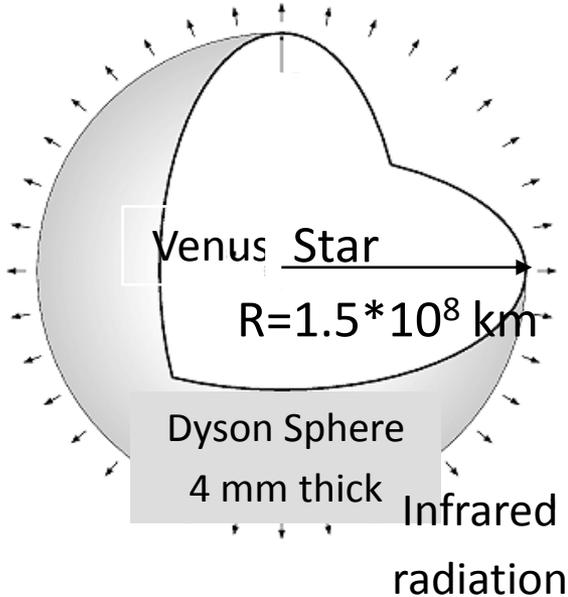
Could look for **rising carbon dioxide** or **freons** (refrigerants)

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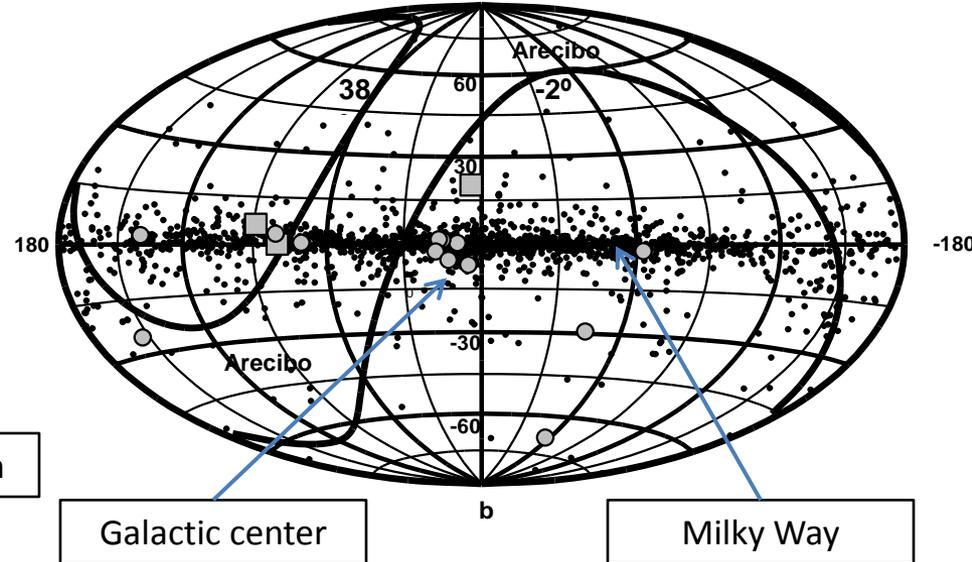
Tough!
30 years out

Effect 3

Dyson sphere - type II Kardashev civilization



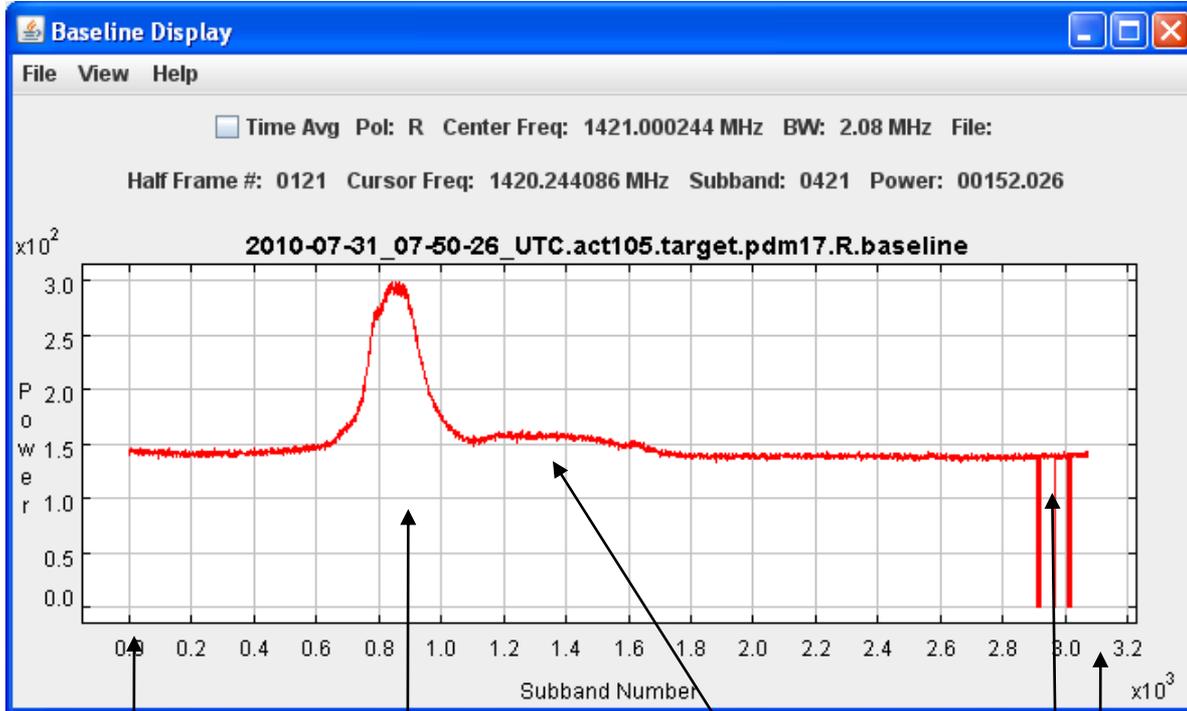
Freeman Dyson



Results

- **Dyson sphere IRAS search, Carrigan, ApJ, 698, 2075 (2009)**
- **Three faintly interesting sources, 13 poor**
- **SETI search with Allen telescope on some**

