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MATHEMATICAL ASTROBIOLOGY: THE STATISTICAL DRAKE EQUATION SOLVED IN 50 STEPS BY MACCONE'S LOGNORMAL METHOD

Abstract

The original Drake equation is a deterministic estimate the number of extraterrestrial civilizations living in the Galaxy and was introduced by Frank Donald Drake in 1961.

In 2008 it was extended by Claudio Maccone so as to embrace Statistics, rather than just being a simple multiplication of factors. This new equation is called the Statistical Drake equation and its inputs are UNIFORM random variables, each centered around its own mean value.

In this paper, we use the mathematical tool of Maccone's lognormal distribution to increase the number of factors in the Statistical Drake equation from seven to fifty. By so doing, we also UPDATE the Statistical Drake equation to the increased amount of scientific knowledge available to scientists as of 2024, which is of course much larger than the one available to Frank Drake back in 1961.

The Maccone approach, in fact, rests on the Central Limit Theorem of Statistics, and so the results it provides become more and more reliable as long as more and more uniform input random variables are introduced.

Our UPDATE necessarily draws upon an array of disciplines ranging from astronomy to chemistry, geology, biology, paleontology and futurology.

Our final results provide the number of planetary systems suitable for Life in its various stages of development:

1) those which have probably hosted Life in the past and

2) those which still host Life at its various evolutionary levels.

3) the current evolutionary level are the galactic civilizations.

The number of resulting galactic civilizations that we find is divided between

1) static civilizations, which do not move around in the Galaxy and whose Kardashev Rating is still low (less than 1.4), of which we find three examples (we ourselves plus, perhaps, two others), and

2) potentially dynamic civilizations, which move around the Galaxy and have a sufficiently high Kardashev Rating (higher than 1.4), of which we find about 2000.