Quantum of action in entangled relativity

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In this talk I will present the fact that the quantum field theory treatment of entangled relativity requires the existence of a new fundamental quantum of action that is not the usual constant of Planck ($\hbar$). Instead, in entangled relativity, $\hbar$ can be thought to be an effective *late times and low energy limit* quantum of action, which therefore depends on the spacetime localisation. I will further show that the only fundamental scale that appears in the quantum phase of theory is the Planck energy—which, surprisingly, remains a fundamental constant in entangled relativity, although neither Newton's constant G nor $\hbar$ are. This is because it turns out that $\hbar$ is proportional to G in the semiclassical limit of entangled relativity, such that the weak gravity limit ($G \to 0$) notably corresponds to the classical limit ($\hbar \to 0$). I will discuss the potential implications at the foundational level. I shall first recall that entangled relativity is a new general theory of relativity that does not allow gravity to be treated separately from matter fields, and that the theory possesses general relativity as one of its limits (for fairly generic classical situations) without any free parameter that can be fine tuned at the classical level.

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