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There is only one time

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We draw a picture of physical systems allowing us to recognize what is the thing we call "time". Elements of the picture are two non-interacting, entangled quantum systems: one acting as a clock, and the other one as the evolving system. The setting is based on the "Page and Wootters mechanism", with tools from Lie-Group and large-N quantum approaches. The theoretical framework, based on a parametric representation with generalized coherent states, allows us to take the classical limit either of the clock only, or of the clock and the evolving system; we derive the Schrödinger equation in the first case, and Hamilton's equations in the second one, showing that there is only one time, that is a manifestation of entanglement.

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