

The Privileged Planet

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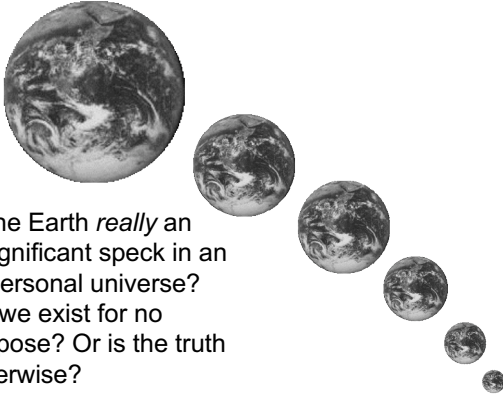
Friday Afternoon, Session 6

Copernican Principle

“Because of the reflection of sunlight . . . the Earth seems to be sitting in a beam of light, as if there were some special significance to this small world. But it's just an accident of geometry and optics. . . . Our posturings, our imagined self-importance, the delusion that we have some privileged position in the Universe, are challenged by this point of pale light. . . .


“. . . Our planet is a lonely speck in the great enveloping cosmic dark. In our obscurity, in all this vastness, there is no hint that help will come from elsewhere to save us from ourselves.”

Carl Sagan, *Pale Blue Dot* 



Is the Earth *really* an insignificant speck in an impersonal universe? Do we exist for no purpose? Or is the truth otherwise?

“The combined circumstance that we live on Earth and are able to see stars—that the conditions necessary for life do not exclude those necessary for vision, and vice versa—is a remarkably improbable one. . . What a fragile balance between the indispensable and the sublime.”

Hans Blumenberg 

A Habitable Planet

- A terrestrial planet that supports complex carbon- and water-based life
- Planet in “Circumstellar Habitable Zone”
- Planetary system in “Galactic Habitable Zone”

Some things you need for a habitable planet

- Right terrestrial planet
- Stabilizing moon
- Plate tectonics
- Right atmosphere
- Right planetary neighbors
- Right single star
- Right galaxy
- Galactic location
- Right cosmic time
- Universe fine-tuned for life

Our Argument

Habitability
correlates
with
measurability

The same narrow circumstances that allow us to exist also provide us with the best *overall* setting for making scientific discoveries.



The very conditions that make Earth hospitable to intelligent life also make it well suited to viewing and analyzing the universe as a whole.



Examples of the "Correlation"

- Perfect solar eclipses
- Layering processes
- Plate tectonics
- Transparency of atmosphere
- Planetary neighbors
- Stars
- Galactic location
- Cosmic time
- Fine-tuned cosmos

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Total Solar Eclipses

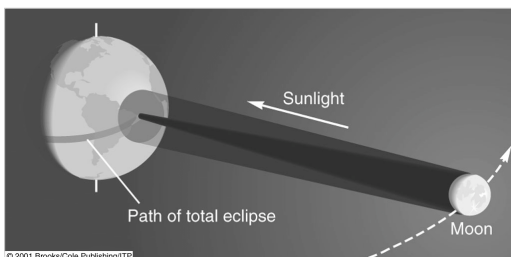


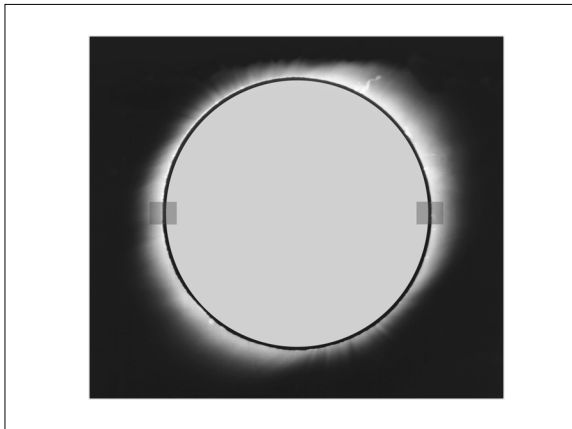
The start of an enquiry...

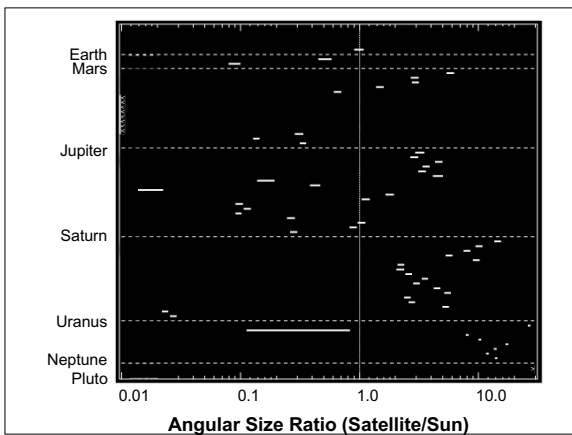
To produce a total solar eclipse you need the following:

- A luminous body
- An eclipsing body
- An observer platform
- The right distances apart
- All in a straight line in space

The apparent size of the Moon just barely covers the Sun as seen from Earth, giving us *perfect* eclipses.







