XIth International Symposium: Quantum Theory and Symmetries(QTS)
July 1-5, 2019
Contributed talk - Session on Cosmology and Gravitation

What does the Central Limit Theorem have to say about General Relativity?

Réjean Plamondon *

antoine.savard@umontreal.ca

In this paper, we study the behavior of massive celestial systems. First, we propose a conceptual framework to point out the emergence of an erfc potential in a modified Schwarzchild space-time geometry [1]. Starting from the premise of an interdependence principle interpreted in a Bayesian setting, the linear case of a weak field static symmetric massive object is analyzed to point out how Einsteiní s equation can be generalized to incorporate a weighting factor that takes into account the probability of presence of a given energy density in its corresponding 4D curved space-time manifold. This premise, which in a sense is a rephrasing of the Mach principle, provides a probabilistic construal to the fundamental link between the space-time curvature and the energy momentum at a given event. Using the Central Limit Theorem to model globally the very slow process of star formation and mathematically express the corresponding density, the new framework provides a rationale for the emergence of a weighted Newtoní s law of gravitation. One key feature of this model is that it relies on the existence of an intrinsic physical constant, a star-specific proper length that scales all its surroundings. Although this new metric provides a consistent set of predictions and explanations regarding some open problems in the solar system, pointing out for example some latent relationships between the Hubble constant, the secular increase of the astronomical unit, the Pioneers delay and the flyby anomalies [2], the residual static offset incorporated in the erfc potential can also be investigated dynamically. This can be done in two steps. First, the metric can be rewritten in an algebraically equivalent erf symmetric form. Then, interpreting the constant time offset into a space-time rotation and the constant radial offset into a space-time expansion, the static metric can be converted into a dynamic one. In other words, the problem is solved by deriving a more general axisymmetric geometry which describes a rotating massive body dragging its curved space-time into a rotation and an expansion. The resulting length element is not invariant under time and azimuth coordinate transformations which leads to revisit

*Département de Génie Électrique, Polytechnique Montréal, C.P. 6079 Succ. Centre-ville, Montréal, QC H3C 3A7, CANADA

some basic properties of a rotating black hole dragging its space-time in four dimensions. Although this asymmetric metric does not have any intrinsic singularity, it can give rise to non-singular black holes with a double horizon. One key feature of this modeling methodology based on the Central Limit theorem is that it can be applied at different scales and used, for example, to model a single star, a galaxy made up of a large number of stars or a universe made up of a large number of galaxies.

[1] Plamondon, R., (2018), General Relativity: an erfc metric, Results in Physics, 9, 456-462.

[2] Plamondon, R., (2017) Solar System Anomalies: Revisiting Hubbleís law, Physics Essays, 30(4), 403-411.