THE PHILOSOPHY OF SUPERDETERMINISM ON A FINITE UNIVERSE

BY: JOHN JOSEPH BANNAN

The philosophy of superdeterminism is based on a single scientific fact about the universe, namely that cause and effect in physics are not real. In 2020, accomplished Swedish theoretical physicist, Dr. Johan Hansson published a physics proof using Albert Einstein's Theory of Special Relativity that our universe is superdeterministic meaning a predetermined static block universe without cause and effect in physics. In the absence of cause and effect in physics, there can be no actual energy in our universe but only the illusion of energy. This is consistent with the zero energy universe theory, which says that the positive matter energy is exactly balanced by the negative gravitational energy, so that the total energy of the universe is zero. An infinite universe would have an infinite amount of positive matter energy exactly cancelling out an infinite amount of negative gravitational energy. However, mathematically infinity minus infinity is not equal to zero, but rather is undefined. Consequently, an infinite universe would be inconsistent with the perfect cancelling balance of positive matter energy and negative gravitational energy under the zero energy universe theory. As a result, only a finite universe is consistent with the zero energy universe theory and the philosophy of superdeterminism.

The philosophy of superdeterminism is based on a single scientific fact about the universe, namely that we live in a predetermined static block[1] universe without cause and effect in physics.[2] In 2020, accomplished Swedish theoretical physicist, Dr. Johan Hansson proved by applying Albert Einstein's Theory of Special Relativity to what has already been scientifically verified about spin measurement correlations observed in entangled particle pairs[3] that cause and

[1] Imagine a cosmic four-dimensional block, where the three familiar dimensions of space (length, width, and height) are combined with a fourth dimension of time. Every single moment in history would occupy a specific location within this block. From this perspective, there is no special "now" moment that separates the past from the future. They all exist equally.

[2] Hansson, Johan. "Bell's theorem and its tests: Proof that nature is superdeterministic – Not random." *Physics Essays* Vol. 33, No. 2 (2020). Dr. Johan Hansson, a professor at Luleå University of Technology in Sweden, has been awarded the "Honorable Mention Award" by the Gravity Research Foundation, a prestigious foundation aimed at advancing the understanding of gravity in fundamental physics. This recognition places him among a group of previous winners that includes Nobel laureates and world-renowned physicists. www.ltu.se/en/latest-news/news/news/2023-05-23-awarded-prestigious-prize-in-gravitational-research#:~:text=Johan%20Hansson%2C%20a%20professor%20at,of%20gravity%20in%20fundamental%20physics.

[3] Dr. Hansson's version of superdeterminism proves the we live in a predetermined static block universe without cause and effect in physics. The other version of superdeterminism posits hidden causal variables responsible for the correlations observed in quantum entangled particles, and thus relies on cause and effect in physics. Indeed, Dr. Hansson's version of superdeterminism disproves any competing version of superdeterminism that relies on cause and effect in physics to posit hidden causal variables.

effect[4] in physics[5] are not real. Dr. Hansson demonstrated that the opposite spin measurements observed in entangled particle pairs cannot occur unless cause and effect in physics are not real. Experiments have shown that when the spin of the first entangled particle is measured, then the spin of the second entangled particle will always be the exact opposite spin regardless of how far apart you place the particles when measured.[6] However, the spin of the first entangled particle measured for spin-1/2 particles, like electrons, will always be a purely random 50-50 result between Up or Down spin. This raises an inconsistency with Einstein's Special Relativity when observed from different inertial frames of reference.[7]

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[4] Dr. Hansson wrote that "[e]verything is predetermined, including the experimenters (non) free will, the 'random' orientation of the spin-analyzers at either end, and anything else you can think of. Each measurement does not create but merely uncovers what already is embedded in space-time. All events leading up to, and including, the 'act of measurement' itself are already there. . . . Bell's theorem and its many experimental tests thus are proof that nature at its fundamental level is superdeterministic – not random. A 'cause' cannot alter the 'effect.' The events in global space-time are predetermined and fixed, much like pebbles cast into a concrete block. . . . What an experimenter seemingly 'chooses' to do at either end A or B is the only thing she can do, and cannot 'cause' either the event at her own position or the event at the other end. All events in the global space-time 'block' we call the universe (past, present and future), observed or not, are superdetermined and unalterable." Hansson, Johan. "Bell's theorem and its tests: Proof that nature is superdeterministic – Not random." *Physics Essays* Vol. 33, No. 2, at 217 (2020).

[5] Physics is the fundamental science that studies matter, energy, motion, and force. Physics explores everything from the incredibly small (subatomic particles) to the unimaginably vast (the cosmos).

[6] Aspect, A. et al. "Experimental Realization of Einstein-Podolsky-Rosen-Bohm *Gedankenexperiment*: A New Violation of Bell's Inequalities" *Physical Review Letters* Vol. 49, No. 2 (1982).

[7] An inertial frame of reference is a frame of reference in which an object at rest remains at rest and an object in motion moves in a straight line at a constant speed unless acted upon by an external force. Essentially, it is a reference point that is not accelerating. Think of it like a smoothly moving train: if you're inside and not near the windows, you can't tell if the train is moving at a constant speed or stationary. This is because the train is an inertial frame of reference.

Observers in different frames of reference can observe a different entangled particle measured first due to the relativity of simultaneity.[8] As a result, two different observers each observing a different entangled particle measured first can observe conflicting spin measurement results for the pair. If Observer 1 sees particle A measured first with an Up spin, then particle B must show a Down spin for Observer 1. But, if Observer 2 sees particle B measured first with an Up spin, then particle A must show a Down spin for Observer 2. Observers 1 and 2 would see inconsistent spin measurement results for the pair of entangled particles. This potential conflict in spin measurement results occurs because of the random 50-50 chance of observing either an Up or Down spin on the first particle observed to be measured.

