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Bandlimited UDW detector dynamics on 2+1 flat and spherical spacetimes

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The potential breakdown of the notion of a metric at high energy scales could imply the existence of a fundamental minimal length scale below which distances cannot be resolved. One approach to realizing this minimum length scale is construct a quantum field theory with a bandlimit on the field. We report on an investigation of the effects of imposing a field bandlimit on a curved and compact spacetime. To achieve this operationally, we couple two Gaussian-smeared UDW detectors to a scalar field on a Sˆ2 x R spherical spacetime through Dirac-delta switching. Delta switching allows for a non-perturbative analysis that includes higher order effects due to the bandlimit. The bandlimit is implemented through a cut-off of the allowable angular momentum modes of the field. We find that the detectors are less sensitive to the bandlimit on the spherical spacetime, and observe features similar to flat spacetime. These include the response of the detectors depending on their geometry and that smaller detectors couple in a stronger manner to the field.

We also explore two squeezed detector setups in both flat and spherical spacetimes, and find notable difference between the two cases. Due to the compact nature of spherical space, the lack of dissipation of any perturbation to the field results in locally excited signals of the field traveling from pole to pole in the spacetime. Quite strikingly, squeezing increases the response of the detectors in flat space but decreases the response on the spherical spacetime. Moreover, we find that squeezing on a sphere introduces extra anisotropies that could be exploited to amplify or weaken the response of the second detector.

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