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## Bra-Ket Wormholes

*Wednesday 5 February 2025 09:00 (1 hour)*

Based on 2408.08351 and some work in progress. We study a model for the initial state of the universe based on a gravitational path integral that includes connected geometries which simultaneously produce bra and ket of the wave function. We argue that a natural object to describe this state is the Wigner distribution, which is a function on a classical phase space obtained by a certain integral transform of the density matrix. We work with Lorentzian de Sitter Jackiw-Teitelboim gravity in which we find semiclassical saddle-points for pure gravity, as well as when we include matter components such as a CFT and a classical inflaton field. We also discuss different choices of fixing time reparametrizations. In the regime of large universes our connected geometry dominates over the Hartle-Hawking saddle and gives a distribution that has a meaningful probabilistic interpretation for local observables. It does not, however, give a normalizable probability measure on the entire phase space of the theory.

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