MOLECULAR CLOCK ON EARTH AND EXOPLANETS AS ENTROPY CHANGING LINEARLY IN TIME. C. Maccone[1],
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Abstract. In two recent papers (refs. [1] and [2]) and in a book (ref. [3]) this author modelled Darwinian Evolution as a stochastic process in the number of living Species since 3.5 billion years ago. After the first Species (RNA ?) the number of living Species increased in a stochastic fashion and nowadays roughly 50 million of Species live on Earth. The mean value of this stochastic process might be:

1) An exponential in increasing in time, and the corresponding stochastic process would then be a Geometric Brownian Motion, i.e. a lognormal (not Gaussian) process well-known in the world of financial mathematics.
2) A cubic function of the time, as proposed in 2007 by the Russian scholar Andrej Korotayev and his colleague Alexander Markov.
3) Or otherwise a generic, increasing function of the time such that the probability density function (pdf) of the stochastic process still is a lognormal starting in time about 3.5 billion years ago and reaching now the mean value of 50 million plus or minus an assigned and known standard deviation.

Now about Cladistics in this new mathematical model of Darwinian Evolution. This author's idea is that each new Species created at time b ("birth") is represented by a lognormal pdf starting at time b (rather than zero) called a b-lognormal: it starts at b, then reaches its peak at time p and then starts declining, since superseded by other new b-lognormals (i.e. new Species) more and more peaked until we reach Homo Sapiens who supersed all other previous Species. Thus, b-lognormals become more and more peaked in time, and one is led to consider "envelope" of them, or, more appropriately, the geometric locus of all the b-lognormal peaks, that is just the mean value (exponential, cubic or otherwise) of the general lognormal stochastic process representing Darwinian evolution on Earth over the last 3.5 billion year. The same curve of Life Evolution might apply to Exoplanets also (with a different timing, either faster or slowlier, depending on the physical conditions of the exoplanet).

Finally about Entropy, i.e. the Shannon Entropy associated to each b-lognormal representing a new Species. This author was able to prove a mathematical theorem, that he calls "Peak-Locus Theorem", yielding the entropy of the generic b-lognormal pdf constrained between the time axis and the locus of peaks that is the mean value of the above general lognormal process yielding the number of Species in time.
The surprise was that, while the mean value increases exponentially (or nearly so), the b-lognormal Entropy increases linearly in time. But a linear increase in time is just what geneticists call "molecular clock", i.e. the apparently constant rate of change of the DNA base pairs in the course of Evolution (this is Kimura's Neutral Theory of Evolution at the molecular level).

The conclusion of all this is that the molecular evolution of Life both on Earth and Exoplantes has thus been described mathematically by virtue of a suitable lognormal stochastic process. This mathematical theory might thus be able to tell us "where" a newly discovered exoplanet stands on its way to Life, and this is crucial in the field of SETI, the Search for ExtraTerrestrial Intelligence, pursued by this author and others for decades. Though no ET civilization was found yet, our "Evo-SETI" model (the mathematical model just described and based of the properties of b-lognormals) might help us to understand how much more evolved than Humanity a new ET Civilization might be when the first one is found by the SETI astronomers.

REFERENCES

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[3] C. Maccone, "Mathematical SETI", a 700-pages technical book published by Praxis-Spriger, 2012, http://link.springer.com/book/10.1007%2F978-3-642-27437-4