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Holographic scattering and non-minimal RT surfaces

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In the AdS/CFT correspondence, the causal structure of the bulk AdS spacetime is tied to entanglement in the dual CFT. This relationship is captured by the connected wedge theorem, which states that a bulk scattering process implies the existence of O(1/G) entanglement between associated boundary subregions. In this paper, we study the connected wedge theorem in two three-dimensional asymptotically-AdS spacetimes: the conical defect and BTZ black hole geometries. In these settings, we find that bulk scattering processes require not just large entanglement, but also additional restrictions related to candidate RT surfaces which are non-minimal. We argue these extra relationships imply a certain CFT entanglement structure involving internal degrees of freedom. Because bulk scattering relies on sub-AdS scale physics, this supports the idea that sub-AdS scale locality emerges from internal degrees of freedom.

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