

Concealed Mass and Gravitation within Whitehead's conception of observability in space and time suggest a Big Bounce Universe

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Erik Verlinde's conception of quantum gravitation (2017) within Whitehead's conception of observability involves new insight in the creation of space and time, it reveals the deep essence of gravitation itself and it suggests another speculation about the origin of the Universe. In order to explain the accelerated expansion of our Universe, Verlinde suggests the existence of apparent positive dark matter. Contrary to the widely accepted theoretical approach involving dark matter, Verlinde's conception of matter does not reduce this factor to the substrate of energy and linear momentum. Matter is deeply connected to pressure-less fluid revealing the emergent nature of gravitation as the intrinsic elastic response of space-time to excitations of the meta-stable micro-groundstate of the de Sitter Space. Since Verlinde does not put a substratum status on mass, and since he does not make curvature of space equivalent with gravitation, he rather reformulates cosmology in a Whitehead's concept of nature.

However, according to Whitehead, nature is disclosed to mind by an ensemble of events characterized by unobservable hidden intrinsic factors (e.g., mass, gravitation) and observable extrinsic factors (e.g., motion, density). Mass is not the substratum of dynamics. It implies spatial extension and temporal duration, which are both necessary conditions of observable natural phenomena. Therefore, an instant, deprived of duration, is immeasurable. Whitehead's claims on mass, space, and time corroborate Verlinde's alternative conception of quantum gravitation. Within the de Sitter space-time, this conception starts from the competition of the short distance degrees of freedom of the Ryu-Takanayagi tensor with long-distance thermalized excitations.

A nonlocally stored thermodynamic entropy $St(V)$ emerges besides the Bekenstein-Hawking area law entropy, proportional to the cosmological horizon. The area law due to the short-distance entanglement of neighbouring degrees of freedom of the Ryu-Takanayagi tensor formulation of emergent space-time generates the entanglement entropy $S(V)$, which is well-known as the area law for entanglement entropy. However, the entanglement entropy is the entropy of the non-observable according to the Ryu-Takanayagi conjecture about contributing short-range and long-range areas. Consequently, this entropy is out of the range of Whitehead's observable ensemble of events. The extensive thermal entropy $St(V)$, on the contrary, implies extension and duration, and consequently, $St(V)$ implies observability of the involved events. A long-time scale creates eigenstate thermalisation accompanied by a thermal volume law contribution of entropy $S(V)$ that competes with the Bekenstein-Hawking entanglement entropy SBH. This means that the so-called Coulomb branch mass and gravitation branches off from Higg's branch stress-strain response of the pre-baryonic Universe. This enables the creation of a baryonic mass and a decrease in de Sitter entropy. The memory effect of the original baryon creation leads to gravitation and the production of extensive thermodynamic entropy. Moreover within Whitehead's conceptions the creation of this appropriate gravitational environment by mass excitation escape settles down energy and momentum in the web of space- and time-like events. Consequently, space and time just emerge after the escape of baryonic mass and the reactive force of gravitation.

However, the baryon production shrinks, and the dissipating space-time transforms into a space-timeless cold sink with an accompanying strong contracting memory effect. This is equivalent to the alternate motion of a giant Carnot engine, where the heat source and sink energy exchange produce the eternal periodic dynamics of the Universe. This suggests that the Universe did not start from Big Bang but oscillated eternally as a Big Bounce.