Title:	Unruh DeWitt probe of late time revival of quantum correlations in Friedmann spacetimes
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Abstract:	Unruh DeWitt (UDW) detectors are important constructs in studying the dynamics of quantum fields in any geometric background. Curvature also plays an important role in setting up the correlations of a quantum field in a given spacetime. For instance, massless fields are known to have large correlations in de Sitter space as well as in certain class of Friedmann-Robertson-Walker (FRW) universes. However, some of the correlations are secular in nature while some are dynamic and spacetime dependent. An Unruh DeWitt detector responds to such divergences differently in different spacetimes. In this work, we study the response rate of Unruh DeWitt detectors which interact with quantum fields in FRW spacetimes. We consider both conventionally as well as derivatively coupled Unruh DeWitt detectors. Particularly, we consider their interaction with massless scalar fields in FRW spacetimes and nearly massless scalar fields in de Sitter spacetime. We discuss how the term which gives rise to the infrared divergence in the massless limit in de Sitter spacetime manifests itself at the level of the response rate of these Unruh DeWitt detectors in a wide class of Friedmann spacetimes. In order to carry out this study, we make use of an equivalence that exists between massless scalar fields in FRW spacetimes with massive scalar fields in de Sitter spacetime. Further, we show that while the derivative coupling regulates the divergence appearing in de Sitter spacetime, it does not completely remove them in matter dominated universe. This gives rise to large transitions in the detector which can be used as a probe of setting up of large correlations in late time era of the universe as well. We also apply the results of these otherwise formal analyses to the coupling of hydrogen atoms with gravitational waves. We show that the coupling of hydrogen atoms with gravitational waves takes a form that is similar to derivatively coupled UDW detectors and hence has significant observational implications as a probe of late time revival of quantum correlators.
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