Dyson sphere candidate investigation for radio SETI with Allen Telescope now underway



1420

Neutral hydrogen

1420.536 MHz

Nom 1420.406

shoulder

1422

1421.969

Man-made interference

Allen telescope



IRAS 20369+5131

$L = 89.09$ $b = 6.29$

Cell phone frequencies go from 450 MHz to 1900 MHz

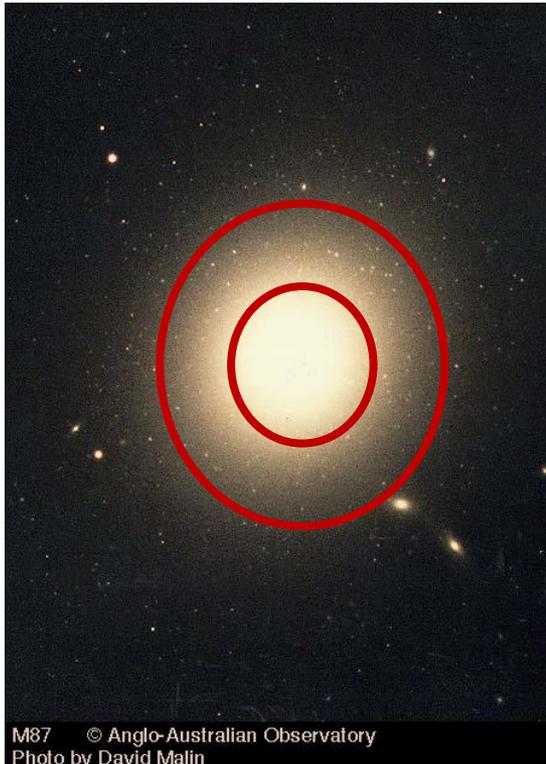
TV 50 – 1000 MHz

Whole galaxy **type III Kardashev civilization**

Fermi paradox, Fermi bubbles

slow interstellar travel possible (can cross galaxy as it rotates) so where are space aliens?

Effect 4



M87 © Anglo-Australian Observatory
Photo by David Malin

Quotes for spirals

Dyson: “a **type III Kardashev civilization** (energy from a whole galaxy) in our own galaxy would change the appearance of the sky so drastically that it could hardly have escaped our attention,”

Annis: “It is quite clear that the Galaxy itself has not transformed into a type III civilization based on starlight, nor have M31 or M33, our two large neighbors.”

Annis:

Try elliptical galaxies

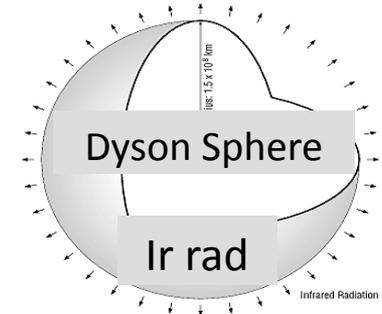
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- **Summing up**

Summary

Interstellar archaeology is difficult, speculative but worth study!



- Effect 1** SETI cultural signals (**nearly possible**)
- Effect 2** Cultural planetary atmosphere signals (**look how fast we are screwing up our own**)
- Effect 3** Dyson sphere (**tough**)
- Effect 4** Type III Kardashev galactic ala Annis (mere replication of DS, a turn of a galaxy)



In IA we are at the stage of Galileo 400 years ago. The situation looks difficult but there are possibilities for progress.



What can you do?

Dick's site

Dyson sphere search

[http://home.fnal.gov/~carrigan/
infrared_astronomy/Search_exercise.htm](http://home.fnal.gov/~carrigan/infrared_astronomy/Search_exercise.htm)

SETI Institute site

<http://www.seti.org/page.aspx?pid=239>

SETI@home (but past prime)

Amateur radio SETI

<http://www.setileague.org/>

Message content, literature

Pictures, music, etc.

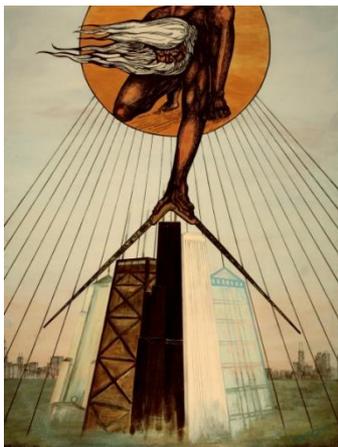
SETI Hacker

[http://home.fnal.gov/~carrigan/
SETI/SETI_Hacker.htm](http://home.fnal.gov/~carrigan/SETI/SETI_Hacker.htm)

Science fiction literature

Stephen Baxter

JBIS 62 131 (2009)



In pursuing SETI and interstellar archaeology remember the words of John Wellborn Root, a famous architect of Chicago, who said “Reason should lead the way, and imagination take wings from the height to which reason has already climbed.”

“I wish I were taller but when looking at the stars it doesn't matter.” Chicago poet Larry Janowski

Questions?



courtesy of the NAIC - Arecibo Observatory, a facility of the NSF



Nancy and Dick at
Arecibo Observatory