Life Based on Energy and Thermodynamics

By Moses Samuelson-Lynn, a living organism from Earth (species Homo Sapiens).

WHAT IS LIFE?

- Definition of life
  - based on energy and thermodynamical relations
  - tendency to resist dying (succumbing to entropy)
    - Example:
      - Bacteria—unicellular organisms which can be easily studied and so much is known about
      - Telomeres at the ends of eukaryotic chromosomes resist chromosomal degradation

What is the Data? Required Information

- Most useful possible tool
  - Entropological and thermodynamic states of the exoplanets under consideration
- Potential pitfalls
  - Data is difficult to determine without an investigative probe sent to a planet at least quite a few light-years away.
    - One would have to determine a way to derive thermodynamic processes from information such as the corona formed by the atmosphere of the planet, if there was one, or its derived distance from its star and thus its likely temperature.
  - Today's telescopes are not of sufficient resolution to be able to handle such an in-depth task.

What is the Data?
What We Already Have

- Extensive studies of exoplanets' information
  - Chemical composition
  - Location
  - Possible viability (at least for Earth-like lifeforms) of life
- Second Earths
  - Some of the more exciting and unexpected examples have been termed "second Earths," but since all exoplanets, much the less viable ones, are outside 4 light-years from the Sun (the distance to Proxima B, the closest exoplanet, is approximately 4.22 light-years away), the possibility of intelligent life on these planets remains speculative.
- Network Signatures
  - Scientists, especially astrobiologists but also astronomers and some biologists, have been more recently excited about the possibility of detecting life from network signatures, but this remains rather unfeasible until the next generation of telescopes can be used to detect the atmospheric chemical relations.

Finding Life on Exoplanets: Obtaining Data and Making Inferences

The detection of life using my definition* would likely be quite difficult using current technologies, since it would require the construction of a network to represent the different entropological interactions in the exoplanet's atmosphere and/or directly on the surface of the exoplanet, but theoretically it could be done in the future. Theoretically, this is quite a sound definition, but there is a technological gap in before it could be used in astrobiological contexts.

* based on energy and thermodynamical relations and the tendency to resist dying (succumbing to entropy)

Logic: What in the Data Would Indicate Life?

Open for discussion! Everyone has great ideas, I'm sure of it. What do you think?

I've listed some possibilities in the previous slides.

Logic: How Would the Data Indicate Life?

As Prof. Walker suggested when she first discussed biosignatures, one major sign of life could be atmospheric interaction networks, but these would be difficult to detect.

Does anyone have other ideas? This question is open for discussion.