

Theorie-Palaver

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Lorentz room (Staudingerweg 7, 5th floor)

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Berry phases, wormholes and factorization in AdS/CFT

Within the AdS/CFT correspondence, the entanglement properties of the CFT are related to wormholes in the dual gravity theory. This gives rise to questions about the factorisation properties of the Hilbert spaces on both sides of the correspondence. We show how the Berry phase, a geometrical phase encoding information about topology, may be used to reveal the Hilbert space structure. Wormholes are characterized by a non-exact symplectic form that gives rise to the Berry phase. For a wormholes connecting two spacelike regions in AdS3 spacetimes, we find that the non-exactness gives rise to one phase space variable appearing in each of the two boundary CFTs located at each end of the wormhole. The two CFTs are thus coupled, reflecting non-factorization. Mathematical concepts such as coadjoint orbits and geometric actions play an important role in this analysis. In addition to its relevance for quantum gravity, the approach presented also suggests how to experimentally realize the Berry phase and its relation to entanglement in table-top experiments involving photons or electrons. This provides a new example for relations between very different branches of physics that follow from the AdS/CFT correspondence and its generalizations. Based on 2202.11717 and 2109.06190.