Einstein was Likely Right: "God Does Not Play Dice" Does Randomness Break Down at the Planck Scale ?

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Abstract

This note briefly outlines how numbers that appear to be totally and independently random switch to become deterministic at the Planck scale. In other words, God does not play dice.[1]

Key words: Independent random variables, breakdown of independence at the Planck scale, Planck time, Planck length, spatial dimension.

From Independent to Deterministic at the Planck Scale?

Contrary to modern physics, we will assume that the smallest particle has spatial dimension and is not a point particle. All of the Special Relativity end equations as well as the Lorentz transformation, for example, can be derived by assuming there exists one such particle, which is always traveling at the speed of light, see [2]. In addition, we find that Lorentz symmetry breaks down at the Planck scale, see [2, 3, 4]. This is not our main concern in this paper, but worth mentioning to point out that the foundation for what we will discuss here also has its own physics theory, which seems to be consistent with all known experiments. However, at the Planck scale the theory has not been tested yet, as this would require very high energy levels, or the ability to measure incredibly short time intervals or distances.

We assume the world only consists of empty space and indivisible particles that are always moving at the speed of light.

Also assume that we have a sphere where the diameter of the sphere is much larger than the diameter of the smallest particle. This means that an enormous number of indivisible particles can fit inside this area. We are monitoring how many indivisible particles are traveling in and out of this space volume for a given time interval, and report the sum of the occurrences. This sum will basically be totally random and also independent of what we observed in the previous time interval.

Next assume that there is a minimum time interval given by how long it takes the smallest particle to travel its own distance. Now assume that instead of observing a large space interval (in a large sphere), we are observing a sphere area that is equal in size to the smallest indivisible particle. Naturally, we will assume this particle is also sphere-shaped. If the diameter of the sphere is the Planck length,[2] then the shortest time interval is the Planck length divided by the speed of light. This is one Planck second. If, in the previous Planck second, we have observed an indivisible particle entering this Planck sphere volume (which had been an empty space), then we now know that the area is full, based on the entry of the single particle. In the next Planck second there is only one possibility: one indivisible particle has to leave the area we are observing. Another indivisible particle can enter this space during the same Planck second that the other is leaving, but no indivisible particle can enter unless one particle also leaves at the same time. In other words, a close analysis of spatial dimensions and indivisible particles indicates that the idea of independent random variables breaks down at the Planck scale. We could say, "God Does Not Throw Planck-Size Dice" — God only plays with larger dice!

This does not mean that we actually could ever observe this without disturbing the system. We also have an observer effect under atomism: an indivisible particle or particle system cannot be observed without affecting the indivisible particles that are being observed. The only way we can observe an indivisible particle is at the counter-strike (collision) with another particle. Still, the variables are not

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[1]See also [1].

[2]The Planck length was first introduced by Max Planck in 1899, see [5, 6].

that independent when we consider them all the way down to the Planck scale. This can naturally lead to long and interesting philosophical discussions, and we would encourage people to reflect further on these systems and their properties. To what degree this also is linked to the Heisenberg uncertainty principle [7] we will not discuss much this time. However, [8] has already pointed out that there seem to be some boundary conditions on the Heisenberg's uncertainty principle as well.

Even if modern physicists are discussing minimum spatial dimensions, there has not been sufficient study of minimum spatial dimensions in direct relation to particles. This is a turn in physics research that has taken us down the wrong path in understanding behavior at the subatomic scale. By re-introducing a close study of spatial dimensions in relation to minimum-sized particles, a series of infinity problems in modern physics vanishes, see [9]. In this example, we show that what may appear to be random and independent variables actually become dependent variables at the Planck scale.

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