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Entanglement entropy in expanding universes

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We study the time evolution of entanglement entropy in expanding universes with various matters. To describe expanding universes holographically, we take into account a braneworld moving in an asymptotic AdS space involving a uniform p-brane gas. In the braneworld model, an observer living in the braneworld detects the bulk motion of the braneworld as an expanding universe. We show that the entanglement entropy of expanding universes increases by the volume law in the early time and by the area law in the late time. We further consider the cosmological horizon, which is the border of the visible and invisible universe, and then investigate the time-dependent quantum entanglement between them across the cosmological horizon.

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