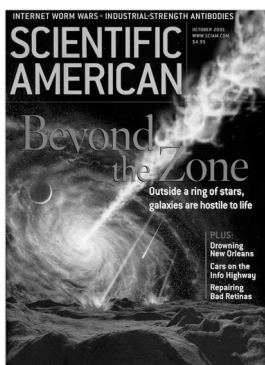
Perfect eclipses of the Sun are important for scientific discovery.

- Test of General Relativity
- Makes chromosphere detectable
- Helps reveal stars as hot balls of gas

Conclusion

The requirements for producing perfect solar eclipses, which provide scientific insight, also contribute to the Earth's habitability. This is only one example where the conditions for habitability overlap the conditions for measurability.

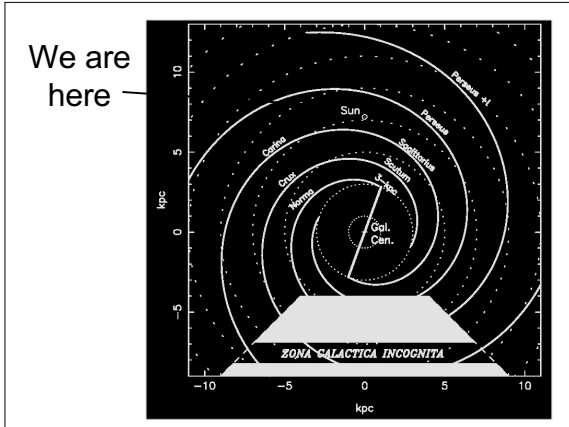
The Galactic Habitable Zone



The Galactic Habitable Zone

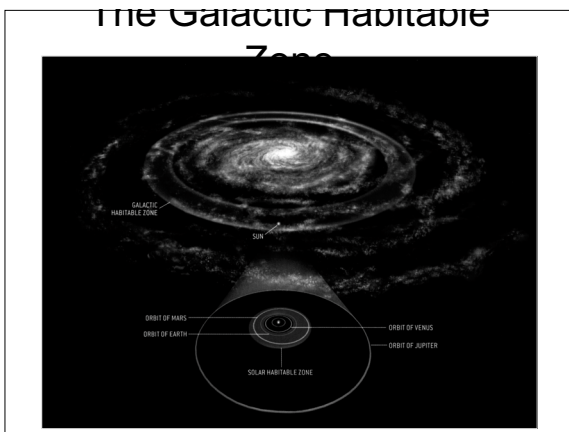
Two broad categories of phenomena define the GHZ:

- Requirements for a habitable planet
- Survival of complex life

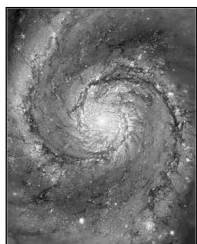


Summary of Galactic Habitable Zone

- Low metallicity in outer disk of Milky Way Galaxy limits terrestrial planet formation there.
- Threats to complex life greater in inner regions of Milky Way.
- The most habitable place in the Milky Way is a ring about half way out from its nucleus (and not including the spiral arms).



For scientific discovery, where would you want to be?



