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Entanglement between two disjoint universes

Friday, 18 December 2020 14:00 (1 hour)

We use the replica method to compute the entanglement entropy of a universe without gravity entangled in a thermofield-double-like state with a disjoint gravitating universe. Including wormholes between replicas of the latter gives an entropy functional which includes an "island" on the gravitating universe. We solve the back-reaction equations when the cosmological constant is negative to show that this island coincides with a causal shadow region that is created by the entanglement in the gravitating geometry. At high entanglement temperatures, the island contribution to the entropy functional leads to a bound on entanglement entropy, analogous to the Page behavior of evaporating black holes. We also apply the formalism to black holes in de Sitter space, and find similar islands.

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