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Quantum Properties and Gravitational Field of a Proper Time Oscillator

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By assuming matter can oscillate in proper time, we demonstrate that a matter field with proper time oscillations can mimic the properties of a bosonic field. The particles observed are proper time oscillators. The assumption also gives rise to properties that can reduce differences between quantum theory and general relativity, e.g., self-adjoint internal time operator and proper time uncertainty relation. If we neglect all quantum effects, a proper time oscillator can be treated as a 'stationary'classical object, equivalent to a point mass at rest in general relativity. Under this assumption, we demonstrate that the proper time oscillator can curve the surrounding spacetime and generate a gravitational field; its solution is the Schwarzschild metric. To test the theory, we propose to study the uncertainty of the neutrinos/photons arrival time and the decaying rate of a muon. In motion, the proper time oscillation translates to oscillations in both time and space. These oscillations lead to uncertainties in particles' decaying time and arrival time. The possible detection of these uncertainties can test the theory proposed. References [1] Yau, H. Y.: Proper time operator and its uncertainty relation. J. Phys, Commun. 105001 (2021) [2] Yau, H. Y.: Schwarzschild field of a proper time oscillator. Symmetry 12(2), 312 (2020) [3] Yau, H. Y.: Self-adjoint time operator in a quantum field. J. Quant. Info. 1941016 (2020) [4] Yau, H. Y.: Thin shell with fictitious oscillations", in Spacetime Physics1907 –2017, Chapter 6 (Minkowski Institute Press, Montreal, 2019) [5] Yau, H. Y.: Time and space symmetry in a quantum field. J. Phys.: Conf. Ser. 1194, 012116 (2019) [6] Yau, H.Y.: Temporal vibrations in a quantized field. In: Khrennikov, A., Toni, B. (eds.) Quantum Foundations, Probability and Information, pp. 269. Springer-Verlag, Heidelberg (2018)

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