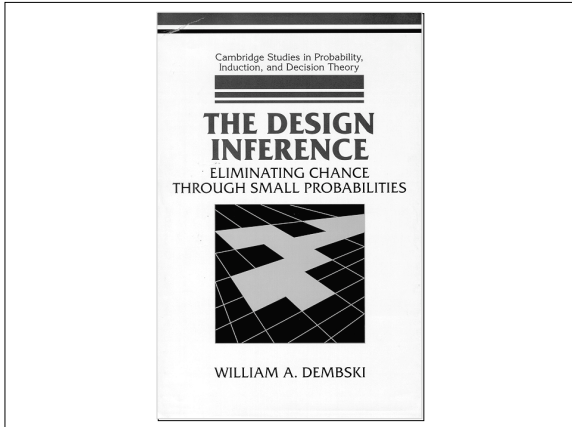
The Galactic Habitable Zone

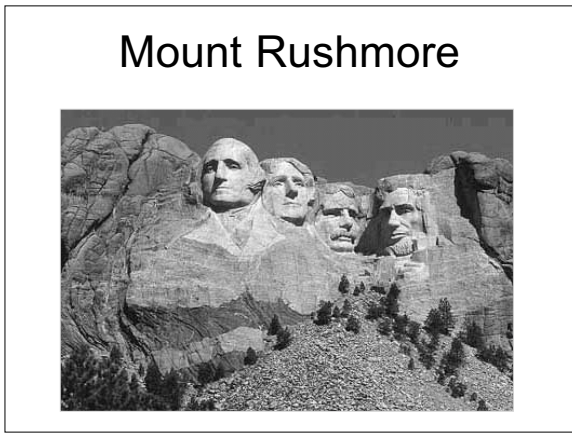
Discovery and the GHZ

- The low gas and dust “pollution” in the solar neighborhood permits clear views of distant galaxies and redshift.
- Location in thin disk gives us close-up view of diverse types of stars—vital for properly interpreting observations of distant galaxies.
- Location far from nucleus and asymmetric shape of galaxy gives us good view of cosmic microwave background radiation.

So what?









Complexity plus specificity:
A signature of intelligence

Complexity = Improbability



- The conditions that allow for habitability are improbable.
- The conditions that allow for measurability are improbable.

Specification = a meaningful pattern



The correlation of habitability and measurability forms a meaningful pattern.

The Pattern:

Observers plus good conditions for observing



The Pattern Recognized

Michael Mendillo and Richard Hart (Boston University), "Resonances," *Physics Today* **27:2** (1974), p. 73:

Theorem: An exactly total solar eclipse is a unique phenomenon in the solar system.

Lemma: There are observers on Earth to witness the remarkable event of an exactly total solar eclipse.

Conclusion A

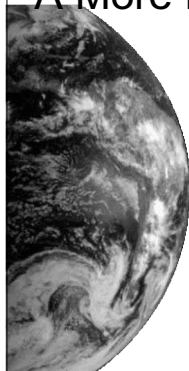
A planet/moon system will have exactly total solar eclipses only if there is someone there to observe them. As only Earth meets this requirement, there is no extraterrestrial life in the solar system.

Corollary In a system composed of nine planets and 32 moons, for only Earth with its single moon to have exactly total solar eclipses is too remarkable an occurrence to be due entirely to chance.

Therefore, there is a God.

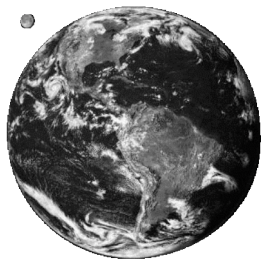


A More Modest Conclusion



The universe is fine-tuned so that environments habitable to observers will provide the best overall conditions for observation and discovery.

The universe is designed for *discovery*



What does design tell us about God?

Design *confirms* theism: The correlation is more likely given theism than given naturalism.

Research Opportunities

- Are there additional examples of the correlation?
- Any research in astrobology has a bearing on our hypothesis.
- Many research opportunities are possible on topic of measurability or discoverability—a topic ignored by naturalists.

Suggested Research Examples

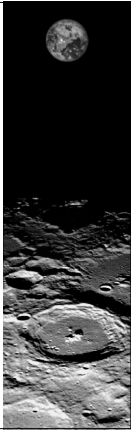
- What is the optimal time in the history of the universe to measure the CMB?
- Are there other historical examples of “natural physics experiments”?
- Would the discovery of Kepler’s Laws be delayed in other planetary configurations?
- What is the optimal stellar spectral type for extracting the highest quality data?

Objections



Objection:
There are lots of
counterexamples.

Response: *Constrained optimization and thresholds.*
Our location is the best *overall* location for measuring and making scientific discoveries.



“All design involves conflicting objectives and hence compromise, and the best designs will always be those that come up with the best compromise.”

Henry Petroski



Objection: Cherry-picking

You're cherry-picking. You have used a biased sample to argue for the correlation.



Response: We've picked **important** examples from a number of scientific disciplines.

Objection: It's inevitable.

Whatever environment we found ourselves in, we would find examples of fine-tuning for measurability.

Response: We can **compare** diverse conditions from other environments (e.g., murky atmospheres).

Objection: It's just a selection effect.

The argument is biased toward measurable phenomena.

Response: Theory may suggest things that are in principle measurable. For these things, we can compare our setting with others.

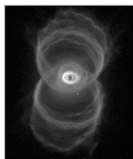
Objection: Complexity

Complexity makes the correlation likely. The greater the complexity, the greater the chance for a correlation.

Response: This concedes part of our argument, and isn't obviously true (e.g., a transparent atmosphere isn't more complex than an opaque one).

Objection: Correlation

The correlation isn't mystical or supernatural, since it's the result of natural processes.



Response: True, but so what?

Objection: God

"God wouldn't do it that way."



Response: Theological objections require theological answers.