

The SJ Vacuum in de Sitter Spacetime

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I present results from a study of the Sorkin-Johnston (SJ) vacuum in de Sitter spacetime for a free scalar field theory. We find evidence for a new vacuum state in de Sitter spacetime which is de Sitter invariant in 4d. Using a causal set discretisation of a slab of $2d$ and $4d$ de Sitter spacetime, we find the causal set SJ vacuum for a range of masses $m \geq 0$ of the free scalar field. While our simulations are limited to a finite volume slab of global de Sitter spacetime, they show good convergence as the volume is increased. We find that the $4d$ causal set SJ vacuum, while de Sitter invariant, shows a significant departure from the continuum Mottola-Allen α -vacua. Moreover, the causal set SJ vacuum is well-defined for all masses, including the minimally coupled massless $m = 0$ case which is ill-defined in other de Sitter invariant vacuum state definitions. I will also briefly discuss how our results differ from earlier work on the continuum de Sitter SJ vacuum.

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