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EVO-SETI SCALE TO MEASURE LIFE ON EXOPLANETS

**Abstract**

In a series of recent papers (Refs. [1], [2]) this author gave the equations of his mathematical model of Evolution and SETI, simply called “Evo-SETI”. Key features of Evo-SETI are:

1) The Statistical Drake Equation is the extension of the classical Drake equation into Statistics. Probability distributions of the number of ET civilizations in the Galaxy (lognormals) are given, and so is the probable distribution of the distance of ETs from us.

2) Darwinian Evolution is re-defined as a Geometric Brownian Motion (GBM) in the number of living species on Earth over the last 3.5 billion years. Its mean value grows exponentially in time and Mass Extinctions of the past are accounted for as unpredictable low GBM values.

3) The exponential growth of the number of species during Evolution is the geometric locus of the peaks of a one-parameter family of lognormal distributions (b-lognormals, starting each at a different time  $b$ =birth) constrained between the time axis and the exponential mean value. This accounts for cladistics (i.e. Evolution lineages).

4) The lifespan of a living being, let it be a cell, an animal, a human, a historic human society, or even an ET society, is mathematically described as a finite b-lognormal. This author then described mathematically the historical development of eight human historic civilizations, from Ancient Greece to the USA, by virtue of b-lognormals.

5) Finally, the b-lognormal’s entropy is the measure of a civilization’s advancement level. By measuring the entropy difference between Aztecs and Spaniards in 1519, this author was able to account mathematically for the 20-million-Aztecs defeat by a few thousand Spaniards, due to the latter’s technological (i.e. entropic) superiority. The same might unfortunately happen to Humans when they will face an ET superior civilization for the first time.

Now the question is: whenever a new exoplanet is discovered, where does that exoplanet stand in its evolution towards life as we have it on Earth nowadays, or beyond? This is the central question of SETI. In this paper we provide mathematical criteria to answer this question within the framework of the Evo-SETI Theory, thus creating the EVO-SETI SCALE.

REFERENCES

- [1] Maccone, C., “SETI, Evolution and Human History Merged into a Mathematical Model”, International Journal of Astrobiology, Vol. 12 (2013), issue 3, pages 218-245.
- [2] Maccone, C., “Evolution and Mass Extinctions as Lognormal Stochastic Processes”, International Journal of Astrobiology, Vol. 13 (2014), issue 4, pages 290-309.