UV Hints in the Hot IR

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Abstract

Bottom-up holographic models of confinement notoriously allow the early universe to supercool to very low temperatures in the deconfined phase. Inspired by top-down examples like the warped deformed conifold, we study the deconfined phases of a more UV-motivated class of 5D models with a decreasing effective Planck scale in the IR. We find that a minimum temperature and an accompanying thermodynamically unstable branch arise generically, fundamentally limiting the amount of supercooling. To understand the generality of the result, we turn to the higher-dimensional interpretation of our models. When it is analytically computable, the scalar potential is a sum of exponentials, a hallmark of dimensional reduction. The exponents fall into disjoint ranges dictated by their higher-dimensional origin (cosmological constant, internal curvature, or fluxes), which lets us identify natural explanations for the bottom-up thermodynamic behaviors. The unstable IR branch, for instance, is just the familiar negative specific heat of an asymptotically-flat Schwarzschild solution. Meanwhile, fluxes in the higher-dimensional theory can introduce a maximum temperature and a second stable branch. I'll close with implications for cosmological phase transitions relevant to BSM physics where such constructions are used.

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