Background instability of quintessence model in light of entropy and distance conjecture

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Abstract

We apply the covariant entropy bound argument supporting the de Sitter swampland conjecture to the quintessence model, to find out the condition for the background to be unstable. More concretely, the background is unstable when the matter entropy given by the species number of the effective field theory increases more rapidly than the geometrical entropy proportional to the apparent horizon area, since it contradicts the covariant entropy bound. The rapid increase in the matter entropy is proposed by the distance conjecture, which states that the time evolution of some scalar field along the geodesic in the field space brings about the descent of a tower of states from UV. From this, we find that for the quintessence model, the accelerating background having the event horizon is unstable, and the instability condition as well as the lifetime of the unstable background is equivalent to the trans-Planckian censorship bound forbidding the classicalization of the trans-Planckian modes.

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