

Why 5? Semi-classical analysis of a Kerr-AdS black hole in five dimensions

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Some of the quantum properties of rotating black holes in (3+1)-dimensional spacetimes remain unresolved. However, studying higher-dimensional cases may provide insight into their behaviour. In this talk, we investigate the behaviour of a massive scalar field in a Kerr-AdS (4+1)-dimensional spacetime. Specifically, we focus on the existence of a Hartle-Hawking state, which is a vacuum state with important properties, such as being a thermal and Hadamard state, which means that it is well-behaved and has a finite energy density. While the Hartle-Hawking state has been studied in various types of black holes, our focus is on rotating black holes where we have observed a correlation between the presence of the light surface and the existence of the Hartle-Hawking state. It should be noted that the Hartle-Hawking state does not exist in Kerr black holes, but it does exist in Kerr-AdS black holes. In four dimensions, the analysis of this state is very challenging, but in five dimensions, the enhanced symmetry of the system simplifies the analysis. Finally, by using the Hartle-Hawking state, we also present a method for evaluating observables, starting with the vacuum polarization.

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