The only way to explain how the spin measurement results can be consistent for all observers regardless of inertial frames of reference is to say that the spin measurement results must be predetermined for all observers.[9] If Observer 1 is predetermined to see particle A measured with an Up spin, and Observer 2 is predetermined to see particle B measured with a Down spin, then the spin measurement results between the two Observers can always match even though the spin measurements still appear to the Observers to be completely random

[8] The relativity of simultaneity in Einstein's Theory of Special Relativity means that two events that occur at the same time for one observer may not occur at the same time for another observer who is moving relative to the first. This idea challenges our intuitive understanding of time. In our everyday lives, we tend to think of time as absolute, flowing uniformly for everyone, regardless of their motion. However, special relativity tells us this is not the case. This happens because the speed of light is constant being the same for all observers regardless of their motion. To visualize this, imagine two lightning strikes hitting opposite ends of a moving train simultaneously from the perspective of someone standing on the platform. To someone on the train, the lightning strikes might appear to happen at different times due to their motion relative to the platform. This concept might seem counterintuitive, but it is a cornerstone of modern physics and has been experimentally verified.

[9] Dr. Hansson concludes that "[t]here is no other possibility than that the outcomes at A and B both are predetermined." Hansson, Johan. "Bell's theorem and its tests: Proof that nature is superdeterministic – Not random." *Physics Essays* Vol. 33, No. 2, at 217 (2020).

results. This is an example of predetermined randomness[10] and not caused randomness. If the random spin measurements were actually caused when the first entangled particle observed was measured, then there would be an inconsistency in spin measurement results which would violate the principle that there is no preferential frame of reference in Special Relativity or quantum mechanics. Consequently, Dr. Hansson proved that actual cause and effect in physics cannot be real using Einstein's Theory of Special Relativity, because eliminating cause and effect in physics is the only way to explain how the spin measurement results can be consistent when viewed from any inertial frame of reference.

Because cause and effect in physics are not real, then past and present events cannot actually cause future events. But, future events arrive nonetheless, which means that future events must already exist in an unseen fourth dimension of time. Consequently, we must live in a predetermined static block universe without cause and effect in physics. However, a static dimension of time cannot actually change the universe in the absence of cause and effect in physics. Rather, the changes in the appearances of the universe are exhibited along this static dimension of time. The block universe is a picture of change and not a changing picture. Because our static block universe is not actually changed by time due to the absence of cause and effect in physics, then our universe must be comprised of timeless physical reality. Movement requires the exertion of a force, and forces involve a mutual interaction between objects with each object playing both the role of cause and effect in the interaction. In the absence of cause and effect in physics, there can be no actual forces or movements in our block universe. Rather,

[10] The idea of "predetermined randomness" simply means an initial encounter with pre-existing pure randomness. So, in our static block universe where all purely random events exist equally whether in the past, present or future, one can encounter pre-existing purely random events for the first time as one enters future portions of the static dimension of time.

there is only an illusion of movement or forces as our static block universe changes in appearance along the static fourth dimension of time. Indeed, energy is the capacity to cause change, which is impossible in the absence of cause and effect in physics. Consequently, our universe has no actual energy, but only the illusion of energy as the static appearances of our universe change in the static fourth dimension of time.

Our static block universe without any actual energy under superdeterminism is consistent with the zero energy universe theory, which says that the positive matter energy[11] is exactly balanced by the negative gravitational energy[12], so that the total energy of the universe is zero. The idea is that "positive matter energy" encompasses the various forms of energy associated with the existence and interactions of matter, while "negative energy" represents a counterbalancing force, such as the gravitational potential energy. The scientifically verified flatness of spacetime evidences the truth of the zero energy universe theory.[13]

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[11] Positive matter energy encompasses the energy associated with the existence and interactions of the particles and fields that constitute the universe. It includes the energy equivalent of the mass of particles namely Mass Energy ($E=mc^2$); the energy of the motion of particles namely kinetic energy; the energy carried by electromagnetic waves such as light and radio waves; and the energy stored within the nucleus of atoms namely nuclear energy.

[12] Negative gravitational energy encompasses energy associated with the attractive force of gravity between masses. Physicist, Lawrence Krauss believes that dark energy contributes to the negative energy balance within the zero-energy universe theory. Krauss believes that the effects of dark energy, particularly its influence on the expansion of the universe, can be interpreted in a way that contributes to the overall negative energy balance.

[13] In General Relativity, the theory of gravity, massive objects can curve spacetime. However, the cumulative curvature of spacetime in our universe from all the matter, energy, dark matter and dark energy results in a perfectly flat universe meaning that light rays travel in straight lines, and parallel lines remain parallel forever. This happens because our universe possesses zero net total energy. If the universe possessed a net positive energy, our universe would curve negatively in a saddle shape. If our universe possessed a net negative energy (gravity), then our universe would curve positively into a sphere shape. Because the positive and negative (gravity) energies of our universe perfectly cancel each other out, then our universe has zero curvature meaning the universe is flat.

In our zero energy static block universe, the positive matter energy perfectly cancels out the negative gravitational energy. An infinite universe would have an infinite amount of positive matter energy exactly cancelling out an infinite amount of negative gravitational energy. However, an infinite amount of positive matter energy could not perfectly cancel out an infinite amount of negative gravitational energy, because mathematically infinity minus infinity is not zero, but rather undefined. Consequently, our universe cannot be infinite, but must be finite as evidenced by the flatness of spacetime and the absence of cause and effect in physics under superdeterminism.