

# There is only one time, and it is a manifestation of entanglement (F)

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We draw a picture of physical systems that allows us to recognize what “time” is by requiring consistency with the way that time enters the fundamental laws of Physics. Elements of the picture are two non-interacting and yet entangled quantum systems, one of which acting as a clock. The setting is based on the Page and Wootters mechanism, with tools from large- $N$  quantum approaches. Starting from an overall quantum description, we first take the classical limit of the clock only, and then of the clock and the evolving system altogether; we thus derive the Schrödinger equation in the first case, and the Hamilton equations of motion in the second.

Once the classical formalism is connected with a full quantum description, ideal tools emerge for breaking through some of the obstacles that make quantum gravity so difficult to process. In particular, we suggest that our approach may provide a link between the geodesic principle and the Schrödinger equation; furthermore, taking into account a possible interaction between evolving system and clock. Work in this direction is in progress and will be also reported, particularly referring to the case of Schwarzschild black holes and Hawking radiation.

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