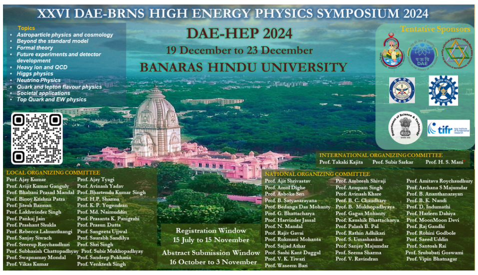

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Single and entangled atomic systems in thermal bath and the Fulling-Davies-Unruh effect

In this work, we revisit the Fulling-Davies-Unruh effect in the framework of two-level atomic systems, both single and entangled, which remain static within a thermal bath. We analyze the interaction between these atomic systems and a massless scalar field, considering both free space and a cavity environment. By computing atomic transition rates and comparing them with the findings of our previous work [*Phys. Rev. D 108 (2023) 085018*], we demonstrate that in free space, an equivalence exists between the upward and downward transition rates of a uniformly accelerated atom, as observed by an inertial observer, and those of a static atom immersed in a thermal bath, provided that the temperature of the thermal bath coincides with the Unruh temperature. However, this equivalence in the level of transition rates is disrupted when the atom is placed inside a cavity. For two-atom systems, when the initial state is in a general pure entangled form, we observe that the equivalence between the accelerated and static thermal bath scenarios holds only under specific limiting conditions in free space and is entirely broken in a cavity setup. Nonetheless, the ratio of the upward to downward transition rates in the thermal bath agrees precisely with those in the accelerated systems, both in free space and within the cavity.

Field of contribution

Theory

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Track Classification: Formal theory