A Double-Headed Centaur in a Black de Sitter Universe

N. Petropoulos

Abstract

We study some aspects of black holes in de Sitter (dS) spacetime with a particular focus on the Nariai and Rotating Nariai geometries. These are maximal black hole geometries on cosmological spacetimes.
We first review spacetime structure of dS. We study different coordinate systems which give rise to different symmetries and causality in dS spacetime.
We then proceed with black hole geometries in dS. We make thermodynamic and rotodynamic analysis and compare them with Minkowski black holes highlighting some essential differences which give rise to potentially special microscopic behaviours. Our focal point are the Nariai and Rotating Nariai geometries which have an S^(n-2) fibration over a dS_2 base space.
Moreover, we make some analysis on quantum field theory in dS spacetimes. We consider pure dS and the Rotating Nariai geometries. We comment on the structure of the vacua that are mainly used on dS, focusing on the so-called Î±-vacua and the Euclidean one.
Furthermore, we explore a direction towards examining possible microscopic properties of the cosmological horizon. This has already been studied for the black hole horizons, mainly via the AdS/CFT correspondence. We employ the Kaluza-Klein decomposition from higher to lower dimensional effective theories. Then we establish a connection with the so-called Centaur geometries.
Finally, we give some insights on constructing more geometrically involved spacetimes, namely the double-headed Centaurs.