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Unruh-de Witt detectors in curved spacetime

The two-level particle detector models, such as Unruh-DeWitt detectors(UDD), play a significant role in understanding quantum effects in different frames of reference such as the Unruh effect. These two-level quantum probes are used to study quantum field theory for different observers in flat spacetime as well as in curved spacetime. In recent years, there has been an interest in relativistic quantum information processes using these quantum probes.
In the presence of gravity, for a detector in stationary motion, it can happen that the acceleration and the tidal acceleration due to curvature can intertwine and affect the response of a detector. We have uncovered such a result in a previous work[1]. We extend these studies[2] for rotational motion in de Sitter and anti-de Sitter spacetimes and arrive at specific conditions in anti-de Sitter spacetime for periodicity in geodesic distance in Euclidean time. We found specific mappings for stationary motion in dS/AdS spacetime to stationary motion in Minkowski spacetime.
We also explore an indirect yet universal role of spacetime curvature in creating entanglement between two quantum probes coupled to a scalar field in a suitable vacuum state. These quantum probes are initially not entangled and are placed at two causally disconnected points. The entanglement between the detectors is affected by the curvature of spacetime and can be elucidated by the deformation of the causal structure and deviation of detector trajectories due to the presence of curvature.

[1] Hari K and Dawood Kothawala, Phys. Rev. D 104, 064032 (2021).
[2] Hari K and Dawood Kothawala, arXiv:2307.16413
[3] Hari K, Subhajit Barman and Dawood Kothawala, in progress

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